The TYCHOS

Our Geoaxial Binary System

"Chi va piano va sano — e va lontano."
(Old Italian adage)

With illustrations by the author

This book is dedicated to

Kerstin & Eyvind

who brought me to this wondrous planet.

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Foreword

This book is a sincere and well thought through effort to present the true configuration of our Solar System. With an easily readable style, Simon Shack makes the complexities of astronomy accessible to the layperson by guiding the reader through the subject in a refreshingly logical and informative way.

He initially demonstrates that the heliocentric model of the Solar System, widely credited to Nicolaus Copernicus, is geometrically impossible. With simple geometry and elementary mathematics, a number of glaring contradictions are revealed. You will be introduced to the many fudge-factors and the questionable reasoning that have been used to explain away anomalies and contradictions over the centuries. He then shows that none of these antics are necessary to make his model work. The TYCHOS is fully consistent with *all* empirical observations made throughout the centuries, without *any* contradictions. Logically speaking, this is very powerful evidence of its correspondence to reality.

In short, Simon Shack shows that our planet does not revolve around the Sun, but is instead located at the centre of a binary system dominated by the Sun and Mars. These move around each other in what could be described as intersecting orbits. At the same time, the Sun orbits the Earth, while all the other planets orbit the Sun. All the while, the Earth moves at a relative snail's pace spinning its way around its own 25344-year orbit.

The basis of this configuration was first proposed in the 16th century by Tycho Brahe, the most rigorous and prolific observational astronomer of all times. Curiously, his work is often either ignored or unfairly disparaged. Using his meticulously recorded data, Tycho Brahe inferred that the Sun and Mars move around each other in a manner that we would identify today as a binary pair. Binary star systems were unknown in the 16th century, since the telescope had not yet been invented. Simon Shack confidently began with Brahe's proposed system (though rejecting its geostationary component) for the simple reason that the vast majority of visible star systems are now telescopically observed to be binary. He then added his own idea of the Earth's PVP orbit in a fantastic feat of conceptual integration that accommodates and explains the precession of the equinoxes, and many other phenomena in what can be considered the final piece of the puzzle. This work also methodically demonstrates how the basic principles of the TYCHOS are strongly supported by numerous modern astronomical discoveries which have been either overlooked, misinterpreted, or perhaps even willfully ignored by the world's scientific community.

It is crucial for any serious investigator of truth to separate the most fundamental question of 'what is it?' from the logically subsequent question of 'how does it work?' First, we must identify what we are looking at. We must ask questions such as 'what shape is it?', and 'how does it move?', to first establish identity. Only *then* can we proceed to address the question of *how* it works and what forces might account for its structure and motion. It is therefore necessary to put aside considerations of *how* the planetary motions are achieved, such as Newton's theory of gravity, and refrain from using this theory as reason to doubt the nature of an integrated and consistent model of what can be observed in the night sky.

It is often claimed that the ideas of men possessing no conventionally recognised qualifications can be dismissed out of hand, but this is both illogical and disingenuous. It is the evidence and the rational argument that should be the focus of investigation. Scientific method regards the falsification of a theory as an essential means to increasing the certainty of what is claimed as truth. Anomalies and contradictions with any theory are the *red warning flags* of error. They are the signal that assumptions must be questioned and that a metaphorical 'return to the drawing board' is required. Yet many experts and astronomers routinely shrug off anomalies and contradictions. They find it hard to question the assumptions of previous generations precisely *because* their qualification is the sum of all those assumptions made to date. Simon Shack is a scientifically minded researcher who is not similarly encumbered with reluctance to go 'back' down to the metaphorical basement and revisit those most fundamental assumptions. He can ask the forbidden questions and is armed with the essential tools to answer them; curiosity, an ability to think logically, and a keen interest in the subject matter. He is both intellectually qualified and intellectually free.

In 2018 Simon presented the first draft of his book to Swedish software developer and IT specialist Patrik Holmqvist. Patrik made computer simulations of the proposed TYCHOS model that later became the Tychosium 3D—the first simulator of our Solar System whose geometric configuration correctly replicates the empirically observed celestial positions of our planets in relation to the stars. He later commented: *"I figured that somewhere along the road, some insurmountable problems with the model would inevitably surface."* But this hasn't been the case. So far, step by step, all observations, experiments and cross-verifications have confirmed the TYCHOS model's validity.

In our bankrupt Western culture, innovation has become stifled and genuine scientific advancement effectively thwarted. Simon's book and Patrik's Tychosium 3D simulator provide a valuable resource for astronomers and researchers across the world. This work represents an inspirational return to rational thinking and presents what I consider to be a truly historical step forward in our understanding of the Solar System.

As you dive into the TYCHOS, I encourage you to peruse the Tychosium 3D simulator and spend time getting familiar with its functions. It's a great tool to help visualize, comprehend and appreciate the awesome geometric beauty of our binary Solar System along with its spirographic, mandala-like orbital patterns. Enjoy your journey into what I believe is the most reasonable and factually accurate interpretation of our Solar System ever devised.

Nigel Howitt
September 2022

Preface

The TYCHOS model is the result of almost a decade of steady research into ancient and modern astronomical literature, data and teachings. It all started as a personal quest to probe a number of issues and incongruities that, in my mind, afflicted Copernicus' famed (and almost universally accepted) heliocentric theory. The TYCHOS model is based on, inspired by—and built around—both modern and time-honoured astronomical data.

As I gradually came to realize that the Copernican/Keplerian model presented some truly insurmountable problems as to its proposed physics and geometry, I decided to put to the test, in methodical fashion, what was once its most formidable adversary, namely the geo-heliocentric Tychonic model devised by Tycho Brahe—arguably the greatest observational astronomer of all times. After his untimely death in 1601 (at age 55), Tycho Brahe's favourite assistant Christen Longomontanus perfected his master's lifetime work in his *Astronomia Danica* (1622), a monumental treatise regarded as Tycho Brahe's testament. The most striking feature of Tycho Brahe's Solar System was that the orbits of the Sun and Mars intersect—as they both 'dance' around the Earth.

Tycho Brahe, however, apparently believed for most of his life that the Earth was completely immobile, not even rotating around its own axis. This unlikely notion was amended by Longomontanus in his *Astronomia Danica* by giving Earth a diurnal rotation. This is known today as the *"Semi-Tychonic model"*, and my TYCHOS model is, in fact, nothing but a revised and 'upgraded' version of the same (the two are geometrically identical). Most notably, the TYCHOS propounds and demonstrates that our rotating planet isn't stationary in space but that it has, in all logic, an orbit of its own, just like all the celestial bodies that we can observe in our skies. In short, the essential soundness of Tycho's (or rather, Longomontanus') original model led me to envision the missing pieces of their rigorous yet incomplete work. If Tycho Brahe and his trusty assistant had been aware of what modern astronomers have learned in later decades, there is no doubt in my mind that they would have reached similar conclusions to those presented in this book.

In the latest decades of astronomical research, a particular realization stands out for its paradigm-changing nature: the vast majority of our visible stars have turned out to have a smaller, binary companion. Thanks to modern, advanced telescopes and spectrographic technologies, such binary pairs—formerly believed to be single stars—are now being discovered virtually every day, with no end in sight. In fact, since the so-called companion stars are often too small and dim to be detected, it is quite plausible that 100% of the stars in our skies are binary systems. In binary systems, a large star and a smaller celestial body revolve in relatively short, mutually intersecting local orbits around a common barycentre.

The TYCHOS posits that the Sun and Mars constitute a binary system, much like the vast majority (or perhaps all) of our surrounding stars. In our system, the Earth is located at or near the barycentre of the revolving Sun-Mars binary duo; it orbits 'clockwise' at the tranquil 'snail-pace' of 1 mph (or 1.6 km/h), completing one orbit in 25344 years—a period commonly known as 'the precession of the equinoxes'. It is noted for pertinent comparison that the Sirius binary system is composed of two bodies (Sirius A and Sirius B) whose observed, highly unequal diameters are, remarkably enough, proportionally identical to those of the Sun and Mars.

Aside from Tycho Brahe's unequalled body of empirical observations, my work has relied and expanded upon a number of lesser-known, overlooked or neglected teachings that were effectively 'obliterated' by the so-called Copernican Revolution. The early insightful architects who laid the groundwork for what should be our correct model for the Solar System include Nilakantha Somayaji (author of the *Tantrasangraha*, 1501) and Samanta Candrasekhara Simha (a.k.a. Pathani Samanta, 1835-1904), in addition to ancient Mayan, Aztec, Sumerian, Greek, Arabic and Chinese astronomers. Alas, their work and findings have long been eclipsed by a celebrated clique of modern science icons (e.g., Kepler, Galileo, Newton, Einstein), all of whom have been shown—in one way or another—to have engaged in deception, plagiarism or quackery, if not outright fraud. Having said that, I do realize that my TYCHOS model is primarily based upon the work of an astronomer from the Western world, Tycho Brahe—yet nothing suggests that he ever engaged in anything else than earnest and rigorous observations of the planetary motions in our skies, for his entire lifetime.

Unfortunately, in spite of the unprecedented accuracy of Brahe's lifelong observational enterprise, his proposed geometric configuration of our Solar System was ultimately flipped on its head by his young and ambitious assistant, Johannes Kepler: in what must be one of the most ruinous setbacks in the history of science, shortly after Tycho's untimely death, Kepler went on to steal the bulk of his master's laboriously compiled observational tables only to tweak and distort them through his tortuous algebraic efforts so as to make them appear compatible with the paradigm of the diametrically opposed, heliocentric Copernican model.

As few people will know, Kepler was ultimately exposed (in 1988) for having crudely manipulated Brahe's all-important observational data of Mars; Brahe had specifically entrusted him with the task of resolving the baffling behaviour of this particular celestial body, and Kepler's laws of planetary motion were, in fact, almost exclusively derived ('mathemagically', one might say) from his harrowing *"war on Mars"*, as he liked to call it in his correspondence with friends and colleagues. Just why Mars presented such exceptional difficulties should become self-evident in the following pages.

> *Kepler's Laws are wonderful as a description of the motions of the planets. However, they provide no explanation of why the planets move in this way.* [1]

It is a widespread popular myth that Johannes Kepler was the man who brought on the era of *"rational scientific determinism"* to the detriment of dogmatic religious belief. However, as pointed out by J. R. Voelkel in his 2001 treatise *"The Composition of Kepler's Astronomia Nova"*, nothing is further from the truth:

> *He [Kepler] sought to redirect his religious aspirations into astronomy by arguing that the heliocentric system of the world made plain the glory of God in His creation of the world. Thus he made the establishment of the physical truth of heliocentrism a religious vocation.* [2]

Paradoxically, the so-called Copernican Revolution was hailed as *"the triumph of the scientific method over religious dogma"*. Yet, when challenged by the likes of Tycho Brahe about the absurd distances and titanic sizes of the stars that the Copernican model's tenets implied, the proponents of the same invoked *"the omnipotence of God"*.

> *Tycho Brahe, the most prominent and accomplished astronomer of his era, made measurements of the apparent sizes of the Sun, Moon, stars, and planets. From these he showed that within a geocentric cosmos these bodies were of comparable sizes, with the Sun being the largest body and the Moon the smallest. He further showed that within a heliocentric cosmos, the stars had to be absurdly large—with the smallest star dwarfing even the Sun. Various Copernicans responded to this issue of observation and geometry by appealing to the power of God: They argued that giant stars were not absurd because even such giant objects were nothing compared to an infinite God, and that in fact the Copernican stars pointed out the power of God to humankind. Tycho rejected this argument.* [3]

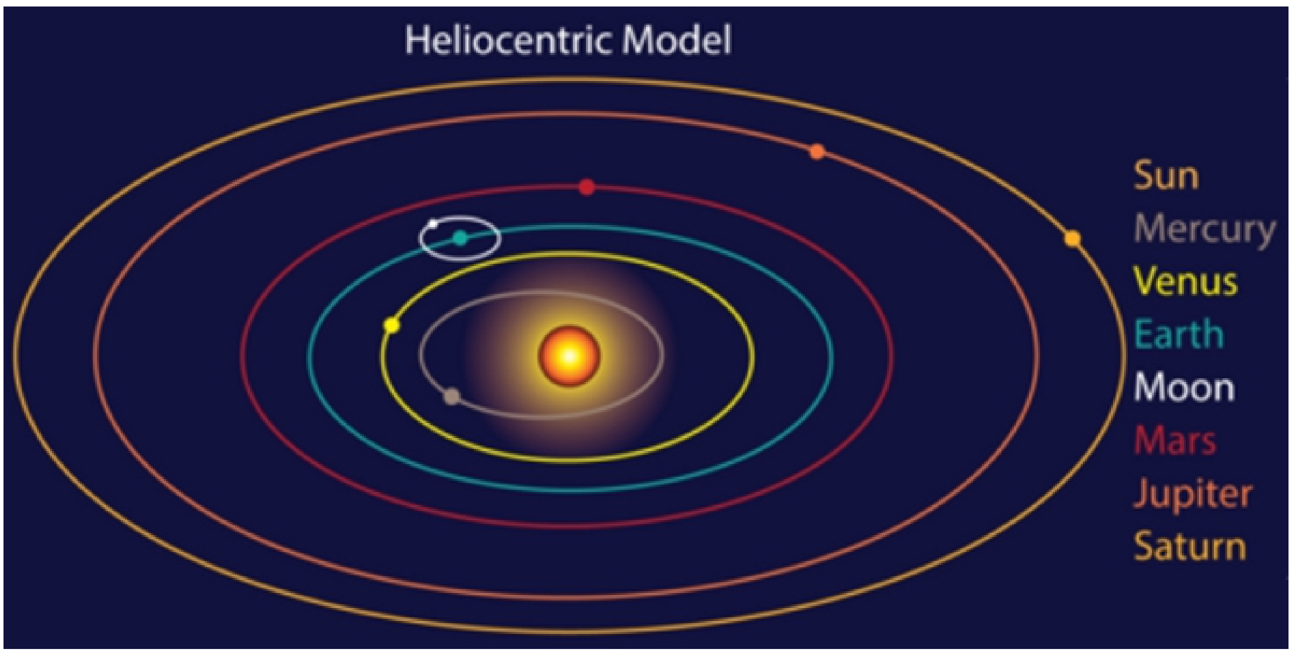
Indeed, if you had been questioning the Copernican model back in its heyday, you might have been called *"a person of the vulgar sort"*, since, according to Copernicans, you were questioning God's divine omnipotence!

> *Rather than give up their theory in the face of seemingly incontrovertible physical evidence, Copernicans were forced to appeal to divine omnipotence. 'These things that vulgar sorts see as absurd at first glance are not easily charged with absurdity, for in fact divine Sapience and Majesty are far greater than they understand,' wrote Copernican Christoph Rothmann in a letter to Tycho Brahe. 'Grant the vastness of the Universe and the sizes of the stars to be as great as you like—these will still bear no proportion to the infinite Creator. It reckons that the greater the king, so much greater and larger the palace befitting his majesty. So how great a palace do you reckon is fitting to GOD?'* [4]

It can hardly be denied that the Copernican model is marred by a number of problems and oddities which, objectively speaking, challenge the limits of our human senses and perceptions. In any event, there is nothing intuitive about the Copernican theory; it is safe to say that its widespread acceptance relies upon the authority accorded to the edicts of a few prominent luminaries who, about four centuries ago, established for all mankind the definitive configuration of our Solar System. Since then, a myriad of questions have been raised as to the validity of its foundational tenets—yet such criticism keeps being dismissed and condemned as nothing short of heretical by the scientific establishment. Indeed, the fundamental premises of the Copernican model have been subjected over the years to countless critiques and falsifications, all of which have been 'patched up' by assorted ad hoc adjustments.

The Copernican/Keplerian 'carousel': pretty—but impossible

Let us now remind ourselves of the Copernican model's simple geometric configuration, 'starring' the Sun as occupying the centre of a multi-lane 'carousel' of planets revolving around our star in concentric/elliptical orbits. Here it is, as presented to us since our school days:



The Copernican configuration.

The Copernican model undeniably appeals to our natural senses, what with its plain and orderly layout; there is a clear 'middle', and what's more: there is an object occupying the middle, which happens to be the brightest object in our skies: the Sun. The problem is that its geometric layout gravely conflicts with empirical observation—unless you are willing to reject the core principles of Euclidean space. To wit, it simply doesn't hold up to scrutiny as it implies impossible planet/star conjunctions and retrograde planetary periods. It cannot therefore possibly represent reality, as will be amply demonstrated in the following chapters. The Copernican model is outright non-physical since it violates the most elementary laws of geometry and perspective.

The current Copernican theory (which claims that the Sun needs some 240 million years to complete one orbit) clashes with the observable fact that the overwhelming majority of our visible stars appear to have small 'local' orbits of their own, with relatively short periods. For instance, Sirius A and B revolve around each other in about 50 (solar) years, the Alpha Centauri A and B binary pair do so in 79 years, while the Polaris A and B binary pair do the same in just 29.6 years. Other recently discovered binary systems exhibit even shorter 'mutual orbital periods' of only a few months, weeks, days, or hours. None of our visible stars are observed to have orbits in the range of hundreds of millions of years. Moreover, no star system has ever been observed to resemble the 'Copernican carousel' (as illustrated above), with a central, 'fixed' star surrounded by bodies revolving in neat, concentric circles.

I will venture to say that the TYCHOS model satisfies both sides of the age-old heliocentric vs. geo-heliocentric debate, since it proposes an ideal and 'unifying' solution that may appeal to both parties—if only they would agree to sit down for a rational discussion. In the TYCHOS, the Earth is neither static nor immobile; nor does it hurtle across space at hypersonic speeds. Nor is our planet located smack in the middle of the Universe *"by the will of God"*. Instead, it is simply located at (or near) the barycentre of our very own little binary system. All in all, the TYCHOS harmoniously combines elements from both of these competing cosmological models and even revives Plato's ideal concept of uniform circular motion:

> *In fact, for Plato, the most perfect motion would be uniform circular motion, motion in a circle at a constant rate of speed.* [5]

Yes, this book is a quite unorthodox scientific publication, much unlike those conventional academic papers we are all accustomed to. I make no apologies for it and can only hope it will be appreciated for its earnest attempt to attract a larger audience to the wondrous realm of astronomy, interest in which, sadly, appears to have reached an all-time low amongst the general public (for a number of reasons which would deserve a separate study). To ease explanations, I have done my best to illustrate the TYCHOS model's tenets visually, with the aid of colourful graphics and diagrams, much in the manner of a children's school book; I have also striven to use the simplest possible maths at all times to make the text accessible to the widest possible readership—including myself: I have always found complex equations exceedingly tedious, abstract and inadequate to describe our surrounding reality. Fortunately, the core principles of the TYCHOS model can be expressed and outlined with a bare minimum of computations—all in the good tradition of Tycho Brahe's philosophical outlook which the great astronomer succinctly summarized in this famous maxim:

> *So Mathematical Truth prefers simple words since the language of Truth is itself simple.*

The TYCHOS model is built upon the mostly unchallenged raw data collected over the ages by this planet's most dedicated and rigorous observational astronomers. Yet, it also integrates and highlights numerous recent studies and discoveries, many of which appear to have been 'swept under the rug' by our world's scientific establishment. Its tenets have been developed around a holistic and methodical reinterpretation of ancient, medieval and modern astronomical knowledge, combined with a few 'lucky strikes' of my own. I will kindly ask all freethinking people of integrity to carefully assess its core principles with an open mind, devoid of any prejudice or preconceptions. If you can overcome the first and most obvious thought hurdle (i.e., *"how could all our world's astronomers possibly be wrong?"*), I trust you'll enjoy the journey across the richly illustrated pages of this book which, after all, presents a fully working geometric configuration of our Solar System while resolving a great many puzzles of modern astronomy.

Simon Shack

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[3] *Regarding how Tycho Brahe noted the Absurdity of the Copernican Theory regarding the Bigness of Stars, while the Copernicans appealed to God to answer that Absurdity* by Christopher M. Graney (2011)
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1

A Brief History of Geo-heliocentrism

1.1 Introduction

Perhaps I should start by reminding all readers of the definitions of the three principal configurations of our Solar System proposed (and relentlessly debated) among astronomers throughout the centuries. I will do so in an extremely succinct and simplified fashion:

Geocentrism The idea that Earth is at the centre of our Solar System (or of the Universe) and that everything revolves around Earth, including the stars. This is the ancient and long-abandoned Ptolemaic/Aristotelian model. It has been effectively and definitively disproven due to a number of incongruities which came to light as more modern observational instruments became available to astronomers (Venus, for instance, was found to transit closer to Earth than Mercury).

Heliocentrism The idea that the Sun is at the centre of our Solar System and that all our planets (including Earth) revolve around the Sun. This is of course the current, widely accepted configuration (i.e., the Copernican/Keplerian model). It requires Earth to be moving at 90 times the speed of sound (107226 km/h), yet this is an assumption that to this day has never been successfully demonstrated, in spite of countless sophisticated experiments performed over the last few centuries. In this book, it will be further demonstrated that the geometric configuration of the Copernican model presents a number of insurmountable problems. As few people will know, the heliocentric model proposed by Copernicus struggled for several decades to attain recognition among the world's scientific community due to its many extraordinary and implausible implications. As we shall see, heliocentrism is, quite simply, an untenable theory.

Geo-heliocentrism The idea that the Earth is at the centre of our Solar System and that all planets except Earth revolve around the Sun. The most renowned geo-heliocentric model is that put forth in 1583 by Tycho Brahe, referred to as the Tychonic system. It is a little-known fact that this model remained the most widely accepted configuration of our Solar System for at least a century after Tycho Brahe's death in 1601. The subsequently refined yet lesser-known 'semi-Tychonic' system (which includes the daily rotation of Earth around its axis) was proposed by Brahe's trusty assistant Longomontanus in 1622. The latter is generally considered every bit as valid as heliocentrism under all observational respects and is the basis upon which my TYCHOS model is founded. It is still unclear why the semi-Tychonic system was so quickly discarded in favour of the Copernican model since the latter was by no means superior to Longomontanus' upgraded Tychonic system, as presented in *Astronomia Danica* (1622).

Fig. 1.1 **Left:** Tycho Brahe
Right: Christen Longomontanus

1.2 Early acceptance of the Tychonic model

In the mid-17th century, the Italian astronomer Giovanni Battista Riccioli was the most eminent supporter of the Tychonic system. In his main treatise, the 1500-page *Almagestum Novum* (New Almagest) [1], he confronted and assessed the pros and cons of the three above-mentioned models in a fair and objective manner, as most historians will acknowledge. The front cover artwork of his New Almagest suggests that Riccioli eventually found the Tychonic model to be 'weightier' than the Copernican model.

Interestingly, as one can read in the Wikipedia, Giovanni Riccioli is also widely known for having discovered the first double star in 1650 (about 50 years after Tycho Brahe's death). Today, however, the astronomy literature generally credits William Herschel with having definitively proven the existence of double stars around the year 1700. In any event, it is beyond dispute that no binary stars were known before the advent of the telescope; hence, in his time, Tycho Brahe was wholly unaware of their existence.

For most of his life, Tycho Brahe apparently believed that Earth was totally stationary, did not rotate around its axis, and that the stars all revolved around it in unison every 24 hours. One can only wonder how Brahe reconciled this belief with the individual proper motions of the stars (all stars move very slowly over time in all imaginable x-y-z directions) which he must have been aware of. Moreover, if the stars all revolved 'in unison' around us every 24 hours, their orbital velocities would be quite unthinkably high. Eventually however, as mentioned above, Brahe's assistant Longomontanus wisely allowed for Earth's daily rotation around its axis in what became known as the 'semi-Tychonic' system. The accuracy of Longomontanus' refined version of his master's geo-heliocentric model has not been surpassed to this day:

> *Longomontanus, Tycho's sole disciple, assumed the responsibility and fulfilled both tasks in his voluminous 'Astronomia Danica' (1622). Regarded as the testament of Tycho, the work was eagerly received in seventeenth-century astronomical literature. But unlike Tycho's, his geo-heliocentric model gave the Earth a daily rotation as in the models of Ursus and Roslin, and which is sometimes called the 'semi-Tychonic' system. [...] Some historians of science claim Kepler's 1627 'Rudolphine Tables' based on Tycho Brahe's observations were more accurate than any previous tables. But nobody has ever demonstrated they were more accurate than Longomontanus's 1622 'Danish Astronomy' tables, also based upon Tycho's observations.* [2]

However, Longomontanus' semi-Tychonic system still lacked an explanation for the slow alternation of our pole stars—or what is commonly known as 'the precession of the equinoxes'; it also proposed a motionless (albeit rotating) Earth, a notion that jars with the fact that all the visible celestial bodies in our skies exhibit some orbital motion of their own.

My proposed TYCHOS model is essentially a natural evolution of the semi-Tychonic system that further refines its unequalled consistency with empirical observation; it provides a long overdue reassessment and completion of the extraordinary work of Tycho Brahe and Longomontanus which, sadly and inexplicably, was discarded in favour of the Copernican theory, with its numerous problems and aberrations. As we shall see, these problems stem from the distinctly unphysical nature of its proposed heliocentric geometry. It is a little-known fact that the Copernican theory was rejected—and justly so—for several decades by the world's scientific community due to the many leaps of logic demanded by its core tenets. One of the most formidable mental efforts required to accept the novel Copernican theory was the extraordinary dimensions and distances of the stars in relation to our system, as illustrated in the following excerpt from *The Case Against Copernicus*:

> *Most scientists refused to accept Copernicus's theory for many decades—even after Galileo made his epochal observations with his telescope. Their objections were not only theological. Observational evidence supported a competing cosmology, the* "geo-heliocentrism" *of Tycho Brahe. The most devastating argument against the Copernican universe was the star size problem. Rather than give up their theory in the face of seemingly incontrovertible physical evidence, Copernicans were forced to appeal to divine omnipotence.* [3]

Another huge problem was, of course, the outrageous implication that our tranquil planet Earth was supposedly hurtling around space at the breakneck, hypersonic speed of 90 times the speed of sound!

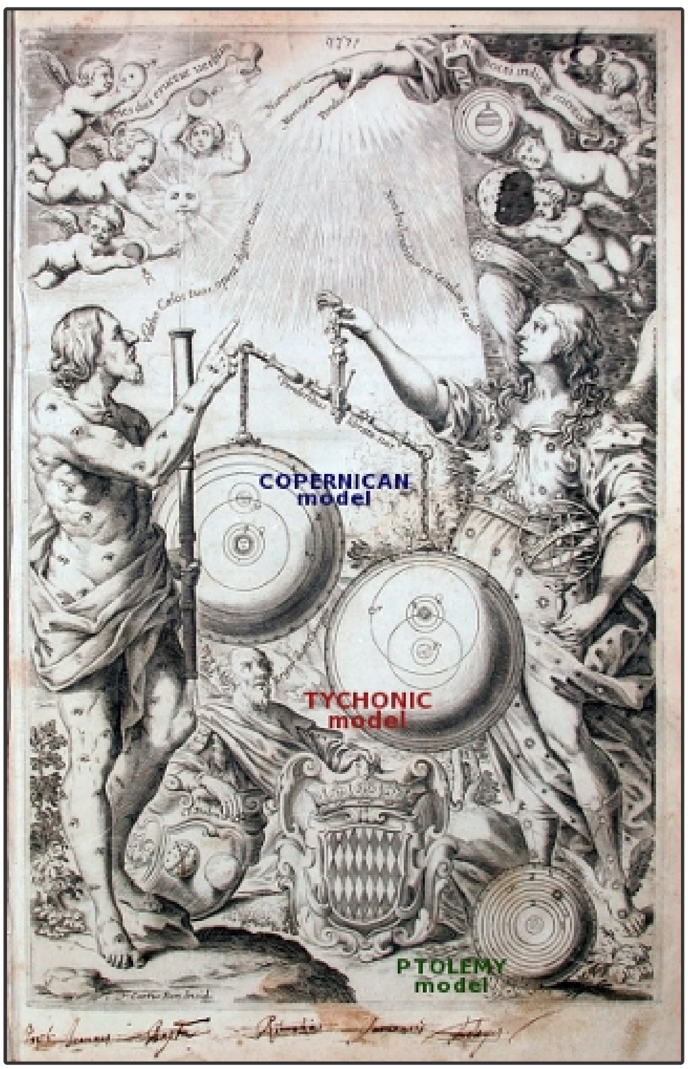


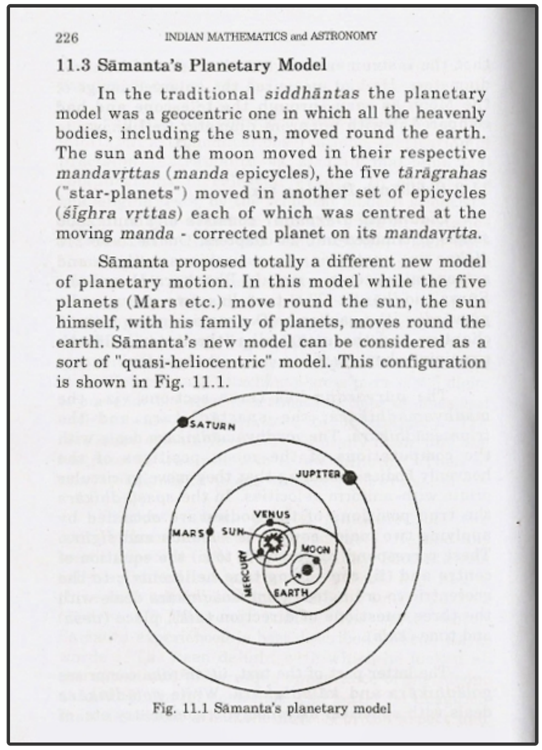
Fig. 1.2 The frontispiece to Riccioli's Almagestrum Novum tells his perspective on the state of astronomy in 1651. Urania, the winged muse of astronomy, holds up a scale with two competing models, a sun-centred Copernican model, and the Tychonic geo-heliocentric model. Under God's hand from the top of the image, the scale reports the Tychonic model to be heavier and thus the winner.

1.3 The geo-heliocentric models of Tycho Brahe and Pathani Samanta

Let us now compare the proposed geo-heliocentric models of arguably the two most proficient naked-eye observational astronomers of all times, Tycho Brahe and Pathani Samanta.Independently of each other, the two astronomers reached practically identical conclusions with regard to the geometric configuration of our Solar System.

To the right is a page scanned from a book titled *Indian Mathematics and Astronomy*. The book was graciously given to me by its author when I visited him in Bangalore, India, in April 2016: Prof. Balachandra Rao, a now retired professor of mathematics, astronomy historian and author of several captivating books on ancient Indian astronomy. The page features an illustration of the planetary model designed by Pathani Samanta, a man rightly heralded as India's greatest naked-eye astronomer.

As you can see, the models of these two outstanding celestial observers are virtually identical. I have highlighted in yellow and red the intersecting orbits of the Sun and Mars which are clearly consistent with what we would today call a binary pair.



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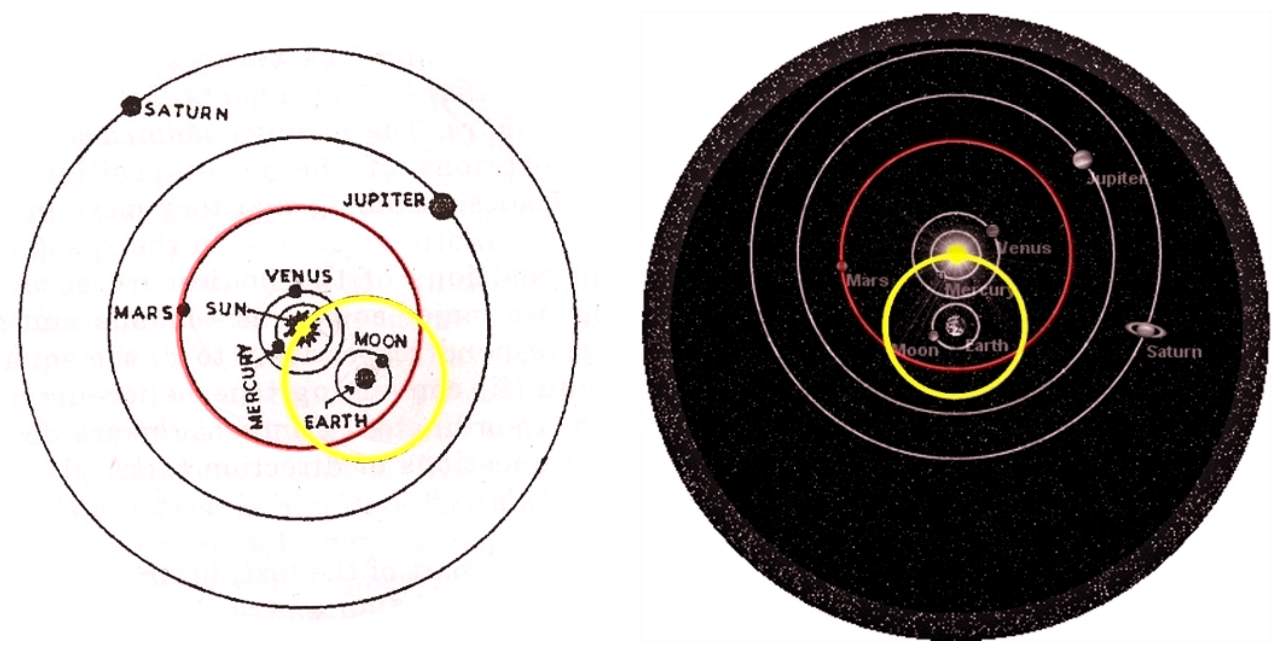
11.3 Sāmanta's Planetary Model

In the traditional *siddhāntas* the planetary model was a geocentric one in which all the heavenly bodies, including the sun, moved round the earth. The sun and the moon moved in their respective *mandavṛttas* (*manda* epicycles), the five *tārāgrahas* ("star-planets") moved in another set of epicycles (*śīghra vṛttas*) each of which was centred at the moving *manda* - corrected planet on its *mandavṛtta*.

Sāmanta proposed totally a different new model of planetary motion. In this model while the five planets (Mars etc.) move round the sun, the sun himself, with his family of planets, moves round the earth. Sāmanta's new model can be considered as a sort of "quasi-heliocentric" model. This configuration is shown in Fig. 11.1.

Fig. 11.1 Sāmanta's planetary model

Fig. 1.3 A page from the book *Indian Mathematics and Astronomy*.



(a) *(b)*

Fig. 1.4 The remarkably similar geo-heliocentric models of ***(a)*** Pathani Samanta and ***(b)*** Tycho Brahe.

Since Tycho predated Pathani by more than two centuries, one might suspect some plagiarism on the part of the latter. However, it seems to be well-documented that Pathani Samanta (who published a monumental work in Sanskrit, the *Sidhanta Darpana*) reached his conclusions through his very own observations and ingenuity, working in semi-seclusion and with little or no contact with the Western world for most of his lifetime. I thus find it most unlikely that Samanta simply plagiarized Brahe's work. Conversely, one could perhaps suspect Brahe of having 'snatched' some ideas from another illustrious Indian astronomer/mathematician, namely Nilakantha Somayaji (1444-1544). He predated Brahe by a century or so and was the first to devise a geo-heliocentric system in which all the planets (Mercury, Venus, Mars, Jupiter and Saturn) orbit the Sun, which in turn orbits the Earth. However, there can be no doubt about the primacy of Brahe's massive body of astronomical observations and their unprecedented accuracy. So, rather than pursuing this conjecture further, let us instead ask ourselves a more interesting and germane question raised by the above-illustrated identical models of Tycho Brahe and Pathani Samanta:

> *How and why did such diverse astronomers, after lifetimes of tireless observations, eventually reach such strikingly similar conclusions, particularly with regard to the intersecting orbits of the Sun and Mars?*

There is probably no easy answer to this question, and we can only marvel at the stunning similarity of their models—something that, to my knowledge, has never been mentioned or discussed in the astronomy literature to this day. In any case, I find it nothing short of shocking that the remarkable lifetime achievements of Pathani Samanta and Tycho Brahe are virtually unknown to the general public today.

Now, if we take a closer look at the illustrations of Brahe's and Samanta's models, there is something that intuitively appears to be missing: What geometric component of all the systems observed in our skies is absent from both of the above planetary models?

In my view, this is the major logical flaw in the above models: the Moon, Mercury, Venus, Mars, Jupiter, Saturn and the Sun all have circular orbital paths drawn in the model. Only one celestial body is, exceptionally, lacking an orbit: the Earth! Now, why would our planet not have an orbit and thus be motionless, unlike all the celestial bodies in the universe?

As I see it, the idea that the Earth—and Earth only—would remain completely immobile in space is a most unfortunate failure of imagination. Nonetheless, the highest praise and respect goes to these two prodigious astronomers of the pre-telescope era who provided us with the most significant clue of all: namely, that the Sun and Mars are, in fact, 'interlocked' in typical intersecting binary orbits, much like the vast majority, or quite possibly all, of the surrounding star systems.

Further on in this book, we shall see how the currently accepted heliocentric model presents a similar logical flaw, namely the notion that our Sun is the only star in our skies lacking a local orbit (i.e., a relatively small orbit) of its own. The formidable absurdity of such a claim should be clear to any thinking person. Indeed, the idea that our Sun is the single odd exception to the rule truly challenges plain common sense. Yes, the Sun is believed by mainstream astronomers to have an orbit of its own—not a local orbit, but an orbit around the galaxy. This presumed 'galactic' orbit is said to require some 240 million years to be completed!

In the TYCHOS model, of course, the Sun has a small, local orbit of its own which lasts for exactly one solar year. The Sun has a tiny binary companion which we all know by the name of 'Mars'. Every 2 years or so (more precisely 2.13 y), Mars and the Sun transit at diametrically opposite sides of the Earth: this is what we call 'the Mars oppositions', coinciding with Mars' closest passages to Earth. Yet, to this day, in spite of this peculiar behaviour of Mars (reminiscent of the regular close encounters observed in binary star systems), it seems never to have occurred to modern astronomers that we may live in a binary system. As I shall progressively expound and demonstrate in the following chapters, there is ample evidence that the Sun and Mars make up a binary pair. Along the way, my TYCHOS model will help elucidate and/or resolve a number of persistent cosmological conundrums and quandaries, the existence of which no earnest astronomers or cosmologists can deny.

A fundamental point that the TYCHOS model will demonstrate is that our Solar System is a most remarkably interconnected 'clockwork' or 'gearbox', the mechanism of which features our Moon as its 'central driveshaft' and extends all the way to the outer planets. Yet, modern astronomers have been suggesting that our outer planets are governed by chaos, most likely because they are unaware of the Earth's own, snail-paced orbital motion which, of course, will ever so slightly 'upset' their measurements of the secular motions of the more distant 'family members' of our Solar System. Since they are oblivious to the Earth's true motion in the opposite direction of the other components of the Solar System, they will invoke chaos or some other extravagant concept to explain away what they take for anomalies.

"The Solar System is Chaotic" (19 March 1999):

> *Although the stability of planetary motion helped Newton to establish the laws of classical mechanics, new research on the positions of the outer planets suggest they are governed by chaos.* [4]

We shall now proceed and take a look at binary star systems. Modern-day astronomers have known for decades that most stars have binary companions which are almost always invisible to the naked eye and very rarely detectable with amateur telescopes. However, despite the continual discovery of new binary systems, the general public remains largely unaware of their existence. One might ask whether those charged with 'the public understanding of science' have been doing their job properly.

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2

About Binary Star Systems

2.1 Is our Sun a single star?

If you were to tell a child that practically all the stars we can see in the sky with our naked eyes have a binary companion, the child's reply might be something like: *"So, if the stars are suns like our own Sun, just farther away, why doesn't the Sun also have a companion?"* Your best answer would probably be: *"That's what the astronomers say, honey, and they should know. They tell us the Sun is a single star."* It might occur to the child that our Sun must be the loneliest star in the universe. Incredulous, the inquiring child might then protest: *"It's not fair! If all the stars in the sky have a partner, then our Sun should have one too!"* You could then attempt to 'save face' by reminding the child that you didn't say *"all the stars"*, but *"practically all the stars"*.

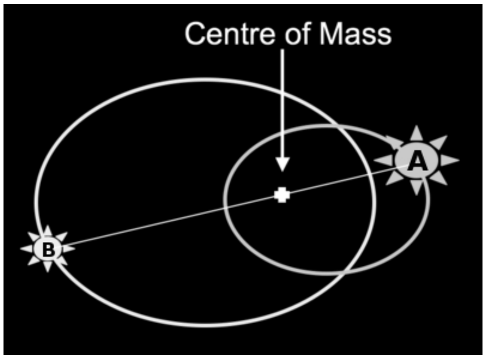


Fig. 2.1 Image source: The SAO Encyclopedia of Astronomy

Yet, it is a matter of historical record that for centuries the Copernicans rejected the very notion of binary stars:

> *In a Copernican view, the idea of stellar systems containing two or more associated stars seemed a priori excluded by heliocentrism; all stars in the universe are suns like our own, all being equal in size and resting at the centre of other possible star systems. Given these premises, there cannot be a system with more than one star.* [1]

Of course, this early Copernican axiom has since been categorically contradicted, as the vast majority of our visible stars have turned out to be double (or multiple) systems in which, more often than not, two central 'stars' revolve around a common barycentre. Wikipedia's entry on double stars lists three main categories of double stars:

Visual binaries Two or more gravitationally bound stars that are separately visible with a telescope.

Non-visual binaries Stars whose binary configuration was deduced by indirect means, such as occultation (eclipsing binaries), spectroscopy (spectroscopic binaries), or anomalies in proper motion (astrometric binaries).

Optical doubles Unrelated stars that only appear close together through chance alignment with Earth.

Note that the third category above—unrelated stars which happen to be aligned along our earthly line of sight—is of no concern to us here.

What we shall see is that, when considering the most recent discoveries of observational astronomy, a reasonable case could certainly be made that 100% of the stars in our skies are, in fact, binary (or multiple) star systems. If this is so, all the apparently single points in the firmament that we think of as individual stars have a smaller companion, almost always undetectable to the naked eye. The two stars in the system revolve around each other in intersecting orbits, and also around a common barycentre (or 'centre of mass', for lack of a better word), completing a revolution in variable time periods, ranging from a few hours, days, weeks, months or—more rarely—a few dozen years.

Examples of binary star periods

Here are a few examples of binary star periods:

- The binary system MIZAR A (composed of Mizar Aa & Mizar Ab) circle each other in about 20.5 days.
- The binary system MIZAR B (composed of Mizar Ba & Mizar Bb) circle each other in about 6 months.
- The binary system Polaris (composed of Polaris Aa & Polaris Ab) circle each other in circa 29.6 years.
- The binary system Alpha Centauri (composed of A. Centauri A & A. Centauri B) circle each other in circa 79.7 years.

Amazingly, some binary systems have recently been observed to revolve around each other in only a few minutes:

> *After a decade of mystery, astronomers have now shown that a pair of white dwarf stars spin around each other in just 5.4 minutes, making them the fastest-orbiting and tightest binary star system ever found, the researchers claim.*

Our Sun, in stark contrast, is currently believed to complete one orbit in about 240 million years! In other words, Copernican astronomers are asking us to believe that the Sun has no 'local orbit' (as I shall call it), unlike practically all other stars. This would of course imply that our Sun is potentially an exception to the rule and a quite formidable cosmic and statistical curiosity. To be sure, what we know today is that the vast majority of our visible stars are, in fact, part of binary/multiple systems. Unfortunately, a number of modern astronomy textbooks still state that no more than 50% of the stars are binary systems, neglecting to report the mounting evidence that over 90% of the known stars have companions.

> *In fact, the majority of stars happens to be part of a binary or multiple system, and consequently binary star research covers most areas of stellar astronomy.* [2]

It is important to point out that Tycho Brahe was unaware of the existence of binary systems. The first binary system (Mizar A and B) was discovered in 1650 by Giovanni Riccioli, half a century after Brahe's death, and only following the invention of the telescope. However, it wasn't until more than a century later that William Herschel formally announced his discovery of what he described as 'binary sidereal systems':

> *In 1797, Herschel measured many of the systems again, and discovered changes in their relative positions that could not be attributed to the parallax caused by the Earth's orbit. He waited until 1802 to announce the hypothesis that the two stars might be "binary sidereal systems" orbiting under mutual gravitational attraction, a hypothesis he confirmed in 1803 in his Account of the Changes that have happened, during the last Twenty-five Years, in the relative Situation of Double-stars; with an Investigation of the Cause to which they are owing. In all, Herschel discovered over 800 confirmed double or multiple star systems, almost all of them physical rather than optical pairs. His theoretical and observational work provided the foundation for modern binary star astronomy.* [3]

Fig. 2.2 is a chart of Herschel's 805 certified double star systems. One can only wonder why Herschel's paradigm-shifting discoveries didn't trigger a revolution within the field of astronomy and why no one to this day has seriously reconsidered the Tychonic model, with its intersecting orbits of the Sun and Mars clearly suggestive of a binary configuration.

In any event, one cannot blame Brahe for failing to notice and identify, within his own Tychonic model, the obvious binary nature of the orbital interactions of Mars and the Sun: in his time, no binary star systems had yet been discovered. He was thus unable—understandably so—to reach the logical conclusion that the Sun and Mars must make up a binary system, like the vast majority (or perhaps all) of the stars in our skies.

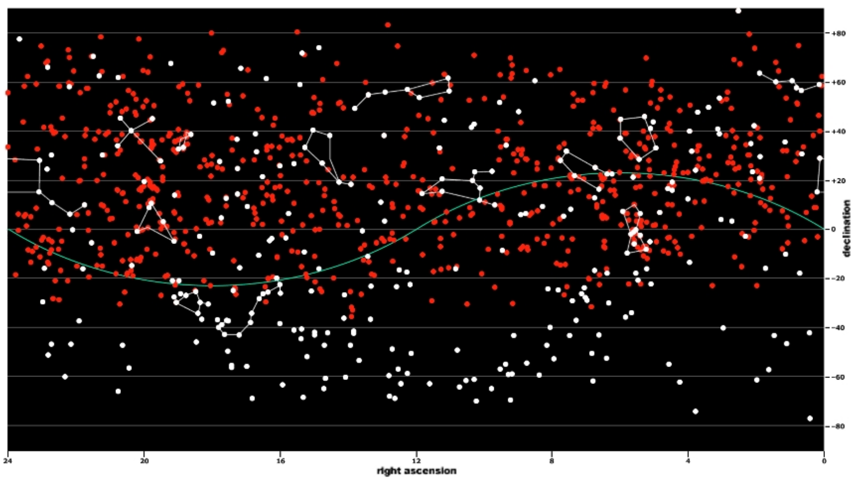


Fig. 2.2 Image source: William Herschel's double star discoveries.

It was precisely this 'bizarre' feature of Brahe's proposed model (the intersecting orbits of Mars and the Sun) that triggered the scoffing and derision of his peers: *"Sooner or later, the Sun and Mars must smash into each other"*, they jeered. This is a good example of how the regrettable group-think mentality pervading the so-called scientific community responds to new ideas that challenge long-held beliefs. I would strongly recommend reading Howard Margolis' impeccable demonstration that the perception that the Sun and Mars would necessarily collide in a system like the Tychonic was never more than a mere illusion—albeit one that befuddled the entire scientific community. It makes for an exemplary case study of how even the sharpest human minds can be fooled for centuries on end by relatively simple tricks of geometry. [4]

Fig. 2.3 depicts a classic binary star scheme taken from the website of the University of Oregon. The site tells us that the vast majority of the stars in the Milky Way are binary systems.

Today, the numbers of known binary star systems are in the range of several hundreds of thousands, as we can read in this Russian academic paper by Malkov, Karchevsky, Kaygorodov, Kovaleva and Skvortsov (October 2018):

> *Binary Star Database (BDB): New Developments and Applications. The Identification List of Binaries (ILB) is a star catalogue constructed to facilitate cross-referencing between different catalogues of binary stars. [...] ILB currently contains about 520,000 entries: 120,000 systems, 140,000 pairs and 260,000 components.* [5]

> *In fact, 85% of the stars in the Milky Way galaxy are not single stars, like the Sun, but multiple star systems, binaries or triplets.*

Clearly, binary systems are anything but rare, as believed only a century ago. For instance, we know today that the 20 stars closest to Earth are, in all probability, 'locked' in binary systems. Now, a most significant aspect to consider is that many of those 20 stars were discovered to be binary/multiple systems as recently as this last half-decade (2015-2020), showing how difficult it can be to detect stellar companions, let alone determine what sort of orbital relationship they have with their host star. This naturally raises the question: How many other distant stars held to be single stars are, in reality, double stars?

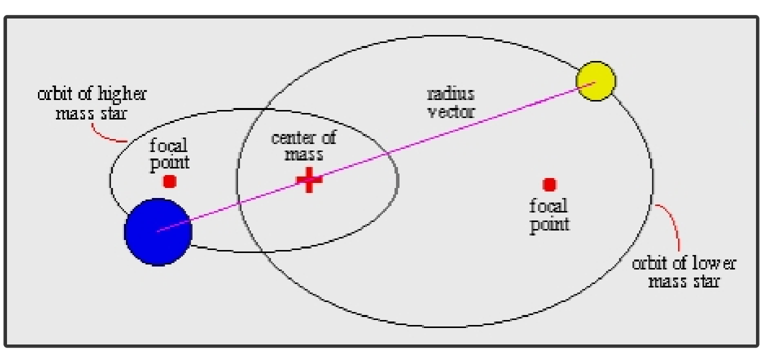


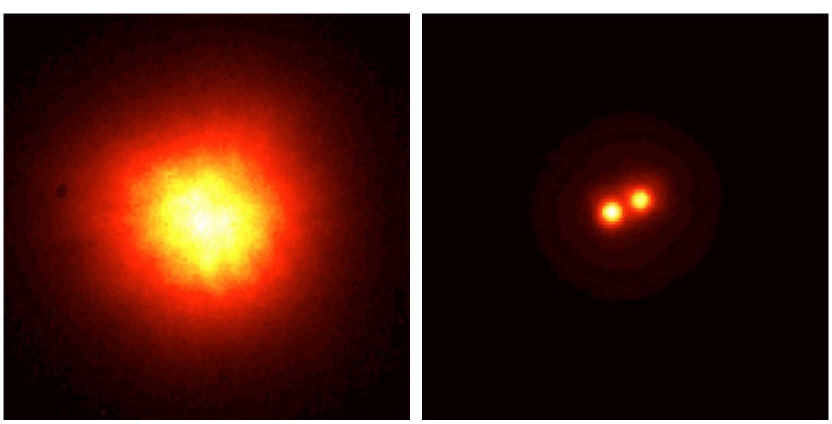
Fig. 2.3 A schematic of a basic binary star system. Image source: University of Oregon

Our 20 nearmost stars and their confirmed or suspected companions

Wikipedia has a list of our 20 nearmost stars and their confirmed or suspected companions [6]:

1. Proxima Centauri A / P. Centauri B / P. Centauri C (companions B & C discovered in 2016 and 2020)
2. Alpha Centauri A / Alpha Centauri B (companion B discovered long ago)
3. Barnard's Star A / Barnard's star B (companion B discovered in 2018)
4. Luhman A / Luhman B (companion B discovered long ago)
5. WISE 0855-0714 A / WISE 0855-0714 B (companion B discovered in 2018)
6. Wolf 359 A / Wolf 359 B / Wolf 359 C (companions B & C discovered in 2019)
7. Lalande 21185 A / Lalande 21185 B (companion B discovered in 2017)
8. Sirius A / Sirius B (companion B discovered long ago)
9. Luyten 726-8 A / Luyten 726-8 B (companion B discovered long ago)
10. Ross 154 ('flare star' in the Wikipedia) (flare stars are suspected of being double stars)
11. Ross 248 ('flare star' in the Wikipedia) (flare stars are suspected of being double stars)
12. Epsilon Eridani A / Epsilon Eridani B (companion B discovered long ago)
13. Lacaille 935 (said in the Wikipedia to have 3 known planets)
14. Ross 128 A / Ross 128 B (companion B discovered in 2017)
15. EZ Aquarii A / EZ Aquarii B / EZ Aquarii C (companions B & C discovered long ago)
16. 61 Cygni A / 61 Cygni B (companion B discovered long ago)
17. Procyon A / Procyon B (companion B discovered long ago)
18. Struve A / Struve B (two more companions discovered in 2019)
19. Groombridge A / Groombridge B (companion B discovered long ago)
20. DX Cancri ('flare star' in the Wikipedia) (flare stars are suspected of being double stars)

As a matter of fact, the percentage of stars observed (or determined by spectrometry) to be locked in binary systems has been rapidly increasing in later years thanks to advanced spectrometers and so-called adaptive optics (based on the Shack-Hartmann principle). The latter technological advancement has spectacularly improved the ability to detect and reveal double stars formerly believed to be single stars. Of course, the difficulty resides in the fact that double stars are always relatively close to each other and/or that the 'junior' companion can sometimes be extremely small (such as the tiny Sirius B, which is only about 0.5% the size of Sirius A). The two images in Fig. 2.4, illustrate how, in May 2013, the star HIC 59206 (previously thought to be singular) was revealed to be yet another binary system thanks to the use of adaptive optics technology (in this case, the two companion stars are fairly similar in size):



(a) *(b)*

Fig. 2.4 ESO imagery of a binary star system (HIC 59206) imaged ***(a)*** without and ***(b)*** with adaptive optics correction. Note the distinct binary appearance with adaptive optics.

Credit: European Southern Observatory, May 13, 2003.

To wit, if it eventually emerges that 100% of the stars in our skies are binary/multiple systems, the current Copernican heliocentric theory, which holds that our Sun is a companionless star, will have to be definitively abandoned, beyond appeal, for being a most improbable exception to the rule or, if you will, a one-of-a-kind cosmic anomaly, unless one accepts the truly astronomical odds of our own star (the Sun) being the one-and-only 'bachelor' in the entire universe—a most irrational and exceptionalistic notion, if there ever was one! In any case, the situation we have today is that virtually all of our nearmost stars are observed to have a binary companion, and more are continually being discovered, with no end in sight.

In the 1980s, one of the world's top experts in binary star systems, Wulff Heintz, announced at the end of his illustrious career that at least 85% of all the stars in our skies must be binary systems, leaving us to wonder whether the remaining 15% are really 'bachelor' stars (as our Sun is believed to be). Now, this announcement was made about 40 years ago; since then, thanks to technological advancements (e.g., adaptive optics, as mentioned above), we have seen an incessant flow of new reports of companions revolving around larger host stars that were formerly believed to be single stars. In later years, we have heard on the news, almost on a weekly basis, about the discovery of so-called 'exoplanets'. Rarely though, if at all, is it suggested that some of these 'exoplanets' might be formerly unregistered companions of larger stars, possibly because of the growing 'academic fear' that all stars, without exception, may turn out to be binary/multiple systems. The scientific establishment is obviously keen to avoid such a conclusion: there could be no more horrifying prospect for 'mainstream' astronomers (for lack of a better term) than having to admit that stars are by definition binary/multiple systems, as this would spell the end of heliocentrism.

Critics of the TYCHOS model have objected that it *"violates Newton's laws"* and, ironically, that it is *"stuck in the past, rehashing obsolete ideas"*, though much of its argumentation is based on modern observations and advances in astronomy. Sir Isaac Newton died in 1726, several decades before Herschel's formal identification of 'binary sidereal systems' in 1797, so he never had a fair chance to study them. Moreover, Newton's laws have been seriously challenged by numerous physicists over the last three centuries, and many paradigm-shifting astronomical discoveries have been made, even in the 21st century. So, rather than continue appealing to 'Newtonian authority', I suggest readers leave Newton's sacrosanct laws at the door for now and allow themselves to take an unprejudiced look at the undeniable evidence of our telescopes and the plain facts of geometry.

Having said that, I am sure Sir Isaac was an exceptionally gifted scientist. But keep in mind that none of his studies addressed the physics or celestial mechanics of binary star systems for the simple reason that little or nothing was known about them in his time. As for that other science icon, Albert Einstein, here's what Tom Van Flandern had to say about his theories as applied to binary stars:

> *If the general relativity method is correct, it ought to apply everywhere, not just in the solar system. But Van Flandern points to a conflict outside it: binary stars with highly unequal masses. Their orbits behave in ways that the Einstein formula did not predict. 'Physicists know about it and shrug their shoulders,' Van Flandern says. They say there must be 'something peculiar about these stars, such as an oblateness, or tidal effects.' Another possibility is that Einstein saw to it that he got the result needed to 'explain' Mercury's orbit, but that it doesn't apply elsewhere.* [7]

In other words, Einstein's famed formulae fail to predict the orbital motions of binary stars. Now, that is a rather serious problem, for if it eventually turns out that our universe is exclusively populated by binary star systems, it is back to the drawing board for the heliocentrists and for the devotees of the general theory of relativity.

2.2 About variable stars and flare stars

At the start of the 20th century, astronomers were debating whether so-called 'variable stars' (stars which change in brightness over regular time periods) were, quite simply, nothing but binary systems where the companion star periodically transited in front of its brighter binary partner, thus temporarily reducing its brightness. However, astronomers are still classifying many stars (those not yet officially recognized as binary stars) as 'variable stars' or 'flare stars'. So what exactly are variable stars? This is what Wikipedia can tell us about them:

A variable star is a star whose brightness as seen from Earth (its apparent magnitude) fluctuates. This variation may be caused by a change in emitted light or by something partly blocking the light, so variable stars are classified as either:

- *Intrinsic variables, whose luminosity actually changes; for example, because the star periodically swells and shrinks.*

- *Extrinsic variables, whose apparent changes in brightness are due to changes in the amount of their light that can reach Earth; for example, because the star has an orbiting companion that sometimes eclipses it. Many, possibly most, stars have at least some variation in luminosity.*

I think we can all agree that the hypothesis of *"stars that periodically swell and shrink"* is rather outlandish. But let us move on:

A flare star is a variable star that becomes very much brighter unpredictably for a few minutes at a time. Most flare stars are dim red dwarfs, although less massive (lighter) brown dwarfs might also be able to flare. The more massive (heavier) RS Canum Venaticorum variables (RS CVn) are also known to flare, but scientists understand that a companion star in a binary system causes these flares.

Thus, in both cases (variable and flare stars) we see that the least speculative explanation is that these stars are, quite simply, binary star systems whose brightness periodically dips as one companion obscures the other. There is no need to classify them as anything else but binary stars.

Here are some relevant extracts from the book *Astronomy of To-day*, by Cecil G. Dolmage:

It was at one time considered that a variable star was in all probability a body, a portion of whose surface had been relatively darkened in some manner akin to that in which sun spots mar the face of the sun; and that when its axial rotation brought the less illuminated portions in turn towards us, we witnessed a consequent diminution in the star's general brightness. [...] The scale on which it varies in brightness is very great, for it changes from the second to the ninth magnitude. For the other leading type of variable star, Algol, of which mention has already been made, is the best instance. The shortness of the period in which the changes of brightness in such stars go their round, is the chief characteristic of this latter class. The period of Algol is a little under three days. This star when at its brightest is of about the second magnitude, and when least bright is reduced to below the third magnitude; from which it follows that its light, when at the minimum, is only about one-third of what it is when at the maximum.

It seems definitely proved by means of the spectroscope that variables of this kind are merely binary stars, too close to be separated by the telescope, which, as a consequence of their orbits chancing to be edgewise towards us, eclipse each other in turn time after time." [...] Since the companion of Algol is often spoken of as a dark body, it were well here to point out that we have no evidence at all that it is entirely devoid of light. We have already found, in dealing with spectroscopic binaries, that when one of the component stars is below a certain magnitude its spectrum will not be seen; so one is left in the glorious uncertainty as to whether the body in question is absolutely dark, or darkish, or faint, or indeed only just out of range of the spectroscope.

Indeed, it is a little-known fact among laymen that many celestial bodies identified as 'stars' do not shine with their own light. For instance, most red dwarfs (by far the most common star type in the universe) are so faint and dim as to remain undetectable by even our largest modern telescopes. In the TYCHOS, of course, this would be the case of Mars (the Sun's proposed binary companion) which exhibits the characteristic orange hue associated with red dwarfs (the rather bright shine of Mars is due to solar light reflection). Now, Mars is only about 0.5% the size of the Sun, and Sirius B (the tiny companion of the brightest star in our skies, Sirius A) also happens to be about 0.5% the size of its far larger partner. In fact, Alvan Clark's discovery in 1862 of the midget Sirius B caused a stir among the 19th century scientific community, since it was totally unexpected under Newton's gravitational theories that a tiny body like Sirius B—reckoned to be slightly smaller than Earth—could possibly be gravitationally bound to such a huge body as Sirius A.

Incredibly enough, the pesky riddle was eventually 'resolved' (explained away) by astrophysicists, claiming, in the absence of any conceivable experimental verification and in what must be one of the most flagrant ad hoc postulations in the history of science, that the mass/density/gravitational attraction (call it what you will) of the tiny Sirius B must be about 400000 times larger than that of Earth. In other words, we are asked to believe that Sirius B's atoms are somehow 'packed' 400 thousand times tighter than our earthly atoms. Ironically though, one of Sir Isaac's most hallowed precepts is that the laws of physics are unvarying and homogeneous across the universe.

2.3 Most recent discoveries of stellar companions

As recently as 2016, it was announced that a companion of our nearmost star, Proxima Centauri, had been discovered: it is now known as 'Proxima b' and it apparently revolves around Proxima A in just 11.2 days. Then, in January 2020, yet another companion to our closest star was announced, 'Proxima c', estimated to revolve around Proxima A in 5.28 years. Additionally, a faint signal with a period of only 5.15 days was detected during a 2019 exoplanet search using radial velocity data. If a planet is confirmed to be the cause of this signal, it would be designated as 'Proxima d'. Again, these quite recent discoveries go to show just how difficult it is, even for our most advanced 21st century instruments, to detect the companion of any given binary system, even when the star is as close as Proxima Centauri. Now, it should be noted that the Proxima 'family' (a, b, c, and possibly d) are themselves reckoned to be slowly revolving around the binary pair Alpha Centauri A and B, the two Centauri star 'families' thus constituting a so-called 'double-double' system (more about this later).

The trend expressed by these recent discoveries seems to support the idea that all stars have binary companions. It is therefore reasonable to conjecture that, sometime in the future, thanks to improved techniques and instruments, all the stars now believed to be companionless will turn out to be binary systems. To be sure, much observational work remains to be done in this particular field of astronomy:

> *Most known double stars have not been studied adequately to determine whether they are optical doubles or doubles physically bound through gravitation into a multiple star system.* [8]

As recently as 2018, it was announced that a companion of our second-nearmost star (or star system), namely Barnard's star, had been confirmed. As it happens, the existence of Barnard's companion was the object of a bitter and long-lasting controversy (which every astronomy historian will remember) between Peter Van de Kamp and Wulff Heintz. The former was convinced he had proven the existence of two companions (which he named B1 and B2) of Barnard's star, but Heintz would have none of it. For decades, vigorous efforts were deployed to discredit Van de Kamp's discovery, including laughable claims that it was just an artefact caused by the improper cleaning of his telescope lenses. Yet, as we shall see, Van de Kamp's observational work was finally vindicated, posthumously, in 2018 (even though yet another study released in July 2021 again disputes his findings; astronomy, it seems, is a permanent 'battleground').

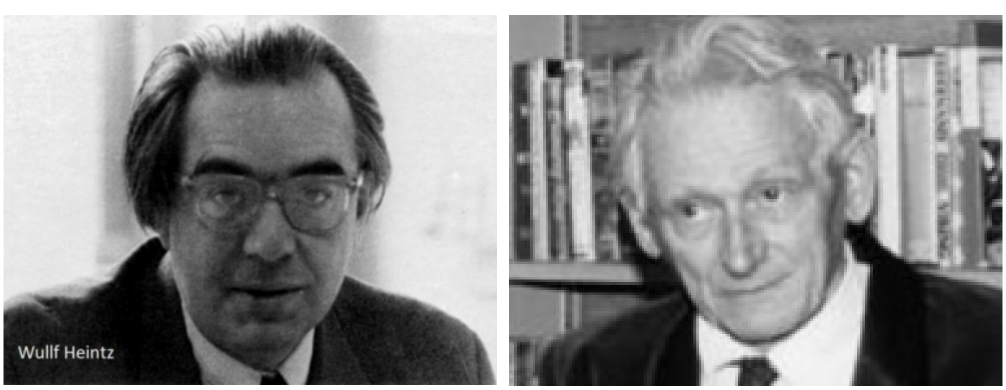


Fig. 2.5
Left: Wulff Heintz
Right: Peter Van de Kamp

For those who are interested, a detailed account of Van de Kamp's discovery of Barnard's star companions is available in a 1969 Time magazine article. The epic feud between the two eminent astronomers and binary star experts, Heintz and Van de Kamp, truly deserves to be revisited. Below is an extract from the Wikipedia which briefly summarizes their protracted dispute. Warning: all Wikipedia entries involving historical controversies should be taken with a large grain of salt. As the old saying goes, one must read between the lines:

> *The Barnard's Star affair. In the spring of 1937, Van de Kamp left McCormick Observatory to take over as director of Swarthmore College's Sproul Observatory. There he made astrometric measurements of Barnard's Star and in the 1960s reported a periodic "wobble" in its motion, apparently due to planetary companions. Astronomer John L. Hershey found that this anomaly apparently occurred after each time the objective lens was removed, cleaned, and replaced. Hundreds more stars showed "wobbles" like Barnard's Star's when photographs before and after cleaning were compared - a virtual impossibility. Wulff Heintz, Van de Kamp's successor at Swarthmore and an expert on double stars, questioned his findings and began publishing criticisms from 1976 onwards; the two are reported to have become estranged because of this. Van de Kamp never admitted that his claim was in error and continued to publish papers about a planetary system around Barnard's Star into the 1980s, while modern radial velocity curves place a limit on the planets much smaller than claimed by Van de Kamp. Recent evidence suggests that there is, indeed, a planet orbiting Barnard's Star, albeit of much lower mass than Van de Kamp could have detected.* [9]

Indeed, it now turns out that Heintz was wrong and that Van de Kamp had been right all along. In November 2018, ESO (the ground-based European Southern Observatory) finally announced that Barnard's star indeed has a companion:

> *Super-Earth Orbiting Barnard's Star Red Dots campaign uncovers compelling evidence of exoplanet around closest single star to Sun. A planet has been detected orbiting Barnard's Star, a mere 6 light-years away. This breakthrough - announced in a paper published today in the journal Nature - is a result of the Red Dots and CARMENES projects, whose search for local rocky planets has already uncovered a new world orbiting our nearest neighbour, Proxima Centauri. The planet, designated Barnard's Star b, now steps in as the second-closest known exoplanet to Earth. The gathered data indicate that the planet could be a super-Earth, having a mass at least 3.2 times that of the Earth, which orbits its host star in roughly 233 days. Barnard's Star, the planet's host star, is a red dwarf, a cool, low-mass star, which only dimly illuminates this newly-discovered world.* [10]

It is interesting to note that both ESA (in 2007) and NASA (in 2010) decided to discontinue their efforts to search for Barnard's companion after having failed to detect it and, apparently, due to *"lack of funding"*. Here's what we may read on Wikipedia about these curious circumstances:

> *Null results for planetary companions continued throughout the 1980s and 1990s, including interferometric work with the Hubble Space Telescope in 1999. Gatewood was able to show in 1995 that planets with 10 MJ were impossible around Barnard's Star in a paper which helped refine the negative certainty regarding planetary objects in general. In 1999, the Hubble work further excluded planetary companions of 0.8 MJ with an orbital period of less than 1,000 days (Jupiter's orbital period is 4,332 days), while Kuerster determined in 2003 that within the habitable zone around Barnard's Star, planets are not possible with an "M sin i" value greater than 7.5 times the mass of the Earth ($M_\oplus$), or with a mass greater than 3.1 times the mass of Neptune (much lower than van de Kamp's smallest suggested value). [...] Even though this research greatly restricted the possible properties of planets around Barnard's Star, it did not rule them out completely as terrestrial planets were always going to be difficult to detect. NASA's Space Interferometry Mission, which was to begin searching for extrasolar Earth-like planets, was reported to have chosen Barnard's Star as an early search target. This NASA mission was shut down in 2010. ESA's similar Darwin interferometry mission had the same goal, but was stripped of funding in 2007.* [11]

So there you have it: both NASA's and ESA's efforts to search for the Barnard's star companion(s) apparently failed and were shut down. One may legitimately wonder why. *"Lack of funding"* is not an entirely convincing explanation. Whatever their motivation is, one fact remains of which there can be little doubt: Van de Kamp's solitary endeavours succeeded where NASA's efforts had failed, in spite of their much touted, multimillion-dollar 'space telescopes' and immensely superior resources.

2.4 Additional links to literature on binary systems

Here's a selection of quotes about binary stars from various astronomy sources:

> *There are many common misconceptions about binary star systems, one of the most common myths is that binary star systems are the cosmic oddity and that single star systems are the most prevalent, when, in fact, the opposite is true. 50 years ago binary stars were considered a rarity. Now, most of the stars in our galaxy are known to be paired with a companion or multiple partners.* [12]

> *Binary stars are two stars orbiting a common center of mass. More than four-fifths (80%) of the single points of light we observe in the night sky are actually two or more stars orbiting together. The most common of the multiple star systems are binary stars, systems of only two stars together. These pairs come in an array of configurations that help scientists to classify stars, and could have impacts on the development of life. Some people even think that the sun is part of a binary system.* [13]

> *Binary stars are of immense importance to astronomers as they allow the masses of stars to be determined. A binary system is simply one in which two stars orbit around a common centre of mass, that is they are gravitationally bound to each other. Actually most stars are in binary systems. Perhaps up to 85% of stars are in binary systems with some in triple or even higher-multiple systems.* [14]

The idea that the Sun is part of a binary system is not a new concept. Headed by Walter Cruttenden, the Binary Research Institute has been looking into this hypothesis for many years. Unfortunately, their reasoning process is stuck in the Copernican heliocentric paradigm; thus, their ongoing search for the Sun's elusive binary companion has never considered Mars as a possible candidate. Their current, favoured candidate for a binary companion of the Sun appears to be Sirius. However, Sirius is itself a binary system (Sirius A and B revolve around their common barycentre every 50.1 years). Nonetheless, Cruttenden and co-workers have done a sterling job demonstrating, in strictly methodical fashion, the untenability of the so-called lunisolar theory: Earth's purported 'wobble' around its own axis (more on this in Chapter 10).

> *A recent study of the phenomenon known as "Precession of the Equinox" has led researchers to question the extent of lunisolar causation and to propose an alternative solar system model that better fits observed data, and solves a number of current solar system anomalies.* [15]

Fig. 2.6 shows a variety of complex patterns published in a fairly recent study (Perryman and Schulze-Hartung - 2010) concerned with the barycentric motions of stars. In the TYCHOS (as we shall see further on), the spirographic orbital paths of our planets bear some resemblance to the complex yet beautiful patterns some modern astronomers are observing in what they call *"the barycentric motion of exoplanet host stars"*.

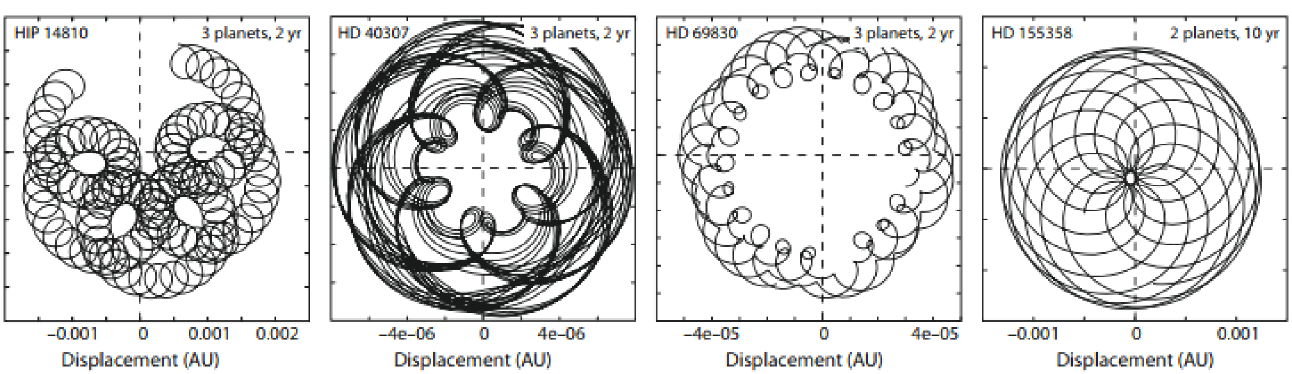


Fig. 2.6 Page 6 of *The Barycentric Motion of Exoplanet Host Stars*, by M. A. C. Perryman and T. Schulze-Hartung (2010)

Only a century ago, astronomers believed that binary star systems were in the minority, mostly because red dwarfs (which make up 70% of all stars) had never been observed to have companions. In recent years, however, pairs of red dwarfs have been discovered to revolve around each other at very close distance, some in less than one Earth-day. This clearly constitutes a 'game changer' in the field of stellar statistics which may ultimately rule out the existence of single, companionless stars. In any event, it certainly lends support to the notion that all stars—without exception—are locked in binary systems.

Cool red dwarfs are the most common sort of star in our Milky Way galaxy. But astronomers said yesterday (January 10, 2022) that they've discovered what they called the tightest ultracool dwarf binary system ever observed. The two stars in this system both are extremely low in mass. And they're so cool they emit their light mostly in the infrared–what we'd perceive as heat–and so are completely invisible to the human eye. What's more, the stars are close together. They take less than an Earth-day to complete a single orbit around one another [16].

In light of the facts and considerations expounded in this chapter, the notion of the Sun and Mars being a binary pair should emerge (not least from a probabilistic perspective) as a perfectly sound and logical proposition. The child's question posed at the beginning of this chapter is worthy of serious consideration: *"If the stars are suns like our own Sun, just farther away, why doesn't the Sun also have a companion?"*

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3

About Our Sun-Mars Binary System

3.1 The Sun, Mars and the Earth, and their moons

The first objection people make to the idea that Mars is the Sun's binary companion is usually something like: *"Nonsense! Mars is a planet, not a star!"* Yes, today's astronomers do indeed refer to Mars as a 'planet', even though, as we shall see, Kepler himself called Mars a 'star' (*Stellae Martis*, in Latin). In any case, the distinction between a planet and a star is not as clear-cut as it may seem. Many 'stars' don't even appear to shine with their own light: for instance, countless red and brown dwarfs are so dim that they remain completely invisible even to our largest telescopes. In fact, red dwarfs are the most common 'stars' in our skies:

> *Red dwarfs are by far the most common type of star in the Milky Way, at least in the neighbourhood of the Sun, but because of their low luminosity, individual red dwarfs cannot be easily observed. From Earth, not one star that fits the stricter definitions of a red dwarf is visible to the naked eye.* [1]

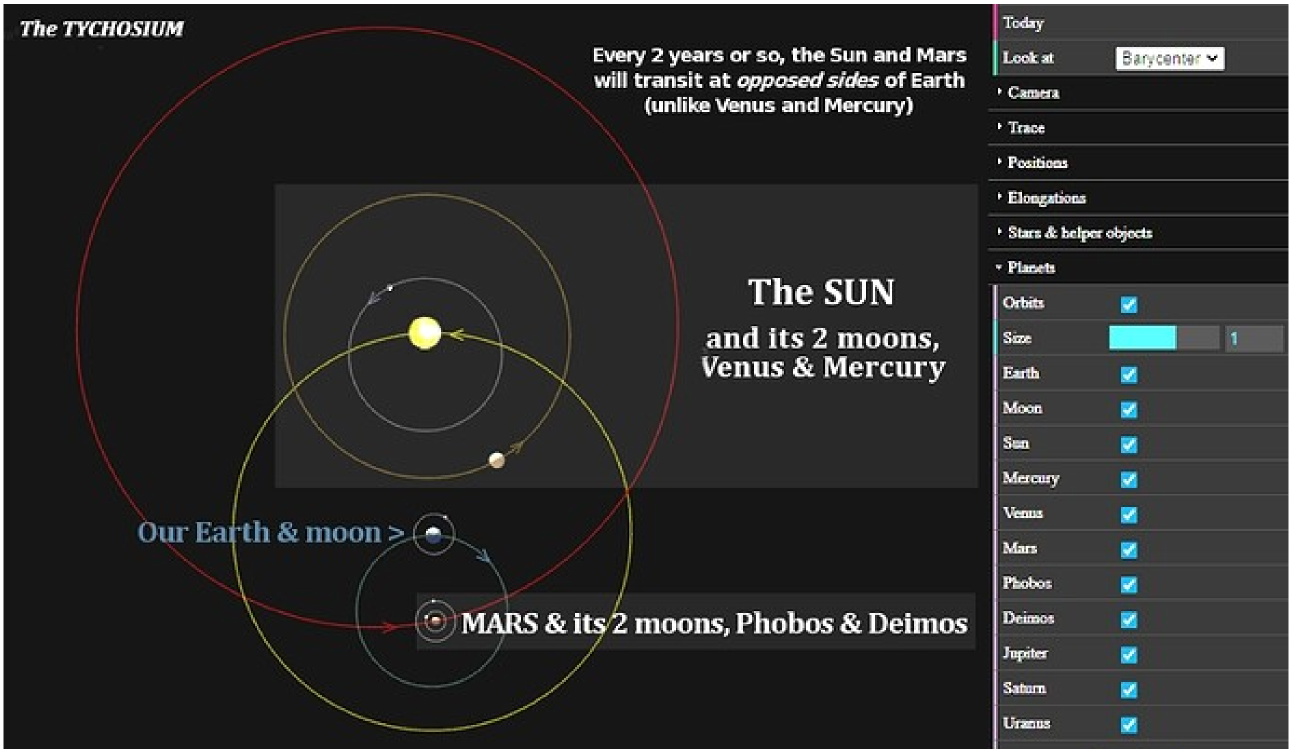
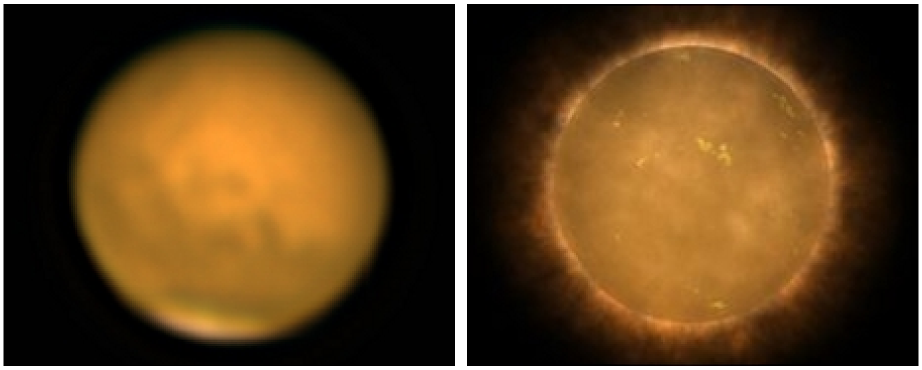


Fig. 3.1 A screenshot from the Tychosium 3D simulator.

As any amateur astronomer will know, Mars is a solid sphere reflecting the light of the Sun, but to the naked eye it shines almost like a reddish-orange star. In fact, it is worth noting that Mars is the only reddish-orange body in our Solar System.

You may now ask: *"How do we know about the existence of dwarf stars which are invisible even to our largest telescopes?"* We know this thanks to sophisticated instruments called spectroscopes which are routinely used to detect the invisible companions of larger stars. Cecil G. Dolmage has succinctly described the basic workings of the spectroscope thus:



(a) *(b)*

Fig. 3.2 Similarities between Mars and a red dwarf.
(a) An amateur astrophotograh of Mars (Rob Pettengill).
(b) An artist's conception of a red dwarf (Wikipedia).

> *There are certain stars which always appear single even in the largest telescopes, but when the spectroscope is directed to them a spectrum with two sets of lines is seen. Such stars must, therefore, be double. Further, if the shifting of the lines, in a spectrum like this, tell us that the component stars are making small movements to and from us which go on continuously, we are therefore justified in concluding that these are the orbital revolutions of a binary system greatly compressed by distance. Such connected pairs of stars, since they cannot be seen separately by means of any telescope, no matter how large, are known as spectroscopic binaries.*

However, it should be noted that even spectroscopes will fail to determine whether star companions detected in such a manner shine with their own light:

> *In observations of spectroscopic binaries we do not always get a double spectrum. Indeed, if one of the components be below a certain magnitude, its spectrum will not appear at all; and so we are left in the strange uncertainty as to whether this component is merely faint or actually dark. It is, however, from the shifting of the lines in the spectrum of the other component that we see that an orbital movement is going on, and are thus enabled to conclude that two bodies are here connected into a system, although one of these bodies resolutely refuses directly to reveal itself even to the all-conquering spectroscope.* [2]

Today, we know that the vast majority of our visible stars have one or more faint or invisible companions, and astronomers are discovering new binary systems at an ever-increasing rate. Surely, this has to be the most significant, paradigm-changing astronomical epiphany of our modern age! One can only wonder why such persistent findings haven't yet sparked a major debate questioning the 'implicit exceptionalism' of the Copernican heliocentric theory—what with its companionless 'non-binary star' (the Sun) and its gigantic 240-million-year orbit.

Having said that, there does appear to be a growing awareness within select astronomy circles of the awkwardness of the notion of a solitary Sun. Here is, for instance, a short excerpt from a recent article published on the Science Alert website in November 2018:

> *Our Sun is a solitary star, all on its ownsome, which makes it something of an oddball. But there's evidence to suggest that it did have a binary twin, once upon a time. Recent research suggests that most, if not all, stars are born with a binary twin. (We already knew the Solar System is a total weirdo. The placement of the planets appears out of whack compared to other systems, and it's missing the most common planet in the galaxy, the super-Earth).* [3]

Another article published in June 2017 on the PhysOrg website carries this most interesting title: *"New evidence that all stars are born in pairs".*

> *Astronomers have speculated about the origins of binary and multiple star systems for hundreds of years, and in recent years have created computer simulations of collapsing masses of gas to understand how they condense under gravity into stars. They have also simulated the interaction of many young stars recently freed from their gas clouds. Several years ago, one such computer simulation by Pavel Kroupa of the University of Bonn led him to conclude that all stars are born as binaries.[…] We now believe that most*

stars, which are quite similar to our own sun, form as binaries. I think we have the strongest evidence to date for such an assertion. [4]

Interesting, isn't it? If all stars are born in pairs, how and why did our Sun separate from its original companion? Did they part ways due to hypothetical cosmic 'turbulences' and 'perturbations' that somehow ruined their primordial, magnetic relationship? If it were eventually found that all stars have a binary companion, this would have profound implications for the entire realm of astrophysics—and this isn't just my personal opinion: it was none other than Jacobus Kapteyn, the world's foremost expert in stellar statistics, who famously stated at the end of his illustrious career that:

If all stars were binaries there would be no need to invoke 'dark matter' in the Universe.

We have seen that modern astronomy studies strongly support the notion that stars are by definition born in pairs. Further on (Chapter 28), we shall see that a very recent study (September 2022) has concluded that stars also die in pairs. As shown above, the evidence that all stars are binary/multiple systems is mounting day by day, yet in the realm of popular science our Sun is still steadfastly claimed to be a single star.

We have all heard of 'dark matter', but are never told exactly what it is. This is because nobody really knows. Modern astrophysicists think of it as an elusive, invisible and imponderable 'stuff' filling the universe and are desperately attempting to detect it—so far with no luck. It is currently contended that about 80% of the universe consists of dark (or 'missing') matter because the observed, highly scattered distributions and the erroneously estimated orbital speeds of celestial bodies and galaxies appear to violate both Kepler's and Newton's hallowed laws, as well as the infamous 'Big Bang' theory. Here's an extract from a Wikipedia page titled *"Galaxy rotation curve"*:

Since observations of galaxy rotation do not match the distribution expected from application of Kepler's laws, they do not match the distribution of luminous matter. This implies that spiral galaxies contain large amounts of dark matter or, in alternative, the existence of exotic physics in action on galactic scales. These results suggested that either Newtonian gravity does not apply universally or that, conservatively, upwards of 50% of the mass of galaxies was contained in the relatively dark galactic halo.

Evidently, Kepler's and Newton's laws, which modern astrophysics relies on, are in serious trouble today. Yet, the world's scientific community does not seem to be much bothered with that. Let us now take a brief look at what is popularly known as black holes.

3.2 Binary stars keep masquerading as black holes

The above title is the actual headline of an article published on sciencenews.org in April 2022. According to this recent discovery, binary stars 'keep masquerading' as black holes. In other words, what astrophysicists for decades have been calling black holes may simply be artefacts caused by formerly unsuspected and still undetected binary star systems.

Here's an extract from the article published on Science News.org on 4 April 2022:

As astronomy datasets grow larger, scientists are scouring them for black holes, hoping to better understand the exotic objects. But the drive to find more black holes is leading some astronomers astray. "You say black holes are like a needle in a haystack, but suddenly we have way more haystacks than we did before," says astrophysicist Kareem El-Badry of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. "You have better chances of finding them, but you also have more opportunities to find things that look like them." Two more claimed black holes have turned out to be the latter: weird things that look like them. They both are actually doublestar systems at never-before-seen stages in their evolutions, El-Badry and his colleagues report March 24 in Monthly Notices of the Royal Astronomical Society. The key to understanding the systems is figuring out how to interpret light coming from them, the researchers say.

Fig. 3.3 Image source: sciencenews.org

So two recently discovered black holes have turned out to be double-star systems at never-before-seen stages in their evolutions. That article is pure dynamite, if you ask me, and is well worth reading in its entirety. But let me submit another excerpt from it:

> *"The problem was that there was not just one star, but a second one that was basically hiding", says astrophysicist Julia Bodensteiner of the European Southern Observatory in Garching, Germany, who was not involved in the new study. That second star in each system spins very fast, which makes them difficult to see in the spectra. What's more, the lines in the spectrum of a star orbiting something will shift back and forth, El-Badry says. If one assumes the spectrum shows just one average, slow-spinning star in an orbit—which is what appeared to be happening in these systems at first glance—that assumption then leads to the erroneous conclusion that the star is orbiting an invisible black hole.*

Amazing, isn't it? In short, black holes may merely be optical illusions created by binary/multiple star systems, one of the components of which spins too fast to be distinguishable in the spectra. Since this astonishing discovery was made as recently as early 2022, the field of astrophysics may be about to undergo a major revolution. Could all black holes be illusory? Let us read the final lines of the quoted Science News article:

> *"Everyone was looking for really interesting black holes, but what they found is really interesting binaries", Bodensteiner says. These are not the only systems to trick astronomers recently. What was thought to be the nearest black hole to Earth also turned out to be pair of stars in a rarely seen stage of evolution. "Of course, it's disappointing that what we thought were black holes were actually not, but it's part of the process", Jayasinghe says. He and his colleagues are still looking for black holes, he says, but with a greater awareness of how pairs of interacting stars might trick them.*

In conclusion, currently available evidence suggests dark matter and black holes could be mere figments of the imagination engendered by our poor understanding of binary systems and 'optical tricks' played by their complex interactions.

3.3 The intersecting orbits of the Sun and Mars

To see what the configuration of the Sun-Mars binary system might look like, let us begin with a classic binary star system (Fig. 3.4).

Note that, if we replace the above 'higher-mass star' and 'lower-mass star' with the Sun and Mars, respectively, we obtain a neatly balanced binary system that incorporates the two moons of the Sun (Mercury and Venus) and the two moons of Mars (Phobos and Deimos).

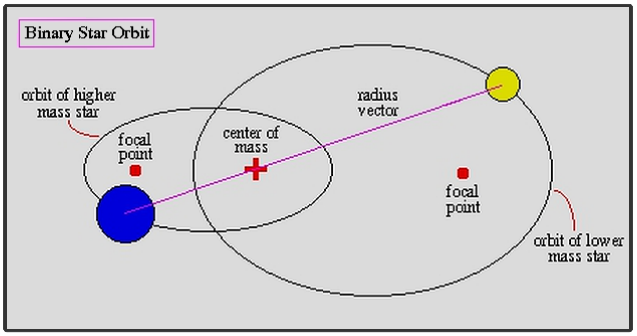


Fig. 3.4 A classic binary star system, as illustrated in the astronomy literature: a larger and a smaller body revolve in intersecting orbits around a common centre of mass.

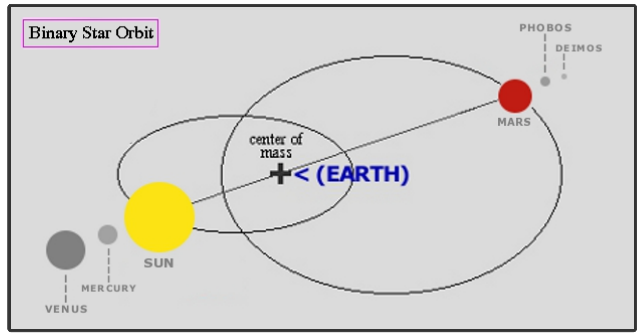


Fig. 3.5 In the TYCHOS model, Earth is positioned near (or at) the centre of mass of the Sun-Mars binary system. Both the Sun and Mars are escorted by a pair of moons (Venus and Mercury, and Phobos and Deimos).

We can see just how harmonious such a binary system would be: our Earth and Moon embraced by the Sun-Mars binary duo, with each of the binary companions hosting a pair of lunar satellites. You may now ask yourself why no one (not even supporters of Brahe's original model) has envisioned to this day Mars as the Sun's binary companion; this may be because Mars returns in opposition every two solar years, instead of every single year—as one might expect of a 'classic' binary system. Moreover, due to the eccentricity of Mars' orbit, this 2:1 ratio will fluctuate back and forth over time (it is currently about 2.13:1). However, as will be demonstrated further on, this oscillating ratio will in the long run average out to a precise 2:1 relationship: the Sun will return to the same place in our skies in 25344 years—the 'Solar Great Year'—whereas Mars will do so in 50688 years (25344 $\times$ 2)—i.e., the 'Martian Great Year'.

3.4 Why Mars?

You may now wonder: *"Why Mars? Wouldn't it make more sense if Jupiter, the largest planet in our system, were the Sun's binary companion?"* Well, size is not everything. Let us not forget that Jupiter is considered a 'gas planet' while Mars is believed to be composed of mostly iron and rock. There is no way of directly determining and comparing the weight of these two bodies, but I trust we can all agree that the density (hence, the relative weight) of iron and rock are several orders of magnitude greater than that of any gas existing in nature.

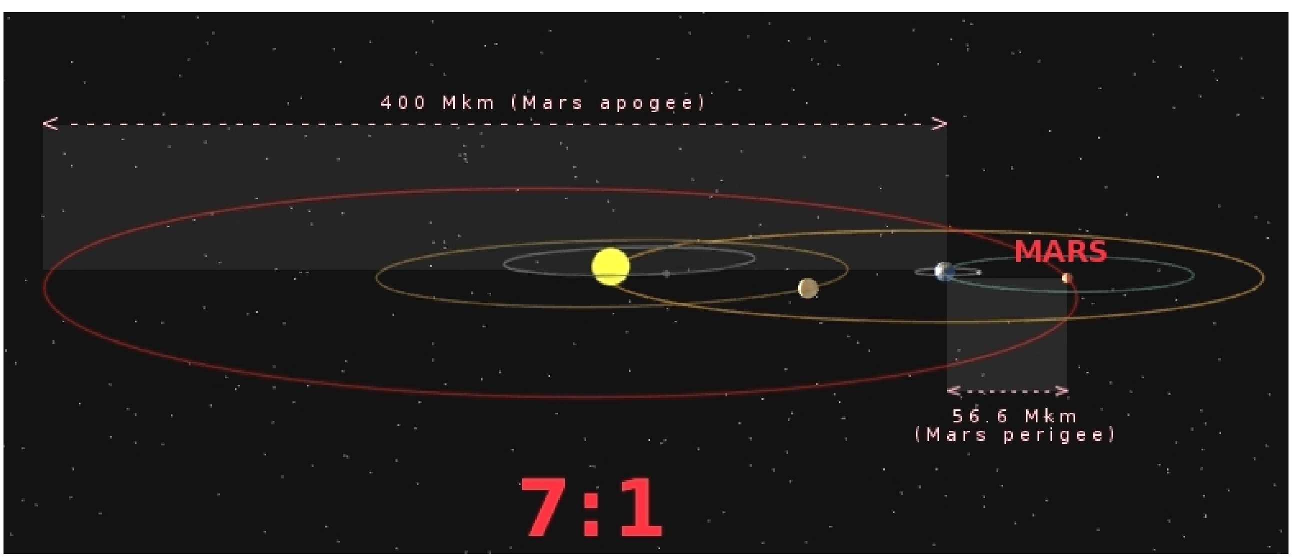


Fig. 3.6 Screenshot from Tychosium 3D simulator. Mars can transit as close as 56.6 Mkm from Earth (perigee) and as far as 400 Mkm (apogee); representing a 7/1 ratio (400 / 56.6).

Furthermore, aren't we told that the Sun itself is composed of hydrogen (70%), helium (28%) and a negligible 2% of other, denser elements? Seen in this light, could Mars have a mass similar to that of the Sun, in spite of their 'David-and-Goliath' difference in diameter? While this type of argument would appeal to the adherents of Newton's gravitational laws, it should be stated for the record that my research for the TYCHOS model has from day one left Newtonian and Einsteinian physics at the door, so to speak. It has instead focused on the all-important, empirically testable, repeatable and verifiable observational data gathered over the centuries by our world's most rigorous observational astronomers. To wit, no physical/astrophysical theorems of our Solar System can be formulated without having first correctly determined its geometric configuration (doing so would be tantamount to putting the proverbial cart in front of the horse).

Mars is the only body of our Solar System that can transit on both sides of Earth in relation to the Sun and whose farthest-to-closest transits from Earth exhibit a whopping 7:1 ratio, with a mean apogee of 400 million km and a mean perigee of 56.6 million km. This is a strong indication that Mars—and no other body in our Solar System—is the Sun's binary companion. Fig. 3.6 should make this clear.

As we shall see in the following chapters, there are many good reasons to think that Mars—and no other body of our system—is the Sun's binary companion. Perhaps the most interesting evidence of Mars' uniqueness among the components of our system is the fact that Kepler formulated his entire set of 'laws' around the motions of Mars. As astronomy historians have thoroughly documented, Kepler, who was recruited by Brahe for the sole purpose of resolving the 'incomprehensible behaviour' of Mars, spent over half a decade in what he called his *"war on Mars"*, obsessively trying to solve the befuddling Martian riddle. Mars was truly the greatest challenge posed by Brahe's exceptionally accurate observational tables.

> Once the main source of error had been removed by Tycho Brahe's accurate recording of the entire cycles of planetary motion, the most outstanding divergence between theory and observation was in the case of Mars. It is especially important to note that Brahe improved the accuracy of parameters and observations at the same time, so as to obtain, for the first time in history, a clear discrepancy between the place of a planet and that predicted by "circular" theories. In the past such happenings had been swamped by all the other errors and uncertainties. Using Brahe's results, Kepler could prove in this one case (but in no other) that circular theory must break down. This is exactly the reason why Kepler ellipses could not be suggested before the work of Brahe, and indeed why Kepler had to develop his theories on the basis of the study of Mars.

Fig. 3.7 Extract from *"Contra Copernicus"*, by Derek J. de S. Price [5]

> **Do we live in a binary solar system?**
>
> Answer Follow · 1 Request
>
> 2 Answers
>
> Gene Ognibene, Systems Analyst/Programmer
> Answered Aug 4, 2018
>
> Here are a few facts about our solar system that could be neatly explained if our sun did have a companion.
>
> 1. The distribution of angular momentum of the sun is wrong. The sun is the most massive object but has the least angular momentum.
> 2. Modern lunisolar precession equations don't accurately explain observed precession data.
> 3. The Kuiper Cliff at 50au shouldn't be there. The number and size of Kuiper Belt objects should gradually decrease the farther you get from the sun.
> 4. There is a slight difference between a sidereal year and a tropical year. The earth doesn't quite make it back to the same position relative to the stars every year, though it should if our sun isn't moving around another body.
> 5. If precession of the equinoxes is caused by a wobble in the earth's orbit, the seasons would not stay constant. Old sites like Stonehenge wouldn't still line up to these celestial events like the equinoxes and solstices.
> 6. Up to 80% of observable stars are binaries. What makes our sun so special?

Fig. 3.8 As for why the Sun is likely to have a binary companion, Gene Ognibene posted 6 points well worth the read.

3.5 Comparing the moons of the Sun and Mars

In the TYCHOS model, Mercury and Venus are moons of the Sun. Similarly, Mars has two lesser-known, 'tidally locked' moons: Phobos and Deimos. The Martian moons were discovered by Asaph Hall as recently as 1877, meaning that Brahe, Newton and Kepler were all unaware of their existence.

A closer look at the moons of Mars brings up some interesting interrelationships with their larger counterparts, Mercury and Venus. Under the Copernican model, according to which Mars is just another planet orbiting the Sun, there would be no conceivable reason for these four celestial bodies to exhibit any sort of 'synchronicity' with each other. In the TYCHOS model, on the other hand, this is one of many 'harmonious resonances' that seem to pervade our Solar System, as will be thoroughly expounded further on.

Each year, Mercury revolves about 3.13 times around the Sun, whereas each day Phobos revolves 3.13 times around Mars. For the sake of comparison, think of the Sun as revolving once every year around Earth, whereas Earth rotates once every day around its axis. It may at first sound bizarre to compare a revolutional period to a rotational period, unless you know that our Moon revolves around Earth in the same time as the Sun rotates around its axis ($\sim$27.3 days, the so-called Carrington number). Moreover, Mercury's synodic period (116.88 days) is 5 times shorter than Venus' synodic period (584.4 days), while Phobos orbits Mars almost precisely 4 times faster than Deimos.

All this appears to indicate an affinity between these two pairs of moons, something Copernicans would have to attribute to happenstance. Conversely, under the TYCHOS model, all these orbital resonances can be interpreted as a natural consequence of the interrelation between the Sun's moons (Mercury and Venus) and Mars' moons (Phobos and Deimos).

You might now justly ask yourself: *"Why are Mercury and Venus the only 'planets' of our Solar System with no moons of their own?"* As a matter of fact, this is one of astronomy's longstanding 'mysteries'. The truth of the matter is: no Copernican astronomer actually knows why Venus and Mercury are moonless, and no compelling theses on this vexing subject have been advanced to this day. Here are, for instance, NASA's timid and tentative explanations of this major cosmic enigma.

> *Most likely because they are too close to the Sun. Any moon with too great a distance from these planets would be in an unstable orbit and be captured by the Sun. If they were too close to these planets they would be destroyed by tidal gravitational forces. The zones where moons around these planets could be stable over billions of years is probably so narrow that no body was ever captured into orbit, or created in situ when the planets were first being accreted.* [6]

(a) *(b)*

Fig. 3.9 The moons of the Sun and Mars: Mecury and Venus, and Phobos and Deimos.
(a) Screenshot from Tychosium 3D
(b) Image credit: Astronoo.com

Curious coincidences

Consider these facts about the moons of the Sun (Mercury and Venus) and the moons of Mars (Phobos and Deimos).

- Venus' diameter is 2.5 times larger than Mercury's diameter.
- Deimos' orbital diameter is 2.5 times larger than Phobos' orbital diameter.
- Phobos' diameter is 1.8 times larger than Deimos' diameter.
- Venus' orbital diameter is 1.8 times larger than Mercury's orbital diameter.

To my knowledge, no mention of these remarkable 'reciprocities' is found in the astronomy literature.

Here's another and intellectually more honest statement found on a NASA website:

Why Venus doesn't have a moon is a mystery for scientists to solve. [7]

As it is, the TYCHOS model has a simple answer to this 'mystery': Venus and Mercury have no moons due to the simple fact that they are moons themselves. In fact, the notion that Venus and Mercury are moons rather than planets can be deduced and backed up in multiple ways. What follows should make it glaringly obvious that Mercury and Venus are moons, not planets.

Definition of a moon or lunar body

Based on the above, the characteristics that set moons apart from planets may be summarized thus:

- No moons have satellites of their own, since they are moons themselves.
- Moons rotate exceptionally slowly around their own axes compared to all other celestial bodies.
- Moons always show the same face to their host star or planet (in astronomy jargon, we say they are 'tidally locked').

3.6 Rotational resonances between Mercury and Venus

- Mercury employs 58.44 days to rotate around its axis [8]. Mercury revolves around the Sun in 87.66 days. For every two of its solar revolutions (175.32 days), it thus rotates precisely three times around its axis ($175.32 / 58.44 = 3$).
- Venus employs 116.88 days to rotate around its axis—exactly twice as long as Mercury ($58.44 \times 2 = 116.88$). As Venus returns to perigee (closest to Earth) every 584.4 days (i.e., every 10 mercurial rotations), it always shows the same face to earthly observers—another fact which is still considered a 'mystery' by modern astronomers. During this period, Venus rotates precisely five times around its own axis ($584.4 / 116.88 = 5$), as stated in Isaac Asimov's *"Book of Physics"* (quote translated from Italian):

> *Between one approach to the minimum distance from the Earth and the next, Venus makes exactly five rotations on its axis, so it always shows us the same face when it is at its closest position to us.* [9]

Continuing the series of troublesome facts that have been baffling astronomers, here is a quote from Science Jrank.org:

> *A curious relationship exists between the length of the Venusian day and the planet's synodic period. The synodic period of Venus, that is, the time for the planet to repeat the same alignment with respect to Earth and Sun, is 584 days, and this is five times the Venusian day ($584 = 5 \times 116.8$). It is not known if this result is just a coincidence, or the action of some subtle orbital interaction. The practical consequence of the relationship is that, should a terrestrial observer make two observations of Venus that are 584 days apart, then they will see the same side of the planet turned towards Earth.* [10]

Needless to say, since the Earth-Moon system is currently claimed to revolve around the Sun outside the orbits of Venus and Mercury (whereas, in the TYCHOS, the Earth is orbited by both our Moon and the Sun-Venus-Mercury trio), most official reckonings of the rotational rates of Venus and Mercury are in error. Let us now compute the respective rotational speeds (around their axes) of our Moon, Venus and Mercury:

- The Moon rotates around its axis in 27.322 days (or 655.73 hours). The Moon's circumference is 10920.8 km. Hence, a distance of 10920.8 km covered in 655.73 hours computes to an equatorial rotational speed of 10920.8 km / 655.73 hours ≈ 16.65 km/h (or about 100 times slower than the Earth's equatorial rotational speed of 1674 km/h).
- Venus rotates around its axis in 116.88 days (or 2805.12 hours). Venus' circumference is 38024.5 km. Hence, a distance of 38024.5 km covered in 2805.12 hours computes to an equatorial rotational speed of 38024.5 km / 2805.12 hours ≈ 13.56 km/h (or about 18.6% slower than our Moon).
- Mercury rotates around its axis in 58.44 days (or 1402.56 hours). Mercury's circumference is 15329 km. Hence, a distance of 15329 km covered in 1402.56 hours computes to an equatorial rotational speed of 15329 km / 1402.56 hours ≈ 10.93 km/h (or about 19.4% slower than Venus).

These are all, of course, exceptionally slow rotational speeds, compared to the speeds of all the other bodies in our Solar System. In fact, they are all in the rotational speed range of a children's merry-go-round. In contrast, Jupiter rotates around its axis at a brisk 43000 km/h, and Saturn at about 35000 km/h. Such hypersonic speeds are completely unlike the sluggish rotational speeds of moons. Further on (Chapter 20) we shall have a look at Mars' rotational speed, which turns out to be synchronous with Earth's (∼24 hours).

In the next chapter, I will illustrate the basic configuration of the TYCHOS model and introduce you to the interactive Tychosium 3D simulator. Although it may seem somewhat premature to unveil it at this early stage of the book, an overview of the TYCHOS model's configuration is necessary to understand the subsequent chapters.

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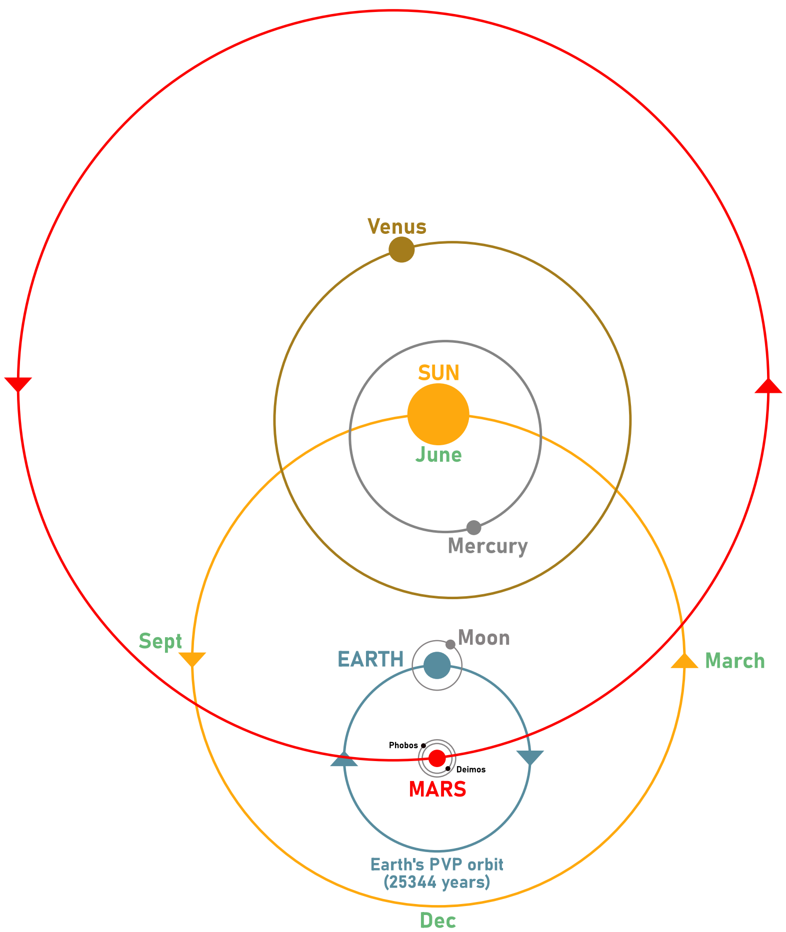
4

Introducing The TYCHOS Model

4.1 A general overview

The Sun and Mars are the main players of what I have called our 'geoaxial binary system'. At or near its barycentre, we find Earth and our Moon, while the Sun (escorted by its two moons, Mercury and Venus) and Mars (escorted by its own two moons, Phobos and Deimos) perform their binary dance around our planet. It is Earth's physical motion around its Polaris-Vega-Polaris orbit (PVP, for short) that causes our north stars to change over time—a very slow process commonly known as the Precession of the Equinoxes.



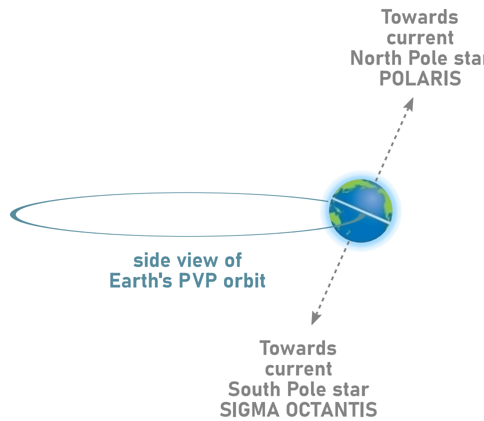


Fig. 4.1 Earth is like the central axis of a classic binary system constituted by the Sun and Mars. As the entire system slowly precesses clockwise (as seen from above our north pole), Earth gets tugged around its PVP orbit, completing one revolution in 25344 years.

The Sun and Mars are both escorted by two moons, Venus and Mercury, and Phobos and Deimos. Remarkably, the orbital periods of all of our system's bodies turn out to be round multiples of our own moon's 'true mean period' of 29.22 days, and are thus united in a most harmonious resonance. We will come back to these multiples and the term 'true mean period' further on.

Table 4.1 – Orbital resonances with our Moon

Body	True Mean Period		Resonance
Moon	29.22	days	1
Mercury	116.88	days	4
Venus	584.40	days	20
Mars	730.50	days	25
Sun	365.25	days	12.5
Earth	9256896	days	306800

In the TYCHOS, Earth is inclined at about 23.4° in relation to its orbital plane, yet at all times its northern hemisphere remains tilted 'outwards', i.e. towards the external circuit of the Sun. The Sun revolves once a year around Earth, travelling at 107226 km/h (this is the orbital speed attributed to Earth by Copernican astronomers). Every 2.13 years, its binary companion, Mars, reconjuncts with the Sun at either side of Earth (the above graphic shows Mars transiting in so-called 'opposition'). Mars is not a third moon of the Sun, as some commentators have suggested, because it is the only body in our cosmic neighbourhood whose orbit has it transiting alternately in opposition to and in conjunction with the Sun. The only reason Mars may seem problematic to reconcile with the popular notion of 'binary motion' is that its orbit is not locked in a 1:1 ratio with the Sun, but in a 2:1 ratio. Hence, Mars will not return in opposition every year, but only every other year or so.

Each year, Earth moves 'clockwise' (as seen from above our north pole) by 14036 kilometres along its PVP orbit—i.e. slightly more than its own diameter of 12756 km. This motion of Earth provides a perfectly simple explanation for the observed annual 'backward' motion of our stars referred to as the Precession of the Equinoxes. I will henceforth refer to this yearly 14036-km displacement of Earth as the EAM (Earth's Annual Motion).

There is thus no need for Earth to "wobble around its polar axis" (also known as "Earth's third motion") as posited by Copernican theory; nor does Earth hurtle around space at hypersonic speeds. Earth only rotates around its axis once every 24 hours at the extremely sluggish rate of 0.000694 rpm while it gently gets tugged around its orbital path at 1.6 km/h (about 1 mph), as the entire Solar System precesses 'clockwise' (as viewed from above our North Pole). In such manner, Earth completes one revolution around the PVP orbit every 25344 years, a period also known as the Great Year. I submit that what I have called the PVP orbit is the missing piece of the puzzle of Tycho Brahe's admirable geo-heliocentric system. The PVP orbit will of course be thoroughly expounded and illustrated further on in this book, as it constitutes the core discovery upon which the TYCHOS model is founded.

It is essential to understand that, in the TYCHOS model, all the planets and moons orbit at constant speeds around uniformly circular (albeit eccentric) orbits. In other words, there never was any need for Kepler's variable orbital speeds or for his proposed elliptical orbits—the latter being just an illusion caused by Earth's motion around its PVP orbit. To wit, since Earth slowly proceeds along an almost straight line (over, say, 100 years) the Sun and our surrounding planets will appear to oscillate slightly back and forth. In the summer of the northern hemisphere the Sun will be moving in the opposite direction of Earth, whereas in the winter it will be moving in the same direction as Earth. Thus, the illusion of elliptical orbits is created, while other apparent speed variations are due to the fluctuating distances between Earth and the various bodies of our Solar System. The circular orbits of those bodies are all eccentric, which means they are slightly off-centre in relation to Earth.

This brings up the age-old question: Orbital speeds, in relation to what? The short answer is: in relation to the 'fixed' stars. Now, the stars also have motions of their own (proper motions). That is, they move ever so slightly (typically 0.1 arcsec/year) in random directions. Hence, we should be satisfied that the star backdrop (the firmament) constitutes a quite reliable, near-static reference frame against which we may compute the orbital speeds of the various bodies of the Solar System, provided we duly account for Earth's own orbital motion. What is empirically observed is that all stars in the firmament drift from west to east in our skies by about 50 arcseconds a year. In the TYCHOS model, this slow 25344-year revolution of the firmament is merely the optical effect of Earth's tranquil 1-mph motion around its PVP orbit.

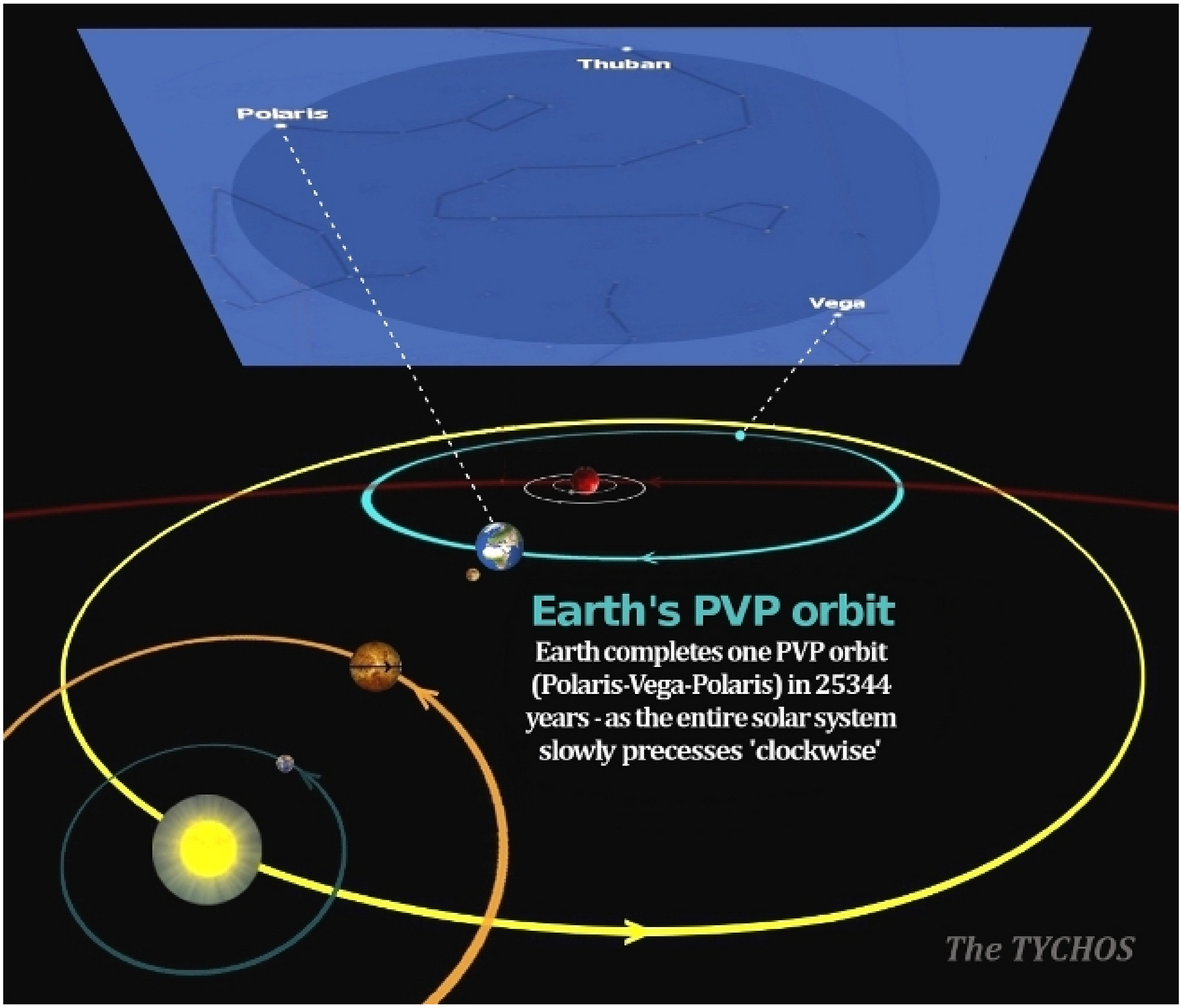


Fig. 4.2 The estimation of the PVP orbit's orbital diameter (113.2 Mkm) is illustrated in Chapter 11. Note that the average Mars-Earth perigee distance (i.e., as Mars transits closest to Earth) is 56.6 Mkm, or precisely the PVP orbit's radius (113.2 / 2 = 56.6).

4.2 Distances to our Solar System's bodies versus distances to the stars

Copernican astronomers use the diameter of the Earth (12756 km) as a baseline to measure the distance between the bodies of our Solar System. The TYCHOS rigorously respects these universally approved measurements, but estimating the distance between the Earth and the stars is an entirely different matter. This is because astronomers have for this purpose chosen as baseline the diameter of Earth's purported orbit around the Sun, which is claimed to be approximately 300 Mkm. Since they are using a nonexistent 300 Mkm, 6-month lateral displacement as baseline, all their calculations of Earth-star distances are grossly and systematically inflated. In the TYCHOS model, Earth moves by only 7018 km every six months, not by 300 000 000 km. This means that the stars are over forty thousand times closer to us than currently claimed—a notion Tycho Brahe would undoubtedly have welcomed and supported. In any case, the notion that stars can be located several thousand light years away and still be visible to the naked eye has to rank among the most bizarre ideas entertained by this world's scientific community.

4.3 The Tychosium 3D simulator

As I timidly started my TYCHOS research back in 2013, I certainly had no ambition or pretence to build a digital planetarium that could remotely attain—let alone challenge—the accuracy of the currently available heliocentric simulators. My initial calculations were done with pen and paper and aided by simple graphic editing programs. However, as my research progressed over the years, I started entertaining the possibility of finding an IT wizard to help me bring to life the TYCHOS model by animating it on an interactive digital 3D platform. At the time of writing (January 2023), I am happy to say that the wondrous Tychosium 3D simulator has already surpassed my wildest dreams and expectations.

The Tychosium 3D simulator is a joint effort by yours truly and Patrik Holmqvist, a Swedish IT programmer I had the good fortune to meet in the summer of 2017. At the time of writing (November 2023), the Tychosium is still being developed and refined, yet we are both satisfied with its potential to become the most realistic and accurate digital simulator of the Solar System ever devised. The principal feature of its superior nature lies in the fact that, once refined and completed, it should correctly show the conjunctions of the bodies of our Solar System with the stars, without any geometric aberrations of parallax and perspective; i.e., without the anomalies and discrepancies that have vexed Copernican astronomers ever since the heliocentric model was introduced.

Before proceeding, I strongly encourage readers to open the Tychosium 3D simulator on their laptop computers and get familiar with its interactive functions. This is an essential requirement to fully visualize, assess and comprehend the workings of the TYCHOS model.

The Tychosium 3D simulator is built upon the official astronomical tables compiled over the centuries by the world's foremost astronomers. That is to say, all the orbital sizes, relative distances and empirically verifiable sidereal periods within the Solar System have been rigorously respected. In the Tychosium, all the planets and moons move in uniformly circular orbits and at constant orbital speeds. This is in stark contrast with the elliptical orbits and variable speeds Kepler had to postulate to make the heliocentric model mathematically compatible with empirical observation. In all logic, I have therefore used the mean values of our planets' estimated orbital velocities, disregarding their putative 'maximum' and 'minimum' values, as computed by Kepler.

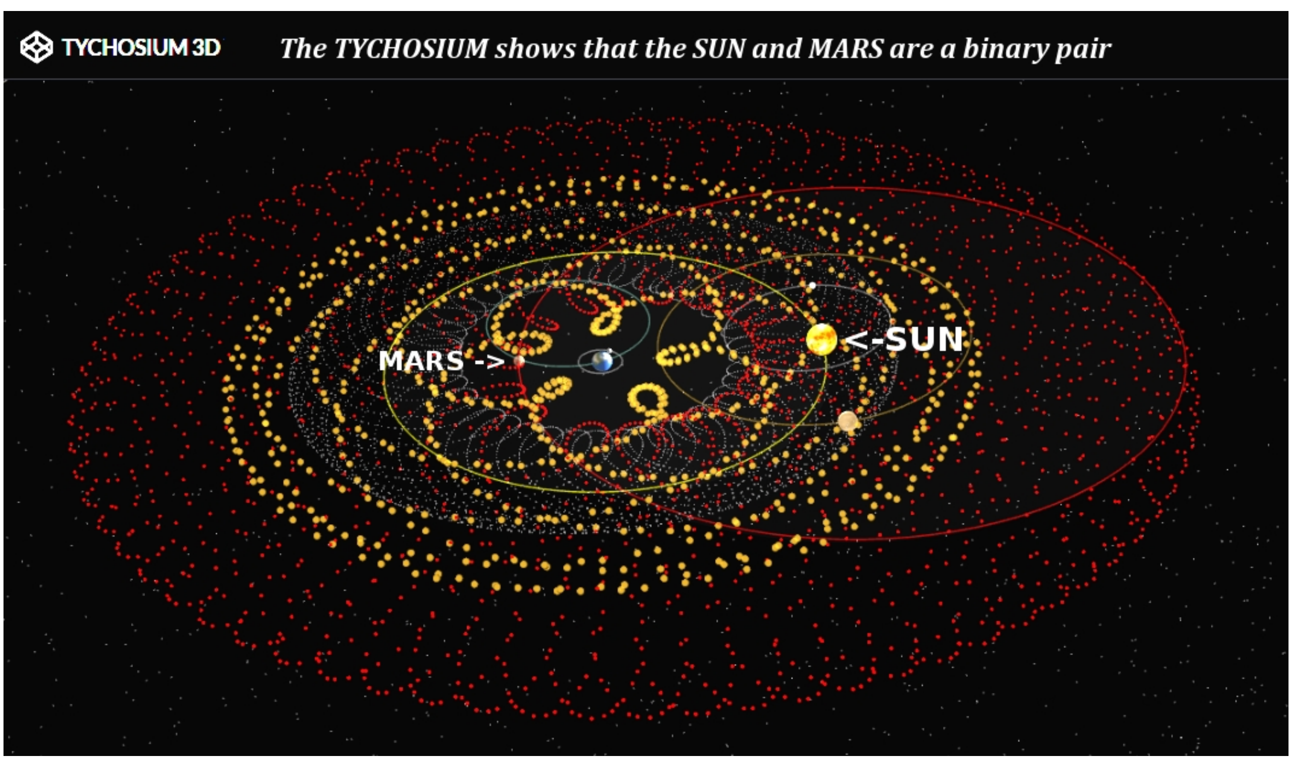


Fig. 4.3 Tracing planet movement in the Tychosium 3D simulator.

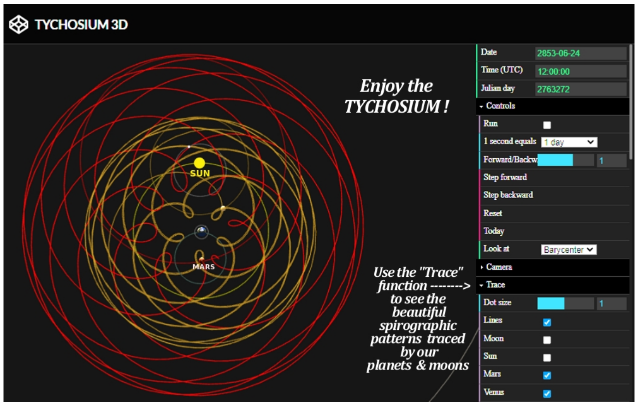


Fig. 4.4 The Tychosium 3D simulator and its control panel.

Throughout the ages, astronomers have been in ceaseless pursuit of a configuration of the Solar System consistent with the natural perception of uniformly circular orbits and constant orbital speeds. The TYCHOS provides an answer to their quest—one which can be challenged and tested in a state-of-the-art simulator.

Patrik and I hope you enjoy interacting with the Tychosium 3D simulator which—we dare say—is already the most realistic and true-to-nature simulator of the Solar System available. If you are puzzled by the spirographic/trochoidal orbital patterns traced out in the Tychosium, keep in mind that all star systems observed in modern times display such patterns (see Chapter 2). From a purely probabilistic viewpoint, it would be unreasonable to think that our own Solar System is the only one in the universe lacking trochoidal orbital patterns like the ones illustrated in Fig. 4.5.

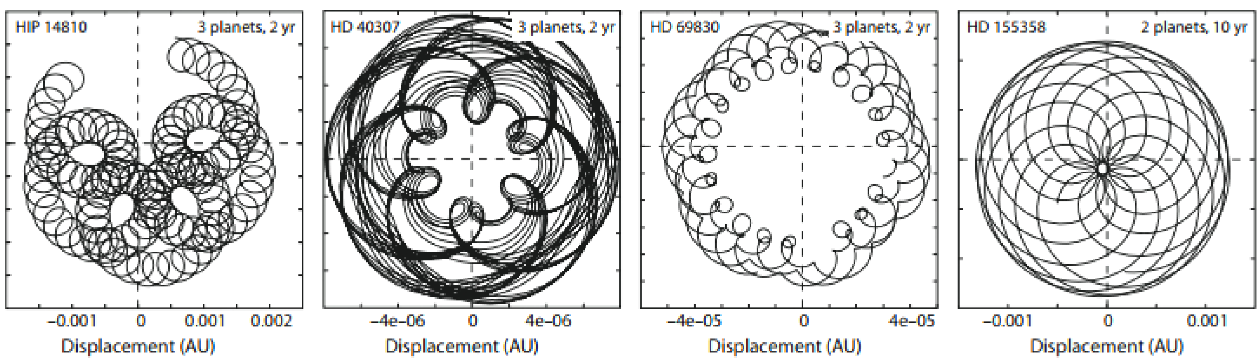


Fig. 4.5 Examples of observed patterns exhibited by the barycentric motions of 4 different exoplanet host stars.

Using the Tychosium 3D simulator

A comprehensive user manual will be implemented along with the upcoming upgrade of the Tychosium 3D simulator scheduled for early 2024. Meanwhile, here are some basic instructions and tips to get started:

1. Click the run button to start the Tychosium. You can speed up or slow down the motion with the "1 second equals" function.
2. Left-clicking (and holding) your mouse will let you toggle the 3-D orientation of our cosmos. The scroll wheel regulates the zoom level.
3. Click on the "Trace" menu and choose any Solar System body whose path you wish to exhibit over time. This will show you the beautiful mandala-like, spirographic trajectories of our Solar System's various bodies, such as the charming 5-petalled flower pattern traced by Venus.
4. To see the orientation of the Zodiac's 12 constellations, click on the "Objects" menu and check the "Zodiac" box.
5. To see the celestial positions (ephemerides) of any of our Solar System's bodies, check the "Positions" box. This will allow you to view the extent to which the Tychosium agrees with other online planetariums, such as the popular Stellarium simulator [2].

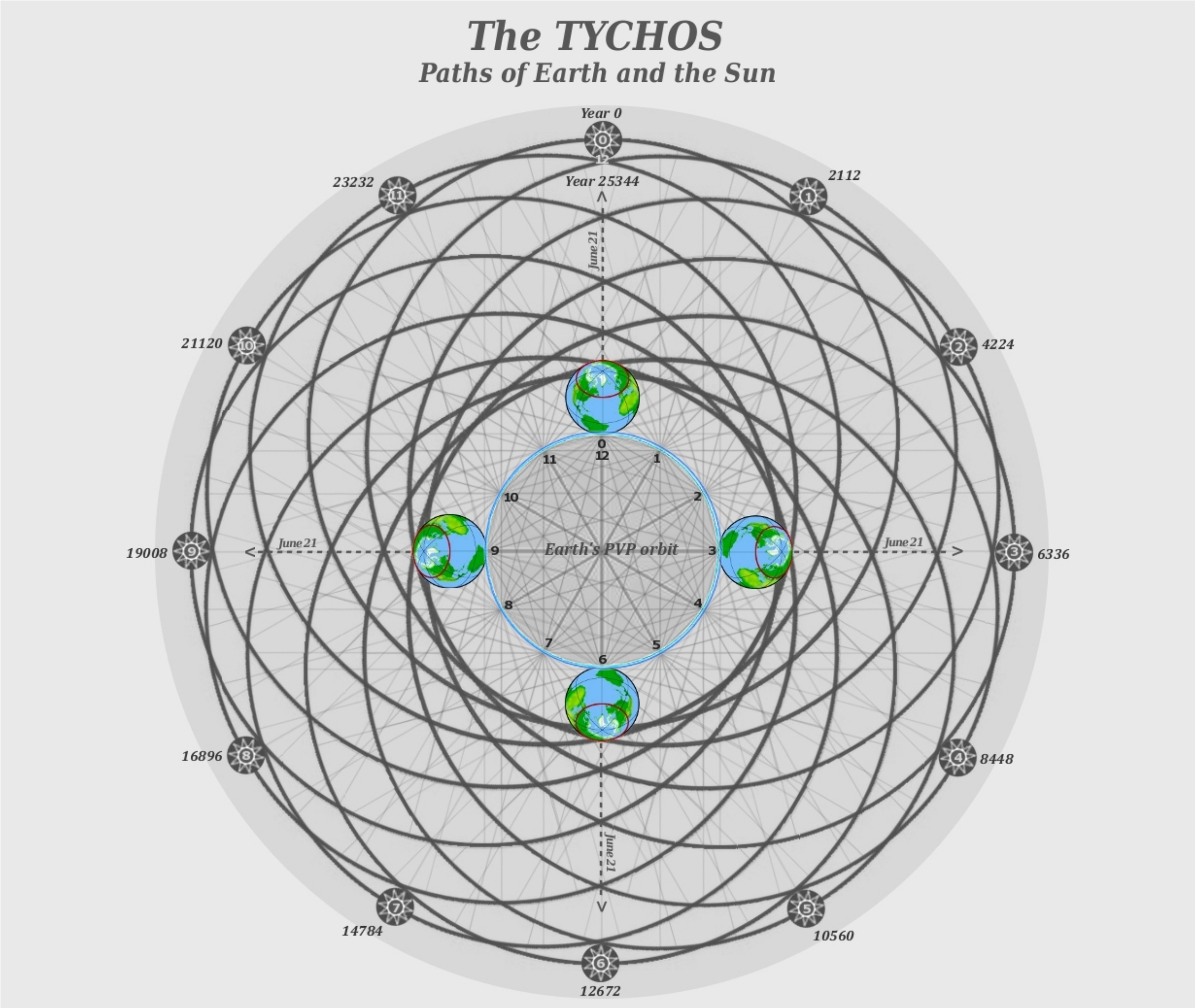


Fig. 4.6 The Sun's path over 25344 years (the TYCHOS Great Year).

So far, the Tychosium has attained excellent concordance with all recorded planetary ephemerides, Mars oppositions, the transits of Venus and Mercury across the Sun's disk, Jupiter-Saturn conjunctions, most other periodic interplanetary alignments and most solar and lunar eclipses. A few issues remain to be addressed (e.g., the secular rate of oscillation of the declinations of our Moon's orbit), yet we are confident that they will be resolved in the upgraded version. Fine-tuning a simulator is a time-consuming task, especially when you are a small team of two brains!

In the next chapter, we shall take a close look at Mars, which Kepler famously stated was the key to understanding the Solar System. Sure enough, Mars is the 'master key' to unlock and unveil the true configuration and mechanics of our system. Ironically though, in spite of his obstinate attempts to reconcile the Martian motions with the heliocentric model, Kepler never found that all-important key, which is why he ultimately decided to forge it.

4.4 References

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5

Mars, the "Key" that Kepler Never Found

5.1 How Kepler subverted Tycho Brahe's lifelong work

Johannes Kepler famously stated that:

> *Mars is the key to understanding the solar system.*

Kepler was notoriously obsessed with Mars for five harrowing years and, in his correspondence with fellow scientists, referred to his relentless pursuit as *"his personal war on Mars"*. We now know that, whether out of exhaustion or premeditatedly, Kepler eventually resorted to the shameless manipulation of Tycho Brahe's data, later published in his *Astronomia Nova* (a book still regarded as *"the Bible of the Copernican Revolution"*). This shocking discovery by Prof. Donahue, the American translator of Kepler's epochal treatise, was made in 1988. Now, if Kepler had to cheat to make his heliocentric model work, what does this tell us about the overall soundness and credibility of the Keplerian and Copernican theories?

It will remain a mystery why Kepler, Brahe's 'math assistant', eventually dismissed his own master's cosmic model in favour of the Copernican—and this in spite of having once plotted a working diagram of Mars' geocentric motions titled *De Motibus Stellae Martis* (see Fig. 5.4). History books only tell us that upon Brahe's untimely death at age 55, Kepler seized the bulk of his master's painstakingly collected observations and annotations only to set about flipping the Tychonian model on its head. Professor Donahue's detailed descriptions of how Kepler fudged his all-important Mars computations to make them appear to confirm the core tenets of his thesis make for a most compelling read (*Kepler's Fabricated Figures - Covering up the Mess in the New Astronomy* [1], W. H. Donahue, Journal for the History of Astronomy, 1988). This short NYT article succinctly sums up Kepler's falsification in his much-heralded master work, *Astronomia Nova.*

> *Done in 1609, Kepler's fakery is one of the earliest known examples of the use of false data by a giant of modern science. Donahue, a science historian, turned up the falsified data while translating Kepler's master work, Astronomia Nova, or The New Astronomy, into English.* [2]

As I see it, Kepler's manipulative antics are destined to go down in history as the triumph of mathematical abstraction over empirical observation. In his urge to make the befuddling behaviour of Mars agree with the heliocentric Copernican theory, he not only misused and twisted but outright subverted Brahe's most precious and exacting observational data. In any event, there can be no doubt that Brahe's priority and main concern was that of understanding the motions of Mars. The fact that he entrusted this crucial task to a young, ambitious and petulant assistant may well have been the greatest mistake of his life. Be that as it may, it is a documented fact that Brahe had identified an unexpected systematical inequality in the planetary motions which was *"not known to Ptolemy or Copernicus"*:

> *Tycho also realized that Copernican predictions for all the planets differed systematically from the observations and wondered whether an additional inequality, not known to Ptolemy or Copernicus, might affect their motions. Or perhaps planetary theories should be referred to the true rather than mean Sun, as Ptolemy had done, and the other inequality could be solved by modifying the solar eccentricity. Given the similarity of Mars's orbit to the Sun's, Tycho suspected that the red planet might provide a key for reworking all the planetary theories.* [3]

5.2 Mars's two empiric sidereal intervals (ESIs)

The ancient Mayan astronomers made careful observations of Mars' motions and were clearly aware of the planet's variable sidereal period, as viewed from Earth. As they kept count of the amount of days needed for Mars to realign with a given reference star, they saw that Mars had in fact two sidereal periods: a longer and more frequent period of about 707 days (the long ESI) and a shorter period of about 546 days (the short ESI).

It is the short ESI of approximately 546 days (nearly 1.5 solar years) that is of primary interest to us here. As will be comprehensively demonstrated in Chapter 7, the Copernican model can in no way account for this 546-day sidereal period.

> *We discuss here a kind of period that we call the empiric sidereal interval (ESI), which we define as the number of days elapsed between consecutive passages of Mars through a given celestial longitude while in prograde motion. At first glance, one would imagine that the ESI would fluctuate widely about some mean because of the intervening retrograde loop, which in the case of Mars occupies 75 days on average between first stationary (cessation of) and second stationary (resumption of normal W-to-E motion). However, a closer look at modern astronomical ephemerides reveals that for a practical observer there are really two ESIs, a lengthier one that includes the retrograde loop (the long ESI) and a shorter one that does not (the short ESI).* [4]

The paper quoted above is a highly recommended read. It describes in great detail the Mayan astronomers' extensive knowledge of Mars' sidereal periods, although it ultimately fails to address the profound implications raised by the existence of two ESIs for the same planet. So, you may ask, if Mars' sidereal period is clearly either ~707 days (the long ESI) or ~546 days (the short ESI), why do most astronomers accept Kepler's figure of 686.9 days? As we shall see, the binary configuration of our Solar System and Mars' peculiar, epitrochoidal orbital motion clearly explains how Mars can realign with a given star within a year and a half.

Here are the observable facts: Mars will realign with a given reference star seven times in a row at intervals of approximately 707 days, but the eighth time around Mars will realign with that same star in only about 546 days. In other words, over a span of approximately 15 years, Mars exhibits seven long ESIs and one short ESI.

Now, since 5495 divided by 8 is approximately 686.9 days, we can see how Kepler simply averaged these eight periods to produce his estimate of Mars' sidereal period. As it is, Kepler's 686.9-day interval is not something that can ever be observed from Earth. Thus, the currently accepted value for Mars' ESI is a mere mathematical extrapolation based on the assumption that Earth revolves around the Sun once a year. Yet, as can be directly observed, Mars actually exhibits two distinct periods of 707 and 546 days (see Table 5.1).

You may now justly ask, *"How is this even possible? How can Mars realign with the same star, as seen from Earth, at two wholly different intervals?"* This is indeed a very good question, one which Copernican astronomers have never been able to answer. In contrast, the TYCHOS model not only provides an answer, but obviates the question altogether: Mars must for demonstrable geometric reasons have two sidereal periods, as I will now further expound upon.

Please note that, in reality, Mars does indeed have a 686.9-day period (approximately 687 days), which is the time needed for Mars to revolve once around the Sun. This, however, is not Mars' mean sidereal period, as viewed from Earth, but the period for Mars to return to its degree position relative to the Sun, as shown in Fig. 5.1.

Why Mars is behaving in this way will become clear as we take a look at the synodic period of Mars.

Table 5.1 – Sequence of Mars' sidereal periods (ESI)

707 days	707 days	707 days	707 days	707 days	707 days	707 days	546 days

Total: 5495 days (approximately 15 years)

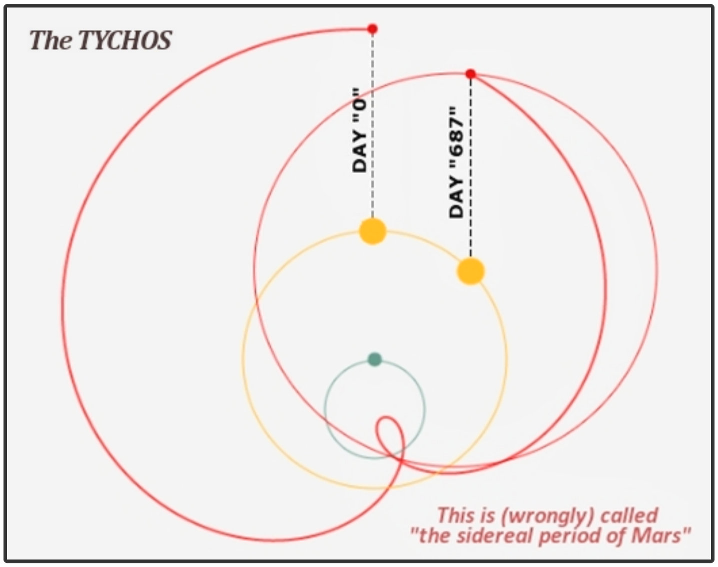

Fig. 5.1 Mars revolves around the Sun in about 687 days.

Chapter 7 contains a thorough exposition of the two sidereal periods of Mars (i.e., the long ESI of 707 days and the short ESI of 546 days), but let us take one step at a time and begin with Mars' synodic period and the interplay between Mars and the Sun.

5.2.1 The synodic period of Mars

We have just seen that Mars' most frequent sidereal period (the long ESI) lasts on average 707 days (about 23 days less than two solar years of 730.5 days). Put differently, Mars returns facing the same star 23.3 days earlier than the Sun does, in a two-year period. The average synodic period of Mars is 779.2 days. This is the time needed for Mars to line up again with the Sun, as viewed from Earth. This is 48.7 days longer than two solar years ($730.5 + 48.7 = 779.2$). Thus, we have:

- The average duration of the 'retrograde periods' of Mars = 72 days.

$$48.7 + 23.3 = 72$$

This leads us to a most remarkable realisation: since the two binary companions, Sun and Mars, are locked in a 2:1 orbital ratio, one might think they would 'meet up' every 730.5 days (2 solar years). But due to Mars retrograding biyearly by around 72 days on average, Mars will 'slip out of phase' with our timekeeper, the Sun—hence, with our earthly calendar. Therefore:

- As viewed from Earth, Sun and Mars will conjunct only every 779.2 days.

$$707.2 + 72 = 779.2$$

- Mars completes 7.5 synodic periods in 16 solar years.

$$\frac{779.2 \times 7.5}{365.25} = 16$$

Every 16 years Mars and the Sun do in fact conjunct with Earth, although on opposite sides of our planet. Mars will need another 7.5 synodic cycles for a total of 32 years (i.e., 2×16, or $15 + 17$) to complete one of its 32-year cycles. Since Mars processes biyearly (in relation to the Sun) by an average of ~45 min of RA, then we can see that:

- In 32 solar years, Mars will process by about 1440 min RA.

$$45 \times 32 = 1440$$

- 1440 min of RA is, of course, equivalent to the 360° (the celestial sphere).

Next, we will see how, as discovered by Tycho Brahe, the respective orbital paths of the Sun and Mars can and do indeed intersect in typical binary fashion, much like the observed orbital behaviour of Sirius A and Sirius B—the brightest star system in our skies.

5.3 The binary dance of the Sun and Mars

As mentioned earlier, Brahe's boldest contention was undoubtedly that the orbits of Mars and the Sun intersect. Back then, his opponents would jeer: *"Preposterous! Sooner or later, Mars and the Sun must collide!"* Their pooh-poohing may perhaps be excused for back in Brahe's day no one was aware of the existence of binary systems, the ubiquity of which was only established long after the invention of the telescope. In hindsight, one may graciously say that Brahe was ridiculed out of pre-telescopic academic ignorance.

The orbital configuration shown in Fig. 5.2 is consistent with the models of Tycho Brahe and Pathani Samanta, with the exception of the 'clockwise' orbital motion of Earth—my main personal contribution to Brahe's brilliant geo-heliocentric model. For now though, let us focus our attention on Mars and its peculiar motion around the Sun and Earth.

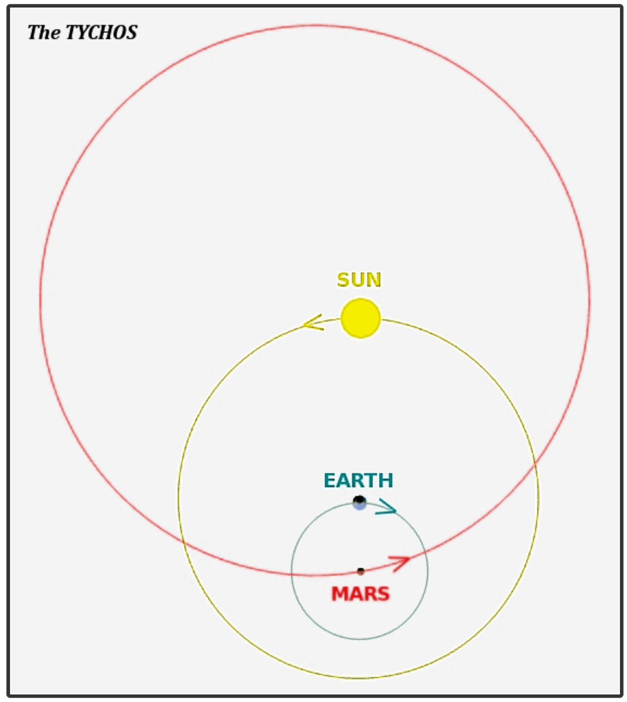

Fig. 5.2 Relative orbital directions of the Sun, Earth and Mars.

The motions of Mars had the greatest astronomers of yore, including Brahe, scratching their heads:

> *We have seen that Tycho, like Ptolemy and Copernicus, assumed the solar orbit to be simply an excentric circle with uniform motion. But already in 1591, he might have perceived from the motion of Mars that this could not be sufficient, as he wrote to the Landgrave that 'it is evident that there is another inequality, arising from the solar excentricity, which insinuates itself into the apparent motion of the planets, and is more perceptible in the case of Mars, because his orbit is much smaller than those of Jupiter and Saturn.* [5]

Mars has been the single most problematic body of observational astronomy for reasons that should become clear as we go along. The astronomy literature is sprinkled with comments hinting at the 'uniqueness' of Mars' cosmic behaviour:

> *Among the planets, Mars is a maverick, wandering off from the deferent-epicycle model more than most of the other planets.* [6]

Of course, all this head-scratching is unnecessary if one uses the correct configuration of the Solar System. Mars has been viewed as a 'maverick' for the simple reason that it is the binary companion of the Sun. In hindsight, one of Kepler's most famous quotes rings like a most appropriate omen, the irony of which I trust future astronomy historians will underline:

> *By the study of the orbit of Mars, we must either arrive at the secrets of astronomy or forever remain in ignorance of them. [Johannes Kepler]*

Most remarkably, it so happens that, during his five-year-long *"war on Mars"*, Kepler evidently spent some serious time considering a geocentric configuration and even called Mars a *"star"*. His little-known diagram, *De Motibus Stellae Martis* (*"Of the Motion of the Star Mars"*), traced the motions of Mars between 1580 and 1596 (a 16-year period). It was obviously based on and computed from Brahe's accurate observations, yet he ultimately discarded it.

Figs. 5.3 and 5.4 compare the motions of Mars traced by the Tychosium simulator with those of Kepler's diagram. It looks like Kepler had at one time really been on to something!

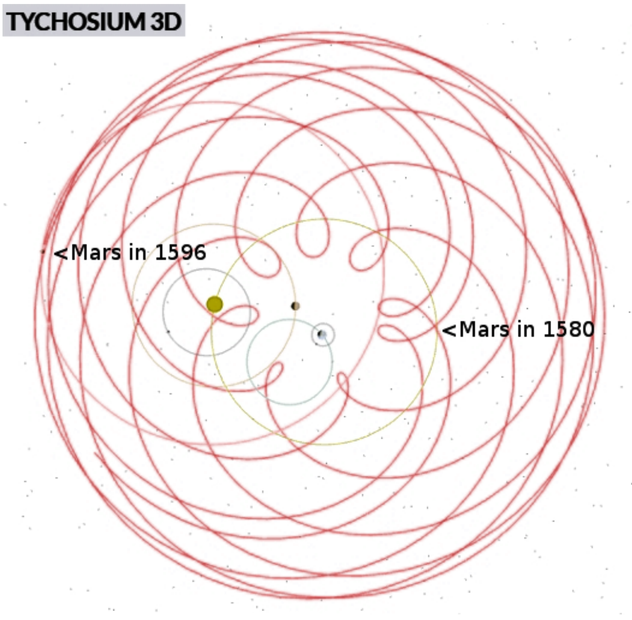

Fig. 5.3 Mars in the TYCHOS model.

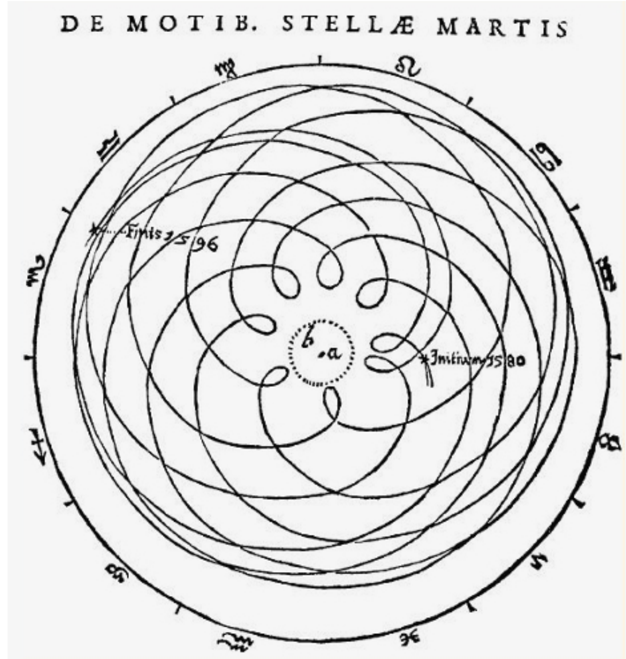

Fig. 5.4 Kepler's little-known diagram.

Presumably, Kepler was simply unable to conceive how and why Mars—or any celestial body, for that matter—could possibly trace such oddly 'looping' trajectories. When it comes to envisioning the geometric dynamics of two magnetically bound, mutually orbiting objects (such as the Sun and Mars), the cognitive power of the human mind meets its limits. Modern motion graphics can help us overcome this mental hurdle and realise that these spirographic orbital patterns are merely the visual effect of an object revolving around another revolving object.

5.4 Is Mars a planet or a star?

Readers might wonder how a planet could possibly be the binary companion of our Sun, when binary systems like Sirius A and Sirius B are understood to be pairs of stars revolving around each other. But is Mars really a planet? Well, while Mars is identified as a planet in every modern school book, we have seen that Kepler for unknown reasons referred to Mars as a star. Although it is beyond the scope of this treatise to investigate how stars and planets are formed, I nonetheless wish to state my support for the hypothesis that planets are in reality very old stars which have cooled down and solidified into rocky spheres.

To be sure, this is not the position of mainstream astronomers who regard stars and planets as wholly different, mutually exclusive entities. On the other hand, in their voluminous study, *Stellar Metamorphosis*, Jeffrey Wolynski and Barrington Taylor make a compelling case that all the bodies in our cosmos are stars at different stages of evolution, and that planets and moons are quite simply very old, cooled-down stars:

> *It is suggested that the rule of thumb of stellar age delineation is that old stars orbit younger ones, the younger ones being the more massive, hotter ones.* [7]

Under this hypothesis, the 'older star' of our binary Solar System would be Mars, as it orbits a 'younger and hotter star' (the Sun). Interestingly, it has also been suggested that our Earth-Moon system may be a former binary star system which, as the two 'shed their skin', ended up as a planet and a satellite. To wit, the notion that Earth may be a former star shouldn't sound too outlandish: after all, the fiery magma trapped in Earth's core which occasionally spurts out of volcanoes may well be viewed as an indication that we are, in fact, living on the surface of an old, cooled-down star. In turn, our barren and volcano-less lunar satellite, the Moon, would according to the same hypothesis be an even older and cooler extinct star.

5.4.1 The 79-year cycle of Mars

Long before Ptolemy, the Babylonians knew that the motion of Mars is repeated, very nearly, in a 79-year cycle – that is, oppositions of Mars occur at nearly the same longitude every 79 years. [6]

The intervals between two Mars oppositions closest to (56.6 Mkm) or farthest from (101 Mkm) Earth will alternate between 15 and 17 years, due to the peculiar epitrochoidal path of Mars around the Sun and Earth. This produces a 15y / 17y / 15y / 15y / 17y pattern repeated every 79 years. Or you could think of it as five cycles of nearly 16 years (79 / 5 = 15.8).

Mars' unique, alternating 15/17-year pattern has never been satisfactorily explained until now. None of our other outer planets exhibits such an irregular pattern. Jupiter, for instance, invariably returns to the same place in our skies in about 12 solar years.

Table 5.2 – The 79-year cycle of Mars

The 79-year cycle of Mars, extracted from a Mars opposition catalogue [8], listing a number of past and future opposition dates between September 1956 and September 2035, along with the respective Mars-Earth distances. The distances vary from a minimum of 56 Mkm to a maximum of 101 Mkm. The full Mars opposition cycle takes 79 years and displays the 15y / 17y / 15y / 15y / 17y pattern described above.

Cycle	Opposition Date			Mkm	
15	1956	Sep	10	56.56	← Mars closest to Earth
	1958	Nov	16	72.96	
	1960	Dec	30	90.78	
	1963	Feb	4	100.30	← farthest
	1965	Mar	9	100.00	
	1967	Apr	15	89.94	
	1969	May	31	71.74	
17	1971	Aug	10	56.20	← Mars closest to Earth
	1973	Oct	25	65.23	
	1975	Dec	15	84.60	
	1978	Jan	22	97.72	
	1980	Feb	25	101.32	← farthest
	1982	Mar	31	95.01	
	1984	May	11	79.51	
	1986	Jul	10	60.37	
15	1988	Sep	28	58.81	← Mars closest to Earth
	1990	Nov	27	77.33	
	1993	Jan	7	93.66	
	1995	Feb	12	101.08	← farthest
	1997	Mar	17	98.64	
	1999	Apr	24	86.54	
	2001	Jun	13	67.34	
15	2003	Aug	28	55.76	← Mars closest to Earth
	2005	Nov	7	69.42	
	2007	Dec	24	88.17	
	2010	Jan	29	99.33	
	2012	Mar	3	100.78	← farthest
	2014	Apr	8	92.39	
	2016	May	22	75.28	
17	2018	Jul	27	57.59	← Mars closest to Earth
	2020	Oct	13	62.07	
	2022	Dec	8	81.45	
	2025	Jan	16	96.08	
	2027	Feb	19	101.42	← farthest
	2029	Mar	25	96.82	
	2031	May	4	82.78	
	2033	Jun	27	63.28	
	2035	Sep	15	56.91	← Mars closest to Earth

In the Tychosium 3D simulator, Mars is shown to revolve around a uniformly circular orbit at constant speed. In fact, Kepler's 'laws' of planetary motion, with their odd elliptical orbits and variable speeds, are simply a mathematical construct to make astronomical data compatible with the Copernican model. The same is true for Einstein's temporally warping time-space, something we will come back to further on when we look at Mercury. It bears reminding that, before Kepler introduced these 'laws', astronomers all over the world had been relentlessly pursuing the ideal concept of uniform circular motion. In fact, so had Kepler himself, before he started stretching and squeezing the recalcitrant Martian motions observed by Brahe into ever more complex equations.

> *The testimony of the ages confirms that the motions of the planets are orbicular. It is an immediate presumption of reason, reflected in experience, that their gyrations are perfect circles. For among figures it is circles, and among bodies the heavens, that are considered the most perfect. However, when experience is seen to teach something different to those who pay careful attention, namely, that the planets deviate from a simple circular path, it gives rise to a powerful sense of wonder, which at length drives men to look into causes.* [9]

Please make a note of Mars' peculiar 79-year cycle. We will soon look into the lesser-known 79-year cycle of the Sun and demonstrate an even closer, interrelated pattern between Mars and the Sun.

5.5 Mars' opposition ring

With an average minimum distance from Earth of 56.6 Mkm and average maximum distance of 101 Mkm, the Mars oppositions allow to establish the diameter of the opposition ring: approximately 157.6 Mkm.

As it happens, this value (157.6 Mkm) reflects the difference between the orbital diameters of Mars and the Sun. Why is this significant? Consider the following:

- Difference between orbital diameters of Mars and the Sun = 157.6 Mkm ($456.8 - 299.2 = 157.6$)
- Diameter of the opposition ring of Mars (on which all Mars oppositions occur) = 157.6 Mkm
- When Mars finds itself in opposition (as it is observed to reverse direction in the sky for 72 days on average) it can transit as close to Earth as 56.6 Mkm and as far as 101 Mkm ($56.6 + 101 = 157.6$).

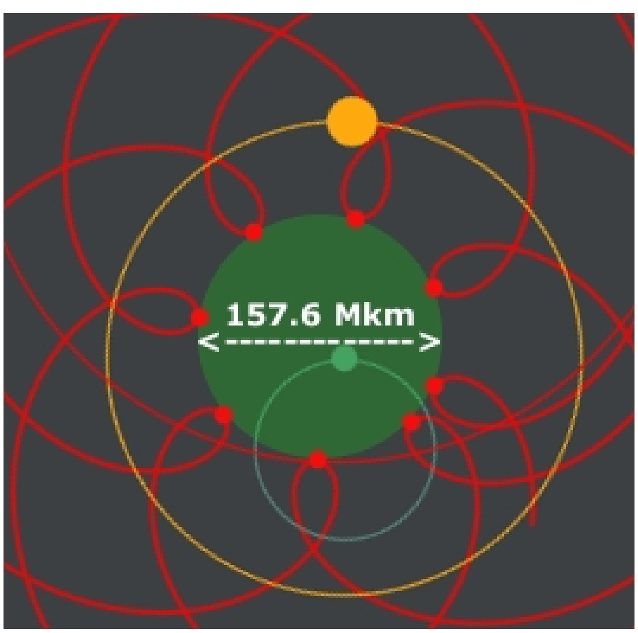

Fig. 5.5 Mars' opposition ring.

5.6 Mars' retrograde periods falsify the Copernican model

As Mars transits in so-called opposition (i.e., when Mars and the Sun find themselves on opposite sides of the Earth), its usual West-to-East motion will appear to reverse direction (or 'retrograde', as we say) and to proceed East to West against the starry background for a variable number of weeks. Fig. 5.6 shows how the famed astro-photographer Tunc Tezel expertly captured the Mars retrogrades of 2003 and 2012, and how these two periods are traced in the Tychosium 3D simulator.

Note that Mars passed almost twice as close to Earth in 2003 (0.373 AU, or 56.6 Mkm) as in 2012 (0.674 AU, or 101 Mkm). Also, note that in 2003 Mars was observed to retrograde against the starry background by about 40 min of RA (over 61 days), whereas in 2012 it retrograded by as much as 72 min of RA (over 83 days). This is shown in Fig. 5.7.

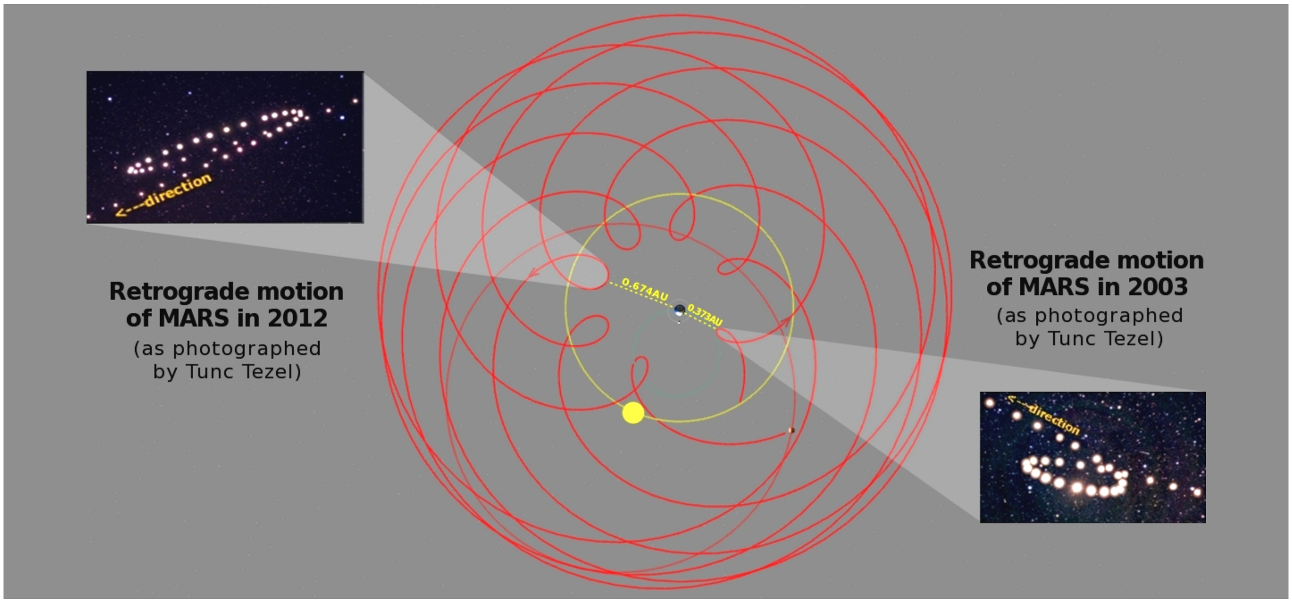

Fig. 5.6

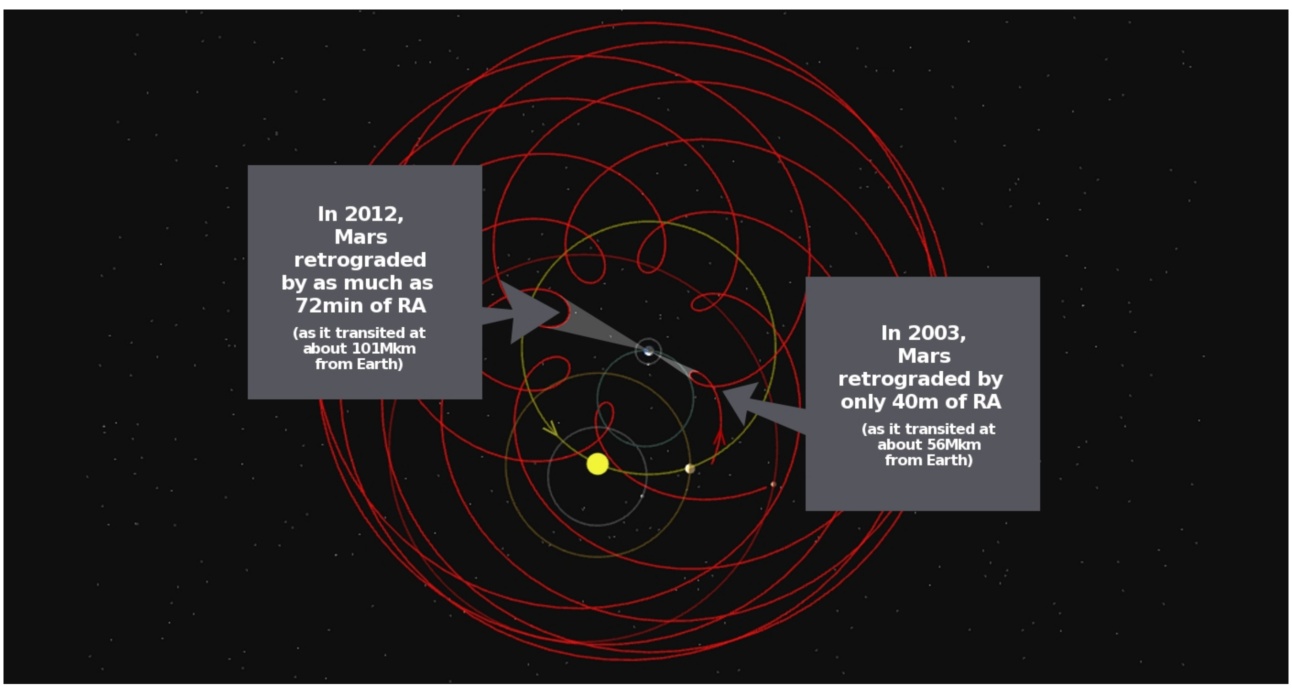

Fig. 5.7

In other words, Mars reversed course for a shorter time and shorter distance in 2003 than in 2012. This is most remarkable because, according to the Copernican model, it should be precisely the other way around. As you may know, Copernicans contend that Mars appears to retrograde whenever Earth (in the 'inside lane') overtakes Mars (in the 'outside lane'). The resulting change in perspective (or parallax) would then produce the optical illusion of Mars back-tracking in the sky against the starry background. If this were the case though, the closer Earth is to Mars during the 'overtaking', the larger the retrograde effect should be. Instead, the exact opposite is empirically observed.

Figures 5.8 and 5.9 provide a closer comparative view of the retrogrades of Mars in 2003 and 2012, as described above:

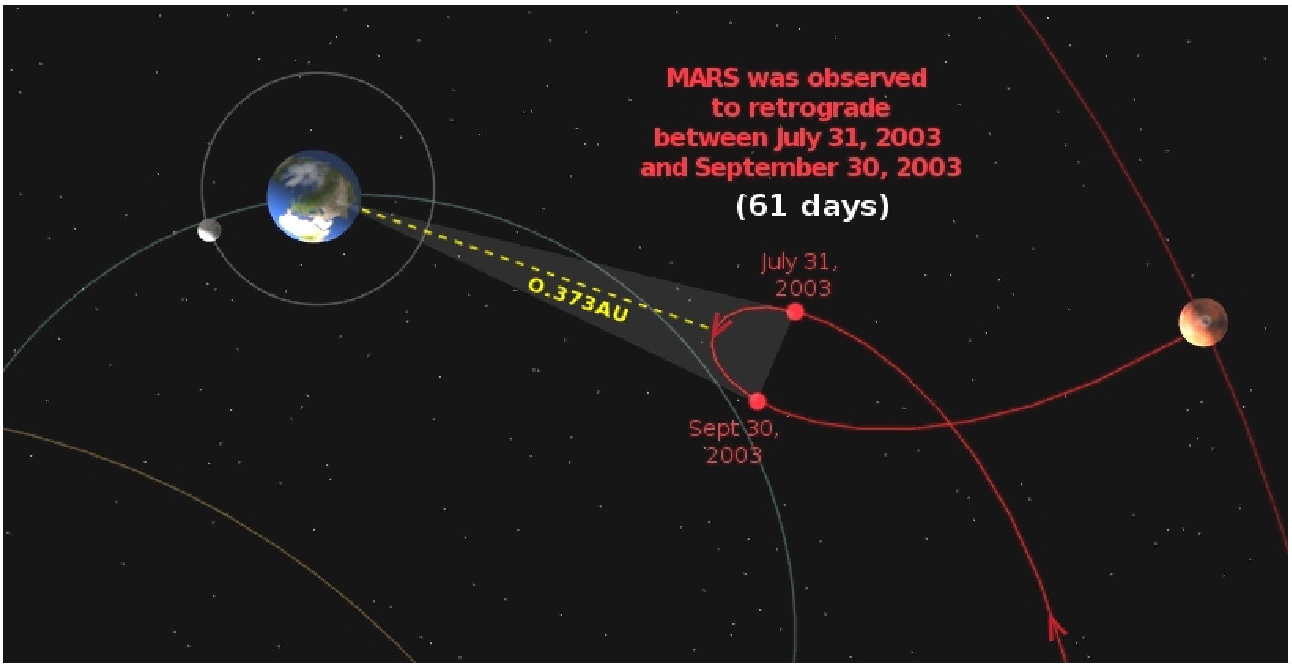

Fig. 5.8

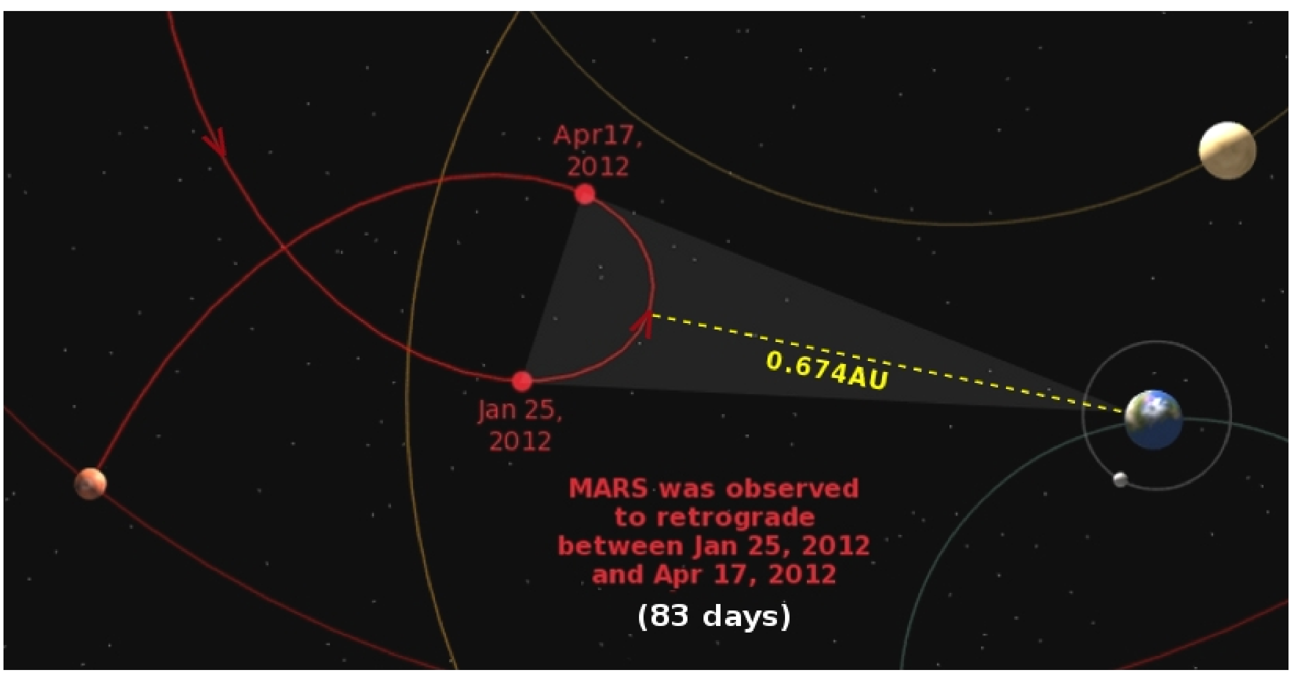

Fig. 5.9

In Fig. 5.10, point 'M' (think Mars) will seem to retrograde by a larger amount to the driver of the red van than to the driver of the yellow van. However, Mars' actual motion is quite simply the opposite of what we would see if the Copernican inner-lane-outer-lane hypothesis were correct.

Mars's observed retrograde motions are enough to falsify the entire Copernican theory beyond appeal. The heliocentric model's explanation for the retrograde motions of our planets is inadmissible and must be discarded since it violates the most basic laws of spatial perspective.

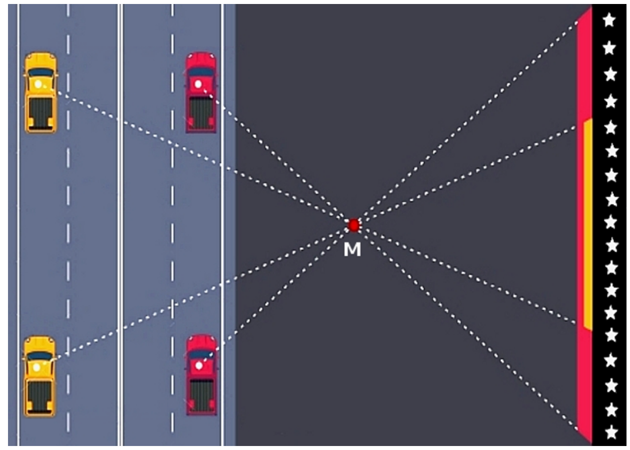

Fig. 5.10 The basic law of perspective, or parallax.

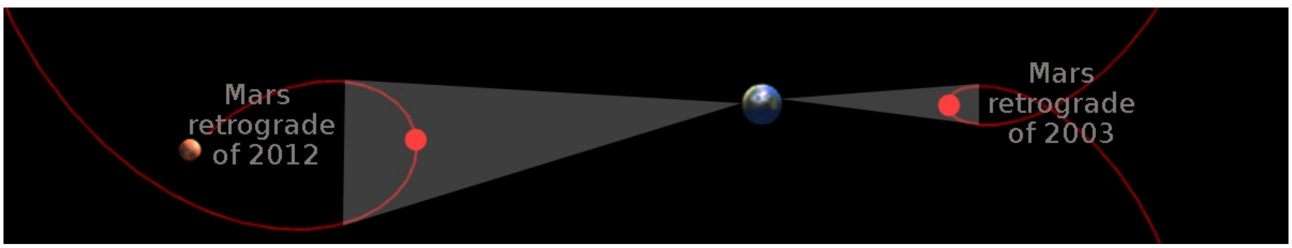

Fig. 5.11 When Mars was closest to Earth in 2003, it retrograded against the stars far less than it did in 2012.

This basic law of perspective is as incontestable as it gets. Yet, incredibly enough, no Copernican astronomer has ever publicly admitted that the observed retrogrades of Mars roundly falsify their explanation of retrograde motions. As we shall see further on, the issue of Mars' retrograde periods is not by any means the only aberration afflicting the Copernican model; there are a number of far graver—indeed insurmountable—problems with the heliocentric model children are taught in school.

There is a simple way to experience and verify this basic law of perspective for yourself, without leaving your living room. The exercise below is based on a real-world optical situation anyone can easily relate to:

Exercise

1. Raise your forefinger (think of it as being Mars) in front of your nose and stretch out your arm as far as you can.
2. Next, aim your outstretched arm at the books on the shelves (think of them as stars) at the far side of your living room.
3. Now rotate your neck from left to right as much as you can while keeping your eyes focused on your forefinger and the books on the shelves.
4. Observe how many books move from side to side in relation to your raised forefinger.
5. Now bring your forefinger 50% closer to your nose and repeat your left-to-right neck rotation.
6. Observe how a significantly larger portion of books will move from side to side in relation to your forefinger.

By now it should be clear why Kepler decided to fudge with the highly accurate observational data provided by his master, Tycho Brahe. As the staunch Copernican he was, he missed the opportunity to make sense of the complex motions of Mars, what with its unequal retrograde periods and seemingly fluctuating orbital speeds. Kepler's *"war on Mars"* was simply unwinnable, since the man was obstinately attached to the idea that the Sun had to be at the centre of the system. I will thus dare say that his devious and obdurate ways will go down in history as a textbook case of how scientific investigations should not be pursued; Kepler's ardent quest was fogged by that all-too-common defect of the human intellect: confirmation bias.

In the next chapter, we will take a good look at the astounding similarities between the Sirius binary system and our own system. Sirius, of course, is the brightest star in our skies. I trust the reader can imagine my pleasant surprise when in the early stages of my TYCHOS research I realised that the observed diameters of Sirius A and Sirius B are proportionally identical to those of the Sun and Mars.

5.7 References

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[2] *Pioneer Astronomer Faked Orbit Theory, Scholar Says* by New York Times (January 23, 1990) https://www.tychos.info/citation/020B_Pioneer-Faked-Theory.htm

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[5] p.346, *Tycho Brahe: a picture of scientific life and work in the sixteenth century* by John Louis Emil Dreyer (1890) https://tinyurl.com/tychobraheDreyer

[6] *The Ballet of the Planets: A Mathematician's Musings on the Elegance of Planetary Motion* by Donald Benson (2012) https://tinyurl.com/balletplanetsBenson

[7] *Stellar Metamorphosis* by Jeffrey Wolynski & Barrington Taylor (2017) https://www.tychos.info/citation/026A_Stellar-Metamorphosis.pdf

[8] *Mars Oppositions* by Hartmut Frommert (2008) https://www.tychos.info/citation/028A_Mars-Oppositions.htm

[9] *Kepler's Discovery* https://keplersdiscovery.com/threeModels.html

6

IS SIRIUS THE 'TWIN' OF OUR SOLAR SYSTEM?

6.1 About Sirius A and Sirius B

One of the primary objections submitted by opponents of the TYCHOS model is that Mars is far too small to be our Sun's binary companion. They argue that this would gravely violate Isaac Newton's gravitational laws and that Mars, being such a small body, would immediately crash into the Sun. As we shall presently see, this argument is directly contradicted by the very existence of the Sirius binary system, which is composed of one large star (Sirius A) and one very small companion star (Sirius B). Remarkably enough, Sirius A and B are in the same proportion to each other as the Sun and Mars.

It is a matter of historical record that astronomers were totally stumped when the first binary star systems were discovered. The extremely small size of some of these newly detected companion stars—which kept multiplying thanks to improvements in telescopes and spectroscopes—made no sense within the framework of Newton's theories. For instance, following the discovery of the tiny Sirius B, here is what Sir Arthur Eddington, renowned Astronomer Royal, had to say:

> *We learn about the stars by receiving and interpreting the messages which their light brings to us. The message of the Companion of Sirius when it was decoded ran: 'I am composed of material 3,000 times denser than anything you have ever come across; a ton of my material would be a little nugget that you could put in a matchbox.' What reply can one make to such a message? The reply which most of us made in 1914 was—'Shut up. Don't talk nonsense.'* [1]

Indeed, as these small binary companions were discovered, Newton's sacrosanct gravitational laws were in grave danger of catastrophic demise. Eventually though, the situation was circumvented in what must be one of the most egregious cases of outright chicanery in science history. The *ad hoc* solution to the Newtonian pickle was to affirm that tiny companion stars were necessarily made of extraordinarily dense matter. And, in fact, astronomy students are taught today that an object the size of a sugar cube would weigh some 1000 kg on Sirius B because the gravitational pull is for unknown reasons 400 000 times greater there than on Earth!

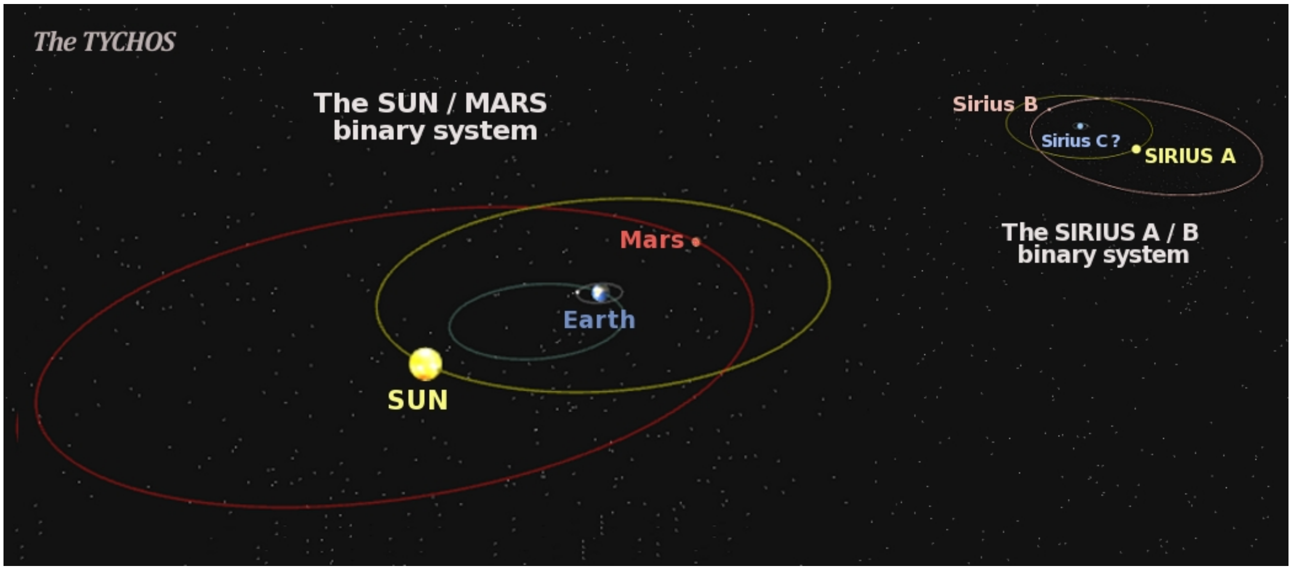
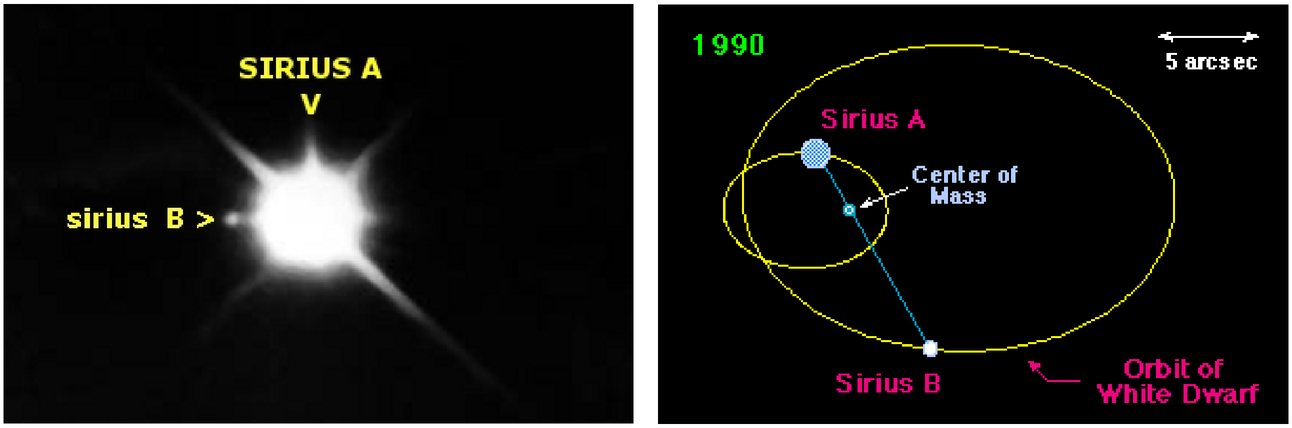


Fig. 6.1



(a) *(b)*

Fig. 6.2 ***(a)*** The earliest photograph of Sirius A and Sirius B (Lindenblad, 1973). ***(b)*** This is how some astronomy websites illustrate the orbits of Sirius A and Sirius B. The two bodies are presumed to orbit around a common centre of mass, or 'barycentre'.
Source: Martin Clutterbuck

That's right, we are told that, in spite of having a slightly smaller diameter than Earth, Sirius B is heavier than our Sun because its atoms are packed almost half a million times tighter than our earthly atoms. I trust any intellectually honest person can see this is nothing but a manoeuvre to preserve the prestige of Sir Isaac Newton—one of our scientific community's most cherished icons.

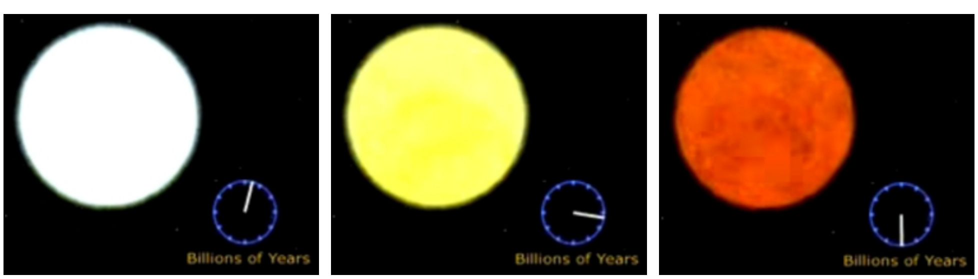
Sirius, the brightest star in our skies, is a 'classic' binary system composed of at least two known bodies, Sirius A and Sirius B, which revolve around a common barycentre in intersecting orbits. The tiny companion star, Sirius B, was discovered by Alvan Clark in 1862 with what was then the world's largest refractor telescope. As we shall see further on, a third body (Sirius C) is now suspected to be part of the Sirius system, despite being invisible even to our largest telescopes. But let us begin by taking a look at the two visible and well-known bodies of the Sirius binary system.

It should be noted that Sirius B is believed to be a so-called white dwarf. In Chapter 3, we saw that Mars to some extent fits the description of a red dwarf. According to cosmologists, the only difference between a white dwarf and a red dwarf is their age, red dwarfs being much older.

Let us now address the first and most frequent objection to the TYCHOS model, namely that Mars is way too small to be the Sun's binary companion. This objection actually stands on very thin ground since it is invalidated by the empirically observable fact that the diameters of Sirius A and Sirius B are proportionally identical to those of the Sun and Mars.

Note that we will only be comparing the observed, relative angular diameters of Sirius A and Sirius B since any claim as to their respective masses would be impossible to verify empirically from Earth. In fact, all mass estimates of distant celestial bodies have to this day been based upon Einstein's and Newton's postulations which in later decades have been seriously questioned, if not roundly falsified. Yet, most astrophysicists seem to be comfortable with the notion that the 'midget star' Sirius B must have a larger mass than that of our Sun. Wikimedia and Wikipedia make the following extraordinary claims:

> *The white dwarf, Sirius B, has a mass equal to the mass of the Sun packed into a diameter that is 90% that of the Earth. The gravity on the surface of Sirius B is 400,000 times that of Earth!* [2]



(a) *(b)* *(c)*

Fig. 6.3 Evolution of a white dwarf star.

In 2005, using the Hubble telescope, astronomers determined that Sirius B has nearly the diameter of the Earth, 12,000 kilometres, with a mass 102% of the Sun's. [3]

Astronomers essentially believe that since Newton's gravitational laws so elegantly predict the masses of the components our system, the same laws may safely be applied to the entire universe. Thus, if a large star and a tiny star can revolve around each other in a binary system, the mass of the tiny star must, they think, be phenomenally large.

I trust anyone can sense the fallacy inherent in this reasoning. It is really nothing but a textbook case of *ad hoc* confirmation bias on part of our world's astrophysicists. So, for now let us skip the abstract question of the unmeasurable masses of distant celestial bodies and focus on the readily measurable relative diameters of the Sun and Mars, and contrast them directly with those of Sirius A and B, as estimated by Copernican astronomers.

Comparing the sizes of Sirius A and B with the sizes of the Sun and Mars

Diameter of Sirius A:	2390000	km
Diameter of Sirius B:	11684.4	km

⇒ Sirius B's diameter is ∼0.4889% that of Sirius A.

Diameter of the Sun:	1392000	km
Diameter of Mars :	6792.4	km

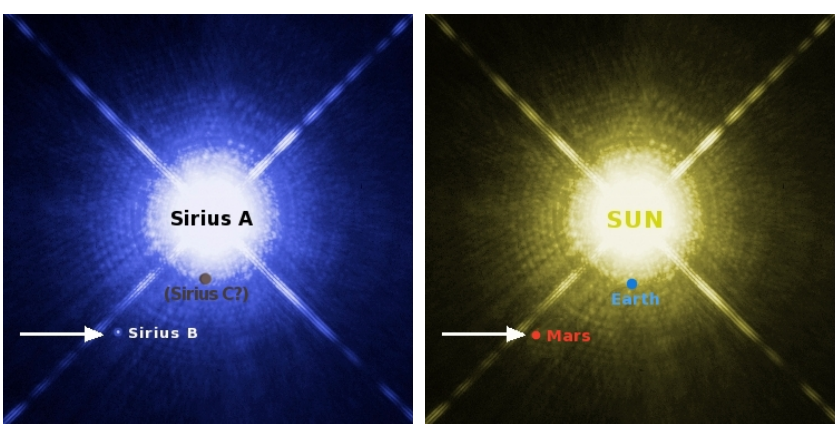
⇒ Mars's diameter is ∼0.4880% that of the Sun.

This corresponds to a proportional difference of barely 0.0009%, or put differently:

- Sirius A is about 205 times larger than Sirius B.
- The Sun is about 205 times larger than Mars.

Thus, since the two companion stars in the Sirius system are practically in the same proportion to each other as the Sun and Mars, the objection that Mars would be far too small a binary companion is a non-starter; the very existence of the Sirius binary system constitutes empirical evidence that such an allegedly unbalanced system can and does indeed exist in our cosmos. No truly scientific mind would dismiss this as mere coincidence unworthy of serious consideration and debate. In any event, this directly observable fact certainly lends support the TYCHOS model's main contention, namely that the Sun and the midget Mars are binary companions, much like Sirius A and the midget Sirius B are empirically observed to be, as they revolve around each other in about 50 solar years.

Surely, it would be extremely difficult or outright impossible to see Earth from Sirius as it would be swamped by the Sun's blinding glare. Conversely, the same would be true for any earthly observer attempting to detect an Earth-like body in the blinding glare of Sirius A.



(a) *(b)*

Fig. 6.4 These pictures are based on a Wikipedia image captioned: *"Image of Sirius A and Sirius B taken by the Hubble Space Telescope. Sirius B, which is a white dwarf, can be seen as a faint point of light to the lower left of the much brighter Sirius A."*

(a) I have added a grey dot (Sirius C?) which will be explained shortly.

(b) My composited image on the right suggests what our own system might look like if viewed from Sirius.

6.2 About the possible existence of 'Sirius C'

As it is, there may be even more astonishing similarities between the Sirius binary system and our own binary system. Although further studies are needed to confirm its existence, it would appear that the Sirius binary system may well harbour a third body—provisionally named 'Sirius C'. We shall now take a look at what is currently known about this controversial third component of the Sirius system, along with its fascinating implications for the TYCHOS model.

A fairly recent (1994) French astrophysical study concluded there are fairly solid indications for the existence of a third body in the Sirius system. Fig. 6.5 provides an extract, but the paper is well worth reading in its entirety.

The study essentially concludes that 'Sirius C' may well exist (though visually swamped by the glare of Sirius A), that it would have a far smaller mass than its two confirmed binary companions, and that its 'host star' would most likely be Sirius A, and not the midget star Sirius B. But before proceeding, let us look at a conventional diagram illustrating the intersecting orbits of Sirius A and Sirius B as they are viewed from Earth. Note that, in Fig. 6.6, Sirius B is labelled a 'carbon star', bringing to mind the fact that 96% of Mars' atmosphere is reputedly composed of carbon dioxide.

According to modern astronomers, Sirius A and Sirius B revolve in intersecting orbits around a barycentre located in the void of space. But if we grant the existence of a third component in the Sirius system, such a body might just be located in the middle of Sirius A's orbit. Fig. 6.7 shows how such an arrangement would compare to the Sun-Mars binary system, as proposed by the TYCHOS model.

Perhaps the most exciting implication of the configuration shown in Fig. 6.7 is the similar distance ratio between the small binary companion and the central body in each system. Thus, we know the distance between Mars and Earth (from perigee to apogee) varies by a 1:7 ratio. Assuming 'Sirius C' exists and is located in the middle of Sirius A's orbit, the exact same 1:7 ratio would apply to the distance between Sirius B and Sirius C. If this is really so—and we are just speculating here—'Sirius C' would be like a 'twin' to Earth.

1. Introduction

Sirius, "The Bright" of the ancients, forms, with its companion discovered a little more than 130 years ago, one of the most amazing double – and maybe triple – star.

Measured as soon as the ancient Egyptians established the relation between the Nile in spate and the first seeing of "Sothis" at dawn – the "heliacal rising" – , Sirius plays an important role in astronomy, for example in the discovery of stellar proper motions (see e.g. Lacaille 1764); in other respects, everybody knows that the evolutionary interrelations between the two stars is still an open question.

The proper motion of Sirius itself, well known since Halley's times, shows periodic variations. Bessel proposed in 1844 the hypothesis that these variations are due to an unseen companion. A theoretical orbit for the suspected double star was computed by Peters in 1851, Safford in 1861 and Auwers in 1862; in this latter year, Alvan Clark actually discovered the now well-known white dwarf Sirius B; the main star of the binary is therefore called Sirius A. So Sirius' companion is one of the first heavenly bodies the existence of which had been predicted through its gravitational effects, together with Neptune.

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* Tables 2 and 3, and the table in Appendix are available in electronic form at the CDS via *anonymous ftp 130.79.128.5*.

1.1. The controversial Sirius C

A tiny star ($m_v \approx 12$) has been observed about twenty times between 1920 and 1930. If there was a real object and not a "phantom" – the observers themselves were sometimes in doubt –, an orbit of around 2 years could roughly agree. However, we will see that this period does not fit with the results of the orbital analysis.

On the other hand, an analysis of the radial velocity of Sirius A between 1899 and 1926 led Voronov (1933, 1934a,b) to the hypothesis of the duplicity of Sirius A, with an orbital period of 4.5 years. Heintze (1968) also suspected such a duplicity, from the spectrum of this star, and concluded in favour of a relatively close companion of Sirius A. However, Lindenblad (1973), after photographic measurements over 6.8 years, did not find any significant perturbation. Moreover, Gatewood & Gatewood (1978) analyzed 60 years of observations with the Allegheny and Yerkes refractors, and concluded that nothing supports the hypothesis of a third body. Nevertheless, recent discussions about a possible change of color of Sirius during historic times (Schlossen & Bergmann 1985; Tang 1986; van't Veer & Durand 1988; Gry & Bonnet-Bidaud 1990) relaunch the debate: if the phenomenon is real, one of the possible explanations is the existence of a third body; Bonnet-Bidaud & Gry (1991) have observed the vicinity of Sirius and proposed several faint stars ($m_v \geq 17$) as candidates, but they are all so far from

Fig. 6.5 Extract from the paper *"Is Sirius a triple star"*, by D. Benest and J. L. Duvent. [4]

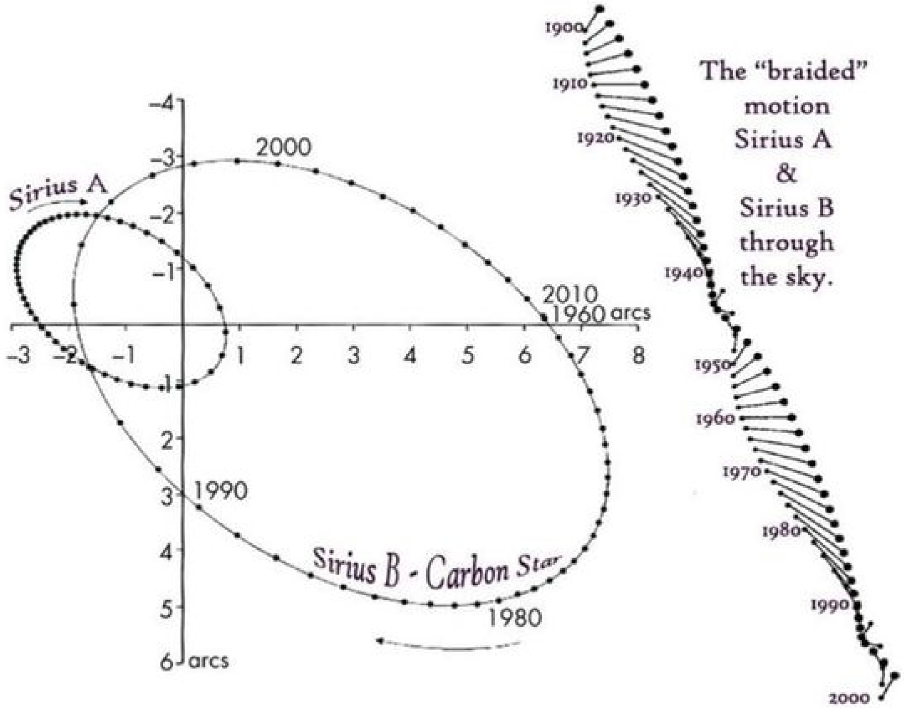
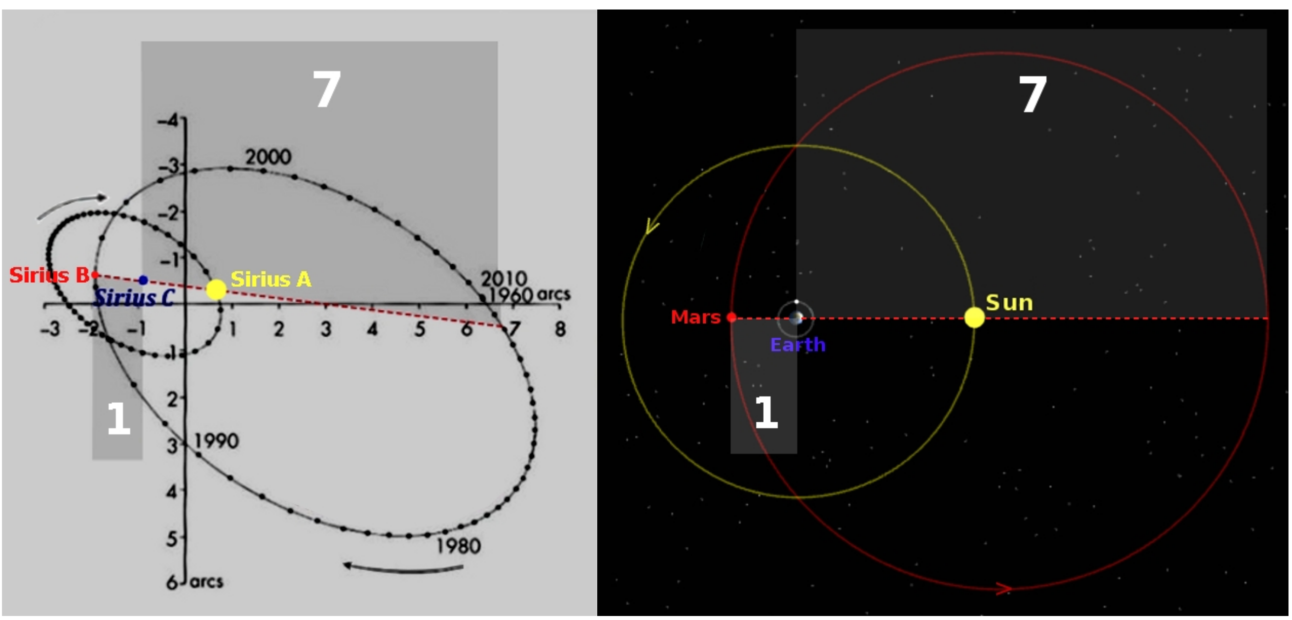


Fig. 6.6 The intersecting orbits of Sirius A and Sirius B as viewed from Earth.
Source: https://tinyurl.com/siriussystemASTRONOMOS



(a) *(b)*

Fig. 6.7 Is the Sirius binary system the ‘twin’ of the Sun/Mars binary system?
(a) The Sirius A/Sirius B binary system.
(b) The Sun/Mars binary system.

6.3 The 7-degree tilt of Mars, the Sun and the Sirius system

As will be expounded in more detail in Chapter 9, our Sun’s axis is observed to be tilted at about 6 or 7 degrees in relation to the ecliptic. This is yet another ‘mystery’ never explained by Copernican astronomers. Why would the Sun be tilted in relation to our system’s planets? Isn’t the Sun supposed to be the central, dominating mass of our system? And shouldn’t all the planets therefore revolve around the Sun’s equatorial plane?

Most interestingly, Mars' axis can also be observed to be tilted at about 7 degrees. This could be seen in July 2018 when Mars passed very close to Earth. On that date, Mars was also 'in opposition to' (i.e., 'facing') the Sirius system. Now, as viewed from Earth, the Sirius system also has a 7-degree tilt component, as shown in Fig. 6.9. Unless this is all coincidental, it would seem to suggest that the axes of the Sun and Mars are tilted 'in sympathy' with the entire Sirius system, at approximately 7 degrees.

As you may know, Mars' axis is also tilted at about 25 degrees, but in the other direction. This is why Mars will alternately show us its north pole and its south pole every 8.5 years or so, as it transits on either side of the Earth. Strangely, to my knowledge no mention of Mars' other and lesser-known 7-degree axial tilt is to be found in the astronomy literature, in spite of the ongoing debate on the Sun's 6 or 7-degree axial tilt (which some authors claim is caused by a hypothetical invisible body to which they have given the name 'Planet Nine').

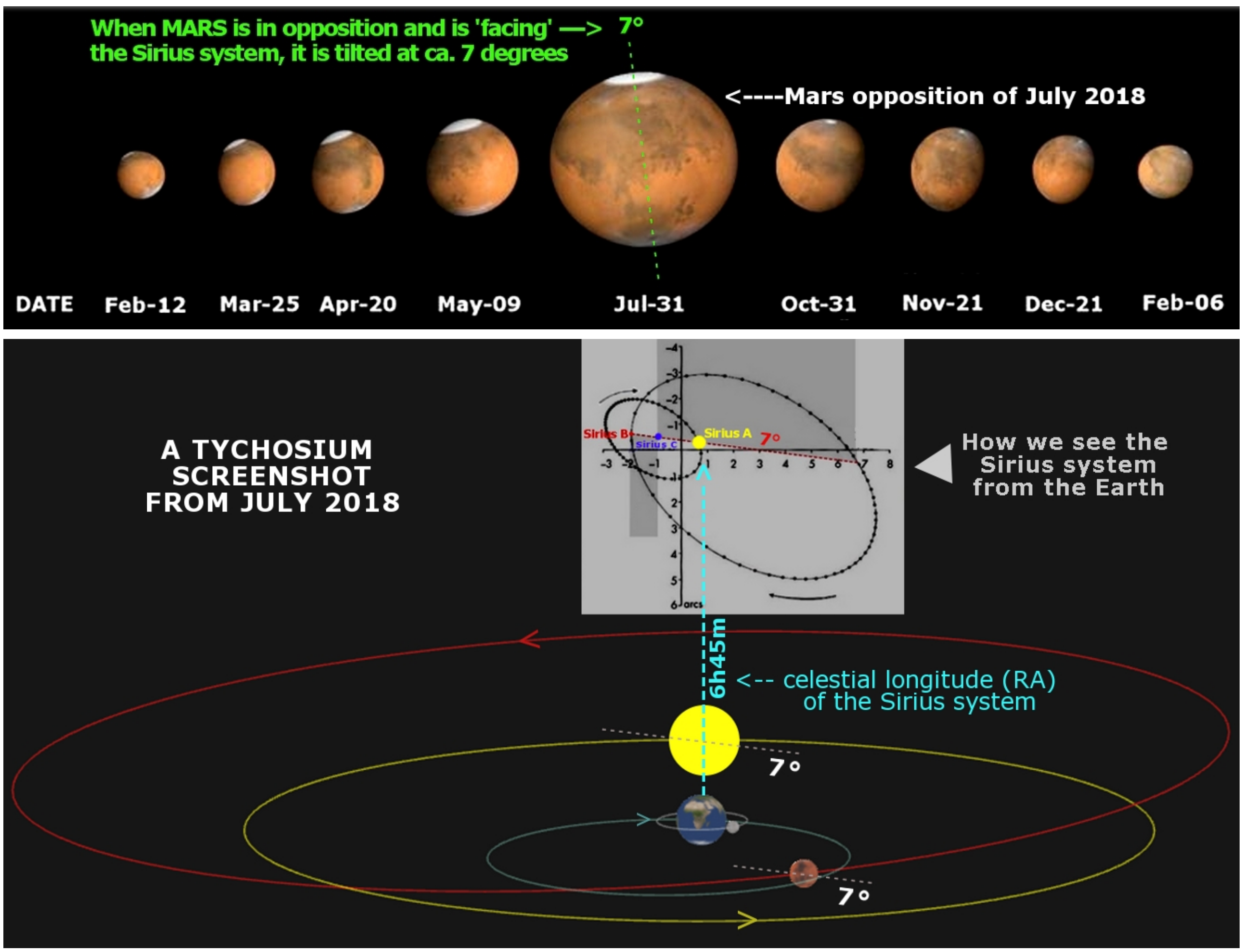


Fig. 6.8 Mars, the Sun and the Sirius system as viewed from Earth. All appear to be tilted at about 7 degrees. Source of the sequential Mars images of its 2018 transit: *Agena Observing Guide*

What about our Moon?

Does it also have an axial tilt? Yes, indeed. Here's what we may read on the Wikipedia:

> *The Moon's axis of rotation is inclined by in total 6.7° relative to the normal to the plane of the ecliptic. This leads to a similar perspective effect in the north-south direction that is referred to as optical libration in latitude, which allows one to see almost 7° of latitude beyond the pole on the far side.* [5]

Remarkable, isn't it?

6.4 The Dogon tribe's curious knowledge of Sirius

'Emme Tolo' is the name given to the elusive Sirius C by the Dogon people, an ancient African tribe that worshipped the brightest star in our skies. In fact, it still remains a veritable mystery how the Dogons even knew of the existence of the tiny Sirius B, since it is not visible without a telescope, except perhaps under exceptional circumstances. Could Sirius have been much closer to the Earth in the distant past?

Fig. 6.9 can be found on various 'alternative' websites. It depicts a proposed configuration of the Sirius system. Interestingly, it appears to feature the elusive 'Sirius C' (or Emme Tolo) positioned at the barycentre of the Sirius A/B binary system.

The Dogons somehow also knew about an even smaller body revolving in lunar fashion around Emme Tolo (or 'Sirius C'), much like our Moon revolves around Earth. They named this satellite 'Nyan Tolo' which translates as 'the women's star'. Of course, our Moon (*la Luna* in Italian, and in Greek mythology represented by the goddess Selene) has always been regarded as 'the women's orb', what with its sidereal orbital period of 27.3 days, approximately matching the average female menstrual cycle.

What are we to make of this remarkable story? As unlikely and bizarre as it may sound, it seems equally unlikely to be just a figment of someone's imagination. Whether or not one labels it a product of mythology and folklore will not change the observable fact: Sirius B does indeed exist, and the existence of 'Sirius C' is by no means an unreasonable hypothesis. Should it eventually turn out that both 'Sirius C' ('Emme Tolo') and its moon ('Nyan Tolo') exist, we will have to seriously consider the compelling possibility that the Sirius system is like a 'twin family' to our own system. [6]

As we saw in Chapter 5, critics of the TYCHOS model think it preposterous to cast Mars in the role of the Sun's binary companion, based on the allegedly highly unequal masses of these two bodies. I think it is time to question whether the assumed masses of the distant stars and planets have any foundation in reality. To be sure, no one will ever be able to weigh celestial bodies directly. Besides, Mars may be 205 times smaller than the Sun, but it is mostly made of rock and iron, whereas the Sun is 96% helium and hydrogen—the two lightest gases known to man. Hence, it is quite conceivable that their respective weights are far more similar than currently believed.

In conclusion, I submit that the very existence of the Sirius system is strongly supportive of the TYCHOS model's tenets. It provides, among other things, empirical evidence that a tiny celestial body can indeed be the binary companion of a large star. Moreover, it suggests that Sirius is like a 'twin family' to our own binary system, although we have no idea why this would be so. In any event, the fact that the Sirius system in so many ways parallels our own system certainly merits closer scrutiny.

Table 6.1 – Proposed twins in the 'twin family'

Object:		**Twin**
Sun	:	Sirius A
Mars	:	Sirius B (or "Po Tolo" in Dogon lore)
Earth	:	Sirius C (or "Emme Tolo" in Dogon lore)
Moon	:	"Nyan Tolo" in Dogon lore

Note that "Po Tolo" means 'the smallest seed star', much like one might describe Mars in our system. The Dogon drawings also place "Emme Tolo" (i.e., the elusive Sirius C) 'in the centre' of the Sirius System, much like the Earth is located 'in the centre' of the Solar System in the TYCHOS model. More remarkably still, according to Dogon lore, a smaller body which they call "Nyan Tolo" revolves around "Emme Tolo", much like our Moon revolves around the Earth.

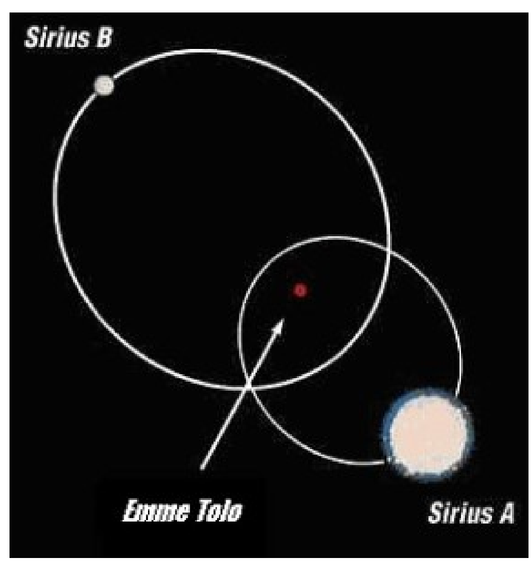


Fig. 6.9 *"The Dogons and the Stars of Sirius"* by Pacal Votan (2007). [7]

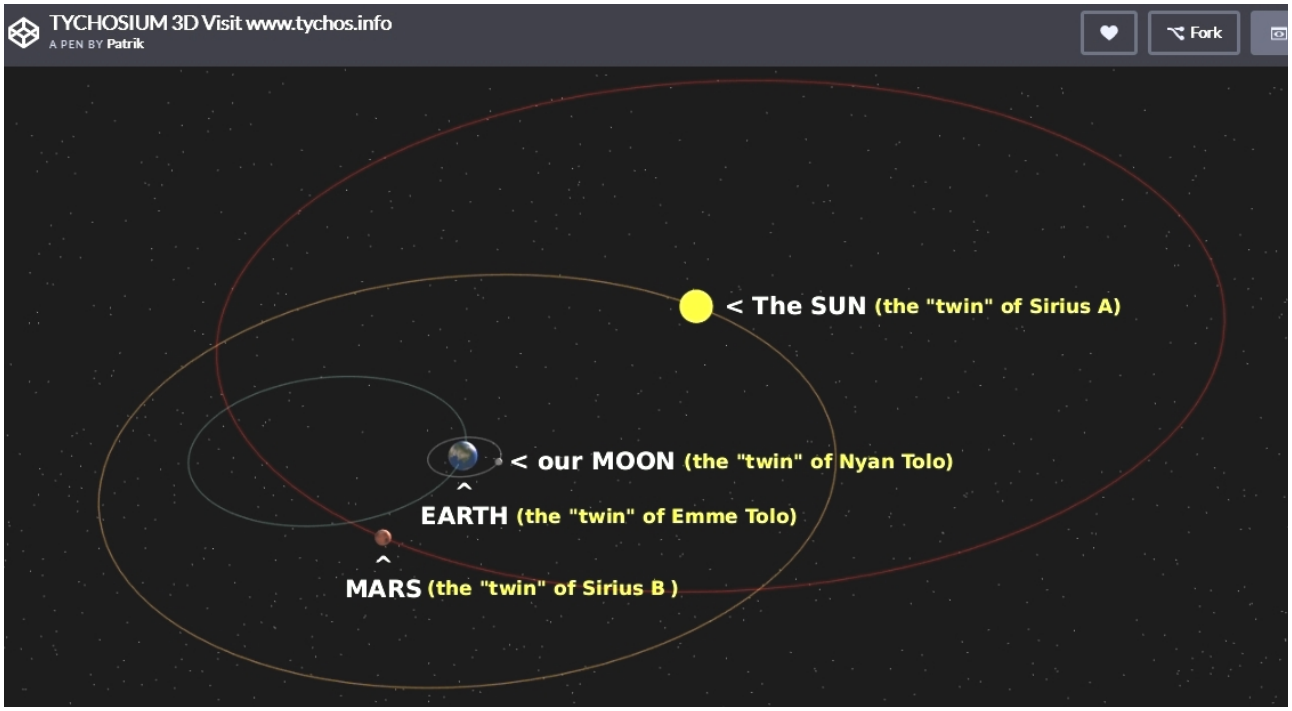


Fig. 6.10 A fascinating prospect: Could the Sun, Mars, Earth and our Moon each have a 'twin' in the Sirius system?

6.5 Are the Sirius system and our Solar System 'double-double' binary companions?

The idea that Sirius is the Sun's binary companion star is nothing new. It has been proposed by several independent researchers in later decades (e.g., Karl-Heinz Homann of the Sirius Research Group, and Walter Cruttenden of the Binary Research Institute), mostly because Sirius does not appear to precess like all the other stars.

> *The fact that Sirius seems to maintain its position relative to the position of the sun was a surprise to most scientists (aware of precession), when it was first noticed by the French scientific community following the Egyptian discoveries of Napoleon (and the Dendera Zodiac) in the early 1800's.* [8]

An intimate connection between Sirius and the Sun was first proposed by the eminent mathematician and egyptologist Schwaller de Lubicz. He made his deductions based on ancient Egyptian calendars that used the heliacal rising of Sirius as their new year date. In his book *Sacred Science*, he observed:

> *For it is remarkable that owing to the precession of the equinoxes, on the one hand, and the movement of Sirius on the other, the position of the sun with respect to Sirius is displaced in the same direction, almost exactly to the same extent.* [9]

According to Jed Buchwald, it was none other than Tycho Brahe who first discovered this remarkable behaviour of Sirius:

> *Sirius remains about the same distance from the equinoxes—and so from the solstices—throughout these many centuries, despite precession. [...] The effect was actually first discovered long ago by Tycho Brahe in fact, who informed the chronologer Scaliger about it.* [10]

Table 6.2 – Heliacal rise dates for Sirius from Eqypt

Over a period of 4000 years (from 3500 BC to 500 AD), Sirius 'precessed' by only about four days (from July 16.4 to July 20.3).

Year	DSVE*	Julian Date
3500 B.C.	87.8	July 16.4
3000 B.C.	92.3	July 16.9
2500 B.C.	95.8	July 16.6
2000 B.C.	100.3	July 17.3
1500 B.C.	104.8	July 17.8
1000 B.C.	108.2	July 17.2
500 B.C.	112.9	July 18.2
1 A.D.	117.3	July 18.3
500 A.D.	123.0	July 20.3

*Listed is the number of days since the time of the vernal equinox on which Sirius will heliacally rise from a latitude of 30° north for an extinction coefficient of 0.35 magnitudes per air mass. Source: B. E. Schaefer [11].

A good summary of the heated Sirius debate may be found on the Human Origin Project website in an article that is well worth reading in its entirety, were it only to show how important Sirius has been for many ancient civilizations in the making of accurate calendars.

> *Ancient calendar systems could be evidence that our solar system is rotating around its binary partner Sirius.* [12]

The existence of so-called 'double-double' stars (i.e., two binary systems revolving around each other in interstellar binary orbits) is beyond question: Many such 'double-double' stars have been documented, one example being the Epsilon Lyrae multiple star system.

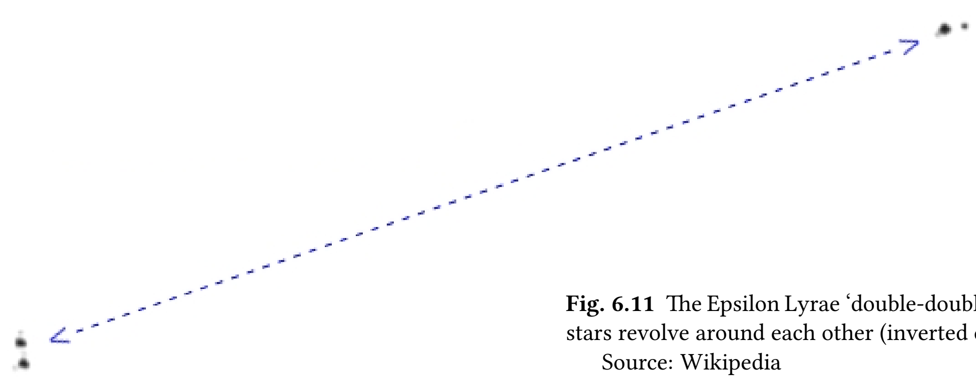


Fig. 6.11 The Epsilon Lyrae 'double-double' pair of binary stars revolve around each other (inverted colours).
Source: Wikipedia

So could the Sirius pair possibly be revolving around the Sun/Mars pair? Or is this exceptional synchronicity between the motions of Sirius and our Sun just a 'cosmic coincidence', as mainstream astronomy has it? Before we move on, you will need to know that, according to the famous celestial mechanist Jean Meeus [13], Sirius may be expected to become our south pole star about 60 000 years from now. At the Constellation Guide website, we can also read the following:

> *Sirius is slowly moving closer to Earth and will gradually increase in brightness over the next 60,000 years, before it starts to recede.* [14]

Fig. 6.12 is a largely speculative graphic based on these interesting data and expert predictions. Note that the relative orbital sizes in the graphic are arbitrary and that the graphic is just an exploratory exercise to probe and visualize the hypothesis that the two binary pairs (Sirius A/B and Sun/Mars) make up a 'double-double' system similar to that of Epsilon Lyrae.

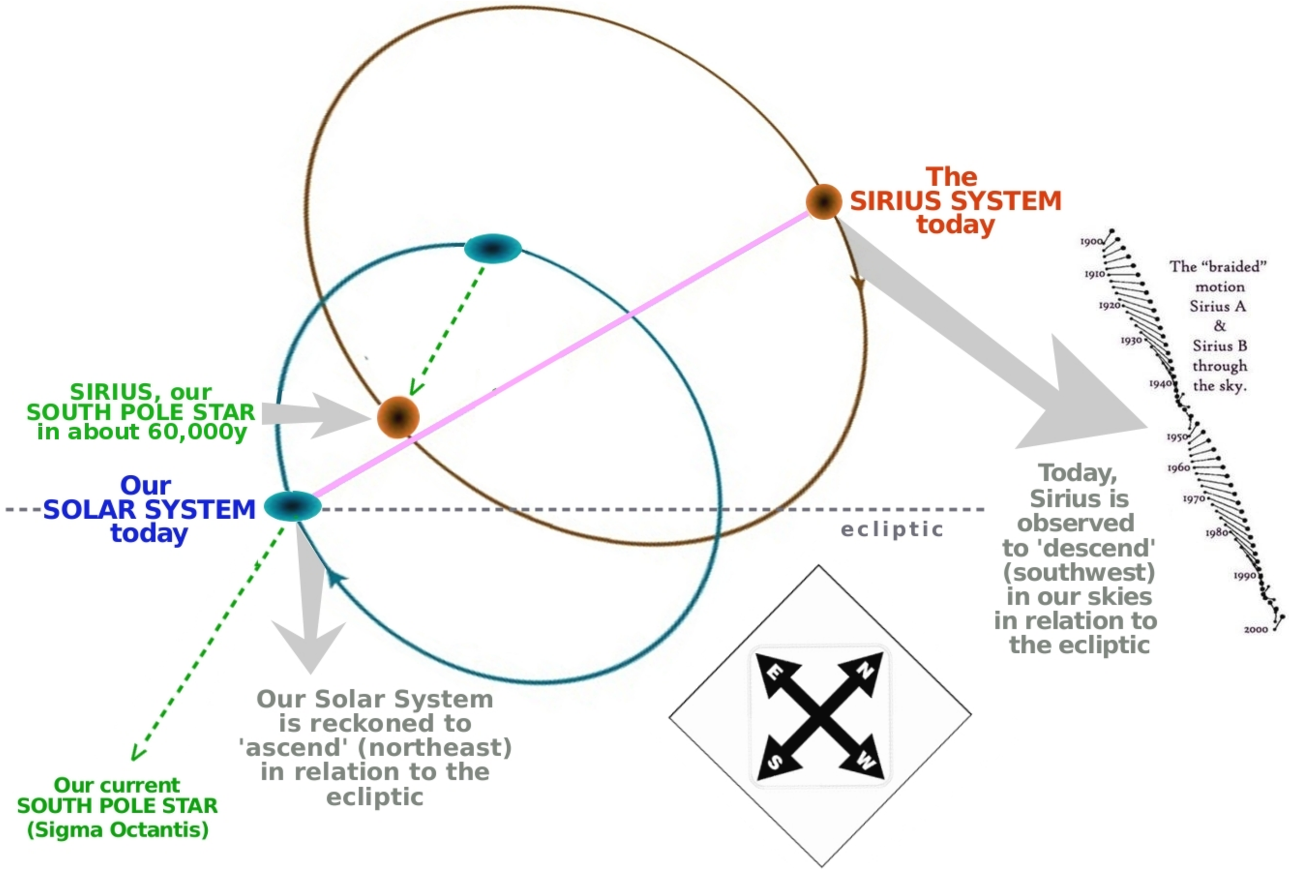


Fig. 6.12 The hypothetical Sirius/Sun ‘double-double’ system. Note that by ‘ascend north-east’ and ‘descend south-west’ I refer to how an imaginary observer in space in the reader’s line of sight would describe the secular motions of the two binary systems.

6.6 Summary

While figure 6.12 is no more than a tentative interpretation of the observational and predictive data available today, if it were to be ultimately proven reasonably correct, it would help elucidate a number of long-debated issues and mysteries surrounding the brightest star in our skies:

- First of all, it would explain why our entire Solar System performs a clockwise precessional revolution around itself every 25344 years.
- It would also explain why Sirius does not appear to precess like all the other stars and has remained almost perfectly ‘aligned’ with our Sun for millennia.
- It would explain why various ancient civilizations used Sirius as a stable and reliable reference on which to base their calendars and even used its heliacal rising to mark their new year.
- It would corroborate the prediction of Jean Meeus that Sirius will become our south pole star in about 60 000 years.
- It may even shed some light on how the Dogon people knew about the existence of the tiny Sirius B, the invisible ‘Sirius C’ and its moon. As shown in Fig. 6.12, the Sirius system would periodically pass much closer to Earth than it is today (i.e., whenever our two binary systems would transit at periastron), thus plausibly allowing its components to be seen with the naked eye.
- Furthermore, it may demystify the 7-degree axial tilts of the Sun and Mars, which are observed whenever the two are aligned towards the Sirius system, and its apparent 7-degree obliquity in relation to the celestial ecliptic.
- Last but not least, it would be consistent with the respective celestial motions of Sirius and our own system, in relation to our ecliptic.

All in all, the notion that the Sirius system is not only like a 'twin family' to our system but may also be connected with our system in a 'double-double' configuration, as posited by a number of modern-day independent researchers, cannot be dismissed off-hand. In any event, the simple fact that the Sun/Mars duo is proportionally near-identical to the Sirius A/B duo—a fact that has gone unnoticed to this day—should give the scientific community some serious food for thought. To continue to overlook this fact would be tantamount to ignoring the proverbial 'elephant in the room'.

6.7 References

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7

The Copernican model is geometrically impossible

7.1 Introduction

We have often heard that the heliocentric model and the geocentric model are geometrically equivalent. Some believe they are like the two sides of the same coin, a mere question of perspective and point of view. However, there can only be one correct interpretation of our celestial mechanics and geometry that unfailingly predicts all the interactions between the planets of the Solar System and between the planets and the distant stars. Through sound logic, induction and deductive reasoning, we should be able to discard impossible hypotheses and retain that which makes physical, geometrical and optical sense and is backed up by empirical observation.

One such untenable proposition is the Copernican model. Its geometry is not only problematic and questionable, but outright impossible. Indeed, since the model was popularised in the 17th century, scientists like Kepler and Einstein have dreamt up fantastical new laws of nature to save it from bankruptcy. In the following we shall—with a little help from Mars—see how the Copernican model falls apart when exposed to honest scrutiny.

7.2 Cassini's determination of Mars' parallax against the stars

Before proceeding, we need to review the famous astronomical enterprise of Giovanni Cassini and his colleague Jean Richer—as described in the Wikipedia entry for *"Giovanni Cassini"*:

> *In 1672, [Cassini] sent his colleague Jean Richer to Cayenne, French Guiana, while he himself stayed in Paris. The two made simultaneous observations of Mars and, by computing the parallax, determined its distance from Earth. This allowed for the first time an estimation of the dimensions of the solar system: since the relative ratios of various sun-planet distances were already known from geometry, only a single absolute interplanetary distance was needed to calculate all of the distances.* [1]

In short, Cassini and Richer made simultaneous observations of Mars from two earthly locations separated by 7000 kilometres. Using trigonometry, the parallax exhibited by Mars against the starry background made it possible to determine its distance from Earth.

It is of prime interest to our argument that a mere 7000 kilometres of separation between two earthly observers was enough to cause Mars to be measurably displaced in relation to the firmament, simultaneously aligning with different stars. Now, if for the sake of argument the two astronomers had been separated by hundreds of millions of kilometres on a given day and time, I think we can all agree that the observed parallax would have been considerably larger. As it happens, the following case of missing parallax is all that is needed to disprove the Copernican theory.

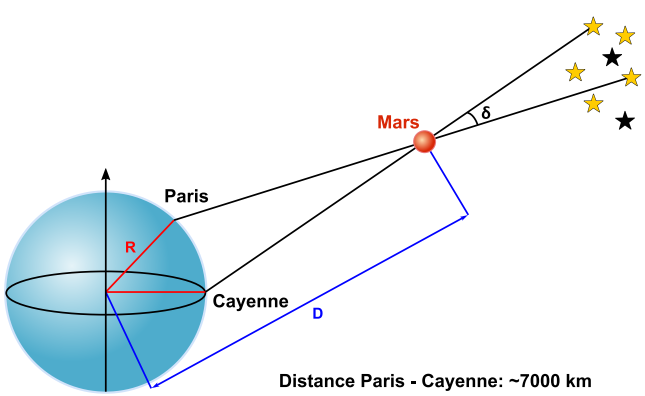

Fig. 7.1 Simple diagram from a French astronomy website illustrating Cassini's ingenious observational experiment.

7.3 How can Mars return facing the same star in only 546 days?

At certain intervals, Mars conjuncts with Deneb Algedi, a binary star located at 21h47min of RA. The following two successive conjunctions occurred within 546 days and thus represent a 'Short ESI' of Mars (see Chap. 5):

Successive conjunctions of Mars with Deneb Algedi

5 November 2018:	21h47min of RA
4 May 2020:	21h47min of RA
Interval:	546 days

Now, the problem is that, if the Copernican model corresponds to reality, Earth should after 546 days (about 1½ years) find itself on the opposite side of a 300 million km wide orbit around the Sun. This position simply cannot be reconciled with what is depicted by standard 3-D simulators of the heliocentric model.

Before we move on, bear in mind that there are two types of modern Copernican simulators. One attempts to simulate the orbital motions of our planets and moons (from a 'spaceship's perspective', e.g., the JS Orrery and the SCOPE planetarium, both of which feature an outer-space 3-D view of the Solar System). The other type of simulators (such as Stellarium and the now defunct NEAVE planetarium) are far more dependable as they visualize the actual positions of our planets in relation to the stars, as viewed from Earth.

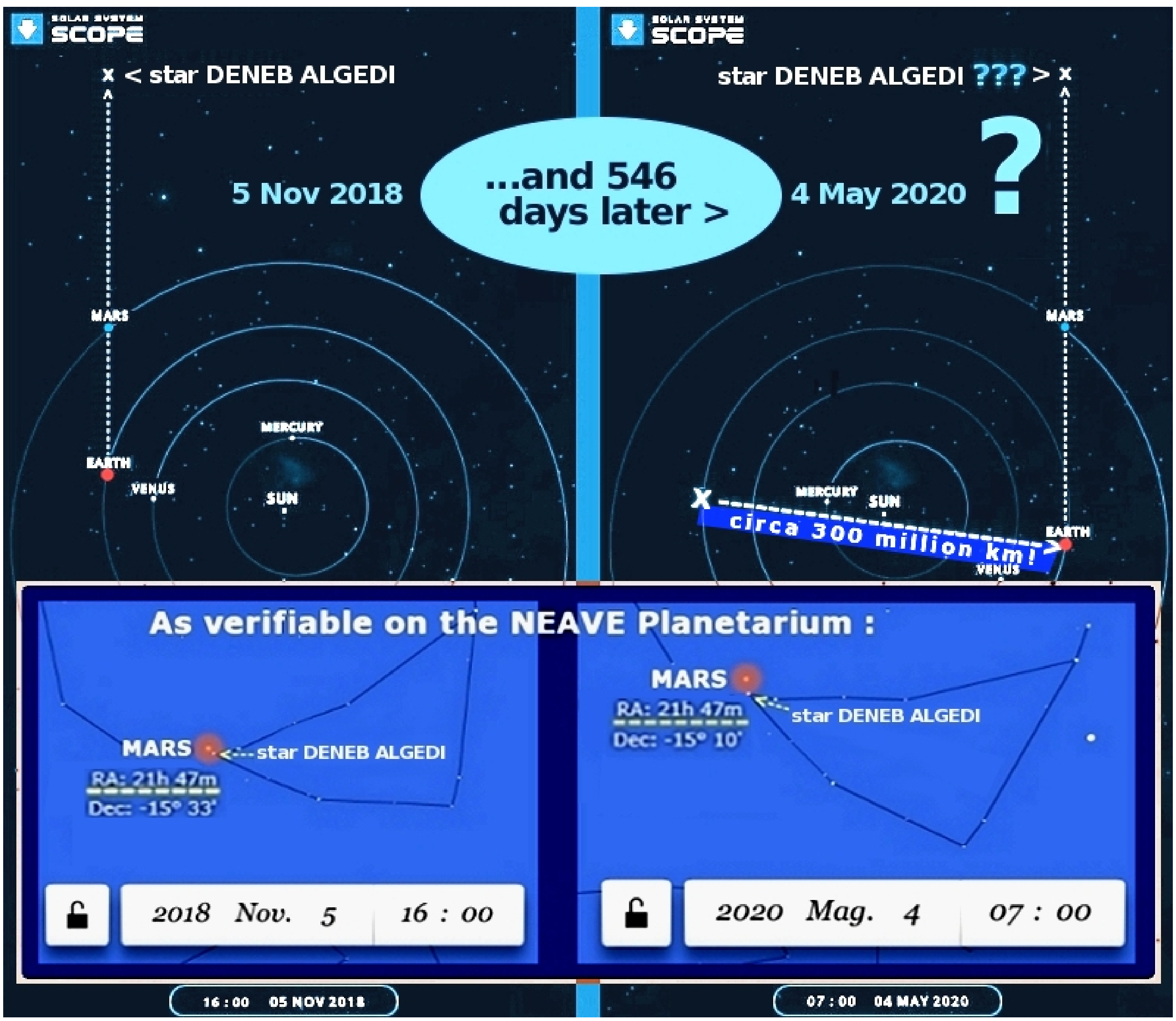

Fig. 7.2 Screenshots from the SCOPE and NEAVE planetariums.

Fig. 7.2 compares the positions of Earth and Mars on two given dates separated by 546 days. In this time interval, both Earth and Mars would according to the Copernican model have moved laterally by about 300 Mkm. Yet, on both occasions an earthly observer will see Mars neatly aligned with Deneb Algedi. How can this possibly occur if the Copernican model is true?

Retrograde loops in a Copernican universe

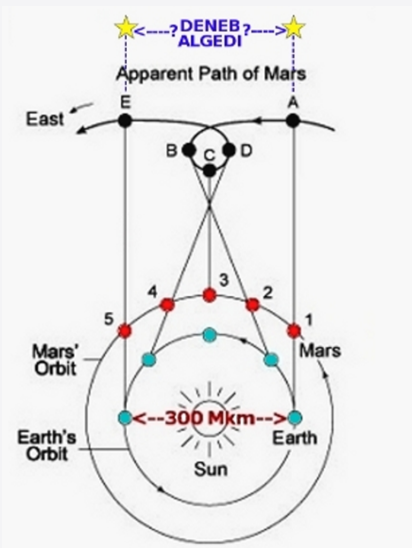

Fig. 7.3 In order to put this problem in due perspective, let us take a look at the classic explanation for the observed retrograde motion of Mars. It is said to be due to a parallax effect caused by Earth overtaking Mars. Yet, how can this be reconciled with the fact that Mars can actually be observed to conjunct with star Deneb Algedi at both ends of a 546-day period (represented by points A and E in the heliocentric diagram)?

Note that the present discussion about Mars' parallax (or absence thereof) in relation to Deneb Algedi, or any given star, is not part of the long-standing controversy over stellar parallax. The latter refers to the nigh-undetectable parallax between more distant and less distant stars (something we will take a closer look at in Chapter 25). The former concerns the parallax between Mars and any distant star in the firmament.

7.4 Summarising our challenge to the Copernican theory

The reconjunction of Mars with a given star after both 707 days and 546 days cannot be reconciled with the geometric configuration of the Copernican model, regardless of which laws of nature are invoked.

The TYCHOS model provides a simple and testable explanation for this 'mysterious' behaviour of Mars. Over a 15-year period, Mars realigns with a given star 7 times at 707-day intervals, followed by a single conjunction after only 546 days. The shorter period of 546 days is known as Mars' short empiric sidereal interval (ESI).

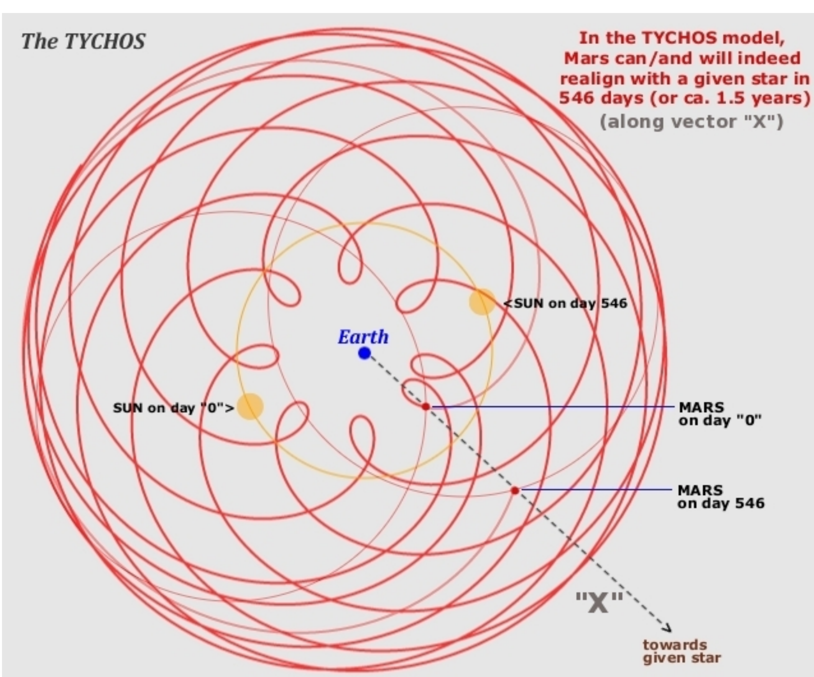

Fig. 7.4 Mars can return to the same celestial longitude after only 546 days.

The 546-day period occurs when Mars' spirographic orbital pattern, which has it realigning with a given star every 707 days on 7 successive occasions, 'skips' its retrograde loop the 8th time around. Mars will thus transit across vector X earlier than during the previous 7 revolutions. It's just plain geometry. As we saw in Chapter 5, Mars returns to face a given star in a 15-year cycle, following the rather curious sequence in Table 7.1.

Table 7.1 – Sequence of Mars' sidereal periods (ESI)

707 days	707 days	707 days	707 days	707 days	707 days	707 days	546 days

In short, Mars returns facing the same star at 707-day intervals seven times in a row, followed by a significantly shorter interval of 546 days. So, you may ask, is this what is actually observed? And does the Tychosium 3D simulator confirm this curious behaviour of Mars? The answer to both questions is 'yes'.

In the Tychosium simulator, all these Mars transits occur on the same line of sight towards Deneb Algedi, including the last one which took place on 4 May 2020, only 546 days after the one on 5 November 2018.

Note that no existing simulator of our Solar System (other than the Tychosium) can account for the fact that Mars will cyclically conjunct with a given star as empirically observed, i.e., at the same longitude and in the peculiar pattern of 7 × 707 days and 1 × 546 days. In this respect, the TYCHOS model simply has no rivals; its detractors will have to argue that what the Tychosium simulator maps, traces and demonstrates is just a matter of random coincidence.

Table 7.2 – The 15-year Martian cycle

Nine documented conjunctions of Mars with Deneb Algedi (Delta Capricorni) between the years 2005 and 2020.

Interval	Date
	2005-04-22
+706 days	2007-03-29
+709 days	2009-03-07
+710 days	2011-02-15
+710 days	2013-01-25
+709 days	2015-01-04
+707 days	2016-12-11
+694 days	2018-11-05
+546 days	2020-05-04

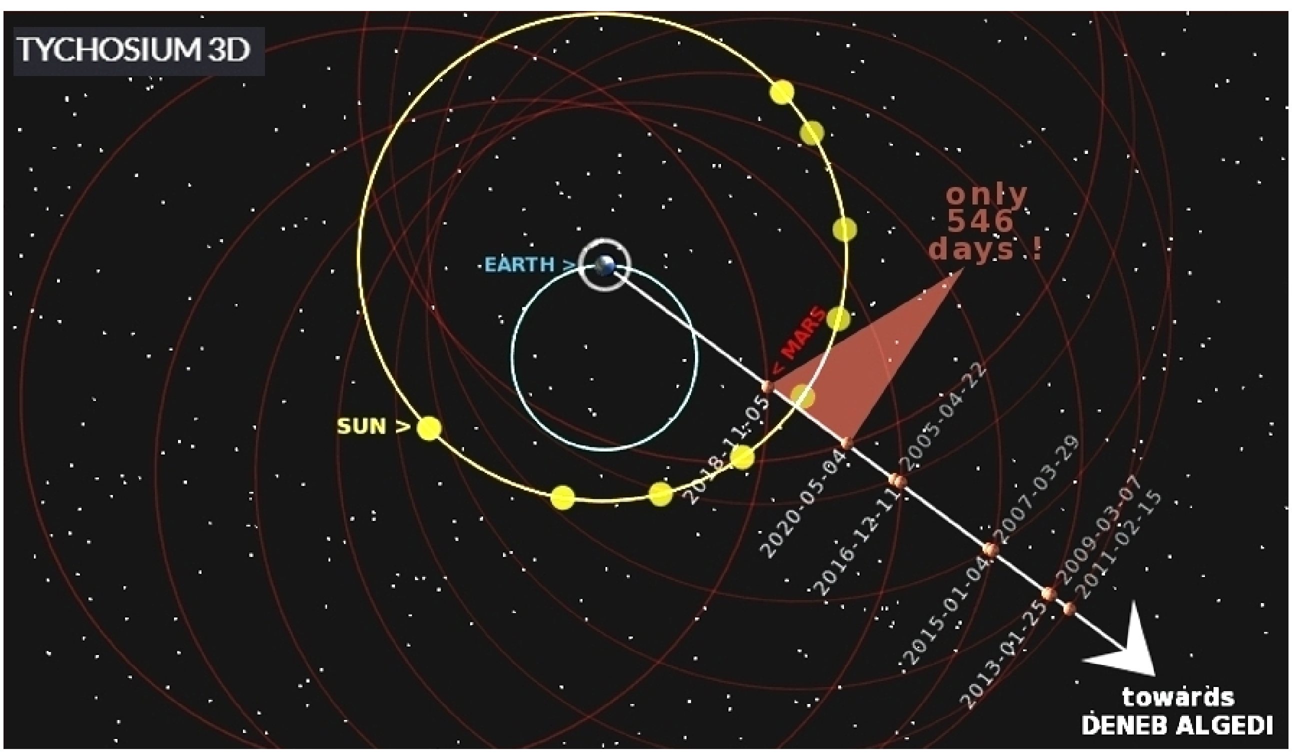

Fig. 7.5 The Tychosium 3D simulator neatly accounts for these 9 transits of Mars at about 21h47m of RA (the celestial longitude of the star Deneb Algedi).

In stark contrast, the Copernican JS Orrery simulator depicts these same 9 transits of Mars as shown in Fig. 7.6. Let us not forget that it was Kepler's 'mathemagics' which allowed the heliocentric model to retain some measure of credibility: by postulating 'variable orbital speeds' and 'elliptical orbits', Kepler managed to at least make Earth and Mars point in the same general direction in space.

Note that we are not theorising here. All the above Mars-Deneb Algedi conjunctions, as viewed from Earth at 21h47m of RA, did indeed happen—a fact not disputed by any astronomer. So how can the Earth 'drift sideways' by about 300 million kilometres and still provide a view of Mars neatly conjuncting with Deneb Algedi? It matters little how far away Deneb Algedi is; what matters is that the much shorter distance between the Earth and Mars would produce a marked parallax if our planet were really scurrying around the Sun in a 300 Mkm wide orbit, as posited by Kepler. Unless you believe the star Deneb Algedi is 300 Mkm across!

Now, Copernican astronomers will tell you that Deneb Algedi is so extraordinarily far away that a lateral displacement of 300 Mkm has no effect on the line of sight towards it. They will also argue that the 9 lines shown in Fig. 7.6 may not be perfectly parallel. Regardless, if you choose to side with the Copernicans, you would have to dismiss the perfect juxtaposition of all 9 conjunctions in the Tychosium 3D simulator as a most spectacular strike of luck. It may be 'spectacular', but it would be stretching common sense beyond breaking point to label it a coincidence.

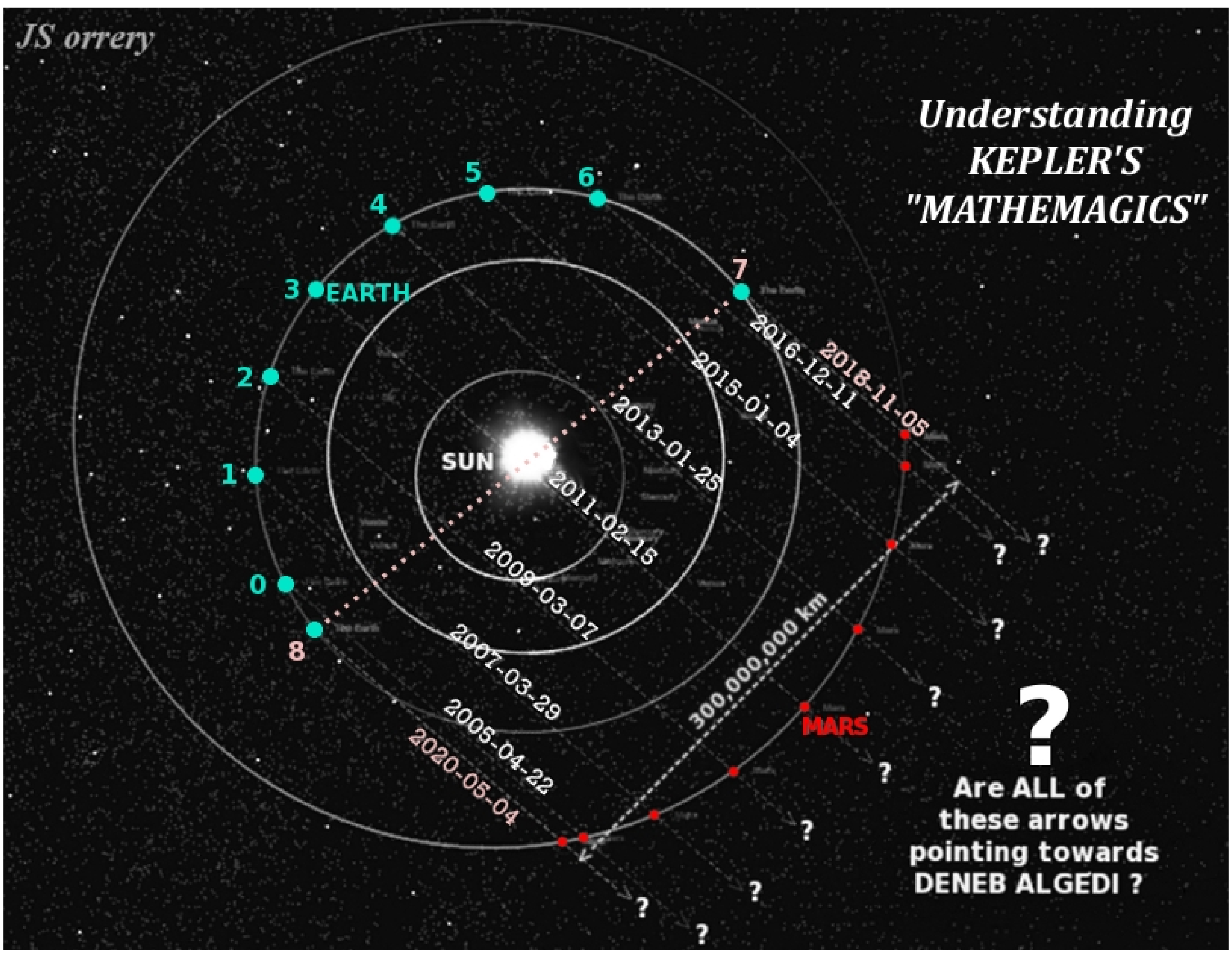

Fig. 7.6 In this Copernican depiction of a 15-year cycle of Mars, the positions numbered 0-6 are all separated by ca. 707 days, whereas the positions 7 and 8 are separated by only 546 days. By introducing the idea of variable speeds and elliptical orbits, Kepler was able to 'make the fit' into the heliocentric theory. However, this cannot represent the physical reality as Mars conjuncted with the same star each time.

7.5 The extremely rare triple conjunctions of Mars with a given star

In order to verify the accuracy of the Tychosium 3D simulator, I have often used another Copernican Solar System simulator, the Star Atlas, for comparison. The Mars-Deneb Algedi conjunctions between 1900 and 2099 shown in Table 7.3 highlight the high level of agreement between the two simulators.

But wait! Something unusual is predicted to happen in the year 2050: a triple conjunction of Mars with Deneb Algedi within a 117-day time frame. How could such a triple conjunction possibly occur in the Copernican model? And if it is true that Mars gets 'overtaken' by Earth every 2.13 years or so, why wouldn't such triple conjunctions be observed each and every time Earth 'overtakes' Mars? The Copernican model offers no rational explanation for this, but the Tychosium 3D simulator promptly comes to our aid: In 2050, Mars' retrograde loop will be almost perfectly centred around the line-of-sight vector joining Earth and Deneb Algedi. This will cause Mars to conjunct with that star on three occasions (A, B and C) within only 117 days. Fig. 7.7 describes these three conjunctions as displayed in the Tychosium 3D simulator.

Table 7.3 – Mars—Deneb Algendi

Highlighted in yellow are Mars' short ESIs of ca. 546 days which occur every 15 or 17 years.

Days	Star Atlas	Tychosium	Days	Star Atlas	Tychosium		Days	Star Atlas	Tychosium
	1900-02-21	1900-02-21	705	1969-12-07	1969-12-07		707	2039-03-24	2039-03-24
710	1902-02-01	1902-02-01	686	1971-10-24	1971-10-24		707	2041-03-02	2041-03-03
710	1904-01-12	1904-01-12	554	1973-04-29	1973-04-29		710	2043-02-10	2043-02-11
708	1905-12-19	1905-12-19	704	1975-04-03	1975-04-04		710	2045-01-20	2045-01-20
700	1907-11-19	1907-11-19	709	1977-03-12	1977-03-12		709	2046-12-30	2046-12-30
543	1909-05-15	1909-05-15	709	1979-02-20	1979-02-20		705	2048-12-04	2048-12-05
699	1911-05-15	1911-05-15	711	1981-01-30	1981-01-30		565	2050-06-21	2050-06-21
707	1913-03-22	1913-03-22	709	1983-01-09	1983-01-09	!	48	2050-08-12	2050-08-12
710	1915-03-01	1915-03-01	708	1984-12-17	1984-12-17		69	2050-10-16	2050-10-16
710	1917-02-08	1917-02-09	699	1986-11-16	1986-11-16		557	2052-04-26	2052-04-27
710	1919-01-19	1919-01-19	543	1988-05-12	1988-05-12		705	2054-04-02	2054-04-02
709	1920-12-28	1920-12-28	700	1990-04-12	1990-04-13		709	2056-03-10	2056-03-10
704	1922-12-03	1922-12-02	708	1992-03-20	1992-03-20		710	2058-02-18	2058-02-18
552	1924-06-07	1924-06-06	709	1994-02-27	1994-02-28		710	2060-01-29	2060-01-29
687	1926-04-25	1926-04-25	710	1996-02-07	1996-02-08		709	2062-01-07	2062-01-08
706	1928-03-30	1928-03-30	710	1998-01-17	1998-01-17		708	2063-12-16	2063-12-16
709	1930-03-09	1930-03-09	709	1999-12-27	1999-12-27		698	2065-11-13	2065-11-13
710	1932-03-17	1932-03-17	704	2001-11-30	2001-11-30		543	2067-05-10	2067-05-11
710	1934-01-27	1934-01-27	550	2003-06-02	2003-06-02		701	2069-04-10	2069-04-11
709	1936-01-06	1936-01-06	689	2005-04-22	2005-04-23		708	2071-03-19	2071-03-19
707	1937-12-13	1937-12-13	706	2007-03-29	2007-03-29		710	2073-02-25	2073-02-26
696	1939-11-09	1939-11-08	709	2009-03-07	2009-03-07		710	2075-02-05	2075-02-06
544	1941-05-06	1941-05-07	710	2011-02-15	2011-02-15		710	2077-01-16	2077-01-16
703	1943-04-09	1943-04-09	710	2013-01-25	2013-01-25		708	2078-12-25	2078-12-25
708	1945-03-17	1945-03-17	710	2015-01-04	2015-01-04		704	2080-11-27	2080-11-28
710	1947-02-24	1947-02-25	706	2016-12-11	2016-12-11		548	2082-05-29	2082-05-29
710	1949-02-04	1949-02-04	694	2018-11-05	2018-11-05		691	2084-04-20	2084-04-21
710	1951-01-14	1951-01-14	546	2020-05-04	2020-05-04		706	2086-03-27	2086-03-27
708	1952-12-22	1952-12-22	703	2022-04-07	2022-04-07		710	2088-03-05	2088-03-05
702	1954-11-25	1954-11-25	708	2024-03-15	2024-03-15		710	2090-02-13	2090-02-13
545	1956-05-22	1956-05-22	710	2026-02-22	2026-02-23		710	2092-01-24	2092-01-24
696	1958-04-18	1958-04-19	710	2028-02-03	2028-02-03		709	2094-01-02	2094-01-02
706	1960-03-25	1960-03-25	710	2030-01-12	2030-01-13		706	2095-12-09	2095-12-10
710	1962-03-04	1962-03-04	708	2031-12-21	2031-12-21		693	2097-10-31	2097-11-01
710	1964-02-12	1964-02-12	702	2033-11-22	2033-11-22		547	2099-05-02	2099-05-03
710	1966-01-22	1966-01-22	544	2035-05-20	2035-05-20				
709	1968-01-01	1968-01-01	697	2037-04-16	2037-04-16				

! = A very rare triple conjunction of Mars with star Deneb Algedi.

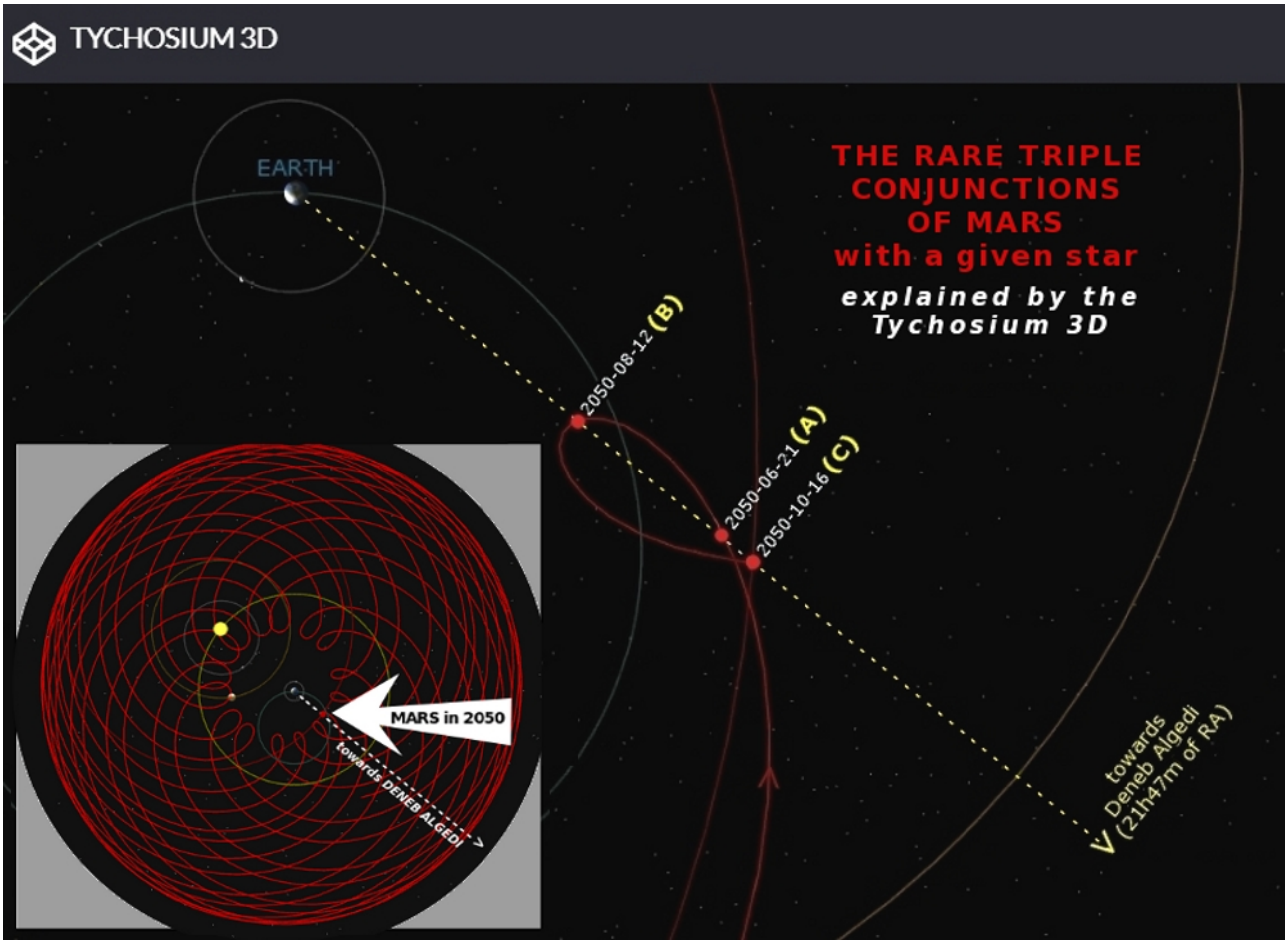

Fig. 7.7 The three conjunctions as displayed in the Tychosium 3D simulator. As they say, a picture is worth a thousand words.

Simply put, in 2050 Mars will be retrograding in the line of sight of Deneb Algedi, resulting in three conjunctions within less than 4 months. You can and should verify all this by yourself by perusing the Tychosium 3D simulator. This is yet another instance of observable celestial conjunctions that the TYCHOS model can fully account for, logically and geometrically, unlike the heliocentric model or any other proposed configuration of our Solar System.

7.6 The impossible 816-day reconjunction of Earth and Venus with a given star

We shall now take a look at Venus by comparing two screenshots from the SCOPE planetarium depicting two conjunctions of Earth and Venus with the star Regulus in the constellation Leo at an interval of 816 days (or 2.234 years). During that period, according to the Copernican model, Earth and Venus would both be displaced laterally (i.e., perpendicularly to Regulus' location) by about 200 million km. Yet, Venus was actually observed to conjunct with Regulus on both these dates (2018-07-10 and 2020-10-03). Just as the Copernican model fails to explain the full cycle of Mars-Deneb Algedi conjunctions, it is at a loss to account for the alignment of Venus and Regulus, as empirically observed in 2018 and in 2020.

Again, Copernican astronomers will claim that Regulus is so immensely distant that the lines of sight towards Venus and Regulus are not totally parallel, but will somehow ultimately converge towards Regulus. Now, we may debate this question of parallelism until the cows come home, but the fact remains: Venus did indeed conjunct with Regulus on those two dates, as documented by astronomers.

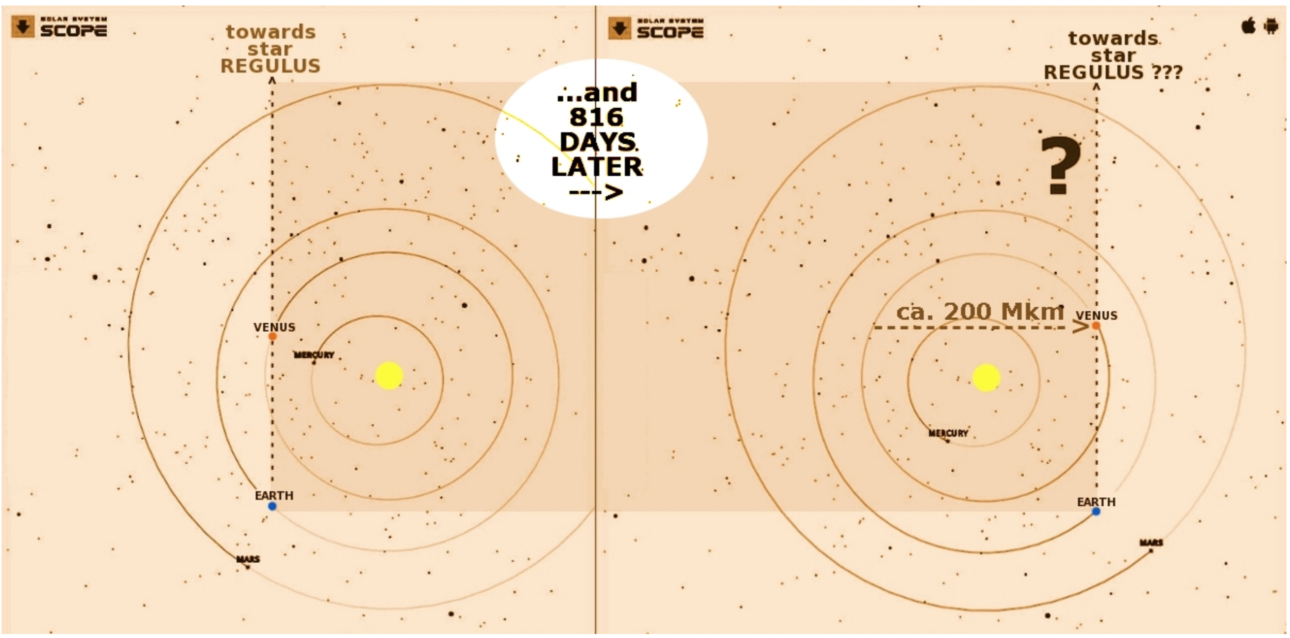

Fig. 7.8 Two screenshots from the SCOPE planetarium. Earth and Venus will align with the same star at both sides of Venus' orbit.

The NEAVE planetarium, which realistically simulates the firmament as observed from Earth, confirms that Venus and Regulus did indeed conjunct on both 10 July 2018 and 3 October 2020, 816 days apart.

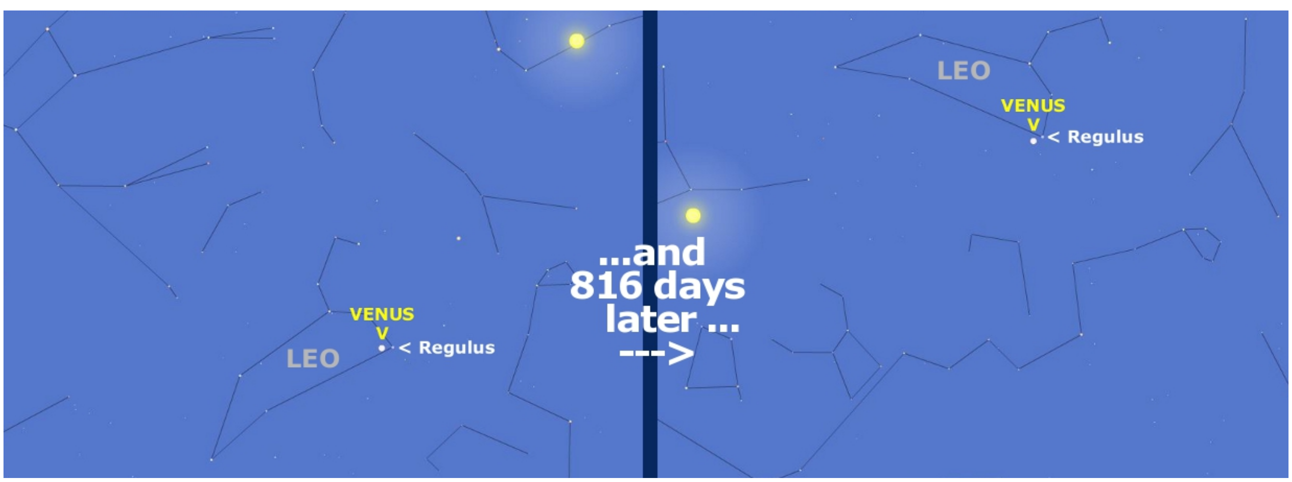

Fig. 7.9 Two screenshots from the NEAVE planetarium showing what can actually be observed from Earth.

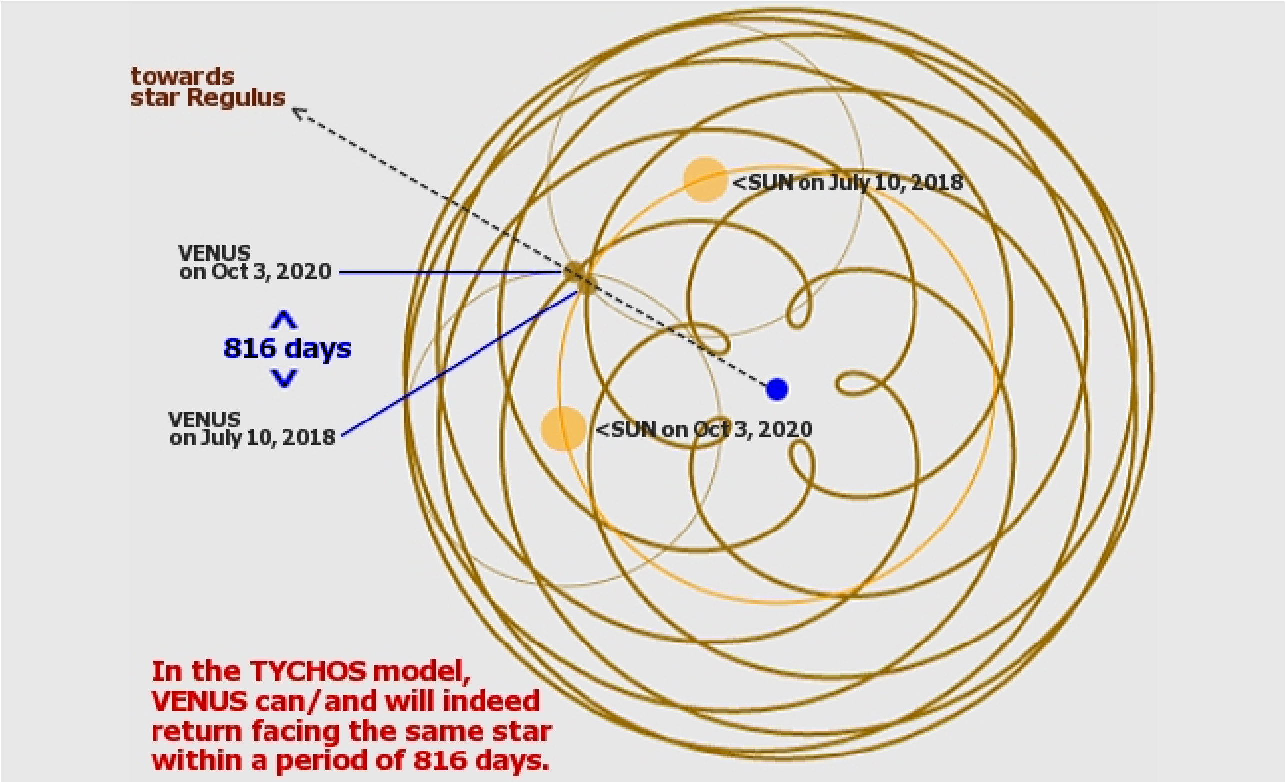

Fig. 7.10 Two superimposed screenshots from the Tychosium 3D simulator.

In Fig. 7.10, the Tychosium 3D simulator shows why Venus can and will return facing a given star in 816 days. The TYCHOS model clearly accounts for Venus' physical return to the same celestial longitude after an 816-day interval to reconjunct with the star Regulus, whereas the Copernican configuration plainly contradicts empirical observation.

- In the Copernican model, Venus conjuncts with the star Regulus every 816 days, but Earth and Venus are also said to travel 'sideways' for about 200 million km during the same period—enough to create a measurable parallax.
- In the TYCHOS model, Venus conjuncts with the star Regulus every 816 days simply because it physically returns to that same celestial longitude. No parallax. No 'mystery' to explain away.

Next, we shall take a closer look at the Sun's two moons, Venus and Mercury. Referring to Venus and Mercury as lunar satellites may sound beyond heretical, but the compelling and easily verifiable facts presented in Chapter 8 leave no room for doubt.

7.7 References

[1] *Giovanni Cassini*, Wikipedia
https://en.wikipedia.org/wiki/Giovanni_Domenico_Cassini

[2] *The JS ORRERY simulator*
https://mgvez.github.io/jsorrery

[3] *The SCOPE planetarium simulator*
https://www.solarsystemscope.com

[4] *The STELLARIUM simulator*
https://stellarium-web.org

8

The Sun's two moons, Mercury and Venus

8.1 Introduction

As briefly mentioned in Chapter 3, in the TYCHOS model, the two celestial bodies known as Mercury and Venus are not planets, as we are taught in school, but the two moons of the Sun—very much like Mars' two moons, Phobos and Deimos. We shall now see how this can be demonstrated in a number of ways, and why the choice of word is not just a mundane matter of nomenclature. Unlike planets, moons have no lunar satellites of their own, rotate exceptionally slowly around their axes, and are tidally (or 'magnetically') locked, meaning they always show the same face to their host. To wit, a moon is a moon and should not be referred to as a 'planet'.

8.2 Mercury: the Sun's 'junior moon'

Mercury was a grave matter of concern for astronomers in the last century, with its seemingly erratic behaviour. Since the precession of its perihelion was in conflict with Newtonian predictions, thus threatening the fundamental physics of the heliocentric theory, Einstein pulled out of his hat a fanciful theory which basically implies that we cannot trust our own eyes. We shall address this theory and the controversial 'anomalous precession of Mercury's perihelion' in Chapter 22; for now, let us focus on the periodic motions of the Sun's 'junior moon'.

As it turns out, Mercury's behaviour is not so erratic after all. Yes, its orbital plane is slightly inclined in relation to the Sun's orbital plane, as viewed from Earth, causing its elevation vis-à-vis the Sun to oscillate quite a bit, yet it simply revolves around the Sun in lunar fashion. Its average synodic period is 116.88 days, which is approximately 4 times the period needed for our Moon to return facing the Sun, as viewed from Earth. As you may remember from Chapter 3, this same period (116.88 days) is precisely the time employed by Venus to revolve around its own axis.

All this would be considered an extraordinary coincidence under the Copernican model, according to which the orbital paths of Mercury, Venus and our Moon are completely unrelated. Conversely, within the geometric configuration of the TYCHOS model, and given the ostensibly 'magnetic' nature of our Solar System, these seemingly uncanny orbital resonances between our Moon, Mercury and Venus are to be fully expected.

Now, is Mercury really tidally locked to the Sun, just as our Moon is tidally locked to Earth? Until around the year 1965, every astronomer in the world would have told you that, yes, Mercury is indeed tidally locked to the Sun. In that year, though, NASA and Russian space agency officials gleefully announced that, according to modern radar data, Mercury was not, after all, tidally locked to the Sun. This caused an uproar in the astronomy community and the question has still not been put to rest. However, when viewed under the TYCHOS model—which has the Sun-Mercury-Venus trio revolving around the Earth and not the other way around—it becomes glaringly evident that both Mercury and Venus are tidally locked to their host, the Sun.

8.3 Mercury's short and long empiric sidereal intervals (ESI)

Every 7 years, an earthly observer will see Mercury conjunct with a given star 6 times at intervals of ~358 days, followed by a conjunction after ~408 days. In other words, the 7th conjunction is delayed by about 50 days, meaning that, just like Mars, Mercury has two empiric sidereal intervals: a 'short ESI' and a 'long ESI'.

For the sake of calculation, over a period of 14 years Mercury completes 12 short ESIs (~358 days) and two long ESIs (~408 days). Table 8.1 shows a series of 14 successive sidereal periods of Mercury, from 6 July 1998 to 5 July 2012, compiled by perusing the NEAVE online planetarium. The chart counts Mercury's yearly revolutions using as starting point its conjunction with the star Asellus Australis in the Cancer constellation, at the beginning of a long ESI.

Table 8.1 – Series of 14 successive sidereal periods of Mercury

The 14 successive sidereal periods of Mercury total 5113 days. Thus, the average sidereal period of Mercury is ~365.22 days (5113/14), or almost exactly 1 solar year.

Start date		End date		Duration in days	ESI
1998-07-06	→	1999-08-19	=	409	Long
1999-08-19	→	2000-08-11	=	358	Short
2000-08-11	→	2001-08-03	=	357	Short
2001-08-03	→	2002-07-25	=	356	Short
2002-07-25	→	2003-07-17	=	357	Short
2003-07-17	→	2004-07-09	=	358	Short
2004-07-09	→	2005-07-04	=	360	Short
2005-07-04	→	2006-08-16	=	408	Long
2006-08-16	→	2007-08-08	=	357	Short
2007-08-08	→	2008-07-30	=	357	Short
2008-07-30	→	2009-07-22	=	357	Short
2009-07-22	→	2010-07-14	=	357	Short
2010-07-14	→	2011-07-07	=	358	Short
2011-07-07	→	2012-07-05	=	364	Short

What is empirically observed is a 7-year pattern, yielding a mean sidereal period of 365.22 days. Provided the right starting point is used to calculate Mercury's celestial motions, Mercury is indeed seen to be tidally locked to the Sun in its yearly orbit around Earth. This is the behaviour one would expect from a moon.

It is truly perplexing that, as far as I know, no one has noticed the fact that Mercury's sidereal periods, in spite of their irregularity, can be averaged out to almost exactly 1 solar year. To be sure, this 'synchronicity' finds no support in the heliocentric model, which has the Earth and Mercury revolving at different speeds and in different 'lanes' around the Sun.

Most astronomy tables give Mercury's mean synodic period as 115.88 days (a synodic period is the time interval between two successive conjunctions of any given celestial body with the Sun). So why is the period obtained with the TYCHOS model (116.88 days) slightly longer? To answer this question, let us look at a duly verified series of 14 successive synodic periods of Mercury, spanning 1636 days (Table 8.2).

Table 8.2 – Series of 14 successive synodic periods of Mercury

The 14 successive synodic periods of Mercury total 1636 days. Thus, the average sidereal period of Mercury is ~116.86 days (1636/14). Hence, our 116.88-day value for Mercury's true mean synodic period is virtually on the mark.

Start date		End date		Duration in days
2003-10-24	→	2004-03-03	=	131
2004-03-03	→	2004-06-18	=	107
2004-06-18	→	2004-10-05	=	109
2004-10-05	→	2005-02-14	=	132
2005-02-14	→	2005-06-03	=	109
2005-06-03	→	2005-09-17	=	106
2005-09-17	→	2006-01-26	=	131
2006-01-26	→	2006-05-19	=	113
2006-05-19	→	2006-08-31	=	104
2006-08-31	→	2007-01-07	=	129
2007-01-07	→	2007-05-03	=	116
2007-05-03	→	2007-08-15	=	104
2007-08-15	→	2007-12-18	=	125
2007-12-18	→	2008-04-16	=	120

8.4 Venus: the Sun's 'senior moon'

It has been observed that Venus presents practically the same face to earthly observers each time it transits closest to Earth, which happens every 584.4 days or so. Note that Venus is, of all our surrounding celestial bodies, the one that passes closest to Earth.

As it is, this apparent tidal locking of Venus to Earth remains a complete mystery to modern astronomers. Of course, in the Copernican model, Earth and Venus are pictured as travelling around in concentric orbits, with Venus requiring less time to complete a lap due to the smaller orbit, yet Venus always shows the same face to us during the so-called 'inferior conjunction with the Sun'. This is yet another instance of puzzling 'synchronicity' for the advocates of the heliocentric theory. In fact, astronomers readily admit they have no explanation for this 'mystery':

> *The periods of Venus' rotation and of its orbit are synchronized such that it always presents the same face toward Earth when the two planets are at their closest approach. Whether this is a resonance effect or merely a coincidence is not known.* [1]
>
> *Every 584 days, Venus and Earth come to their point of closest approach. And every time this happens, Venus shows Earth the same face. Is there some force that makes Venus align itself with the Earth rather than the Sun, or is this just a coincidence?* [2]
>
> *Whether this relationship arose by chance or is the result of some kind of tidal locking with Earth is unknown.* [3]
>
> *Tidal locking of Venus planet: [...] so that the Venus planet shows always almost the same face to the Earth planet during each meeting, and shows that same face to both Earth and Sun during heliocentric opposition of Earth and Venus planets.* [4]

Every astronomer is aware of this 'inconvenient' fact, but who can explain it? As with so many other long-standing enigmas, the TYCHOS model provides a satisfactory and rational answer: Venus, just like Mercury, is tidally locked to its host, the Sun, quite simply because it is a lunar satellite, much like our Moon is tidally locked to Earth. But let us do the math:

- Venus employs 584.4 days to return to perigee.
- This is slightly more than 1½ solar years, which is 547.875 days.
- The difference is 36.525 days.
- 36.525 days corresponds to 1/10 of 365.25 days and 1/16 of 584.4 days.

$$365.25 \times 1.5 = 547.875$$
$$584.400 - 547.875 = 36.525$$

In fact, for every 16 solar revolutions around Earth, Venus transits 10 times behind the Sun (apogee). Every 8 years, Venus transits 5 times closest to Earth (perigee). Every 16 years, Venus conjuncts with Mars at diametrically opposite sides of Earth, and every 32 years or so Venus and Mars re-conjunct on the same side of Earth. The TYCHOS model is shining a light on a fact the Copernican model has obscured for centuries, namely that the entire system is composed of magnetically interlocked micro-systems in perfect synchrony.

- Venus has an 8-year cycle of 2922 days...
- ... or 5 synodic periods of 584.4 days each.

$$8 \times 365.25 = 2922$$
$$5 \times 584.4 = 2922$$

This period of 2922 days equals 100 TMSPs. The TMSP is our Moon's true mean synodic period of 29.22 days. This will be duly explicated in Chapter 13.

8.5 Verifying the 584.4-day value for Venus' synodic period

Some may hold up that official astronomy tables give Venus' mean synodic period as 583.9 days, not 584.4 days, but life teaches that 'official' and 'true' are not necessarily synonymous. As we shall see, the official figure is easily challenged by averaging the five synodic periods of Venus' 8-year cycle of solar conjunction.

Table 8.3 clearly shows that the mean synodic period of Venus is ~584.4 days. Note that synodic periods fluctuate slightly over time due to eccentricity, and that all planetary and lunar orbits are slightly eccentric (i.e., off-centre) in relation to their host body. 'Eccentric' should not be confused with 'elliptical': the elliptical orbits proposed by Kepler do not exist in the TYCHOS model or, I suspect, anywhere in the physical universe.

Table 8.3 – Series of 5 successive synodic periods of Venus

The 5 successive synodic periods of Venus (as depicted by the NEAVE planetarium) total 2922 days, or 365.25 × 8. The average length of Venus' synodic period is 584.4 days, or 2922 / 5. The TYCHOS model's 584.4-day value for the mean synodic period of Venus is empirically observed and therefore beyond dispute.

Start date		End date		Duration in days
2011-08-13	→	2013-03-24	=	589
2013-03-24	→	2014-10-25	=	580
2014-10-25	→	2016-06-05	=	589
2016-06-05	→	2018-01-08	=	582
2018-01-08	→	2019-08-13	=	582

As current theory has it, Venus rotates clockwise around its own axis. This, however, is an unproven claim (much like the recent claim that Mercury is not tidally locked) apparently originating from purported radar surveys performed back in the 1960s. Lengthy debates on this issue can be found in the astronomy literature, yet no Copernican astronomer has been able to settle the matter.

The reason why heliocentrists reckon that Venus rotates in clockwise or 'retrograde' fashion is, in all likelihood, an illusion caused by the heliocentric perspective: since Venus employs more than one year (more precisely, 1.6 solar years) to return to perigee, and since heliocentrists erroneously believe the Earth revolves around Venus during this same period, their analysis of Venus' rotational direction is faulty.

8.6 The retrograde motions of Mercury, Venus and Mars

The fact that our planets appear to periodically come to a halt and start moving 'backwards' for a few weeks or months and then resume their 'forward' (prograde) movement has mystified astronomers over the ages. It certainly is the most striking phenomenon affecting our planets' motions, as viewed from Earth. To be sure, and contrary to popular belief, these irregular retrograde motions have never been accounted for by Copernican astronomers in a satisfactory or even plausible manner, as we had the opportunity to demonstrate in Chapter 5.

> *The ancients never believed that the planets actually halted in space and traveled backward for a while; they assumed there was a mechanism by which the motion appeared retrograde from our vantage point. They also believed in the Aristotelian ideal that planets move with constant speed in circular orbits. Therein lay the seemingly insurmountable challenge to astronomical model-makers: how to account for a planet's observed irregular movements without violating the Aristotelian principle of circular motion at constant speed. That these model-makers nearly succeeded is a testament to their ingenuity.* [5]

The retrograde behaviour of the Sun's two moons, Venus and Mercury, is similar to that of Mars. When viewed in the Tychosium 3D simulator, they both produce teardrop-shaped loops as they transit in inferior conjunction with the Sun. It is a perfectly natural, dynamic geometric pattern known in geometry as an epitrochoid, yet one that the human mind understandably finds it difficult to process. The illustration in Fig. 8.1 should help visualize how these 'teardrop loops' are formed.

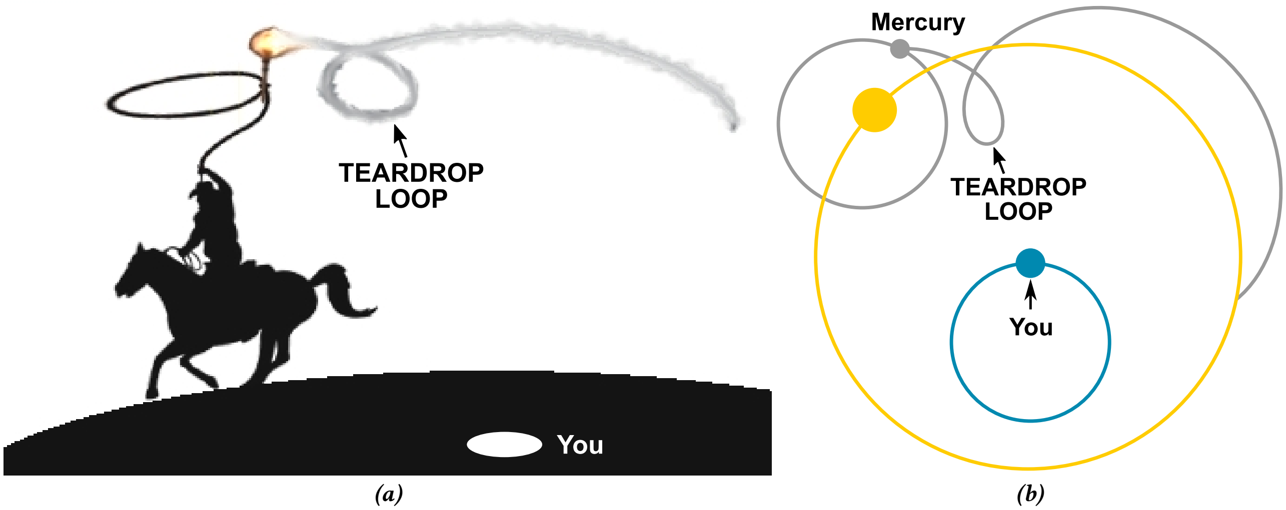

Fig. 8.1 What astronomers refer to as 'retrograde motions' are, in the case of Mercury, Venus and Mars, just a natural geometric effect. ***(a)*** We see how the smoke plume from the cowboy's torch will produce this 'teardrop loop'. ***(b)*** Mercury orbits around the Sun producing a similar effect to an observer on the Earth.

Heliocentrists see retrograde motions as a mere illusion of perspective, but these apparent 'backward' motions, as observed from Earth, are part and parcel of the actual physical paths traced by the celestial bodies of our system. In Fig. 8.1, the cowboy's torch will leave a teardrop-shaped smoke plume because the torch actually swirls around that patch of sky. When viewed from our central point of reference (the Earth), it will appear as if the swirling torch periodically reverses direction, but of course this isn't the case: the 'teardrop loop' is simply a combination of the horse's forward motion with the lasso's circular motion. Fig. 8.2 shows the retrograde period of each of the Sun's two moons.

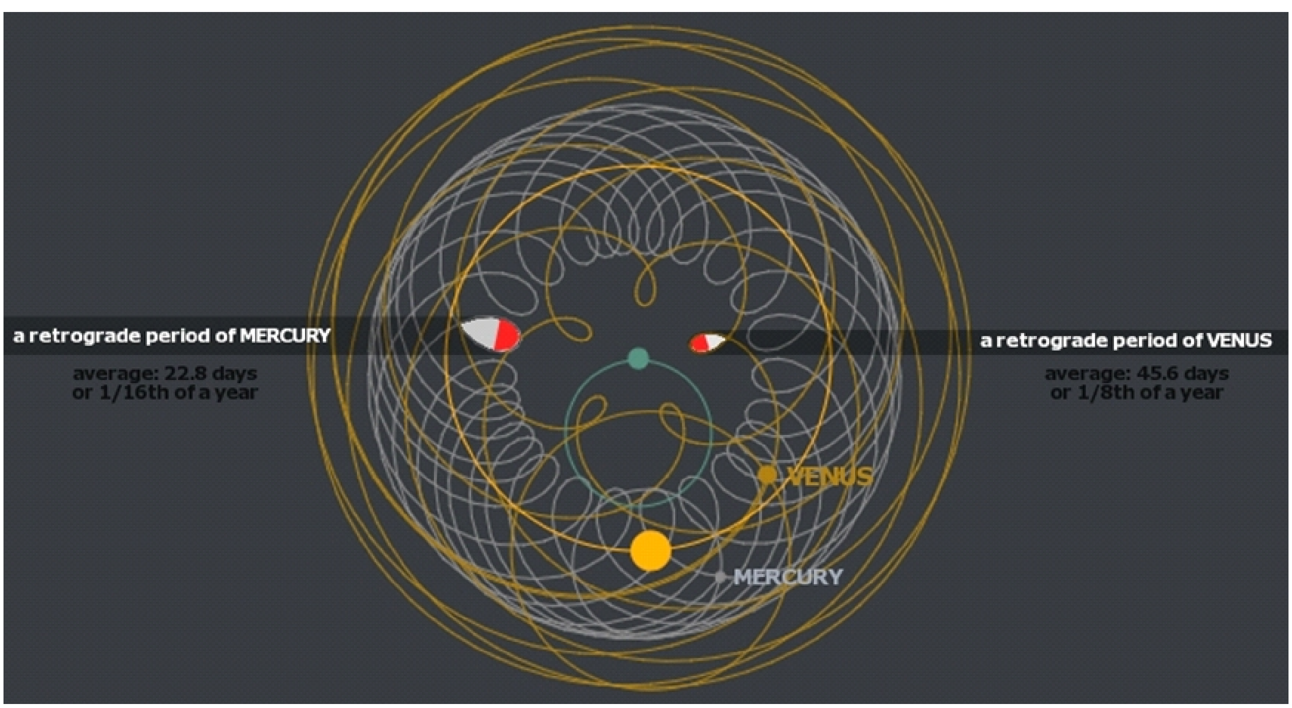

Fig. 8.2 Screenshot from the Tychosium 3D simulator.

Retrograde periods

During these retrograde periods, we see Mercury and Venus moving in the opposite direction of the Sun. Thereafter, they resume their 'prograde' motion, moving from west to east against the starry background along with the Sun (of course, we always perceive the Sun as moving from east to west due to Earth's daily west-to-east axial rotation).

- Mean retrograde period of Mercury: ~22.828 days, or 1/16 of a solar year.
- Mean retrograde period of Venus: ~45.656 days, or 1/8 of a solar year.

Prograde periods

During these much longer prograde periods, Mercury and Venus are seen from Earth as moving in the same direction as the Sun. In actuality, the two solar moons are not visible from Earth whenever they transit behind the Sun.

- Mean prograde period of Mercury: ~94 days.
- Mean prograde period of Venus: ~538.7 days.

Note that there is nothing elliptical about the motions of Venus and Mercury. They both revolve around the Sun in uniformly circular paths and at constant speeds, even though their orbital axes are slightly 'eccentric' (off-centre) in relation to their host, the Sun.

In the next chapter, I shall provide conclusive evidence that Venus and Mercury are the moons of the Sun by demonstrating that their orbits are inclined along the Sun's 'mysterious' axial tilt of 6 or 7 degrees. Venus and Mercury are therefore not just the only 'Keplerian planets' of our system with no moons of their own, they are also the only bodies whose orbits are coplanar with the Sun's equatorial ecliptic.

8.7 References

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9

Tilts, obliquities and oscillations

9.1 Kepler's accelerating and decelerating planets

Earth's well-known 23.4° axial tilt accounts for our alternating seasons and is a fundamental requisite for the Copernican model to work. The most popularly held, yet academically supported, theory as to exactly why Earth's axis would be skewed goes like this:

> *When an object the size of Mars crashed into the newly formed planet Earth around 4.5 billion years ago, it knocked our planet over and left it tilted at an angle.* [1]

Yet, and in spite of such a fanciful explanation for Earth's tilt, Copernicans also believe that our planet slowly wobbles around its own axis. In the TYCHOS model, the Earth is indeed tilted at 23.4° in relation to its orbital plane, yet with some notable differences: it is the Sun that revolves around the Earth, while our planet's own orbital motion proceeds at the tranquil speed of 1.6 km/h, with our northern hemisphere 'leaning outwards' at all times with respect to its 25344-year PVP orbit.

Interestingly, it is beyond dispute among geophysicists that our planet's northern hemisphere is 'heavier' than its southern hemisphere. It is estimated that over two thirds (68%) of the Earth's land mass is in the northern hemisphere, meaning that our planet is 'top heavy'. This notion is almost universally accepted by both mainstream and 'dissident' scientists:

> *The northern hemisphere consists of the great land masses and higher elevations, from a mechanical aspect, the Earth is top heavy, the northern hemisphere must attract a stronger pull from the Sun than the southern hemisphere. This lack of uniformity should impact on the movements of the Earth.* [2]

It would thus seem intuitively logical, even to devout Newtonian advocates, that Earth's heavier hemisphere would hang 'outwards' as our planet goes around its Polaris-Vega-Polaris (PVP) orbit. Conversely, it is hard to fathom how and why Earth's axis would maintain a fixed, peculiar inclination while circling around the Sun (whilst also wobbling around its axis), as posited by the heliocentric theory. In fact, one of the latter's most problematic aspects has to be its proposed cause for the observed secular stellar precession and our alternating pole stars. As will be expounded in Chapter 10, the hypothesis of a 'third motion' of Earth—a slow, retrograde wobble of Earth's polar axis—has been roundly disproven in recent years.

As illustrated in Fig. 9.1, the TYCHOS model provides an uncomplicated solution to the enigma of the General Precession and our alternating pole stars: the phenomenon is simply due to Earth's slow, 'clockwise' motion around the PVP orbit, completed in 25344 years. Our current northern and southern pole stars are Polaris and Sigma Octantis, but over time these will be replaced by other stars, namely Vega (∼11000 years from now) and Eta Columba (∼12000 years from now).

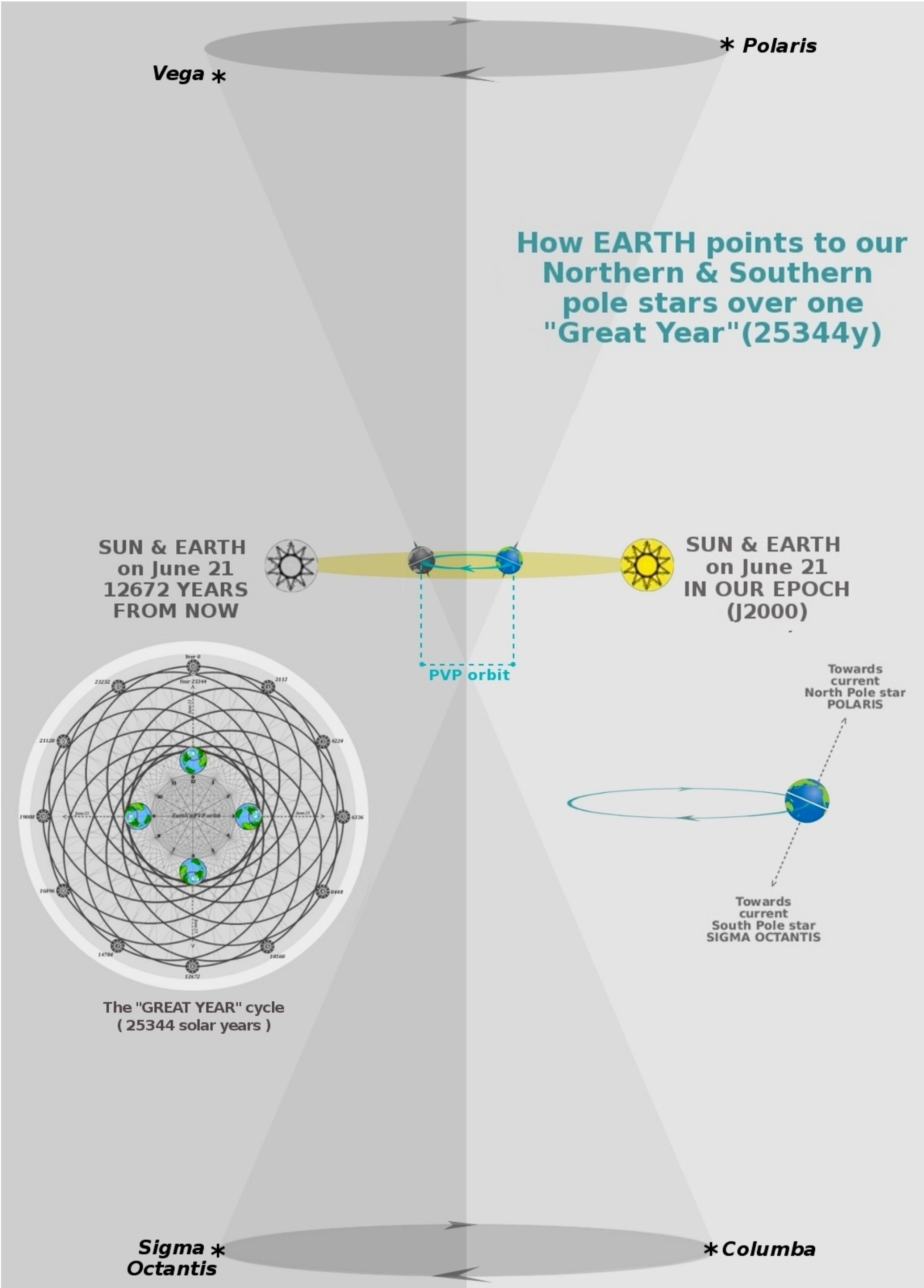


Fig. 9.1 How the PVP orbit causes the pole stars to alternate.

The fact that Earth is tilted may also explain why the Sun is further from Earth around July and closer to Earth around January, the difference being 5 Mkm (or 3.3%). As a matter of fact, the Sun is observed to be about 3.3% smaller in July than in January (Fig. 9.2), regardless of which earthly hemisphere it is viewed from (incidentally, one wonders how flat earth proponents would account for this particular empirical observation).

If we envision the Earth's magnetic charge as a repelling force which prevents the Sun from 'falling into it', the force would likely peak around summer solstice in the northern hemisphere when the 'heavier' part of the globe is maximally tilted towards the Sun (Fig. 9.3). Six months later, when the southern and 'lighter' hemisphere is maximally tilted towards the Sun, the repelling force would wane somewhat, allowing the Sun to get a little closer to Earth. However speculative this scheme for the Earth's axial tilt and the variation in the Earth-Sun distance may seem, it is worthwhile to consider, were it only as a point of departure for future inquiry.

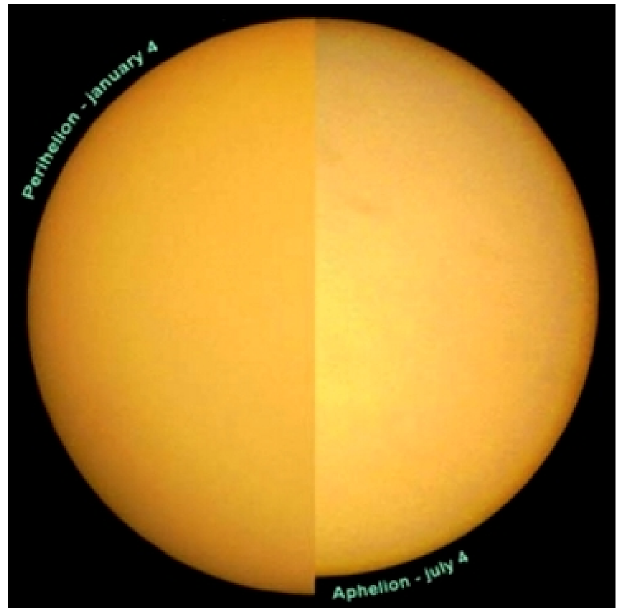


Fig. 9.2 The Sun appears 3.3% smaller in July than in January.

Earth's orbital velocity as of heliocentric theory

According to a NASA fact sheet:

- Earth's maximum orbital velocity: 30.29 km/s
- Earth's minimum orbital velocity: 29.29 km/s

A difference of 3.3%. The annual variation in the distance between the Earth and the Sun is also 3.3%.

The 3.3% annual variation in the distance between the Earth and the Sun may explain why Kepler claimed that all the bodies in the Solar System keep accelerating and decelerating. Kepler's model has Earth travelling around the Sun while alternately speeding up and slowing down. In the TYCHOS model, of course, the annually orbiting body is not the Earth, but the Sun. The above orbital velocities, attributed to the Earth by mainstream astronomers, would therefore apply to the Sun.

Note that this is no small variation. It means Earth would have to speed up by as much as 3600 km/h (about 3 times the speed of sound) between July and January. But how to account for such hefty, yet formidably consistent, speed variations? Well, the Copernican astronomers' explanation is that, due to the Sun's 'gravitational pull', the closer a planet is to the Sun, the faster it will travel.

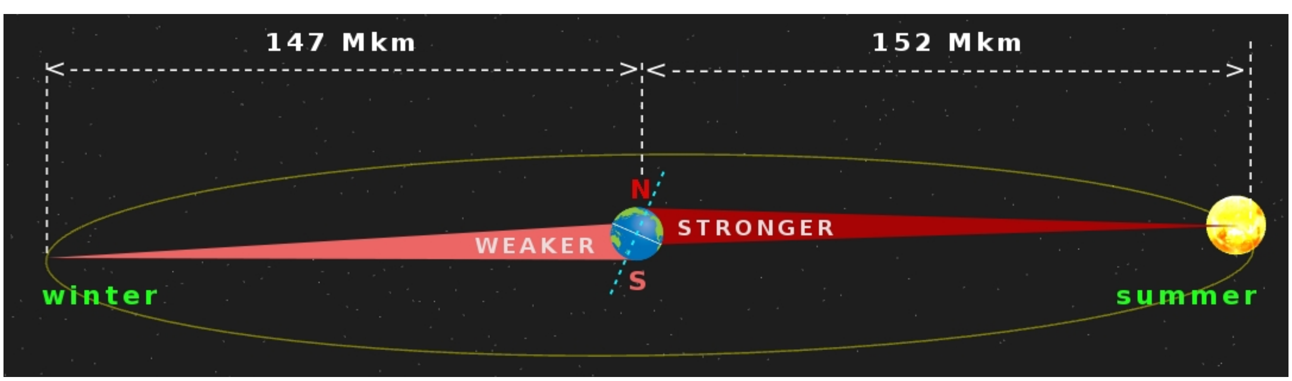


Fig. 9.3 Speculative scheme of the magnetic influence of Earth on the Earth-Sun distance.

However, one has to wonder how the Sun's 'gravitational pull', exerted perpendicularly to a given planet's orbit, could cause it to speed up and slow down, linearly. Yet, this is what Kepler was forced to conclude in order to 'make things work'. I trust the astute reader has already perceived a far more obvious explanation for these apparent velocity fluctuations: quite simply, since the Sun transits 3.3% closer to Earth in January (perigee) than it does in July (apogee), it will be perceived to travel 3.3% faster in relation to the firmament. In reality, though, the Sun always travels at a constant speed (29.78 km/s), and so do all the other bodies in the system. In other words, their apparent orbital speed variations are an optical illusion caused by changes in relative distance and spatial perspective.

9.2 Venus and the Sun's 5 Mkm oscillation

What follows is something that will require the reader to return for a second reading later on to fully appreciate its remarkable nature and significance. For now, suffice it to say that the TYCHOS model submits that Earth's orbital diameter (i.e., the diameter of the PVP orbit, as expounded in Chapter 11) is 113.2 Mkm. Venus is often referred to as 'Earth's sister' because it is almost the same width as Earth (12103.6 km vs. 12756 km, respectively). According to all official estimates, the average Sun-Venus distance is 108.2 Mkm. As illustrated in Section 9.1, the Earth-Sun distance varies by about 5 Mkm between winter and summer. Thus, since Venus is a moon of the Sun, as posited by the TYCHOS model, it should also oscillate in relation to the Earth by 5 Mkm between summer and winter. In other words, the maximum Earth-Venus distance would add up to 113.2 Mkm (108.2 + 5 Mkm), a figure that would seem to 'reflect' the diameter of Earth's PVP orbit. The significance of this is unclear, yet it certainly merits further investigation.

9.3 The Sun's 'mysterious' 6 or 7-degree tilt

It's such a deep-rooted mystery and so difficult to explain that people just don't talk about it.

You may never have heard of it, but one of the most baffling mysteries in astronomy is the 6° (or 7°) tilt of the Sun. Others refer to it as *"the common plane of all of our planets' orbits with respect to the Sun's polar axis"*. Make no mistake: the observable fact that the Sun's axis is tilted at an angle with respect to the entire Solar System's plane is no petty matter. For why would this be? Isn't the Sun supposed to be the massive 'central driveshaft' of the system? Shouldn't therefore all our planets' orbits be co-planar with the Sun's equator? Well, they are not, and this fact is an absolute mystery for academic astronomy—an unresolved quandary which all by itself falsifies both Newton's and Einstein's edicts. As recently as 2016, an academic study admitted that it's *"such a deep-rooted mystery and so difficult to explain that people just don't talk about it"*. The study went on, bizarrely enough, to speculate that this tilt of the Sun's axis might be caused by what they call *"Planet Nine"*, a hitherto unseen and entirely hypothetical celestial body!

The long-standing tilt riddle is admittedly *"a big deal"* for mainstream astronomers:

All of the planets orbit in a flat plane with respect to the sun, roughly within a couple degrees of each other. That plane, however, rotates at a 6-degree tilt with respect to the sun—giving the appearance that the sun itself is cocked off at an angle. Until now, no one had found a compelling explanation to produce such an effect. 'It's such a deep-rooted mystery and so difficult to explain that people just don't talk about it,' says Brown, the Richard and Barbara Rosenberg Professor of Planetary Astronomy. [3]

The Sun's rotation was measured for the first time in 1850 and something that was recognized right away was that its spin axis, its north pole, is tilted with respect to the rest of the planets by 6 degrees. So even though 6 degrees isn't much, it is a big number compared to the mutual planet-planet misalignments. So the Sun is basically an outlier within the solar system. This is a long-standing issue and one that is recognized but people don't really talk much about it. Everything in the solar system rotates roughly on the same plane except for the most massive object, the Sun—which is kind of a big deal. [4]

As you will remember, in Chapter 6 we saw that the rotational axes of both Mars and our own Moon are also inclined by about 7° degrees, a remarkable fact heliocentrists are hard pressed to explain. As it turns out, the 6° (or 7°) tilt of the Sun's rotational axis with respect to our ecliptic plane was known long before 1850. It was discovered by Christoph Scheiner back in the 1600s during his extensive 20-year-long sunspot observations. His work was richly illustrated and published in his monumental treatise *Rosa Ursina* (1630). In fact, the sunspot issue triggered a bitter and infamous 30-year-long feud between Galileo and Scheiner (who, incidentally, was a staunch supporter of the Tychonic model). To be sure, the observed inclination of the Sun is no trivial matter but a true bone of contention in the endless debate between heliocentrists and geocentrists.

> *Scheiner, in his massive 1630 treatise on sunspots entitled 'Rosa Ursina', accepted the view of sunspots as markings on the solar surface and used his accurate observations to infer the fact that the Sun's rotation axis is inclined with respect to the ecliptic plane.* [5]

The Sun's north pole tilts towards us in September and away from us in March, as described in a paper by Bruce McClure:

> *The Sun's axis tilts almost 7.5 degrees out of perpendicular to Earth's orbital plane. (The orbital plane of Earth is commonly called the ecliptic.) Therefore, as we orbit the Sun, there's one day out of the year when the Sun's North Pole tips most toward Earth. This happens at the end of the first week in September. Six months later, at the end of the first week in March, it's the Sun's South Pole that tilts maximumly towards Earth. There are also two days during the year when the Sun's North and South Poles, as viewed from Earth, don't tip toward or away from Earth. This happens at the end of the first week in in June, and six months later, at the end of the first week of December.* [6]

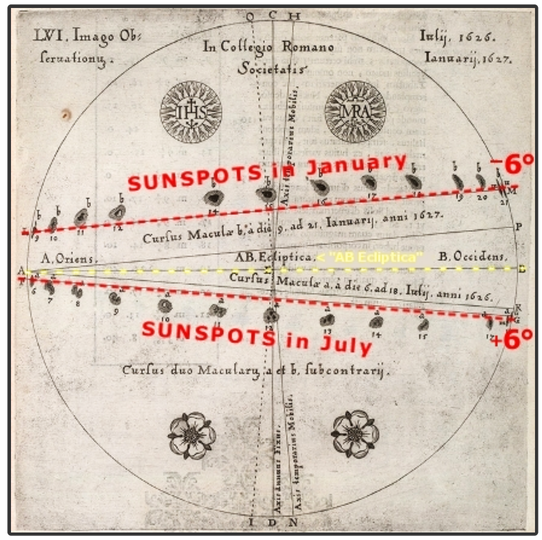


Fig. 9.4 Illustration by Cristoph Scheiner, with the 6° inclination of his observed sunspot transits in January and July highlighted in red.

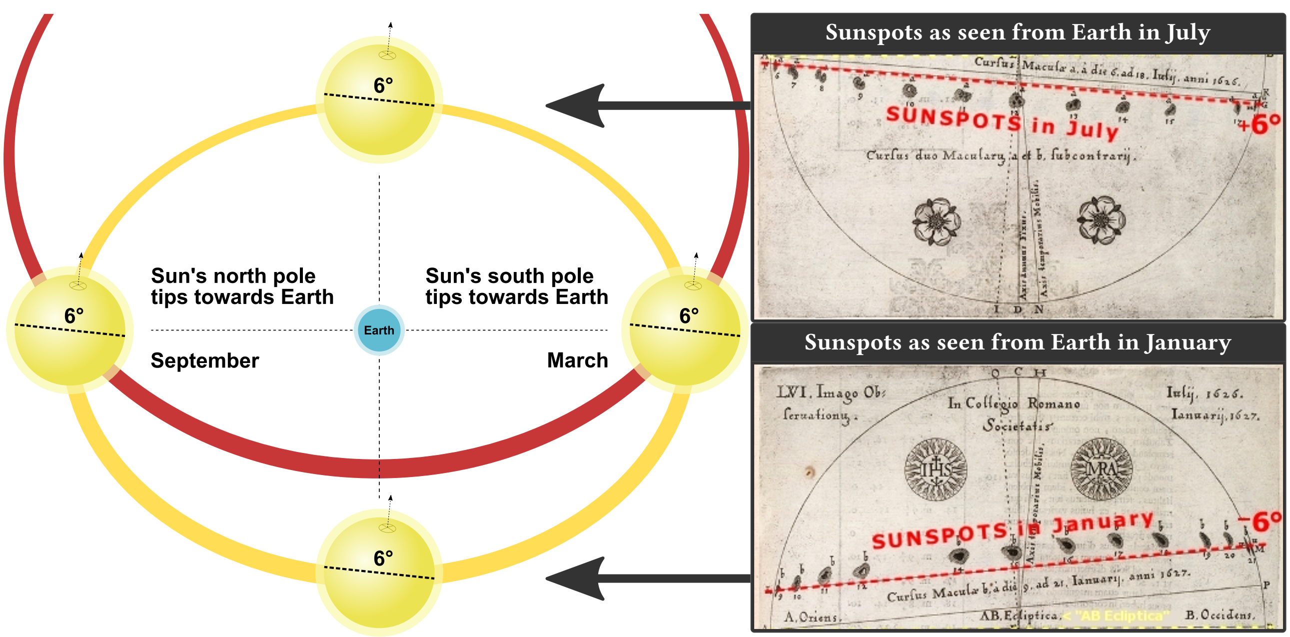


Fig. 9.5 Illustration of this 6° (or 7°) tilt of the Sun in the TYCHOS model.

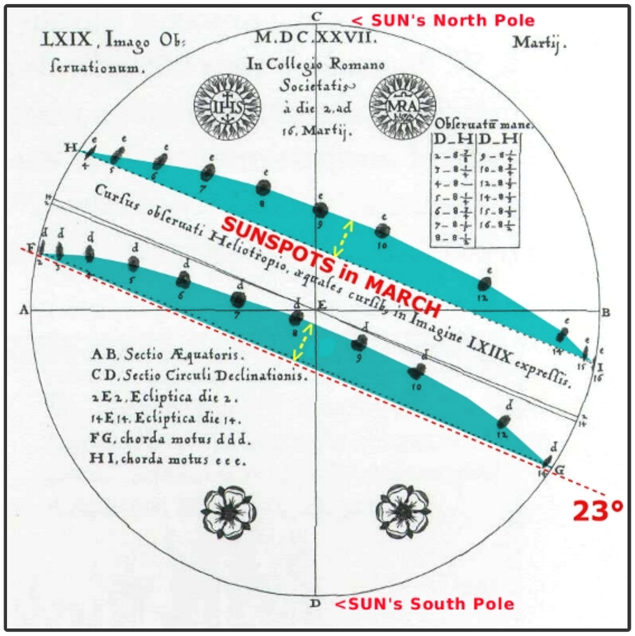
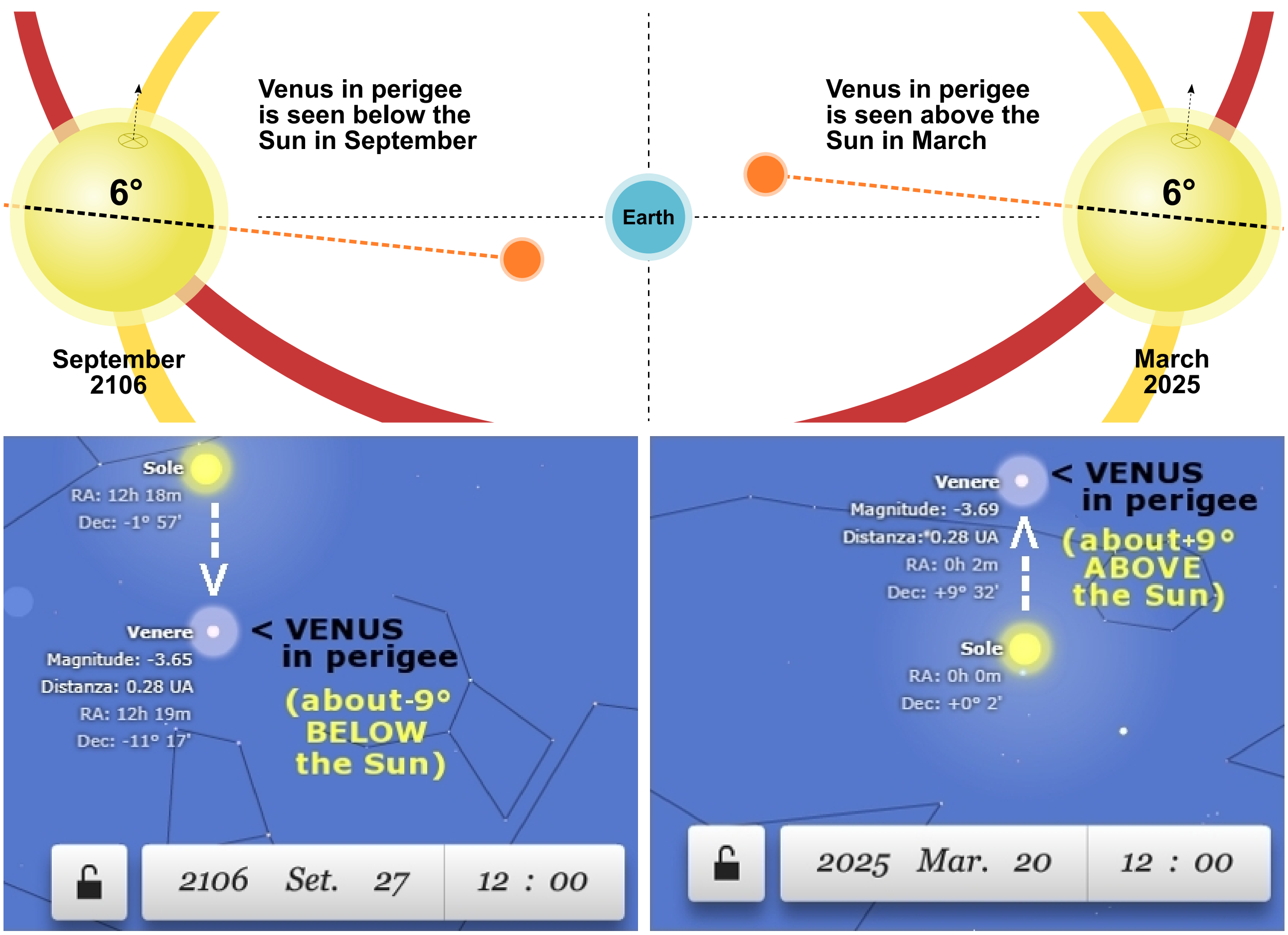


Fig. 9.6 Illustration based on another of Scheiner's illustrations, showing how he personally observed the movement of two sunspots around the solar sphere in the month of March.

Note that the inclination marked in red as 23° in Fig. 9.6 is simply caused by Earth's own axial tilt. What concerns us in Scheiner's drawing is the tilt highlighted in yellow arrows and blue arcs. It's hard to make out exactly what amount of inclination they show, but 6 or 7 degrees would seem to be a fair estimate. In any case, the drawing clearly indicates that the Sun's north pole tilts away from Earth in the month of March. We may also be satisfied that the Sun's polar axis is indeed tilted by 6° or 7° in relation to the ecliptic.

9.4 Are the orbits of Venus and Mercury co-planar with the Sun's axial tilt?

We shall now proceed to verify whether the orbits of the Sun's two moons, Venus and Mercury, can be correlated with the Sun's 6° or 7° tilt.



(a) *(b)*

Fig. 9.7

Orbital tilt

Official astronomy provides the following figures for the orbital tilts of Venus and Mercury:

- Orbital tilt of Venus: 3.4°
- Orbital tilt of Mercury: 7°

In reality however, Venus can from our earthly perspective be observed to be as many as 9° below or above the Sun. Again, spatial perspective can be misleading as it depends on several factors, such as relative distances and inclinations.

Transits of Venus and Mercury

- Whenever Venus transits in perigee in September, we see it below the Sun by about −9°.
- Whenever Venus transits in perigee in March, we see it above the Sun by about +9°.
- Whenever Mercury transits in perigee in September, we see it below the Sun by about −3°.
- Whenever Mercury transits in perigee in March, we see it above the Sun by about +3°.

The TYCHOS model allows to make a conceptual illustration of the above empirical observations (Fig. 9.8).

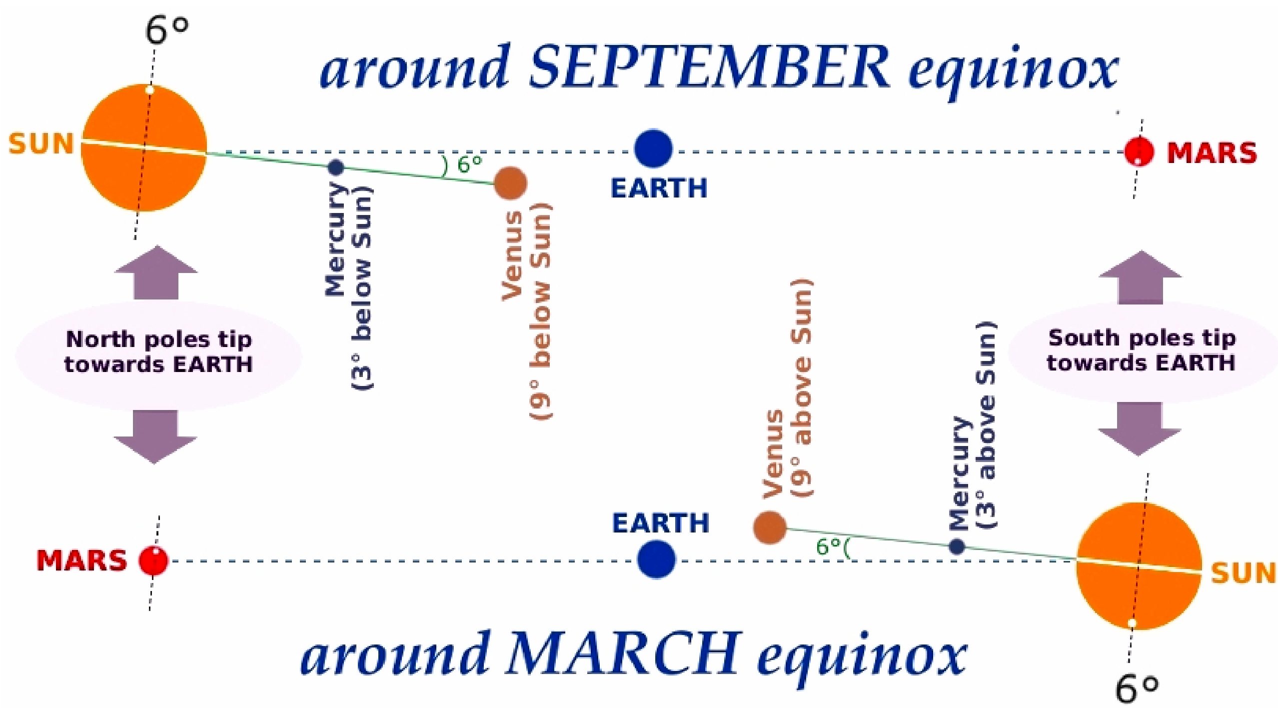


Fig. 9.8 Venus' and Mercury's orbits can be shown to be co-planar with the Sun's tilt.

Unsurprisingly, heliocentric astronomers do not seem ever to have noticed or debated this stunning fact. But then, you may ask, does the Tychosium 3D simulator show the orbits of Venus and Mercury to be co-planar with the Sun's axial tilt? Indeed it does: as you can personally verify, the Tychosium 3D simulator shows how the virtual 'disk' that encompasses the orbits of Venus and Mercury around the Sun remains permanently tilted by about 6° or 7° in relation to the Sun's orbital plane. Whether the Copernicans like it or not, the orbits of Venus and Mercury are demonstrably co-planar with the Sun's equatorial plane. The four screenshots from the Tychosium 3D simulator in Fig. 9.9 illustrates this fact.

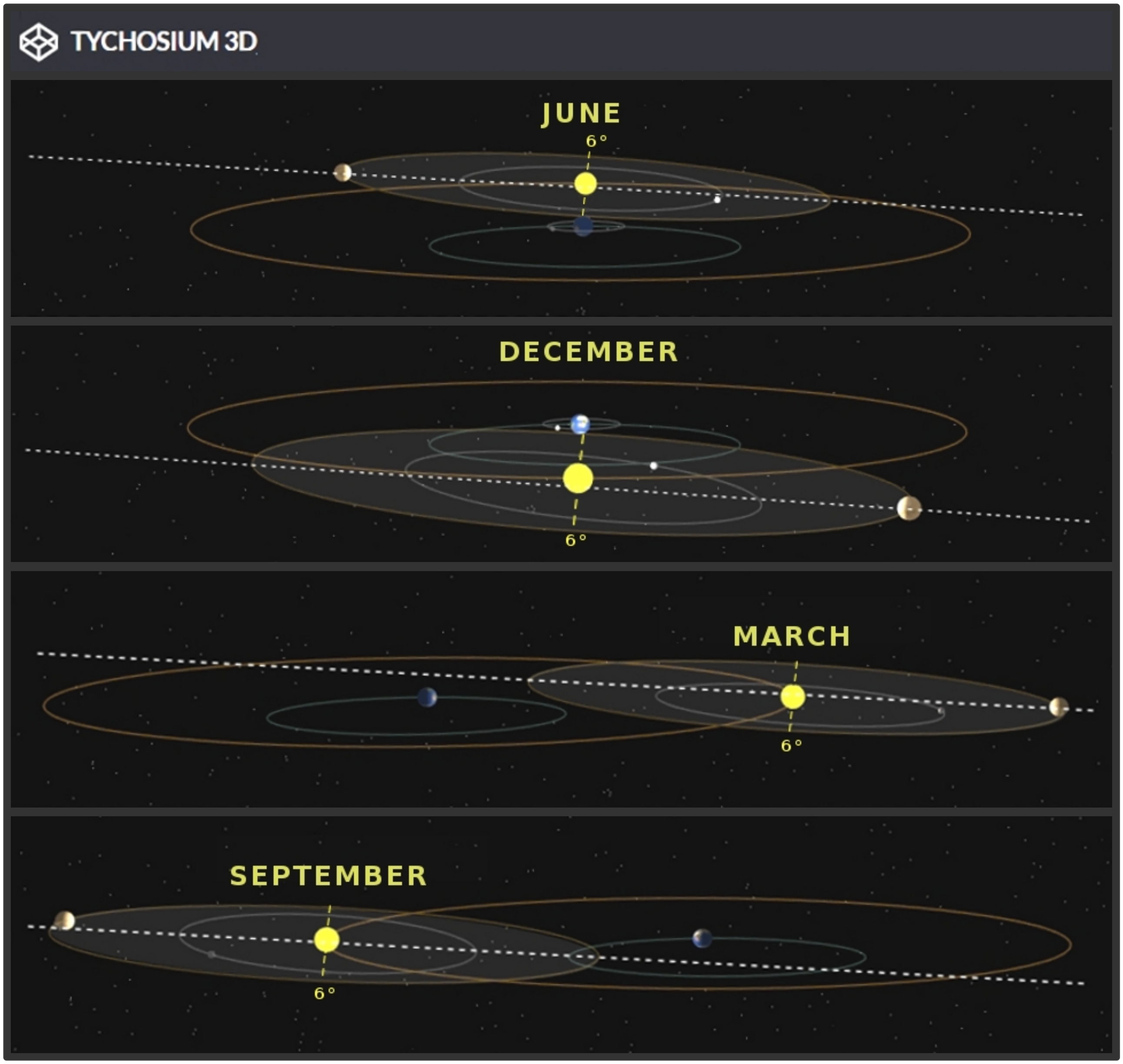


Fig. 9.9 The orbits of Venus and Mercury are co-planar with the Sun's tilted equatorial plane.

One could not wish for stronger and more spectacular evidence that Venus and Mercury are the two lunar satellites of the Sun. As it is, Venus and Mercury are not just the only moonless 'planets' of our Solar System, they are also the only two bodies whose orbits are fine-tuned to the Sun's axial tilt. Everything suggests that we ought to start referring to them as 'moons of the Sun', instead of 'planets'. Add to this the fact, expounded in Chapter 6, that our own Moon's rotational axis is also tilted by about 7° in relation to the ecliptic, meaning the Moon is likewise fine-tuned to the Sun, Venus and Mercury. To what, one may ask, would the advocates of the heliocentric model attribute this wondrous accord? Try submitting this question to your local astronomy professor, but prepare to be treated with disdain.

9.5 The Sun's 79-year cycle and 39.5-year oscillation period

The Sun is observed to slightly oscillate around its own nucleus. According to current theory, the reason for this oscillation is the extra-solar location of the system's 'centre of mass':

> *The center of mass of our solar system is very close to the Sun itself, but not exactly at the Sun's center (it is actually a little bit outside the radius of the Sun). However, since almost all of the mass within the solar system is contained in the Sun, its motion is only a slight wobble in comparison to the motion of the planets.* [7]

According to the Wikipedia, what is observed is actually *"the motion of the solar system's barycenter relative to the Sun"*.

> *The barycenter (or barycentre) is the center of mass of two or more bodies that are orbiting each other, or the point around which they both orbit. It is an important concept in fields such as astronomy and astrophysics. The distance from a body's center of mass to the barycenter can be calculated as a simple two-body problem. In cases where one of the two objects is considerably more massive than the other (and relatively close), the barycenter will typically be located within the more massive object. Rather than appearing to orbit a common center of mass with the smaller body, the larger will simply be seen to wobble slightly.* [8]

The Wikipedia goes on to say that the Sun's observed wobble/oscillation is caused by *"the combined influences of all the planets, comets, asteroids, etc. of the solar system"*. However, the TYCHOS model allows us to explore other possibilities, such as the direct influence of the Sun's binary companion, Mars. After all, such subtle oscillations on the part of host stars in binary systems are precisely what our modern-day astronomers look for, with their sophisticated spectrometers and assorted state-of-the-art techniques, when trying to determine if a given star may have a smaller binary companion. In light of this, it seems perfectly reasonable to attribute the Sun's small oscillation around its nucleus to ordinary binary system physics.

Earlier on we saw how Mars has a distinctive 79-year cycle within which it returns to the same celestial location. As it is, even Mercury, the Sun's junior moon, exhibits a 79-year cycle and thus conjuncts regularly with Mars every 79 years. Now, it turns out that, according to modern-day researchers of solar activity, the Sun also has a 79-year cycle. According to studies conducted by Theodor Landscheidt, the cycle of solar activity is related to the sun's oscillatory motion about the centre of mass of the Solar System.

Theodor Landscheidt (1927-2004) is held in the highest esteem by many independent astronomers and climatologists who have noticed that our Earth's climate is closely correlated with the periodic fluctuations of solar activity, which in turn depend on the Sun's observed oscillations around the *"center of mass of the planetary system"*, to use Landscheidt's own words. Now, as their theory goes, this observed oscillation of the Sun would be caused by the gravitational pull of the larger planets of our system (Jupiter, Saturn, Uranus and Neptune) and some believe even Mercury and Venus are involved in this collective 'solar nudging'. Oddly enough, Mars—and Mars only—is never mentioned in their papers, despite Landscheidt's discovery of the Sun's peculiar 79-year synchronicity with Mars.

Table 9.1 – Initial phases E of the 79-year cycle 5300 B.C. to A.D. 2248

Landscheidt's exhaustive studies of the cycles of solar activity clearly indicate that the Sun has a distinct 79-year cycle.

−5300.3	−4349.3	−3393.1	−2443.2	−1487.2	−530.5	419.5	1375.7
−5221.8	−4268.5	−3314.0	−2359.2	−1408.2	−453.3	497.7	1453.6
−5142.7	−4186.4	−3236.7	−2280.4	−1325.5	−374.5	581.7	1532.7
−5065.1	−4108.5	−3151.6	−2202.4	−1245.0	−297.9	660.6	1616.8
−4985.2	−4031.8	−3075.8	−2125.7	−1168.2	−210.2	738.3	1694.8
−4902.3	−3951.2	−2996.4	−2042.3	−1090.5	−135.8	816.1	1772.5
−4823.3	−3868.8	−2917.3	−1962.9	−1010.3	−55.2	899.3	1850.8
−4746.1	−3789.6	−2841.9	−1883.3	−927.5	22.9	979.5	1929.6
−4668.9	−3712.4	−2755.2	−1806.4	−849.3	100.5	1056.9	2013.8
−4584.2	−3633.5	−2678.8	−1726.0	−772.8	184.5	1134.8	2091.2
−4508.8	−3550.7	−2599.8	−1643.4	−692.8	263.5	1215.5	2169.2
−4427.2	−3470.6	−2521.2	−1564.2	−609.8	341.8	1298.3	2248.6

The mean value of the 95 intervals between −5300.3 and 2248.6 is: $\dfrac{5300.3 + 2248.6}{95} \approx 79.4$

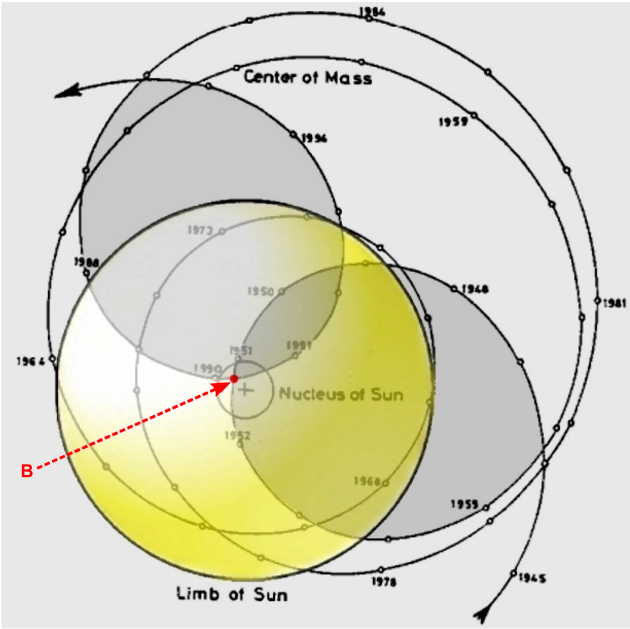


Fig. 9.10 In the TYCHOS model, Mars and the Sun are binary companions. The two are locked in a 2:1 orbital ratio. Mars has a well-known 79-year cycle in which it returns to the same place, i.e., its oppositions occur at the same longitude. 'B' marks the Sun's center of mass, to which it returns approximately every 39.5 years (79/2). Landscheidt's caption for the graphic reads:

> *Master cycle of the solar system. Small circles indicate the position of the center of mass of the planetary system (CM) in the ecliptic plane relative to the Sun's center (cross) for the years 1945 to 1995. The Sun's center and CM (center of mass) can come close together, as in 1951 and 1990 (ed- i.e. ca. 39.5 years) or reach a distance of more than two solar radii.* [9]

Interestingly, Landscheidt also points out that the Sun's nucleus and centre of mass *"can come close together (i.e., return to the same place in space) as in 1951 and 1990"*, that is, within a ~39.5-year period. The study features the well-known diagram shown in Fig. 9.10, plotting the Sun's observed oscillation around its own centre of mass. Since the Sun and Mars are locked in a 2:1 orbital ratio, it would stand to reason that the Sun exhibits such a period, since Mars exhibits a 79-year (39.5 × 2) orbital cycle. Just as the Sun revolves twice for every Mars revolution, the Sun's nucleus would complete two 39.5-year oscillatory periods for every 79-year cycle of Mars.

Other independent authors have detected a peculiar *"80-y/40-y"* periodicity (an approximation of the TYCHOS model's 79-y/39.5-y periodicity) in relation to the Sun's barycentric dynamics and what is termed *"solar angular momentum inversions"*.

> *We apply our results in a novel theory of Sun-planets interaction that it is sensitive to Sun barycentric dynamics and found a very important effect on the Suns capability of storing hypothetical reservoirs of potential energy that could be released by internal flows and might be related to the solar cycle. This process (which lasts for ca. 80 yr) begins about 40 years before the solar angular momentum inversions, i.e., before Maunder Minimum, Dalton Minimum, and before the present extended minimum.* [10]

In any event, the observed 'wobble' or oscillatory motion of the Sun and its 39.5-year periodicity would certainly seem to lend additional support to the notion that the Sun and Mars constitute a binary system locked in a 2:1 ratio.

9.6 Galileo and Scheiner

As a brief anecdotal aside, it is interesting to note that Galileo (a staunch crusader for Copernicus' theories) seemingly perceived Cristoph Scheiner's sunspot observations as a threat to heliocentrism. The notoriously ill-tempered Galileo engaged in fierce verbal battles with numerous astronomers of his time, often wrongfully claiming primacy over new discoveries made by others with the aid of the telescope. Outraged by Galileo's accusations of plagiarism regarding the discovery of the sunspots, Scheiner decided to move from Ingolstadt to Rome in order to better defend his work. The feud between Galileo and Scheiner soon escalated. Galileo did not refrain from smearing his German colleague, calling him *"brute"*, *"pig"*, *"malicious ass"*, *"poor devil"* and *"rabid dog"*!

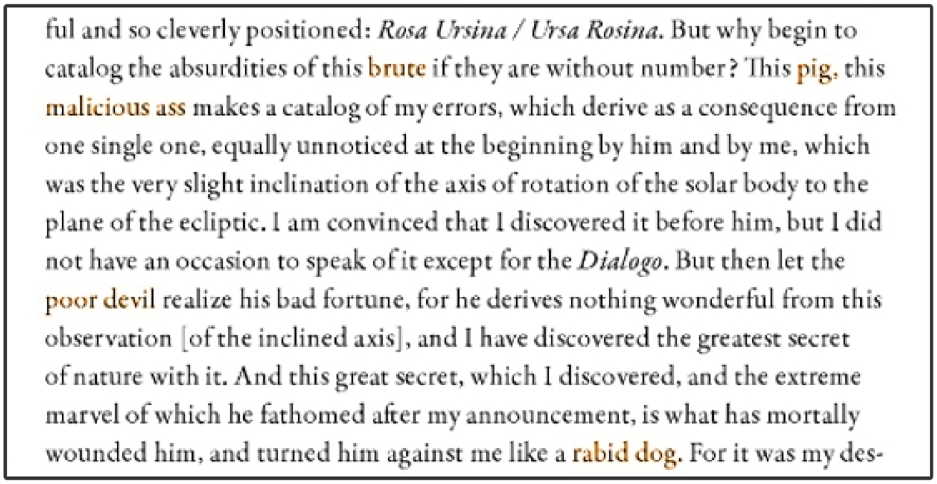

ful and so cleverly positioned: *Rosa Ursina / Ursa Rosina*. But why begin to catalog the absurdities of this brute if they are without number? This pig, this malicious ass makes a catalog of my errors, which derive as a consequence from one single one, equally unnoticed at the beginning by him and by me, which was the very slight inclination of the axis of rotation of the solar body to the plane of the ecliptic. I am convinced that I discovered it before him, but I did not have an occasion to speak of it except for the *Dialogo*. But then let the poor devil realize his bad fortune, for he derives nothing wonderful from this observation [of the inclined axis], and I have discovered the greatest secret of nature with it. And this great secret, which I discovered, and the extreme marvel of which he fathomed after my announcement, is what has mortally wounded him, and turned him against me like a rabid dog. For it was my des-

Fig. 9.11 Galileo writes about his sunspot-rival, Scheiner. [11]

One may thus be forgiven for questioning the legacy of this most revered 'science icon', what with his dreadful arrogance and contempt of his peers. In any case, Galileo's most acclaimed telescopic discoveries (the phases of Venus and the moons of Jupiter, both of which had, in fact, been previously observed by other astronomers) did not contradict in any way the Tychonic model which, in his time, and as few people will know today, was the predominant 'system of the world'. What's more, in his writings, Galileo virtually ignored the widely accepted geo-heliocentric model proposed by Brahe and Longomontanus.

> *After 1610, when Galileo engaged himself fully in astronomy and cosmology, he showed little direct interest in Tycho's system and none at all in Longomontanus' version of it. [...] Moreover, he never mentioned explicitly the Tychonian world system by name.* [12]

One must wonder why Galileo Galilei, the man hailed as the 'father of the scientific method', would have been so dismissive of his illustrious Danish colleagues and instead used Ptolemy and his already moribund geocentric system as a straw man in order to forward his heliocentric convictions. The reason why Galileo 'passed over' the Tychonic (or semi-Tychonic) system will forever remain a mystery, and it certainly doesn't say much about his adherence to the scientific method. To be sure, Galileo never provided any sort of evidence for the Earth's supposed revolution around the Sun. The only argument he put forth towards this idea—his infamous 'tide theory'—proved to be entirely spurious:

> *Clearly inspired by the behaviour of water when boats come to a halt, Galileo Galilei concluded that the ebb and flow of the tides resulted, similarly, from the acceleration and deceleration of the oceans. This, in turn, was caused by the movement of the Earth around the Sun, and its rotation on its own axis. However, Galileo was completely mistaken in this theory.* [13]

In the next chapter, we shall tackle the so-called 'third motion of Earth' and see if the idea that the Earth slowly wobbles around its axis, in the opposite direction of its axial rotation, holds any water. Spoiler: it does not!

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Requiem for the 'lunisolar wobble' theory

The Precession of the Equinoxes is the slow and nearly imperceptible 'backward displacement' of the entire firmament over an extended period of time. The motion was known to Hipparchus as long ago as the second century BCE:

> *Hipparchus was the first person to notice the earth's precession. He did this by noting the precise locations stars rose and set during equinoxes—the twice yearly dates when night length and day length are exactly 12 hours.* [1]

To account for this phenomenon, the heliocentrists have contrived a fantastic scheme referred to as the 'lunisolar wobble' theory. Earth's equinoctial precession is said to be caused by an extremely slow 'reverse wobble' of Earth's polar axis which, to complete a single 360° rotation, would require approximately 26000 years. But does Earth's polar axis really wobble? Can the lunisolar wobble theory be tested empirically? As we shall see, these questions can be answered with a resounding *"no"*.

As the official theory goes, this apparent retrograde rotation of our planet's axis would be caused by a combination of gravitational forces generated by the Moon and the Sun (hence 'lunisolar') to which the Earth is susceptible due to its oblateness. The 'wobble' allegedly resulting from this pull is the currently favoured explanation for the Precession of the Equinoxes:

> *It is now known that precessions are caused by the gravitational source of the Sun and Moon, in addition to the fact that the Earth is a spheroid and not a perfect sphere, meaning that when tilted, the Sun's gravitational pull is stronger on the portion that is tilted towards it, thus creating a torque effect on the planet. If the Earth were a perfect sphere, there would be no precession.* [2]

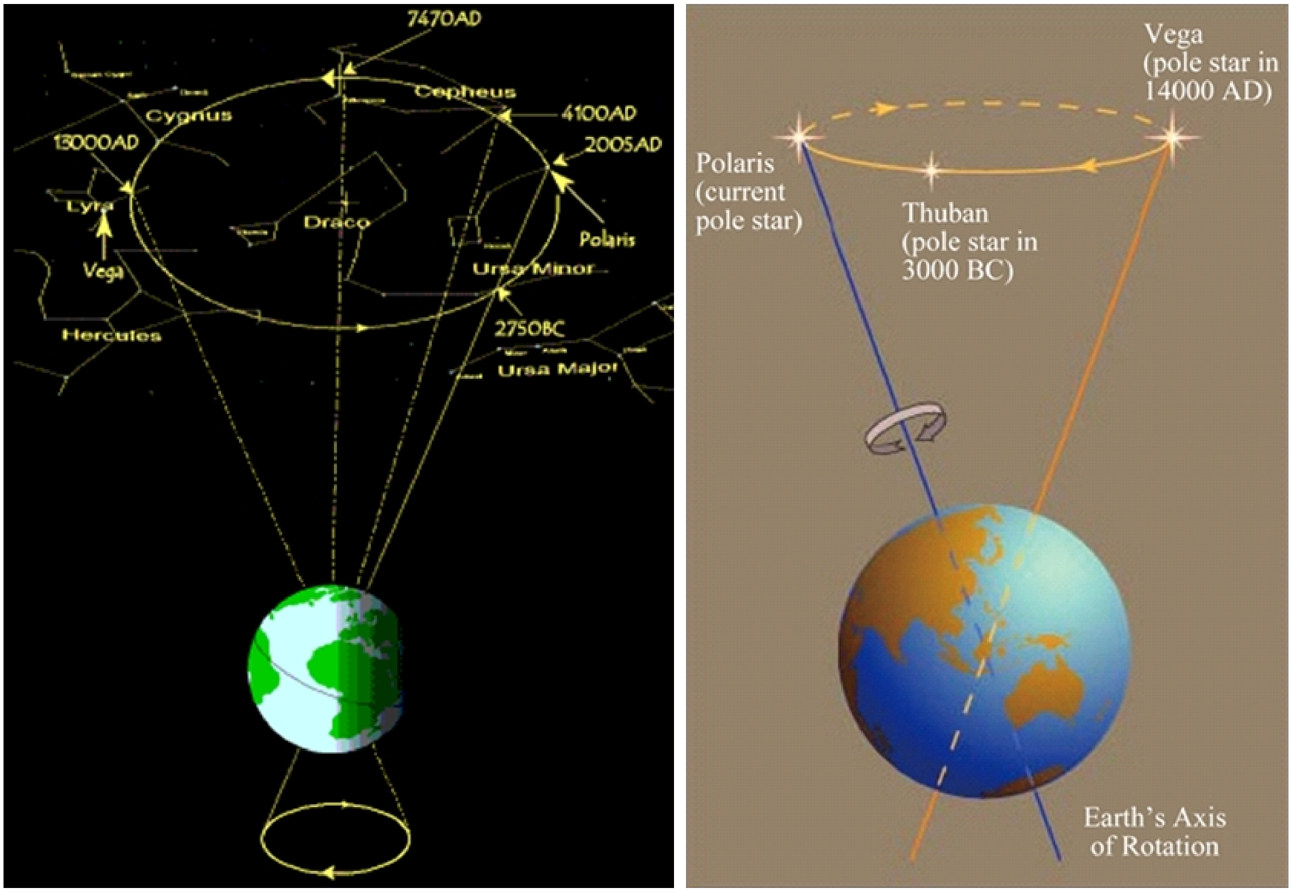
This bizarre theory is still obstinately upheld by academia as a firmly established scientific fact, despite the many glaring problems afflicting its fundamental tenets, as compellingly demonstrated in later years by a number of independent authors:

> *In summary, a number of independent groups, all studying the same problem of lunisolar mechanics have concluded that precession is most likely caused by something other than a local wobbling of the Earth.* [3]

Prerequisites for the Copernican model

In order to work, the Copernican model requires three distinct motions of Earth:

- A 'counterclockwise' motion around the Sun at hypersonic speed (∼90 times the speed of sound).
- A 'counterclockwise' diurnal rotation around its polar axis (duration: ∼24 h).
- A 'clockwise' 360° retrograde motion of its polar axis (duration: ∼25500 years).



(a) *(b)*

Fig. 10.1 Two conventional illustrations of the hypothetical 'lunisolar wobble', also referred to as 'the third motion of Earth'. *(a)* [4] *(b)* [5]

This 'third motion of Earth' has always been a prerequisite for the Copernican theory's survival. Without it, astronomers are left without an explanation for the observable fact that the stars precess (i.e. 'drift eastwards' in relation to Earth's equinoxes) by about 50.3 arcseconds per year, thereby causing our pole stars to change over time.

> *The dynamic universe model has revealed serious problems with the wobble or Lunisolar theory. Newtonian equations that use the Lunisolar theory to calculate the rate of precession don't work. [...] Precession of the equinox is far better explained as a movement of our entire solar system against the background stars. The binary-star system helps fix the Lunisolar theory. It includes the speed of movement of the sun, with the motion of the whole solar system that follows.* [6]

The above article goes on listing a number of issues afflicting the current explanation for the Precession of the Equinoxes (mostly related to the observed secular behaviour of the star Sirius). However, it fails to mention what may be the most glaring problem with the 'lunisolar wobble' concept: what is known today as the 'precession paradox' is best summarised in the following statement by Walter Cruttenden, whose Binary Research Institute has thoroughly exposed the untenability of current precession theory.

> *Precession only occurs relative to objects outside the solar system—the Earth does not precess or change orientation relative to objects within the solar system.*

Cruttenden and several other independent researchers have dealt a mortal blow to the 'lunisolar wobble' theory by showing that, as astounding as it may seem, the Copernican model is unable to account for the all-important Precession of the Equinoxes—one of the heliocentrists' many 'cosmic mysteries' awaiting a rational and verifiable explanation. Actually, the demise of the 'lunisolar wobble' theory is enough to invalidate the heliocentric model we were all taught in school.

The following quotes expound the insurmountable problems afflicting the 'lunisolar wobble' theory.

When Earth spins on its axis in West to East direction (Anti clockwise) it is natural that North Pole of the axis moves in the same direction. It is how North Pole can describe a circle of precession about star Polaris in a clockwise direction opposite to the natural rotation of North Pole of the axis conspicuously that remains unexplained. The hypothesis of Earth's wobble does not explain above contradiction. Hence, the hypothetical proposition that the retrograde motion of North Pole is due to Earth's wobble is not credible. [5]

If the slow wobble of Earth's axis causes the precession of the equinoxes, it is a product of shifting perspective and should affect everything we view from Earth. Some astronomers argue that objects within our solar system do not appear to precess. Only objects outside of the solar system do. If this is the case, then the Earth's wobble cannot be the cause of precessional movement. [7]

The Earth's changing orientation to inertial space (as required by any binary orbit of our Sun), can be seen as Precession of the Equinox. This fact has been masked by the illusion called the lunisolar explanation for precession. [...] Lunisolar wobble required the pole to move by about one degree every 71.5 years based on the current precession rate, hence the pole should have moved about 6 degrees since the Gregorian Calendar change (420 years ago), thereby causing the equinox to drift about 5.9 days. This has not happened; the equinox is stable in time after making leap adjustments. [8]

How the clockwise slow wobbling motion of axis causes the earth to fall back by 36581.97 km in the orbit equivalent to 0.0139688667° relative to the center of the sun is beyond imagination and mathematically incomprehensible concept. So, the notion of axial precession, assumed to create difference between sidereal and tropical years (Capderou, 2005; Snodgrass, 2012; Yang, 2007) lacks mathematical substantiation and absolutely has no possibility to be illustrated diagrammatically. [9]

Tycho Brahe rightly predicted that 'the triple motion of Earth', as proposed by Copernicus, would be refuted.

The Copernican system, Tycho Brahe proclaimed, with its "triple motion of the earth will be unquestionably refuted, not simply theologically and physically, but even mathematically, even though Copernicus hoped that he had proposed to mathematicians sufficiently mathematical statements to which they could not object". [10]

It is ironic that Copernicus is often hailed as the man who 'simplified' and 'elegantly resolved' the complex riddle of our cosmic motions, while the models of Ptolemy and Brahe were dismissed as 'too complex' simply because, according to some critics, they allegedly required too many different motions of our Solar System's bodies. Fig. 10.2 depicts the not-so-simple and not-so-elegant motions of Earth required by the Copernican theory.

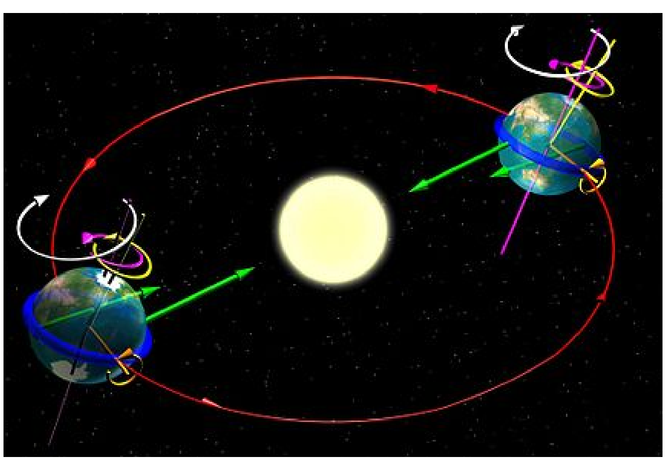


Fig. 10.2 'Precessione degli equinozi' (Italian Wikipedia) [11]

Note that the white clockwise arrows represent the so-called 'lunisolar precession', while the other arrows represent all the other motions piled onto Earth in an attempt to explain the observable motions of our system. One can only wonder why the Copernican 'lunisolar wobble' theory was accepted by the world's scientific community in the first place, and how it can possibly have remained unquestioned and unchallenged for so many centuries.

The Italian Wikipedia page referred to above contains the following statement in the section titled *"Clockwise precession of the Earth's axis"*:

> *Clockwise precession of the Earth's axis. The fact that the precession motion of the Earth is clockwise while that of rotation on itself is counterclockwise is not in contrast with the example of the spinning top. In fact, if the Earth were straight and a force tried to tilt it, then it would develop a motion of counterclockwise precession, in the same direction as the rotation on itself, just as in the case of the spinning top. In this case, however, the opposite situation occurs: the Earth is inclined and a force tends to straighten it, giving rise to a clockwise precession motion, contrary to the counterclockwise direction of Earth's rotation.* [11]

An editor or fact checker of the section posted a sagacious comment which has since been redacted, but the original comment deserves to be reproduced here, translated into English:

> *Editor's note: This lacks an explanation for the exact reason why the direction of rotation of the precession is opposite to that expected by common logic.*

Sadly, this much-needed appeal to common sense has been replaced with a formidably tortuous explanation as to why Earth would slowly wobble in the opposite direction of its axial rotation.

Most people will be familiar with the notion, inspired by Occam's razor, that simpler explanations are more likely to be true than more complicated ones. Evidently, such elementary wisdom was lost on the proponents of the heliocentric theory. Indeed, the idea of Earth wobbling around its polar axis in the opposite direction of its own rotation once every twenty-six thousand years or so does not conform to any physical phenomenon known to mankind.

In short, the Copernican model is falsified by the observed Precession of the Equinoxes: its proposed explanation is simply inconsistent with empirical observation. The Binary Research Institute has long demonstrated the non-existence of Earth's third motion. Although they still hold on to the idea that Earth revolves around the Sun, they believe the apparent clockwise rotation of our earthly frame of reference is due to our entire Solar System revolving around a distant binary star companion of the Sun, such as Sirius (which, in fact, does not precess like all the other stars).

> *Lunar rotation equations clearly show the Earth goes around the Sun 360 degrees in an equinoctial year, and contrary to observations of the Earth's orientation relative to inertial space, these same equations show the Earth orbits the Sun 360 degrees plus 50 arc seconds in a sidereal year. Interestingly, if one only plugs the sidereal data into the rotation equations, they show the Earth moves 360 degrees relative to the fixed stars in a sidereal year, yet this orbit path of the Earth around the Sun takes 20 minutes longer and is 22,000 miles wider in circumference than the Earth's actual path around the Sun. Now obviously, the Earth does not have two different orbit paths around the Sun each year. So which is right? Mathematically, they are both correct; the Earth does move 360 degrees around the Sun in a solar year and does appear to move 360 degrees relative to the fixed stars in a longer sidereal year. The startling conclusion is, while the Earth is moving 360 degrees counterclockwise around the Sun in a solar year, the entire solar system (containing the Earth Sun reference frame) is moving clockwise relative to inertial space. The relationship between the mathematical calculations supports no other conclusion.* [12]

Prerequisites for the TYCHOS model

The TYCHOS model requires no more than two terrestrial motions:

- A 'counterclockwise' rotation around the polar axis (∼24 h).
- An exceedingly slow 'clockwise' motion around the PVP orbit (25344 years).

The next chapter will introduce the concept of the PVP orbit which, as you may appreciate, provides the simplest imaginable explanation for the Precession of the Equinoxes. The PVP orbit is my most essential contribution to the celestial mechanics of the geo-heliocentric model devised by Tycho Brahe and Longomontanus and may just be the 'missing cog' of the same. In fact, the TYCHOS model is no more than a respectful—yet long-overdue—revision of the unjustly abandoned Tychonic world view. The assignment of this ingenious system to the dusty cellars of science history is no longer acceptable.

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11

Earth's PVP orbit

11.1 Introduction

We shall now proceed to see how the TYCHOS model accounts for the Precession of the Equinoxes or, as modern astronomers like to call it, the General Precession. The name change is explained in the Wikipedia entry for axial precession:

> *With improvements in the ability to calculate the gravitational force between planets during the first half of the nineteenth century, it was recognized that the ecliptic itself moved slightly, which was named planetary precession, as early as 1863, while the dominant component was named lunisolar precession. Their combination was named general precession, instead of precession of the equinoxes [1].*

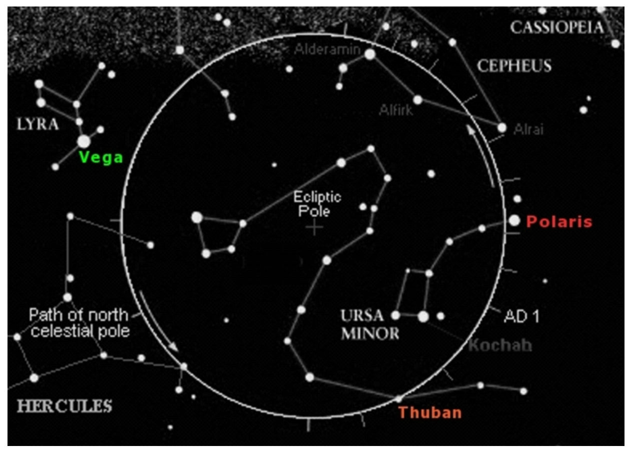

Fig. 11.1 Image source: Oakton Edu [2]

If, as demonstrated by several modern-day independent studies, Earth does not wobble around its polar axis, it follows that we need to explain how and why our pole stars keep changing over time. Currently, the triple star system Polaris acts as our north star, but we know that the binary star system Thuban was our north star roughly 4200 years ago, and that in about 11500 years from now (∼13500 AD) the binary star system Vega will play the role as north star. This is generally agreed upon by astronomers of all stripes.

Fig. 11.1 is a conventional plot of the circular motion responsible for the cyclical change in north stars. Note that, if viewed from an imaginary spaceship hovering above our north pole, the direction of the motion is clockwise.

Assuming that, contrary to Copernican dogma, Earth does not wobble around its polar axis, but moves clockwise in a local orbit under the pole stars, the same effect would be produced. It may at first seem highly unorthodox to assign a local orbit to Earth, but is it really? After all, every single celestial body in our skies is known to move in a local orbit of its own. Let us put this proposition to the test and see if we can determine at what speed the Earth would travel as it completes this circular journey, from Polaris to Vega and back again to Polaris (hence, PVP). To do so, we will first need to estimate the diameter of this local orbit.

11.2 The PVP orbit: Earth's path below our north stars

In 'Earth-based' digital simulators, such as the Neave Planetarium, the Sun can be seen to cover a distance subtending 2h56min of RA (Right Ascension) in 44 days (1056 hours) as it moves around our 360° celestial sphere.

The following figures illustrate the method used to estimate the diameter of the PVP orbit.

The diameter of the PVP orbit can be estimated with a simple calculation. Assuming the Sun travels at 107226 km/h and covers the distance between Polaris and Vega in 44 days (1056 hours), we would have:

$$107226 \times 1056 \quad = \quad 113\ 230\ 656\ (km)$$

The circumference will be:

$$113\ 230\ 656 \times \pi \quad \approx \quad 355\ 724\ 597\ (km)$$

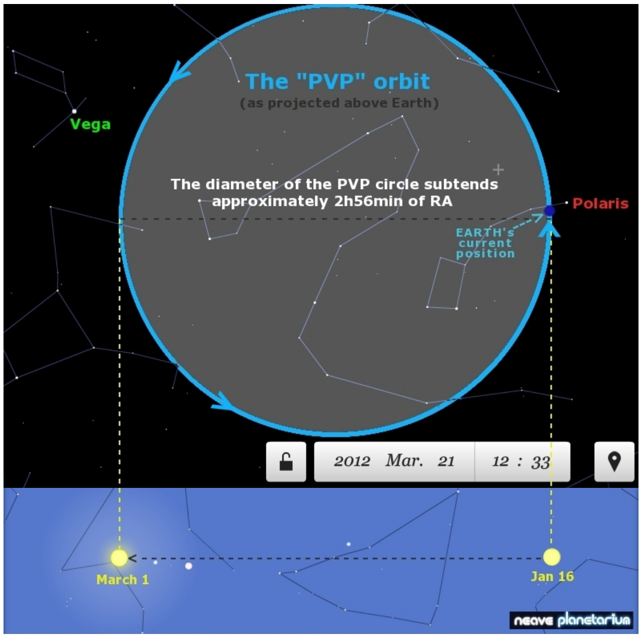

Fig. 11.2 Earth's 25344-year journey underneath our 'north stars'. In 44 days, the Sun moves by ca. 113 230 656 km. Hence, this will be the PVP orbit's diameter.

Fig. 11.3 is a conceptual graphic showing how the Sun would 'visually' employ around 44 days to cover the distance between Polaris and Vega, as viewed under an imaginary circumpolar orbit of the Sun. Conceptual graphics can be somewhat challenging to translate in the mind, but they are the best I can do to 'materialise' the train of thoughts that led me to formulate the PVP orbit in the TYCHOS model.

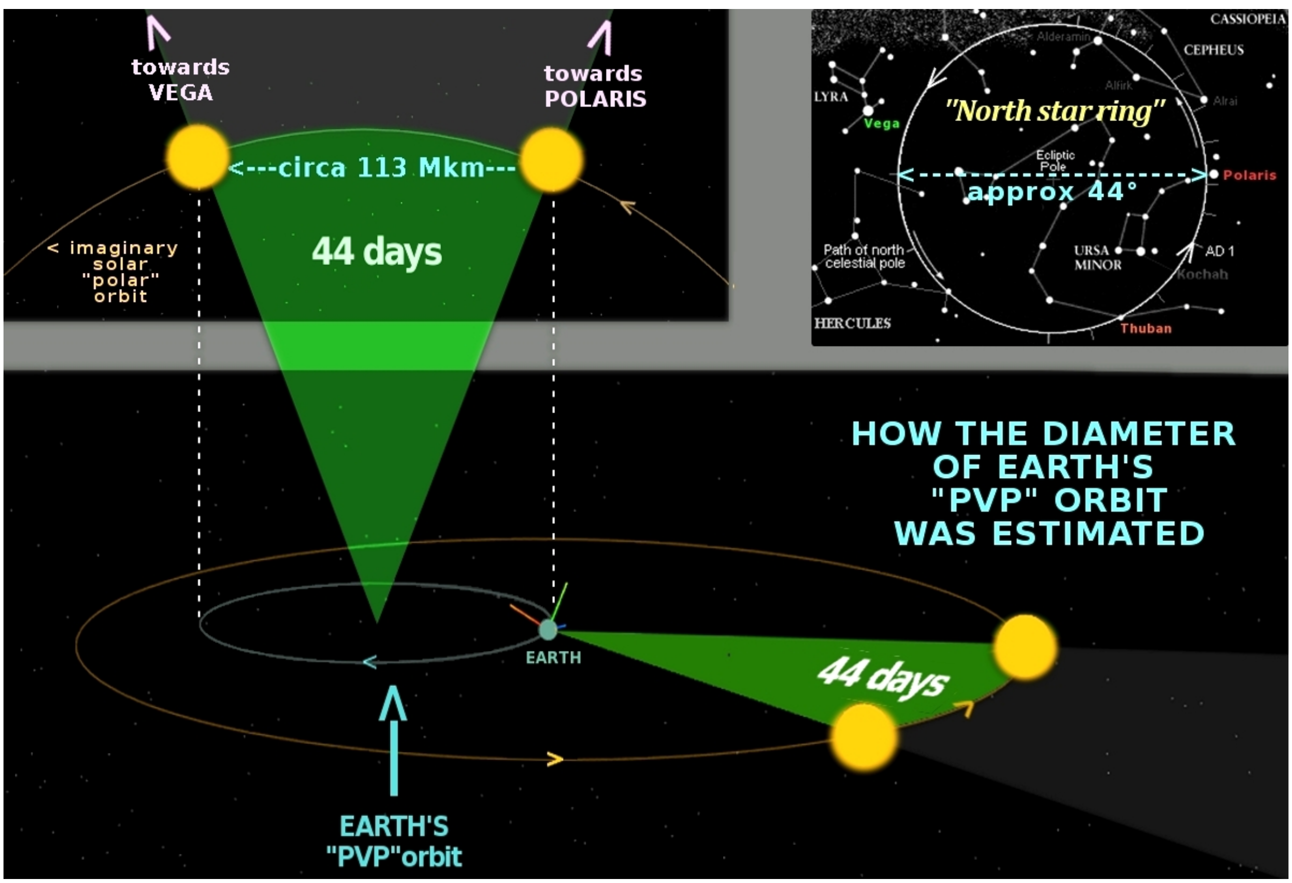

Fig. 11.3 The diameter of the north star 'ring' subtends about 44° of our celestial sphere and the Sun moves by about 44° in 44 days (covering ca. 113 Mkm). Hence, we can draw an imaginary solar polar orbit—a 44° segment of which will represent the diameter of Earth's PVP orbit.

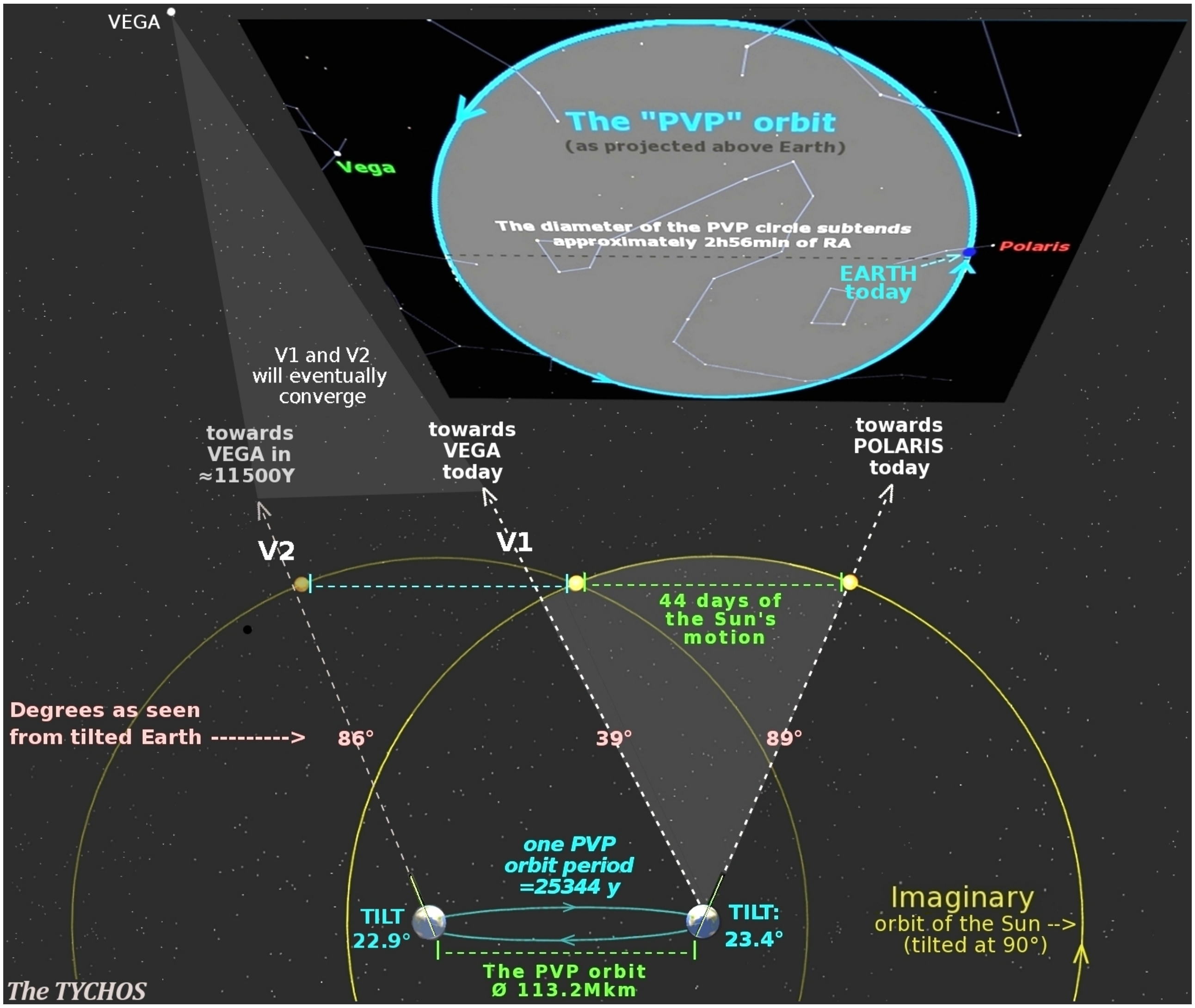

Fig. 11.4 This illustration shows how the geometry, implied by the proposed PVP orbit, would be consistent with officially calculated (heliocentric) predictions.

- Polaris is currently observed to be at 89° of declination (i.e., almost exactly above our north pole).
- Vega is currently observed to be at 39° of declination (i.e., about 50° from Polaris).
- In about 11500 years, Vega will be our north star (at 86° of declination).

In about 11500 years, Earth's axis will, according to official predictions, be tilted by 22.9°, as opposed to the current 23.4°, for a total axial rotation of 46.3° in relation to the 180° northern celestial hemisphere. This 3.7° difference between 50° and 46.3° can be accounted for by Earth's 113.2 Mkm displacement along its PVP orbit. This is because, in the TYCHOS model, as we shall see later on, the Earth-Vega distance is estimated to be ~37 astronomical units (AU). The PVP orbit's diameter of 113.2 Mkm (0.757 AU) amounts to approximately 2.05% of 37 AU. The 3.7° difference observed above amounts to approximately 2.05% of 180°. Fig. 11.4 illustrates in greater detail how all this would be consistent with the geometry implied by the proposed PVP orbit, as well as with officially calculated (heliocentric) predictions.

11.3 Estimating the orbital speed of Earth

The time required for a complete Precession of the Equinoxes is often referred to as 'the Great Year'. Copernican astronomers estimate the duration of the Great Year to be 25771 solar years. However, the TYCHOS model allows to correct this estimate to 25344 solar years (henceforth referred to as the TYCHOS Great Year, or TGY), a claim that will be extensively tested and cross-verified throughout this book. For reasons that will be clarified in Chapter 12, the TGY is about 1.68% shorter than the Copernican Great Year.

Calculating the orbital speed of Earth:

- 1 year = 365.25 days = 8766 hours
- 1 TGY = 25344 solar years × 8766 hours = 222 165 504 hours
- The PVP orbit's circumference = 355 724 597 km
- Orbital speed of Earth ≈ 1.601169 km/h
- 1.601169 km/h is approximately 1 mph (1.609344 km/h)

$$\frac{355\,724\,597}{222\,165\,504} \approx 1.601169$$

That's right: in the TYCHOS model, Earth's proposed orbital speed is approximately 1 mph! Could old Mother Earth really be strolling along at window-shopping pace, and not at breakneck speed, as the heliocentrists demand?

When I discovered Earth's languid pace around the PVP orbit, my very first thought was that life on Earth may not only benefit from but actually require a very low orbital speed. Could this exceptional tranquillity graced to Earth for being 'stuck' at the barycentre of the Sun-Mars binary system be a key prerequisite for habitability and biological life? It would seem that this serene situation enjoyed by our planet is almost like that of a ship gently circling around the calm zone in the eye of a tropical storm, with everything else spinning in the opposite direction.

For now though, I shall leave my poetic and philosophical musings aside and proceed to put this posited orbital speed of Earth to the test in systematic fashion. As we proceed one step at the time, we shall see that Earth's 1-mph motion around its PVP orbit effectively resolves a long series of puzzles and enigmas that have been haunting not only astronomers but the entire scientific community for centuries.

We can now work with an empirically testable Sun-Earth velocity ratio. To be sure, this is very different from the heliocentrists' claim that the Sun hurtles around the galaxy at 800000 km/h, along with our system's planets, while Earth revolves around the Sun at 107226 km/h, all of which in the dire absence of any observational or experimental evidence to support such formidable, hypersonic speeds. One may say that these outlandish velocities proposed by Copernican theorists have been an offence to human intelligence all along since they imply that our Solar System travels across space by more than 7 billion kilometres each year. Yet, our surrounding stars, which allegedly all revolve in unison around the centre of our galaxy, only exhibit infinitesimal 'proper motions' in any direction from one year to the next. In fact, the only common motion of the stars is that constant annual ~50 arcsecond eastward drift known as the General Precession. In the TYCHOS model, of course, this ~50 arcsecond eastward drift of the entire firmament is simply an optical effect of Earth's motion around its PVP orbit.

Those familiar with the infamous Michelson-Morley experiment, billed as *"the most failed scientific experiment of all time"*, will by now have realized that the results of that experiment are actually supportive of the TYCHOS model. The objective of the experiment was to measure Earth's translational velocity across space (or through the 'aether'), expected to be in the vicinity of 107000 km/h, yet nothing of the sort was found. Fig. 11.5 is an extract from the astronomy literature [3].

> The relative velocity of the earth to the ether again seemed to be zero, in conflict with Lorentz's theory. By this time, Michelson had become more cautious in interpreting his data and even thought of the possibility that the solar system as a whole might have moved in the opposite direction to the earth; therefore he decided to repeat the experiment 'at intervals of three months and thus avoid all uncertainty'.[3] Michelson, in his second paper, does not talk any more about 'necessary conclusions' and 'direct contradictions'. He only thinks that from his experiment 'it appears, from all that precedes, *reasonably certain* that if there be any relative motion between the earth and the luminiferous ether, it must be *small*; quite small enough entirely to refute *Fresnel*'s explanation of aberration'.[4] Thus in this paper Michelson still claims to have refuted Fresnel's theory (and also Lor-

Fig. 11.5

As you can see, not only did Michelson conclude that Earth's speed had to be quite small, but he even thought of the possibility that the Solar System as a whole might have moved in the opposite direction to the Earth. In hindsight, both assertions would seem to be congruent with the TYCHOS model's proposed snail-paced motion of Earth, as it revolves in the opposite direction of the system's other components. In any event, the long series of interferometer experiments performed by other scientists all failed to detect speeds anywhere near the presumed orbital speed of Earth (107226 km/h, or ~30 km/sec). The detected speeds were, oddly enough, dismissed as 'null' by the scientific community of the time. However, none of the many interferometer experiments yielded 'null' results; they generally agreed with each other to some extent and, as we shall see in Chapter 24, rather support the notion of an orbital speed of 1.6 km/h.

11.4 Estimating the annual constant of precession

If we consider that 25344 years represents a full 360° equinoctial precession, we can easily determine how long it takes for Earth's equinoctial axis to rotate by 1° in relation to the firmament. For the sake of curiosity, let us see if we can correlate the TGY with the observed synodic periods of Mars, Venus, Mercury and the Moon:

- 1 equinoctial precession = 25344 years (1 TGY)
- 1° of precession = 70.4 solar years — $\frac{25344}{360} = 70.4$
- Mars' synodic period = 779.2 days
- 33 synodic periods of Mars = 25713.6 days — $779.2 \times 33 = 25713.6$
- Venus' synodic period = 584.4 days
- 44 synodic periods of Venus = 25713.6 days — $584.4 \times 44 = 25713.6$
- Mercury's synodic period = 116.88 days
- 220 synodic periods of Mercury = 25713.6 days — $116.88 \times 220 = 25713.6$
- The Moon's synodic period = 29.22 days
- 880 synodic periods of the Moon = 25713.6 days — $29.22 \times 880 = 25713.6$

We can now compute Earth's annual 'equinoctial procession rate' as of the TYCHOS system. If Earth's equinoxes process by 1° every 70.4 years, then in every century (100 years) they will process by:

- Equinoctial procession rate per century ≈ 1.42045° (5113.6363″) — $\frac{100}{70.4} \approx 1.42045$
- Earth's annual 'equinoctial procession rate' ≈ 51.136″ — $\frac{5113.6363}{100} \approx 51.136$

I will henceforth refer to this all-important periodic value of 51.136″ as our 'annual constant of precession' (ACP). Interestingly, back in the 16th century, when most astronomers estimated the annual precession to be about 50″ or less, Longomontanus and Brahe used a fixed rate of 51 arcsecs/year for their precession calculi:

> *Rather than using the Prutenic precession (variable rate) Longomontanus used Tycho's precession (fixed rate of 51 arcsecs/year). [4]*

Further on in the book, we shall see how the ACP, derived from the Earth's tranquil revolution around the PVP orbit, admirably accounts for the observed motions of our Solar System.

11.5 Mars' closest passages to earth, in the middle of the PVP orbit

As we saw in Chapter 5, Mars can transit as close as 0.373 Mkm from Earth (as it did in 2003). However, as shown in Table 11.1, the mean figure of its closest passages is about 0.379 AU.

I'd like to state, for the record, that I only realized this astounding fact long after I had estimated the diameter of the PVP orbit (113.2 Mkm, or 2 × 56.6 Mkm). Needless to say, it lends considerable support to the proposed diameter of the PVP orbit—unless you are willing to chalk it all up to sheer coincidence.

Table 11.1 – Closest Mars oppositions (1924-2050)

Distance in AU	Date
0.372838	1924-08-23
0.387873	1939-07-27
0.378090	1956-09-07
0.375684	1971-08-12
0.393141	1988-09-22
0.372709	2003-08-27
0.384955	2018-07-31
0.380399	2035-09-11
0.374041	2050-08-15
3.419730	

- Sum of the 9 oppositions = 3.41973 AU
- Mean distance during oppositions = 3.41973 / 9 ≈ 0.379 AU
- 0.379 AU = almost exactly the PVP orbit's radius of 0.37845 AU (≈ 56.6 Mkm)

Let us examine the figures obtained so far to see if we can identify any possible correlations:

- The mean Earth-Sun distance = 149.5978707 Mkm (1 AU)
- Mars' mean perigee distance = 56.615328 Mkm
- Ratio between the mean Earth-Sun distance and the closest Earth-Mars distance ≈ 2.6423

$$\frac{149.5978707}{56.615328} \approx 2.6423$$

- My estimation of the PVP orbit's diameter = 113.230656 Mkm
- The Sun's orbital diameter = 299.193439 Mkm.
- Ratio between the Sun's orbital diameter and the PVP orbit ≈ 2.6423

$$\frac{299.193439}{113.230656} \approx 2.6423$$

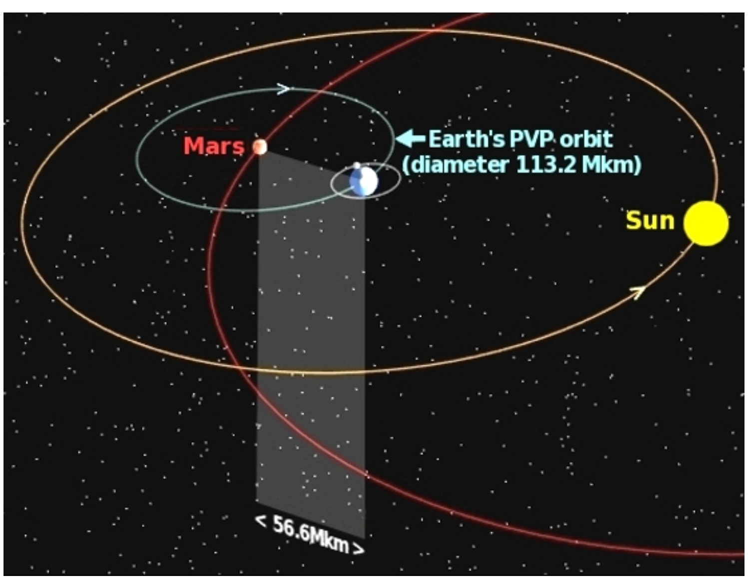

Fig. 11.6 Mars regularly transits in the middle of the PVP orbit.

So, if Mars regularly transits in the middle of the PVP orbit, what long-term implications would this have under the TYCHOS paradigm? Well, as Patrik Holmqvist and I proceeded to fine-tune the Tychosium simulator, we were obviously curious to see how Mars would 'behave' over a full Great Year of 25344 solar years. The result of this test is illustrated in Fig. 11.7 which was put together by simply superimposing 4 screenshots from the Tychosium simulator, each one of them separated by 6336 years. All in all, the TYCHOS model reveals the breathtaking beauty and geometric harmony of our Solar System—in an even more spectacular manner than Johannes Kepler ever envisioned in his dreamy *"Harmonices Mundi"* treatise.

Note how even the highly eccentric orbit of Mercury maintains its geometric relationship with the Sun throughout the TGY of 25344 years.

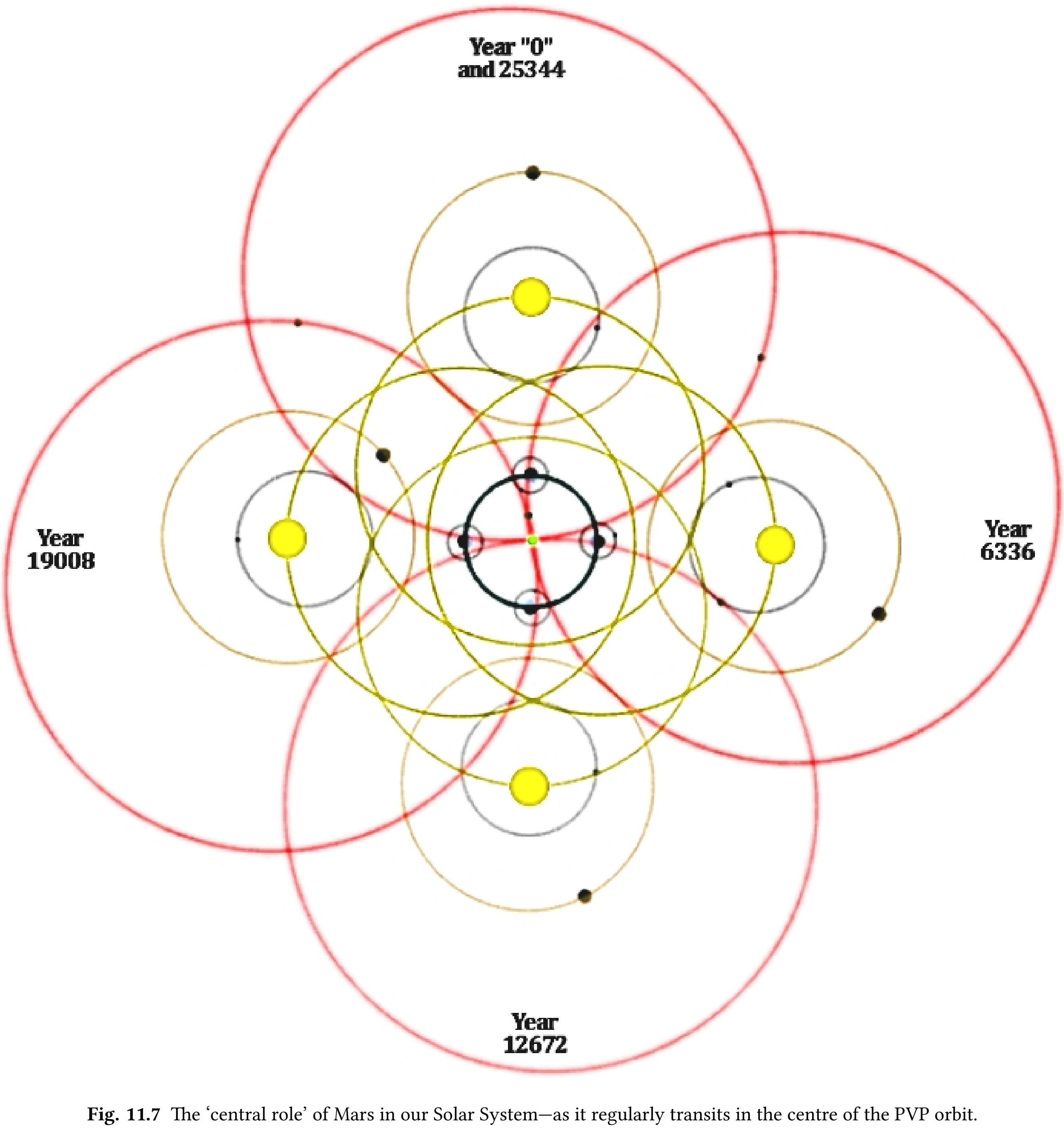

Fig. 11.7 The 'central role' of Mars in our Solar System—as it regularly transits in the centre of the PVP orbit.

11.6 The PVP orbit and the parsec

We shall now look at a most remarkable accord between Earth's PVP orbit and the astronomical unit known as the 'parsec' (a household term among astronomers and astrophysicists). Here are two official definitions of the parsec:

Parsec, unit for expressing distances to stars and galaxies, used by professional astronomers. It represents the distance at which the radius of Earth's orbit subtends an angle of one second of arc. Thus, a star at a distance of one parsec would have a parallax of one second, and the distance of an object in parsecs is the reciprocal of its parallax in seconds of arc [5].

A parsec is the distance from the Sun to an astronomical object which has a parallax angle of one arcsecond. (1 pc ≈ 206264.81 AU). A corollary is that 1 parsec is also the distance from which a disc with a diameter of 1 AU must be viewed for it to have an angular diameter of 1 arcsecond [6].

At this point it would be interesting to perform a thought experiment using the orbital speed (1.6012 km/h), orbital radius (56.615328 Mkm) and ACP (51.136″) estimated with the help of the TYCHOS model. Let us imagine a scenario in which Earth travels in a straight line along its orbital radius:

- Annual displacement of the Earth at 1.601669 km/h ≈ 14035.85 km
- Time required to travel 56 615 328 km in a hypothetical straight line along the orbital radius ≈ 4033.62304384 years
- Amount of precession during 4033.62304384 years ≈ 206264.81″
- 206264.81 arcseconds = 206264.81 AU = 1 parsec
- Multiplying this with 2π gives us ≈ 1 296 000″
- 1 296 000 arcseconds = 360° circle = our celestial sphere

$$\frac{56\ 615\ 328}{14035.85} \approx 4033.62304384$$

$$4033.62304384 \times 51.136 \approx 206264.81$$

$$206264.81 \times 2\pi \approx 1\ 296\ 000$$

You may now rightly wonder how a value in units of arcseconds can be commensurate with or even related to a value in AU. The Wikipedia entry for 'angular diameter' [7] can help us understand the optical issues involved:

In astronomy, the sizes of celestial objects are often given in terms of their angular diameter as seen from Earth, rather than their actual sizes. Since these angular diameters are typically small, it is common to present them in arcseconds (″). An arcsecond is 1/3600th of one degree (1°) and a radian is 180/π degrees. So one radian equals 3,600 × 180/π arcseconds, which is about 206265 arcseconds (1 rad ≈ 206264.806247″). These objects have an angular diameter of 1″:

- *an object of diameter 725.27 km at a distance of 1 astronomical unit (AU)*
- *an object of diameter 1 AU (149 597 871 km) at a distance of 1 parsec (pc)*

In fact, if we multiply 725.27 km by 1 296 000 arcseconds (a full circle), we obtain 939 949 920 km, which is the Sun's orbital circumference. Remarkably enough, we also see that:

$$206264.81'' \times 725.27\ km \approx 149\ 597\ 678.7\ km \text{ (near-exactly 1 AU)}$$

I am sure you will agree that the fact that the stars would precess by 206264.81 arcseconds in a hypothetical scenario which has the Earth travelling the length of the radius of its PVP orbit is quite significant and worthy of consideration. This concludes my account of how Earth's PVP orbit was determined and, as a result, how Earth's orbital speed of approximately 1.6 km/h was estimated. Below are some basic values obtained with the TYCHOS model which you may wish to get familiar with before continuing on your journey of discovery.

TYCHOS data for the Sun

- The Sun employs ∼365.25 days to complete one revolution around its orbit.
- During this same time, Earth has moved by 14036 km in the opposite direction along its PVP orbit.
- The Sun completes 25344 revolutions around Earth in 25344 solar years (1 TGY).
- The circumference of the Sun's orbit $\approx 299\ 193\ 439 \times \pi \approx 939\ 943\ 910$ km
- The Sun's orbital speed = 107226 km/h
- Daily distance covered by the Sun $\approx 107226 \times 24 \approx 2\ 573\ 424$ km
- Annual distance covered by the Sun, or, the circumference of the solar orbit $\approx 107226 \times 8766$ $\approx 939\ 943\ 910$ km

TYCHOS data for the Earth

- Earth employs 25344 years to complete one revolution around its PVP orbit.
- The circumference of Earth's PVP orbit $\approx 113\ 230\ 656 \times \pi \approx 355\ 724\ 597$ km
- Earth's orbital speed = 1.601169 km/h or 0.9949197 mph (roughly 1 mph)
- Daily distance covered by Earth $\approx 1.601169 \times 24 \approx 38.428$ km
- Annual distance covered by Earth $\approx 1.601169 \times 8766 \approx 14036$ km

In the next chapter, we shall see how the TYCHOS model elegantly and accurately accounts for solar vs sidereal days and years, and why the same cannot be said of the heliocentric model.

11.7 References

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12

THE RELATIVE MOTIONS OF THE SUN AND THE EARTH

12.1 Introduction

Each year, planet Earth covers a distance of ~14036 km along its PVP orbit at the tranquil speed of 1.6 km/h. This distance amounts to 0.0039457% of the PVP orbit's circumference of 355 724 597 km. From one year to the next, the Earth and the Sun will thus meet up at a slightly 'earlier' point in space, with the difference corresponding to a 0.0039457% slice of the solar orbit's circumference.

- Circumference of the PVP orbit = 355 724 597 km
- Annual displacement of the Earth = 14036 km
- 14036 km amounts to 0.0039457% of 355 724 597 km
- The Sun's orbital circumference = 939 943 910 km
- Ratio between the Sun's orbital diameter and the PVP orbit ≈ 2.64233
- Annual displacement of the Earth projected onto the Sun's orbit ≈ 37088 km

$$\frac{939\ 943\ 910}{355\ 724\ 597} \approx 2.64233$$

$$14036 \times 2.64233 \approx 37088$$

In our epoch (2000 AD), the firmament is observed to drift 'eastwards' by about 50.3 arcseconds annually. However, as I will demonstrate below, the actual annual eastward drift of the firmament amounts to 51.136 arcseconds, i.e., ~1.68% more than the observable drift. In Chapter 11, we referred to this value as the 'annual constant of precession' (ACP).

- 1 296 000″ = 360° (our celestial sphere)
- ACP = 51.136″ (periodic)
- ACP = 0.0039457% of 1 296 000″
- TYCHOS Great Year (TGY) = 25344 solar years
- ACP × TGY = 1 296 000″

In other words, the so-called Precession of the Equinoxes is caused by Earth's clockwise motion around its PVP orbit.

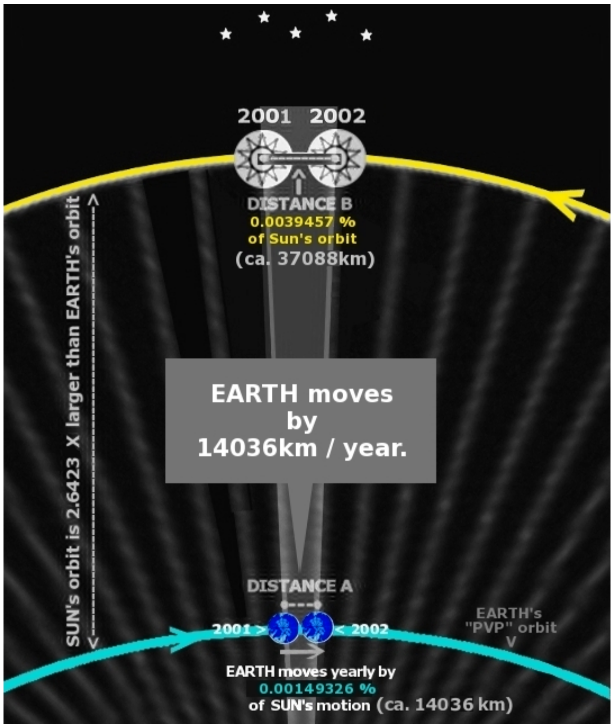

Fig. 12.1

12.2 The 'sidereal day' versus the 'solar day'

We shall now see how the TYCHOS model accounts for the 'sidereal day' and the 'solar day'. The Earth employs 23h56min to complete one 360° revolution around its axis and realign with a given star; this is known as the 'sidereal day'. During that time, the Sun will move 'eastwards' in relation to the stars by about 1°. Hence, an earthly observer will have to wait another 4 minutes or so to realign with the Sun and complete a 'solar day' of 24h00min.

I think you will agree the TYCHOS model accounts for the sidereal and solar days in the simplest manner imaginable. As we shall see shortly, the heliocentrists' explanation for the sidereal and solar days is not only complicated; it is inherently *unphysical.*

Unphysical: Not supported by, or contrary to, the laws of physics. [1]

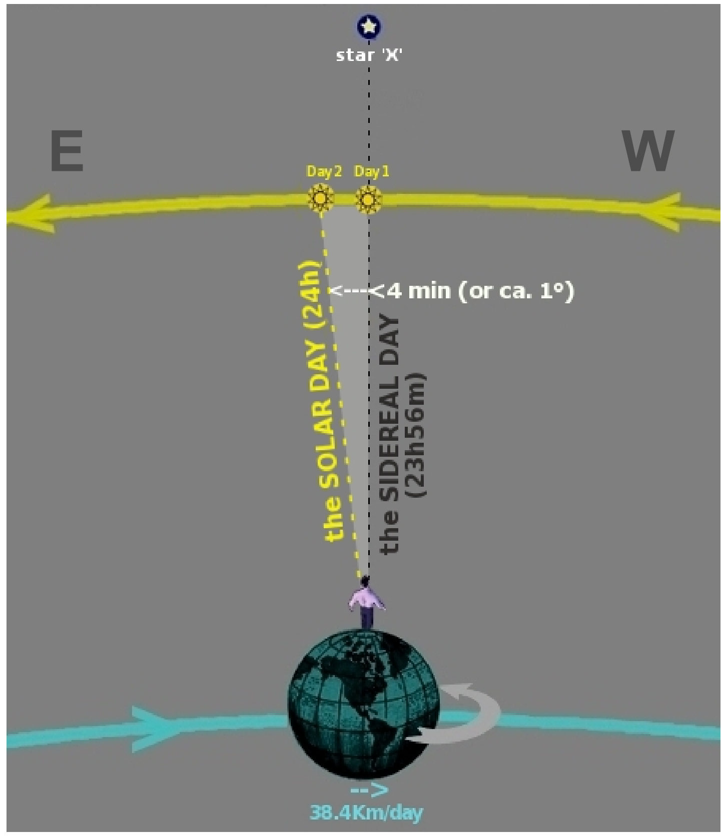

Fig. 12.2 As Earth completes its daily rotation, the Sun will have moved a little 'eastward'. This is why the solar day is 4 minutes longer than the sidereal day.

The Sun moves every day by about 1° (or 4 minutes of RA) in relation to the firmament. This fact alone suggests that it is indeed the Sun and not the Earth that moves each day by 2 573 424 km, for this value equals roughly twice the Sun's diameter of 1 392 000 km. Since the Sun's apparent size in the sky subtends about 0.5°, it makes perfect optical sense that its observed daily displacement of about 1° corresponds to approximately twice its visible diameter.

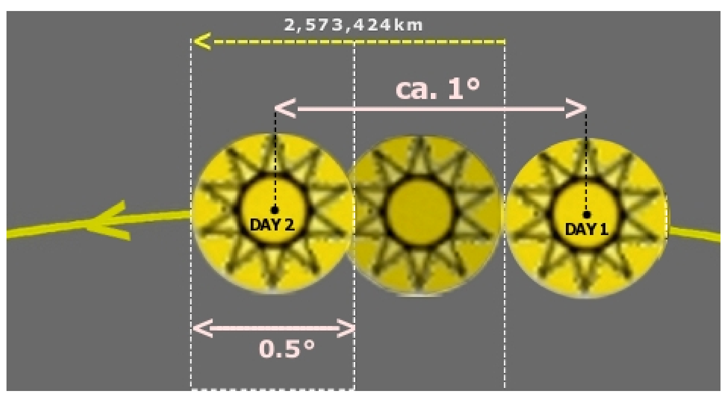

Fig. 12.3 At the speed of 107226 km/h, the Sun will cover 2 573 424 km each day; almost twice its own diameter.

Let us now see if the notion that the Sun orbits around Earth can be further confirmed.

- The Sun's orbital circumference = 939 943 910 km
- Distance subtended by 1 arcsecond ≈ 725.265 km

$$\frac{939\ 943\ 910}{1\ 296\ 000} \approx 725.265$$

The concept of 'angular diameter' is explained in the Wikipedia:

An object of diameter 725.27 km at a distance of 1 AU (average Earth > Sun distance) will have an angular diameter of one arcsecond. [2]

Incidentally, this is why the observed solar parallax value is 8.794 arcseconds. If we take 8.794 and multiply it by 725.265 km, we get 6378 km (Earth's radius). Therefore:

- Earth's angular diameter (as viewed from the Sun) $= 17.588''$

$8.794 \times 2 = 17.588$

The currently accepted value of solar parallax is $8.794143''$. Let us calculate how many kilometres of the Sun's orbital circumference is subtended by the ACP:

- Sun's orbital circumference subtended by the ACP ≈ 37088 km

$51.136 \times 725.27 \approx 37088$

This is an excellent confirmation of our above estimate of 37088 km for the annual drift of the Sun's position against the starry background (which, as we have seen, is caused by Earth's annual displacement), representing 0.0039457% of the Sun's orbital circumference. One could also put it this way: 51.136 arcseconds equals 0.05681 minutes of time, and 0.05681×25344 equals 1440 minutes (360°) (the celestial sphere is measured with a spherical ruler divided in 1440 minutes, or 24 hours).

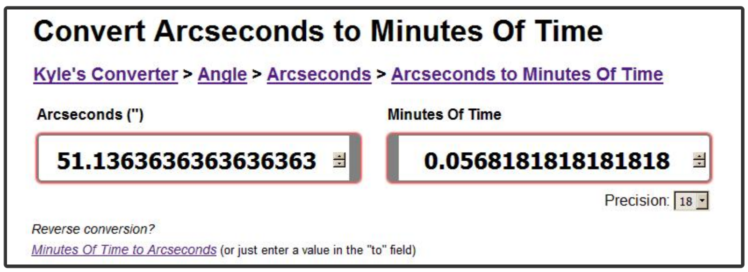

Fig. 12.4

Once more, it would seem our value for the TGY (25344 years) holds up quite nicely. Next, let us unpack the heliocentrists' unphysical explanation for the different lengths of the sidereal day and the solar day.

12.3 Solar versus sidereal day in the heliocentric model

Fig. 12.5 is a classic Copernican diagram intended to explain the sidereal/solar day discrepancy. Keep in mind that Earth is supposedly travelling over 2.5 million km every day, yet no parallax whatsoever is observed between the Sun and the stars at the completion of one sidereal day (23h56min). Once again, the Copernican explanation for this inconvenient fact is that *"the stars are almost unimaginably distant"*. However, if we take a closer look, this makes no optical sense.

Earth is supposed to have moved some 2.5 Mkm between the positions of 'Day 1' and 'Day 2'. But what exactly is implied by this Copernican diagram?

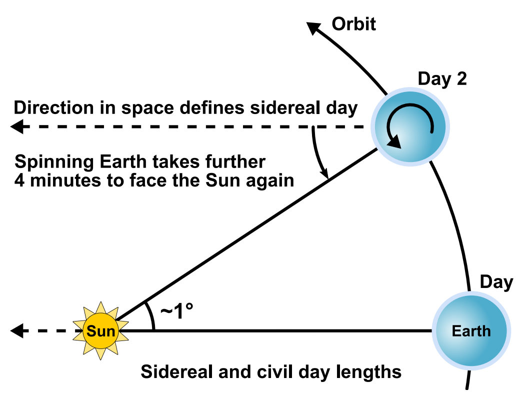

Fig. 12.5

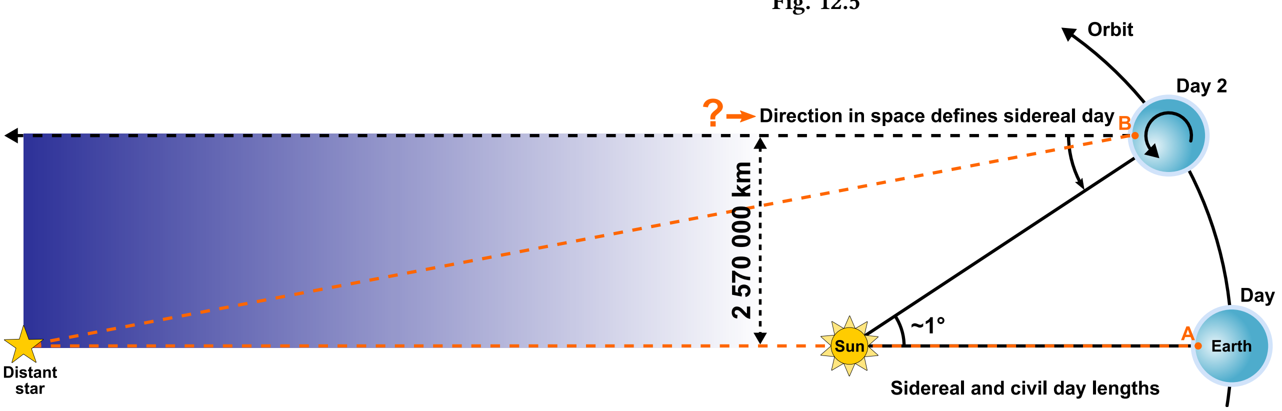

Fig. 12.6 An observer at point A should expect the distant star to have drifted noticeably 'eastward' as point B is reached.

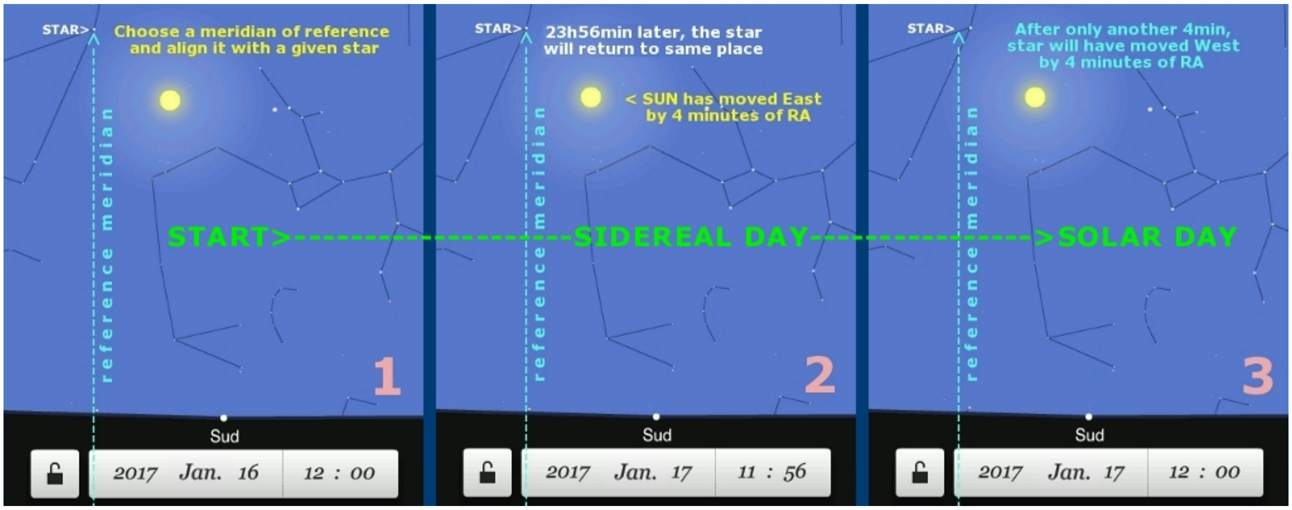

Fig. 12.7 The sidereal day (23h56min) vs. the solar day (24h00min) day, as depicted by the NEAVE planetarium.

To think that Earth would be moving by over 2.5 million km each day without the background stars drifting by any noticeable amount besides these last 4 minutes of earthly rotation has to be among the most surreal claims of the advocates of the Copernican model! To put this problem in due perspective, observe the sidereal and solar day unfold in the 3 frames of Fig. 12.7.

The following description is what is observed, in reality, from one day to the next: In 23h56m, an earthly observer will line up again with the same given star. At such a point and time, the Sun will already have moved eastwards by approximately 4 minutes of RA. Four minutes later, we see the stars have drifted westwards by 4 min of RA. Ergo, the entire amount of our daily westward stellar drift will appear to an earthly observer to occur in the last 4 minutes of earthly rotation. In other words, Earth might just as well be stationary while only rotating around its axis. Many astronomers in ancient times believed this to be true, not because they were poor astronomers, but because this is what matches careful and patient observation of the Sun's behaviour.

Of course, the TYCHOS model submits that Earth moves by a mere 38.4 km per day, which is hardly a noticeable amount of lateral displacement to the naked eye. Those 4 min of RA are the consequence of Earth having rotated by 360° in 23h56min, thus needing another 4 minutes to line up again with the Sun since it has, in the meantime, moved eastwards by about 4 minutes of RA.

Instead, the Copernican theory would have us believe that Earth is moving each day by 2.5 million km with no amount of the observed daily 4-minute stellar drift optically attributable to this enormous displacement. It is as if the Earth's rotation is the only thing that changes the star positions, while Earth's alleged daily 2.5-Mkm displacement has no effect.

12.4 Solar versus sidereal year in the TYCHOS model

The sidereal year is 20.41 minutes longer than the solar (or 'tropical') year. This may seem counterintuitive, considering that the sidereal day is 4 minutes shorter than the solar day. As we shall see, this apparent contradiction turns out to be due to Earth's 1-mph motion around the PVP orbit.

The Copernican model offers yet another incredibly convoluted explanation for this conundrum. If you are not familiar with it, you can go to sources like the Wikipedia or browse the example data compiled by Michael J. White [4], an Arizona State University professor of philosophy. In any case, the riddle is nicely summarised in this discerning question raised by the Binary Research Institute:

> *Sidereal vs. Solar Time: Why is the delta (time difference) between a sidereal and solar day attributed to the curvature of the Earth's orbit (around the Sun), but the delta between a sidereal 'year' and solar year is attributed to precession? [...] The burden of proof lies with those who support the current lunisolar precession theory which requires a different explanation for the two deltas.* [5]

Let us look at the math behind the time difference between the solar year and the sidereal year:

- Average duration of a solar year = 365.24219 days or 525948.753 minutes
- Average duration of a sidereal year = 365.256363 days or 525969.163 minutes
- Difference = 20.41 minutes (0.00388%)

As shown above, 20.41 min is 0.00388% of 525960 min (365.25 days) and, in fact, the currently observed amount of annual equinoctial precession (50.29 arcseconds) amounts to 0.00388% of 1 296 000 arcseconds (a full circle). Hence, those 20.41 min are, manifestly, a direct consequence of the so-called equinoctial precession which, in the TYCHOS model, is caused by Earth's orbital motion.

In the preceding chapter, we determined the annual constant of precession (ACP):

- Currently observable annual precession rate = 50.29″
- Adding ~1.68% gives us the ACP of 51.136″

Note that the official estimate of the duration of one full 360° equinoctial precession (the Copernican Great Year) is ~25771 years. This is approximately 1.68% longer than the TGY (25344 solar years).

Fig. 12.8 should help visualize why a small portion (~1.68% in our epoch) of the equinoctial precession will always remain unobservable from Earth. The 'hidden angle' of precessional drift can, without the slightest difficulty, be attributed to Earth's orbital motion. To demonstrate this, let us first recall that Earth's yearly displacement (14036 km), if projected unto the Sun's orbit, corresponds to 37088 km. Travelling at 107226 km/h, the Sun covers ~36475 km in 20.41 min (0.3401667 hours). That is about 1.68% less than 37088 km.

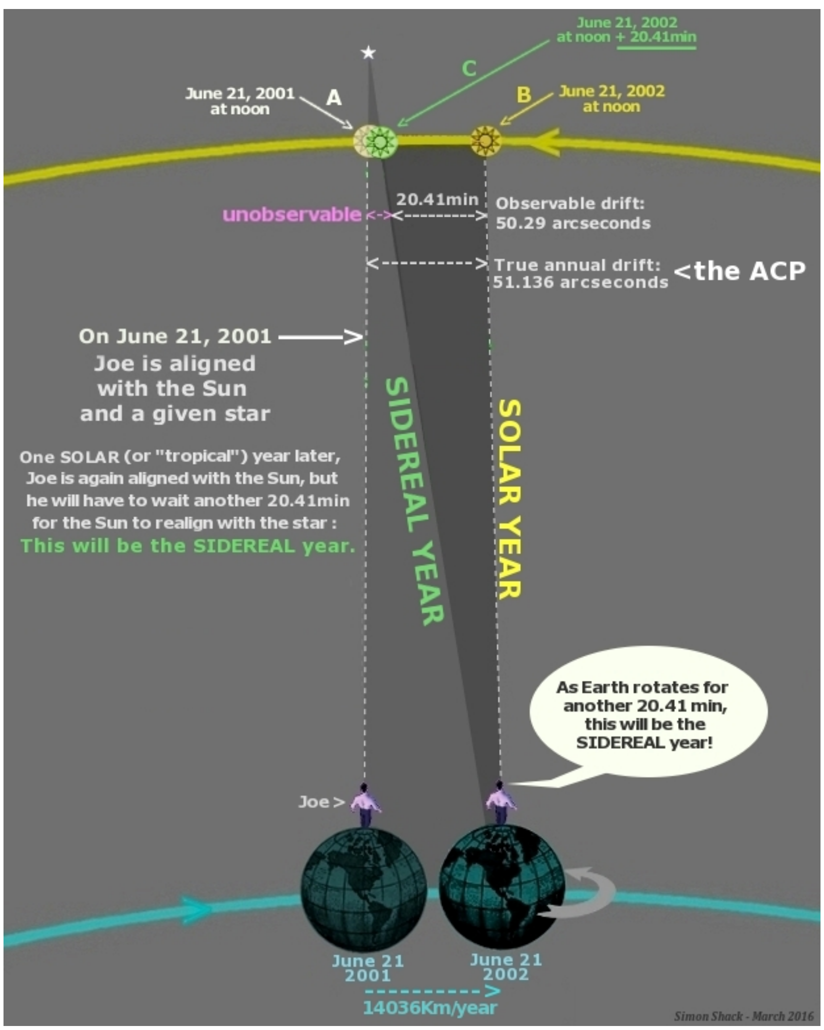

Fig. 12.8 As Joe, our earthly observer, moves from A to B (from 21 June 2001 to 21 June 2002) he will have experienced a 'solar year'. Since Earth has moved along by 14036 km in that same period, Joe will meet up with the Sun at an earlier point of the solar orbit in 2002. The Sun's orbit being 2.64233 times larger than Earth's PVP orbit, Joe's lateral displacement will be proportionally equivalent to a 37088-km slice of the solar orbit (14036 × 2.64233 ≈ 37088 km). This is the distance between A and B.

It thus becomes plainly evident what causes this 20.41-min difference between the solar and sidereal year: it is simply the extra time needed for the Sun to realign with a given star, as viewed from Earth. These 20.41 minutes will effectively reset the Earth-Sun-star alignment which, in actuality, has been offset by Earth's motion around its PVP orbit.

The small angular offset with respect to the Sun-star alignment caused by Earth's motion will quickly be 'regained' by the Sun's speedy motion (107226 km/h). In only 20.41 minutes, the Sun will have lined up with the same star it faced one year earlier (point C). The distance between B and C is 36474 km, or 37088 km minus 1.68%.

Within Earth's rotational frame of reference:

- Daily rotation = 1440 min (or 1 296 000″)
- 1 min of rotation = $900''$
- 20.41 min of rotation = $18369''$
- Observed annual 'equinoctial precession' = $50.29''$

$\frac{1\,296\,000}{1440}$	=	900
20.41×900	=	18369
$\frac{18369}{365.25}$	=	50.29

This explains why our earthly observer will not realize the full extent of the annual stellar precession: a small portion (∼1.68%) will remain unobservable to him. Joe is unaware of Earth's 1-mph motion and so mistakenly believes Earth has returned to the same physical location as the previous year. He will naturally conclude that the annual stellar precession rate amounts to $50.29''$, rather than the actual annual constant of 51.136″ (ACP). Once again, the TYCHOS model provides a simple, rational and elegant explanation for a Copernican quandary, namely the fact that the sidereal year is longer than the solar year.

This further corroborates our demonstration in Chapter 10, showing that the observed precession has nothing to do with the heliocentrists' hypothetical 'lunisolar wobble'. As a final confirmation that these 20.41 minutes also correspond to a portion of the Earth's axial rotation, we see that 18369″ amounts to 1.4173% of 1 296 000″ (i.e., 360°); since Earth rotates at 1674 km/h, it will rotate by 568 km in 20.41 minutes. And in fact, 568 km amounts to 1.4173% of 40075 km (the Earth's equatorial circumference).

12.5 About the 'anomalistic' year

The oddly-named 'anomalistic year' is the period required for the Sun to return to its closest or farthest point from Earth. On average, it lasts 365.259636 days, which is approximately 4.7 min longer than the sidereal year of 365.256363 days.

> *The anomalistic year is usually defined as the time between perihelion passages. Its average duration is 365.259636 days (or 365 d 6 h 13 min. 52.6 s—at the epoch J2011.0).* [6]

In the TYCHOS model, the anomalistic year might more aptly be described as 'the time interval between the Sun's perigee transits'. In our current epoch, the Sun's perigee transit occurs around January 3rd. In short, the anomalistic year is determined by the Sun's perigee procession. During those ∼4.7 min with which the anomalistic year surpasses the sidereal year, a given point on Earth's equator will rotate by 4230 arcseconds, as viewed within the terrestrial rotational frame of reference.

- 1 min of rotation = $900''$
- 4.7 min of rotation = $4230''$

$\frac{1\,296\,000}{1440}$	=	900
4.7×900	=	4230

Let us now imagine two hypothetical signposts (S and A) placed on the line of equator. The signposts are designed to slide along the equator according to the following parameters.

Signpost S (sidereal):	Kept pointing towards a given star.
Signpost A (anomalistic):	Kept pointing towards the celestial spot of each year's passage of the anomalistic year.

Note that in this thought experiment we will disregard Earth's daily rotation. Since signpost S is conceptually always being kept oriented towards a given fixed star, it will complete 1 revolution around Earth's equator in 25344 years. On the other hand, signpost A will have moved each year by an extra 4230 arcseconds compared to signpost S. By the end of the TGY (25344 solar years), signpost A will have moved by 107 205 120 arcseconds.

- Displacement of signpost A = 107 205 120″
- A/S spin ratio = 82.72

$$4230 \times 25344 = 107\,205\,120$$

$$\frac{107\,205\,120}{1\,296\,000} = 82.72$$

Considering a spin ratio of 82.72, during 1 TGY (25344 solar years) signpost A will complete 82.72 times as many revolutions as signpost S. Since we know that signpost A moves by an additional 4230 arcseconds annually, we can calculate the annual displacement of signpost S:

- Annual displacement of signpost S ≈ 51.136″ (or 1 ACP)

$$\frac{4230}{82.72} \approx 51.136$$

You couldn't make it up: the so-called anomalistic year, with its 4.7-min difference in relation to the sidereal year, corroborating the PVP orbit and its ACP value of 51.136 arcseconds!

As if that wasn't good enough, there is yet another way of confirming the ACP value, namely by using the 'progressive motion of the apogee in a year', a parameter estimated at 11.75 arcseconds in the astronomy literature.

On the anomalistic year: the year called the anomalistic year is sometimes used by astronomers, and is the time from the sun's leaving its apogee till it returns to it. Now, the progressive motion of the apogee in a year is 11.75″, and hence the anomalistic must be longer than the sidereal year, by the time the sun takes in moving over 11.75″ of longitude at its apogee. [7]

- TGY = 25344 solar years
- Progressive motion of the apogee in a year = 11.75″
- Precession of the Sun's apogee during 1 TGY = 297792″
- Time required by the Sun's apogee to complete a 360° precession ≈ 4.35203094777 TGY
- ACP ≈ 51.136″
- 4.35203094777 TGY ≈ 110297.87 years

$$25344 \times 11.75 = 297792$$

$$\frac{1\,296\,000}{297792} \approx 4.35203094777$$

$$4.35203094777 \times 11.75 \approx 51.136$$

$$4.35203094777 \times 25344 \approx 110297.87$$

This last value is only 0.6% smaller than the value officially referred to as the '111000-year precession of the perihelion of Earth's orbit':

The perihelion of the earth's orbit, and of all the planets, is moving around the sun, and completes its revolution in 111,000 years. [8]

Note the underlying absurdity of the above statement. Why would the Earth and all the planets share such a period and return to their respective perihelions in unison? It is obviously the orbital motion of the Sun (i.e. of its apsides) that displays this periodicity.

In the following two chapters, we shall be 'howling at the Moon' and the many lunar mysteries that have befuddled astronomers for millennia. As it is, the complexity of the Moon's motions is, still today, a subject of intense study and unceasing reappraisal. So let us gather courage and see if the TYCHOS model can help us clear up this most perplexing affair.

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13

Our system's 'central driveshaft': the Moon

13.1 The Moon's true mean synodic period

There is very strong evidence that our lunar satellite—the Moon—acts as a sort of 'central driveshaft' for the entire Solar System. If this can be proven to be so, we can all say good-bye to heliocentrism. For Copernican astronomers, it simply makes no sense that our Moon would play such a central role in the Solar System, but if we envision the Moon as a body revolving around Earth, at the centre of the Sun-Mars binary system, things take on a very different appearance.

In the TYCHOS model, our Moon has an average synodic period of 29.2194 days, but for simplicity's sake we shall use the rounded figure of 29.22 days. I will refer to this period as the Moon's true mean synodic period (TMSP). It turns out that the synodic periods of all our system's bodies are exact multiples of the Moon's TMSP. This stands in stark contrast to the Copernican notion that the Moon is just a random peripheral appendage circling around Earth. But let us examine the numbers:

Orbital resonance

- Orbital resonance pattern of the Moon, Mercury, Venus and Mars: 1 : 4 : 20 : 25
- Sum of these four resonance ratios: $1 + 4 + 20 + 25 = 50$
- The Sun-Moon orbital resonance ratio: $50 / 4 = 12.5$

Table 13.1 –

The lunar orbital resonance of the innermost planets.

Moon	1	TMSP	⇒	$1 \times 29.22 = 29.22$	days
Mercury	4	TMSP	⇒	$4 \times 29.22 = 116.88$	days
Venus	20	TMSP	⇒	$20 \times 29.22 = 584.4$	days
Mars	25	TMSP	⇒	$25 \times 29.22 = 730.5$	days
Sun	12.5	TMSP	⇒	$12.5 \times 29.22 = 365.25$	days

Table 13.2 –

This lunar orbital resonance rule also applies to the so-called outer planets.

Jupiter	150	TMSP	⇒	$150 \times 29.22 = 4383$	days	⇒	12 solar years
Saturn	375	TMSP	⇒	$375 \times 29.22 = 10957.5$	days	⇒	30 solar years
Uranus	1050	TMSP	⇒	$1050 \times 29.22 = 30681$	days	⇒	84 solar years
Neptune	2062.5	TMSP	⇒	$2062.5 \times 29.22 = 60266.25$	days	⇒	165 solar years
Pluto	3100	TMSP	⇒	$3100 \times 29.22 = 90582$	days	⇒	248 solar years

In other words, the synodic periods of all the bodies in our Solar System are 'round' multiples of the Moon's TMSP of 29.22 days!

As we shall see, the only reason why this perfect clockwork, encompassing all our system's bodies revolving at exact multiples of the Moon's TMSP, has gone unnoticed by astronomers throughout the ages is, essentially, Earth's previously unimagined 'snail-paced' motion around the PVP orbit.

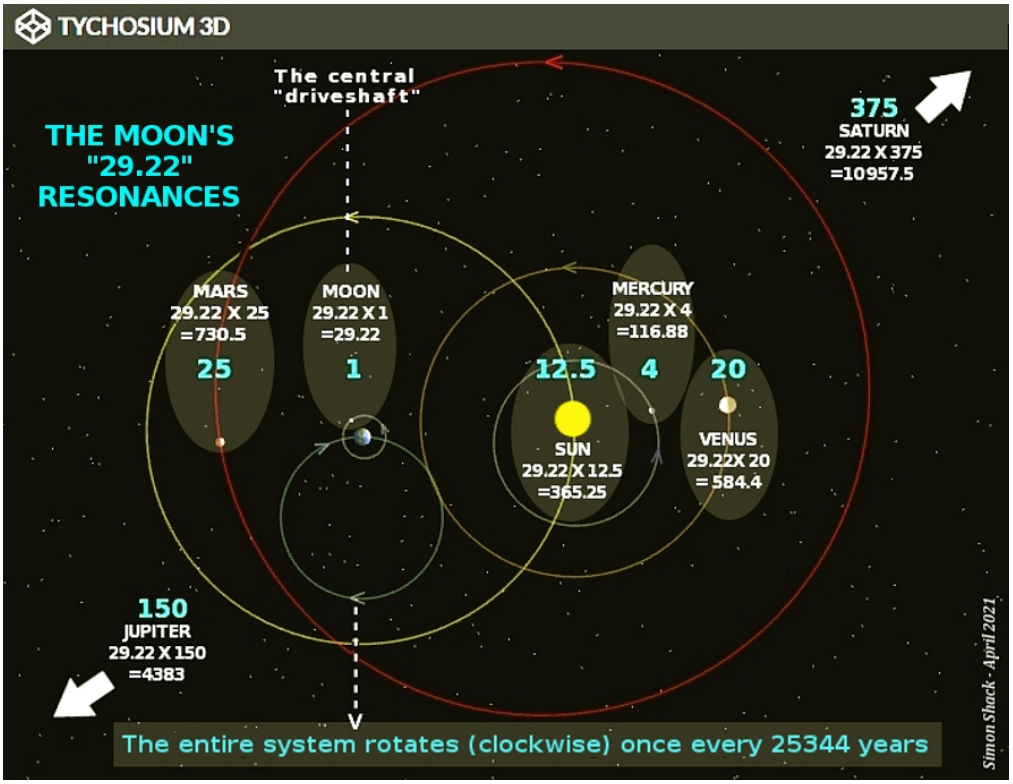


Fig. 13.1 The Moon is manifestly at the centre of our Solar System, acting as a sort of 'pacemaker' or 'central driveshaft' for the entire system.

Unless one is aware of this motion, all earthly determinations of the orbital periods of our system's bodies will be ever so slightly in error. However, ordering the pieces within the TYCHOS model's geometry unveils a breathtaking cosmic harmony. This is illustrated in Fig. 13.1.

At this point, some may object that the Moon's synodic period is 29.53 days, not 29.22 days. That is indeed what an earthly observer may hastily conclude. Yet, that value will depend on the particular time window chosen to compute the Moon's average long-term (secular) synodic period. In fact, only by spending centuries of careful observation will a correct average value of the Moon's synodic period be obtained. That is just what the meticulous Aztecs appear to have done, as their famed Toltec Sunstone suggests.

> *To summarize, then, the Toltec Sunstone is an image of the motion of Venus, consisting of two hundred sixty, 8-year periods, divided up into forty 52-year periods, as encoded in the ring of 40 quincunxes surrounding the ring of 20-day names. Each 8-year period of 2922 days is counted by a rotation of the 20 day-sign ring, where each day-sign actually represents one month of 29.22 days. Therefore, one complete revolution of the day-sign ring counts 20 × 29.22 days, or the average Venus year of 584.4 days. Five of these revolutions, each uniquely named in the center quincunx, counts 100 × 29.22 = 2922 days, or five Venus years of 584.4 days each, which is equivalent to eight years of 365.25 days each. By assigning the 20 day-sign symbols to a lunar month of 29.22 days, each month of the Venus year has a unique name, just as the twelve months of our Earth year has, making it easy for the public to mark the months, or 'moons', as they went by.* [1]

For instance, if you choose a time window of 65 years ±2 days, a little-known interval at both ends of which the Moon will realign with the Sun, you will conclude that the Moon's average synodic period is 29.53 days. Simply put, 65 solar years of 365.25 ±2 days equals ~23743 days. If we divide 23743 days by 67 (the number of possible integer lunar years in 65 years), we obtain 354.373 days. Therefore, one average long empiric synodic interval (ESI) of the Moon will compute to ~29.53 days (354.373 / 12).

On the other hand, if you choose a time window of 19 years (the Metonic cycle, a well-known interval at both ends of which the Moon will realign with the Sun), you would conclude that the Moon's average period is 28.91 days. Simply put, 19 solar years of 365.25 days equals 6939.75 days. If we divide 6939.75 days by 20 (the number of possible integer lunar years in 19 years), we obtain 346.98 days. Therefore, one average short ESI of the Moon will compute to 28.915 days (346.98 / 12).

However, the Aztecs were smart enough to average the long and short ESIs to obtain a more accurate long-term TMSP:

$$\frac{29.530 + 28.915}{2} \approx 29.22$$

The Moon also has a little-known 8-year cycle as it very nearly realigns with the Sun every 2922 ±1.5 days. This number corresponds to 100 revolutions of 29.22 days (2922 days, or 8 solar years). Notably, the Moon's 8-year cycle mirrors Venus' 8-year cycle of 2922 days (5 synodic periods of 584.4 days).

Thus, our TMSP of 29.22 days can be considered the 'master coefficient' of our Solar System. The higher and lower values observed (29.53 days and 28.91 days) are simply long-term fluctuations caused by the eccentricity of the Moon's orbit and the 1-mph motion of the Earth-Moon system as it proceeds along the PVP orbit. Since the Earth-Moon system revolves in the opposite direction of the Sun, their respective revolutions will be opposed or co-directional, depending on the time of year. This explains the illusion of the Moon accelerating and decelerating, and its apparently variable synodic periods.

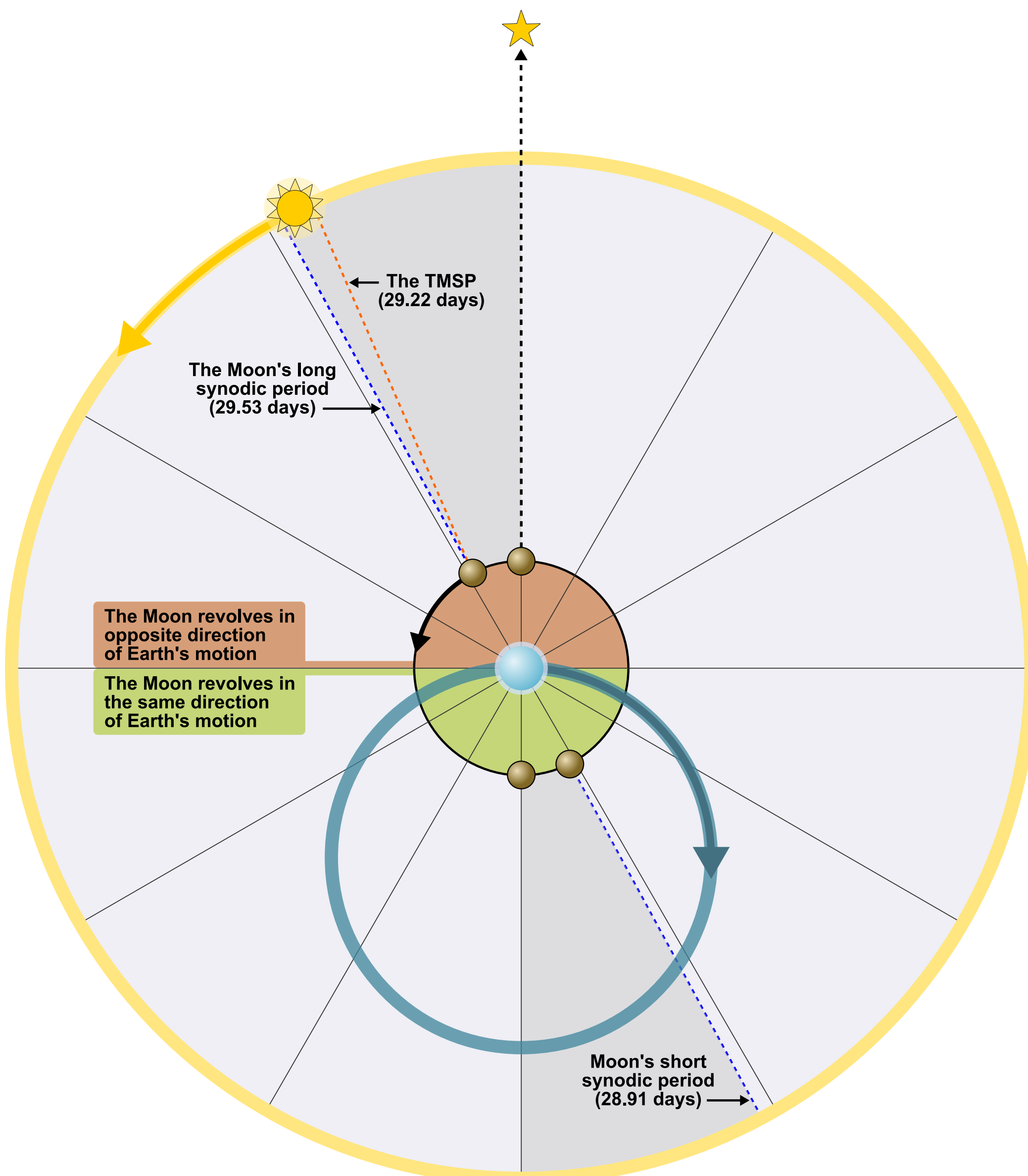


Fig. 13.2 A combination of factors determines the much debated 'variations and inequalities' of our Moon's motion. The Moon appears to slightly accelerate or decelerate depending on which half of its orbit it is travelling. Just like Mars, the Moon's orbit is off-centre (in relation to Earth) by about 4.85% of its orbital diameter. Thus, it will appear to cover more or less distance (against the stars) when closer or farther from Earth.

13.2 The Moon-Sun 'synchronicities'

A string of remarkable 'synchronicities' emerge when comparing the respective rotations and revolutions of Earth, the Sun and the Moon. They are remarkable in the sense that, if viewed through Copernican lenses, they would be regarded as highly improbable coincidences. After all, if Earth, with its Moon, is just one of several planets circling the Sun, one would hardly expect these three separate celestial bodies to display 'commensurate' or 'resonant' gyrational periods.

Firstly, one has to wonder why the Sun rotates around its axis in just about the same amount of time (~27.3 days) our Moon uses to complete one orbit.

> *The Carrington rotation number identifies the solar rotation as a mean period of 27.28 days, each new rotation beginning when 0° of solar longitude crosses the central meridian of the Sun as seen from Earth.* [2]

To my best knowledge, this remarkable synchronicity between the Sun's rotation and the Moon's sidereal revolution has never been pointed out, let alone discussed, in the astronomy literature.

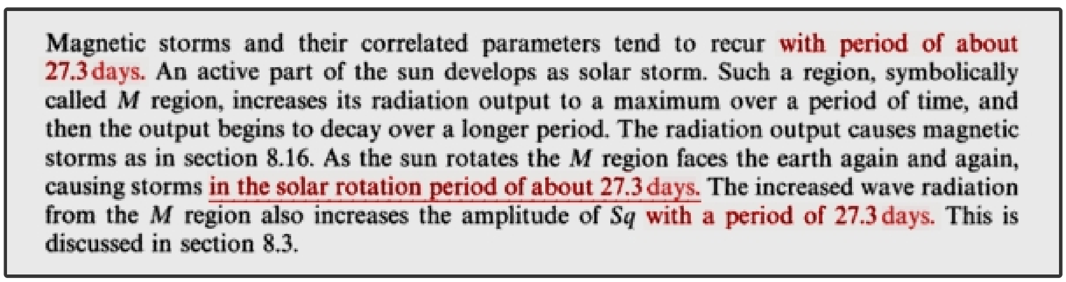

Magnetic storms and their correlated parameters tend to recur with period of about 27.3 days. An active part of the sun develops as solar storm. Such a region, symbolically called *M* region, increases its radiation output to a maximum over a period of time, and then the output begins to decay over a longer period. The radiation output causes magnetic storms as in section 8.16. As the sun rotates the *M* region faces the earth again and again, causing storms in the solar rotation period of about 27.3 days. The increased wave radiation from the *M* region also increases the amplitude of *Sq* with a period of 27.3 days. This is discussed in section 8.3.

Fig. 13.3 Extract from "Equatorial Electrojet" (p.13) by C. Agodi Onwumechikli.

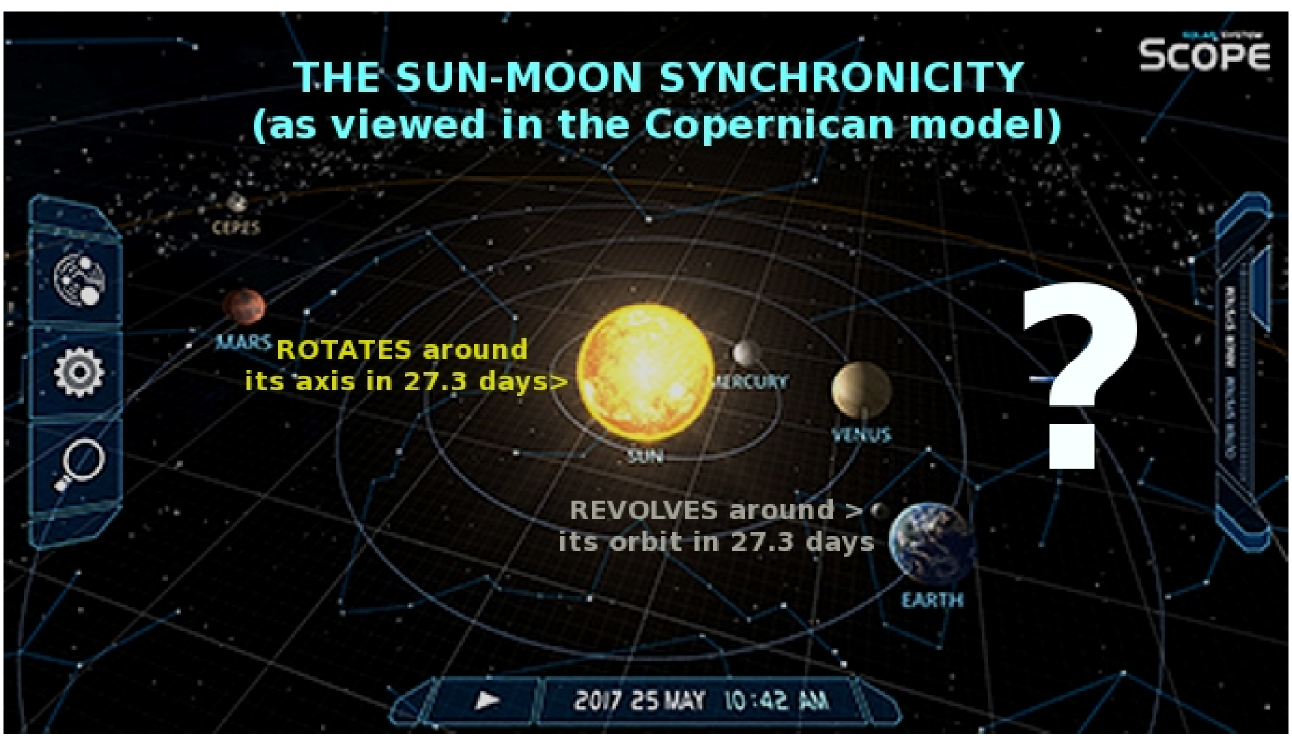


Fig. 13.4 The Sun and Moon's 27.3-day synchronicity, as viewed in the Copernican model.

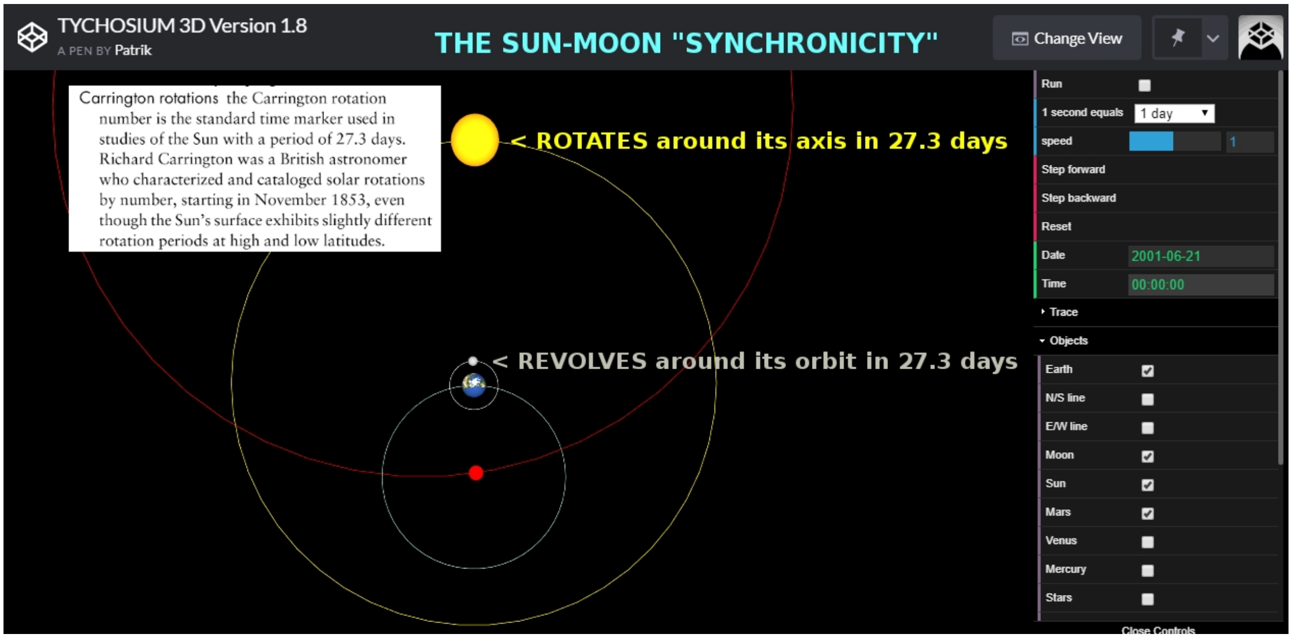


Fig. 13.5 The Sun and Moon’s 27.3-day synchronicity, as viewed in the TYCHOS model.

Fig. 13.4 is a screenshot from the heliocentric Scope simulator. Note what an extraordinary thing it would be, as viewed under the Copernican model, for our Moon to return facing the same star every 27.3 days (as it does), i.e., in the same time period employed by the Sun to rotate around its own axis. And all this, while the Earth-Moon system would hurtle around the Sun at Mach 90, covering some 70 million km in 27.3 days (or roughly 1/13 of its annual revolution).

Heliocentrists might rightfully wonder why only one of the hundreds of moons in our Solar System (Jupiter’s moons, Saturn’s moons, etc.) would be so fine-tuned to the Sun. But if the Moon is instead central to the Sun’s orbit, as posited by the TYCHOS model (Fig. 13.5), this particularity begins to make sense, both intuitively and philosophically. So let us now compare the respective rotational speeds of the Sun, the Earth and the Moon.

These ‘resonances’ and ‘synchronicities’ would have no reason to exist if our planet were simply racing around the Sun in the Copernican third lane. However, the privileged barycentric position within the Sun’s orbit assigned to the Earth-Moon system in the TYCHOS makes the affair a lot less mysterious. This should gradually become apparent even to the most sceptical reader.

Table 13.3 –

Body	Rotational speed	Orbital speed
Sun	6675 km/h	
Earth	1670 km/h	1.601669 km/h
Moon	16.68 km/h	

Conclusions

From the data in Table 13.3 we can conclude the following:

- The Sun’s rotational speed is near-exactly 4 times the Earth’s rotational speed.
- The Sun’s rotational speed is near-exactly 400 times our Moon’s rotational speed.
- Earth’s rotational speed is near-exactly 100 times our Moon’s rotational speed.
- In the TYCHOS, the Moon’s rotational speed is approximately 10 times the orbital speed of Earth.

13.3 The heliocentric model's 'lunatic' sidereal period

For this next argument against the Copernican theory, keep in mind that if the Earth-Moon system really travelled around the Sun at 107226 km/h, it would move by about 70 million km every 27.3 days. Yet, in actual observation, our Moon lines up with the very same star at intervals of 27.3 days. It should be obvious that this easily observable pattern is incompatible with the Copernican model, which has Earth and the Moon circling the Sun in a 300 Mkm wide orbit. Now let us see how the Copernican theory fares in an imaginary 'real-world' scenario we can easily relate to:

Imagine a prisoner held on a ship which perpetually travels around a huge, circular route. It takes 365 calendar days for the ship to complete this circle, and the prisoner can sense the ship is moving at a constant speed. His only equipment is a magnetic compass. One night, he sees through his porthole a distant lighthouse and estimates its location as being due north in relation to the middle of the ship's circular path. He really wants to figure out how long it takes for the ship to complete its circular journey so he raises his forefinger in front of his nose and patiently starts counting the days needed for the lighthouse to align again with his forefinger.

Should we expect the man to see that lighthouse regularly lining up with his finger every 27.3 days? Of course not. Yet, this is exactly what is implied by the heliocentric theory. Fig. 13.6 shows how the Copernican model envisions the Moon aligning with a given star every 27.322 days, in spite of the Earth's alleged orbital motion around the Sun.

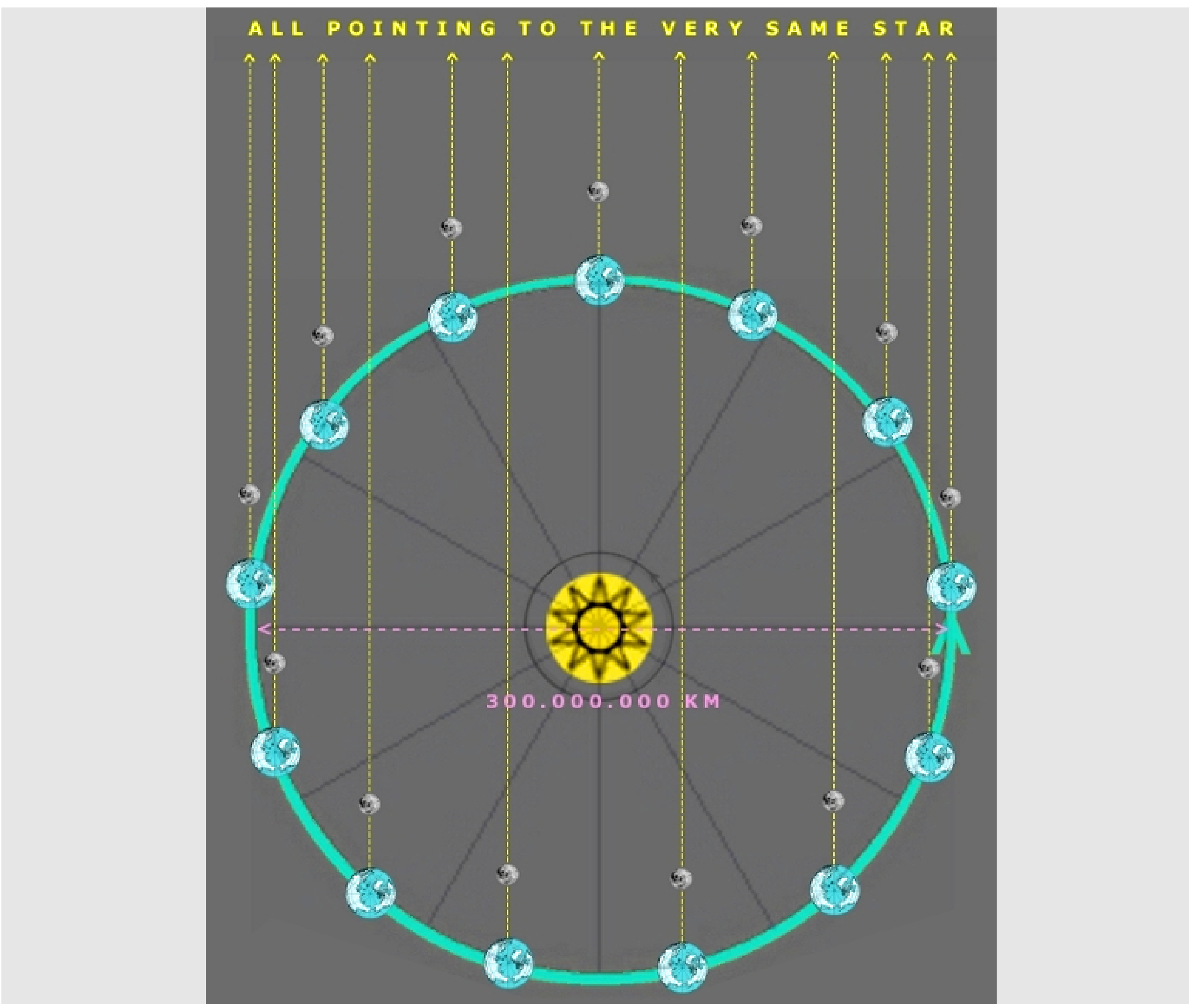


Fig. 13.6 The absurdity of the heliocentric model's geometry with respect to the Moon's 27.3-day sidereal period.

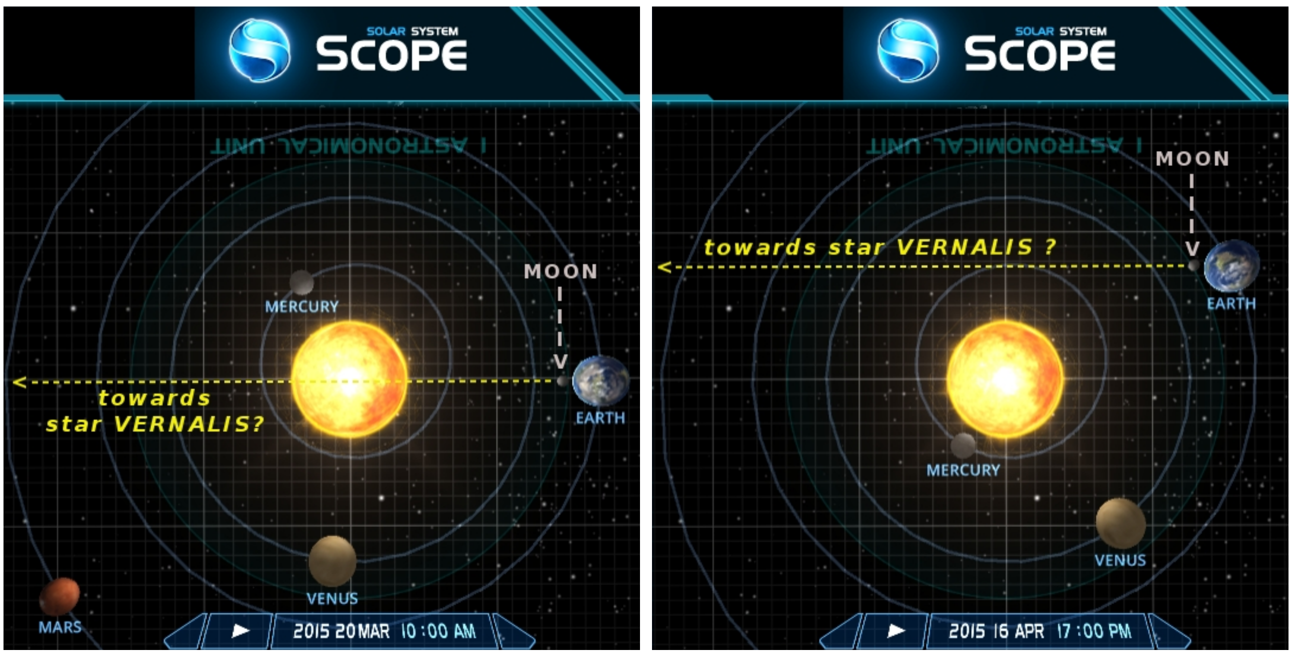
To further illustrate this Copernican aberration of optical perspective, Fig. 13.7 shows how the SCOPE Solar System simulator depicts the solar eclipse of 20 March 2015 at 10:00 UTC (which I personally viewed from Rome) compared to a subsequent position of the Earth-Moon pair (27.3 days later, on 16 April 2015 at 17:00 UTC). On both these dates, the Moon conjuncted with the star Vernalis.

In fact, the entire Copernican theory relies on the misconception that very distant stars will not be affected by parallax. Allow me now to state the obvious with regard to the basic laws of perspective underpinning the concept of parallax:

YES A very small parallax will indeed occur between two very distant objects, such as two unequally distant stars.

NO A relatively nearby object, such as the Moon, cannot possibly remain aligned with any distant star whilst an earthly observer and the nearby object (in this case, our Moon) both drift laterally, and perpendicularly to that star's location, for several million kilometres.

It is truly astonishing that the Copernican theory has survived, largely unchallenged, for over 400 years!



(a) *(b)*

Fig. 13.7 ***(a)*** During the solar eclipse of 20 March 2015, the Moon and the Sun were both aligned with the star Vernalis. ***(b)*** 27.3 days later, the Moon was again aligned with the star Vernalis.

13.4 About the saros and exeligmos cycles

The saros is a period of approximately 223 synodic months (approximately 6585.3211 days, or 18 years, 11 days, 8 hours), that can be used to predict eclipses of the Sun and Moon. [3]

The saros cycle

- Saros cycle = 6585.3211 days
- Full moon cycle = 411.78433 days [4]
- Number of full moon cycles:

$$\frac{6585.3211}{411.78433} \approx 16$$

Now, the 18-year Saros cycle is just part of a longer and more complete triple Saros cycle known as an 'exeligmos'. An exeligmos comprises approximately 19756 days, corresponding to nearly 48 (or 3 × 16) full moon cycles.

The exeligmos cycle

- Duration of 1 exeligmos = 19756 days
- Number of full moon cycles:

$$\frac{19756}{411.78433} \approx 48$$

An exeligmos (Greek: ἐξέλιγμος—turning of the wheel) is a period of 54 years + 33 days that can be used to predict successive eclipses with similar properties and location. For a solar eclipse, after every exeligmos a solar eclipse of similar characteristics will occur in a location close to the eclipse before it. For a lunar eclipse the same part of the earth will view an eclipse that is very similar to the one that occurred one exeligmos before it. [5]

As a 54.1-year exeligmos is completed, any lunar or solar eclipse will recur close to the geographic location it occurred 54.1 years earlier, albeit approximately one month later. The lunar and solar eclipses are therefore actually seen to 'precess' by 1/12 against the firmament from one exeligmos to the next.

One could say that the exeligmos is the 'master cycle' of the Moon's complex dance around Earth, at the completion of which the Moon returns to the same position with respect to the Sun. This 54.1-year cycle has long remained an unsolved riddle. Since the exeligmos has been observed for millennia, mainstream astronomers can only acknowledge its existence as a matter of fact, yet no attempt to explain it has materialized in the astronomy literature.

We shall now see how the TYCHOS model accounts for the peculiar kinematics responsible for the exeligmos cycle. Considering the daily displacement of Earth (38.428 km), moving at 1.6 km/h, the distance covered by the Earth-Moon system in the course of an exeligmos cycle turns out to be very close to the orbital diameter of the Moon (∼763000 km).

Earth's displacement

- Duration of 1 exeligmos = 19756 days
- Earth's daily displacement along the PVP orbit = 38.428 km
- Earth's displacement over 1 exeligmos = 19756 × 38.428 = 759184 km

This is only about 3816 km less than the Moon's orbital diameter. However, it is reasonable to assume this discrepancy can be accounted for by the diameter of the Moon itself (3476 km). In short, it would seem intuitively logical that an exeligmos cycle will be completed when the Earth and the Moon have together covered a distance almost equal to the Moon's orbital diameter of 763000 km. Fig. 13.8 shows how this 54.1-year period would look like in the TYCHOS model.

It would seem the mysterious exeligmos is not so enigmatic after all, provided we use the right configuration of the Solar System. The exeligmos cycle is a natural consequence of the Earth-Moon system's 1.6 km/h motion: every 54.1 years, the system will cover a distance equal to the Moon's orbital diameter and, therefore, the Moon will return to an Earth-Moon-Sun alignment similar to the one observed 54.1 years (19756 days) earlier. Simple as that!

We can use the Tychosium simulator to verify the exactitude of the exeligmos' 19756-day period. For instance, the solar eclipse I witnessed in Rome on 20 March 2015 at 10:00 UTC will recur exactly 19756 days later, on 21 April 2069 at 10:00 UTC.

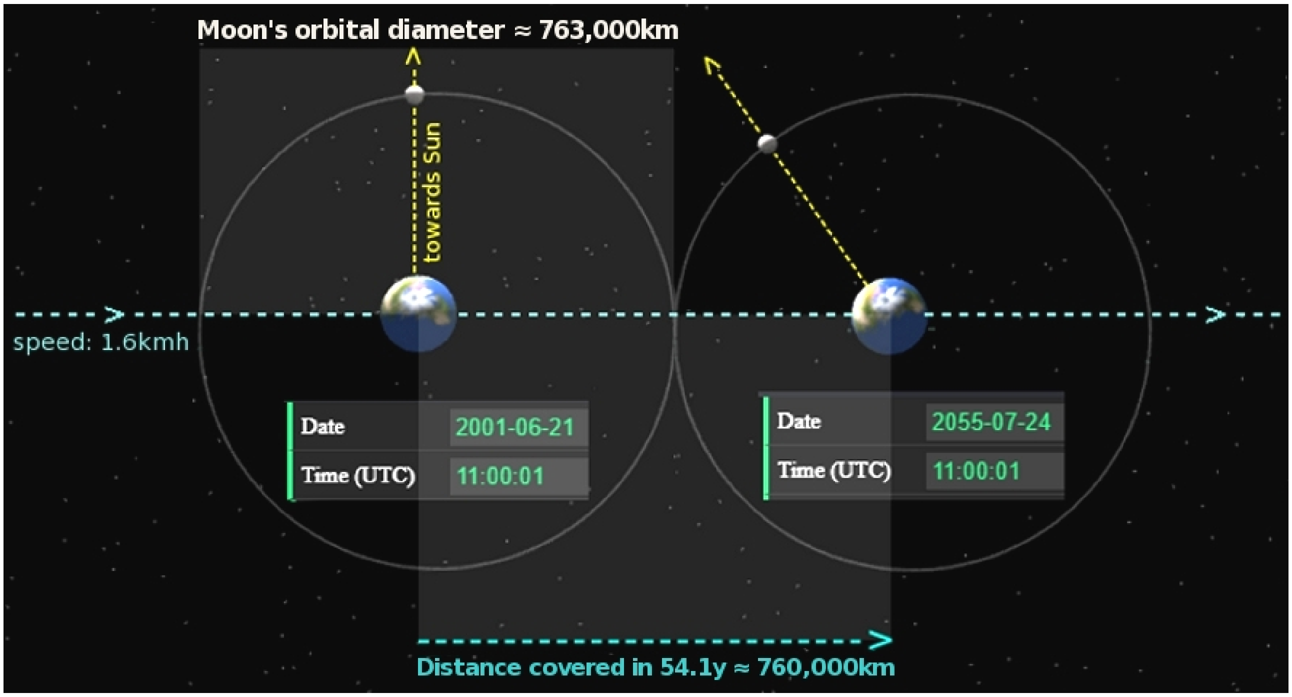


Fig. 13.8 As the Earth-Moon system (moving at ~1.6km/h) covers the distance of the Moon's orbital diameter (in 54.1 years), it naturally completes what is known as the 'exeligmos cycle'.

Finally, let us verify whether the TYCHOS model can mathematically reconcile the exeligmos cycle with the TYCHOS Great Year:

The TYCHOS Great Year (TGY)

- TGY = 25344 solar years
- Circumference of the PVP orbit = 355 724 597 km
- Distance covered by the Earth-Moon system over 1 exeligmos = 759184 km
- Number of exeligmoi in 1 TGY:

$$\frac{355\ 724\ 597}{759184} \approx 468.5$$

- The Moon's master cycle = 54.1 years
- 468.5 exeligmoi = 468.5 × 54.1 = 25345.85 years
- 25345.85 years correspond almost precisely to 1 TGY.

Hence, the exeligmos cycle turns out to be in perfect agreement with the Earth-Moon system's orbital speed of ~1.6 km/h. The odds of all this being entirely coincidental are, you may admit, 'astronomical'. And thus the TYCHOS elucidates the Moon's 'master cycle' of 54.1 years.

13.5 The Moon's 76-year Callippic cycle

Named after the Greek astronomer Callippus (∼330 BC), the Moon's Callippic cycle of 76 years (27759 days) allows for greater accuracy than the so-called Metonic lunar cycle of 19 years. Indeed, the Moon returns to almost the exact same celestial longitude in the sky at intervals of 27759 days. For instance, using the Tychosium simulator, the Moon may be seen to return near-exactly to 6 h of RA on the two dates below, separated by 27759 days:

- 2001-06-21 (12:00:00 UTC)
- 2077-06-20 (14:00:00 UTC)

The Callippic cycle

- Callippic cycle = 27759 days
- The Moon's TMSP = 29.22 days
- Number of Moon TMSPs in 1 Callippic cycle = 950 $\frac{27759}{29.22} = 950$

Another interesting aspect of our Moon's Callippic cycle is its officially estimated 'error rate' of 1 day for every 553 years.

The (Callippic) cycle's error has been computed as one full day in 553 years [6]

When viewed in the TYCHOS model, this Callippic 'error rate' may be interpreted as follows: As will be expounded in Chapter 21, the Sun's annual 'error rate' in relation to our earthly clocks amounts to about 31.4 min, as the Sun is empirically observed to oscillate from east to west around its 'mean zenith' by a little more than half an hour every year. However, thanks to the ingenious gimmick known as the Equation of Time, our clocks, which tick at a constant rate, are nonetheless able to give us a useful approximation of the passage of time—accurate enough for our daily purposes.

Now, we see that 31.4 min amounts to 2.18% of 1440 min (the complete celestial sphere). Similarly, 553 years amounts to about 2.18% of 25344 years (The duration of 1 TYCHOS Great Year). It would therefore be reasonable to assume that the 'error rate' of the Callippic cycle is actually the lunar equivalent of the annual 'error rate' of the Sun.

13.6 Testing the Moon's perigee precession in the TYCHOS

Annual precession

- ACP × TGY = 360° (complete precession of the firmament)
- Daily precession of the Moon's perigee = 0.1114°
- Time (in days) to complete a full cycle ≈ 3231.5978 $\frac{360}{0.1114} \approx 3231.5978$
- Time (in years) to complete a full cycle ≈ 8.8476 $\frac{3231.5978}{365.25} \approx 8.8476$
- Annual precession (in degrees) of the Moon's perigee = 40.68885° $0.1114 \times 365.25 = 40.68885$
- Annual precession (in arcseconds) ≈ 146480″

The lunar perigee precesses in the direction of the moon's orbital motion at the rate of $n - n^{\sim} = 0.1114^\circ$ *per day, or 360° in 8.85 years.* [7]

Empirically observed annual precession

A comparison of this empirically observed annual precession of the Moon's perigee with our annual constant of precession (ACP) reveals that the Moon's perigee precesses 2864.5 times faster than the firmament.

- Annual precession of the Moon's perigee $\approx 146480''$
- ACP $= 51.136''$
- Rate of the Moon's perigeal precession versus the ACP ≈ 2864.5 $\quad \frac{146480}{51.136} \approx 2864.5$
- Time to complete a full cycle ≈ 3231.5978 days
- TMSP $= 29.22$ days
- TMSPs in 1 complete perigee precession ≈ 110.5954 $\quad \frac{3231.5978}{29.22} \approx 110.5954$
- Number of TMSPs in 1 TGY of 9 256 896 days $= 316800$ $\quad \frac{9\,256\,896}{29.22} = 316800$
- Number of 'complete' perigee precessions of the Moon in 1 TGY ≈ 2864.5 $\quad \frac{316800}{110.5954} \approx 2864.5$

In other words, the Moon's empirically observed perigeal precession is in excellent agreement with the TYCHOS Great Year (25344 solar years, or 9 256 896 days).

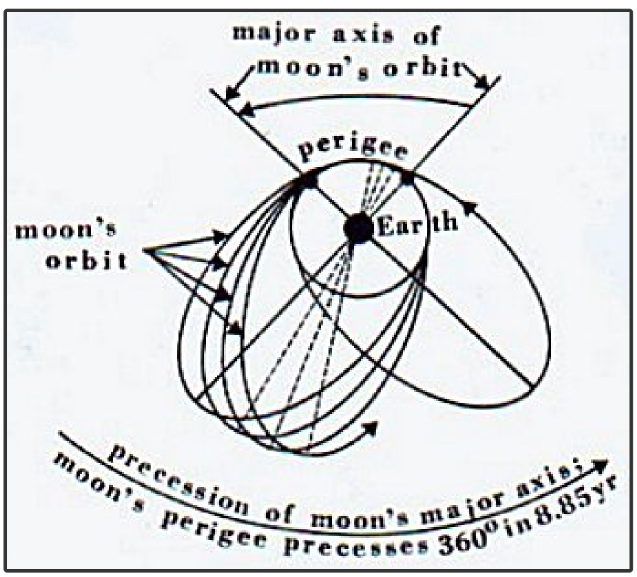


Fig. 13.9 The current astronomical understanding of the Moon's perigee precession, or 'apsidal precession'.

13.7 The Moon's apsidal precession 'mirrors' the EAM

What follows is nothing short of astounding: using the TYCHOS model, the Moon's so-called apsidal precession can be shown to 'mirror' Earth's annual motion (EAM) of 14036 km. In simple words, the apsidal precession is the gradual rotation of the line connecting the apsides of an astronomical body's orbit (referred to as the 'line of apsides'). The apsides of the Moon are the orbital points closest (perigee) and farthest (apogee) from Earth.

We have just seen that the observed angular rate of the Moon's perigee precession nicely agrees with the TGY. We shall now look at two other aspects of the Moon's oscillations, namely the observed magnitude (in km) of the Moon's perigee precession and the observed magnitude (in km) of its full apsidal precession (from perigee to apogee). The Moon completes a full apsidal precession in $\sim$8.85 years.

Let us first have a look at how the Moon's perigee and apogee are conventionally illustrated. Fig. 13.10 is a classic diagram one can find in astronomy books depicting the minimum and maximum Earth-Moon distances (perigee vs. apogee).

The Astro Pixels database features annual charts of the Moon-Earth distances for the lunar perigee and apogee transits, and this may well be of interest to the TYCHOS model. As I consulted their detailed chart of the Moon's perigee transits, my attention was naturally drawn to this statement regarding the long-term (secular) average minimum and maximum lunar perigee distances:

> *Over the 5000-year period from –1999 to 3000 (2000 BCE to 3000 CE), the distance of the Moon's perigee varies from 356,355 to 370,399 km.* [8]

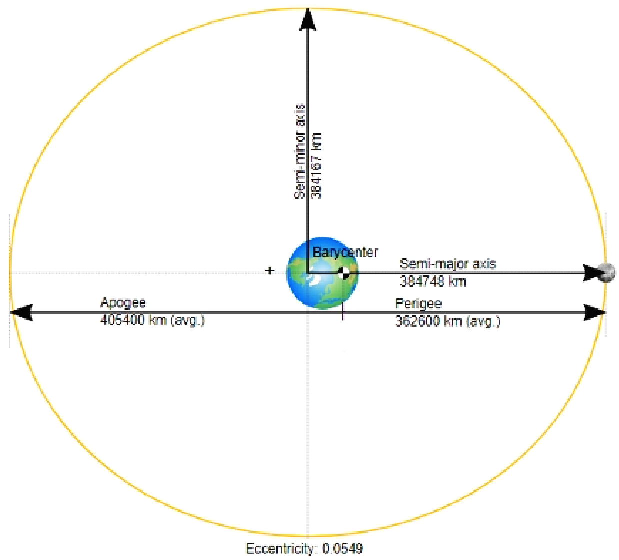


Fig. 13.10 Schematic view of the orbit of the Moon as seen from above. The eccentricity is overemphasised, and size and distance are scaled differently. Source: http://beltoforion.de

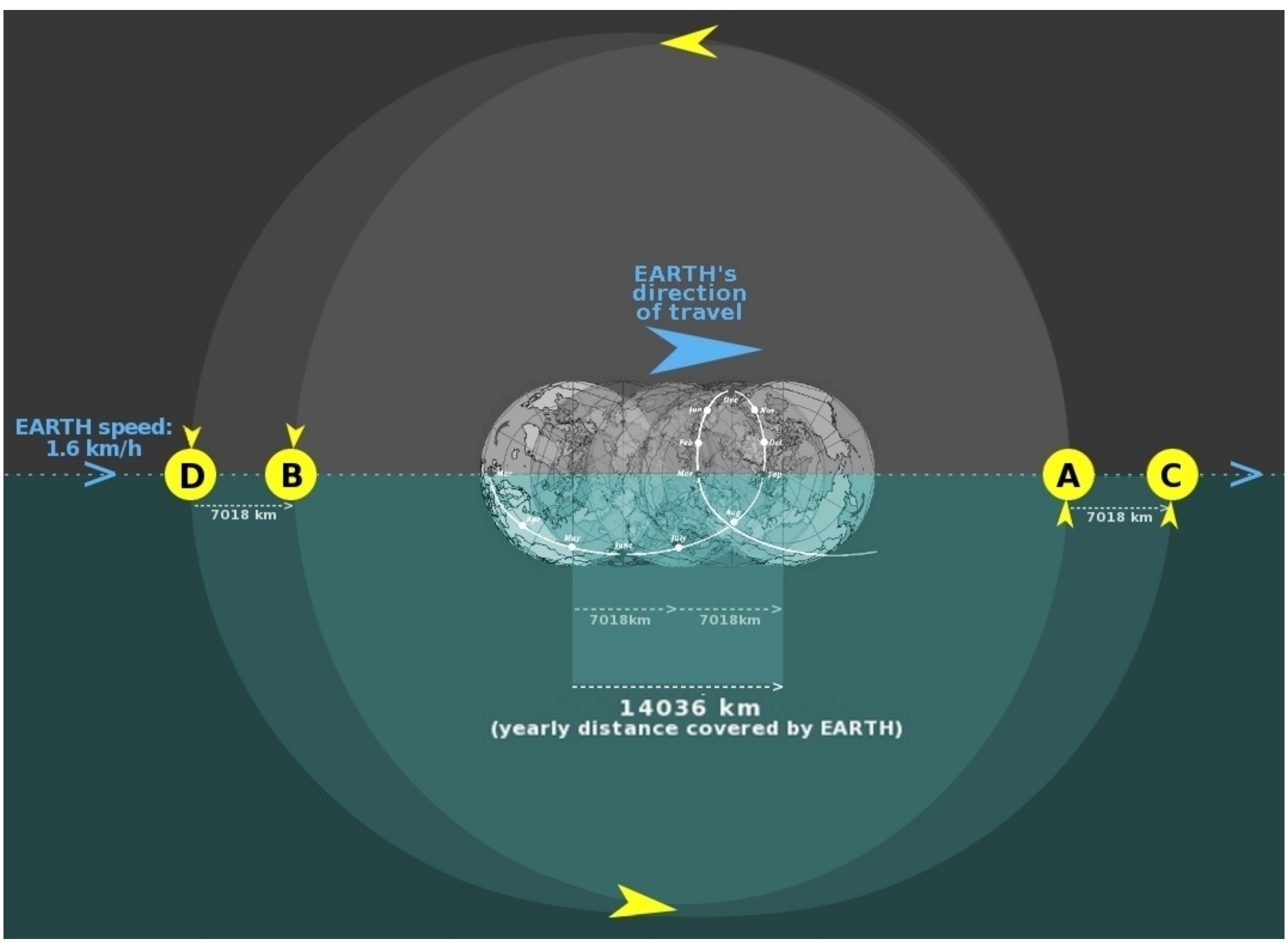


Fig. 13.11 Graphic showing how the Moon's perigee will oscillate radially by about 14000 km, arguably in harmony with the EAM.

So let's see: the difference between 356355 km and 370399 km is 14044 km. This distance is almost identical to the EAM. In fact, by carefully consulting these lunar perigee charts, one can easily verify that the Moon's perigee regularly oscillates back and forth every solar year by an average distance of approximately 14000 km. This is illustrated in Fig. 13.11.

But it gets even more exciting! This is what the Astro Pixels website has to say about the mean variations between the lunar perigee and apogee:

> *The Moon's distance from Earth (center-to-center) varies with mean values of 363,396 km at perigee (closest) to 405,504 km at apogee (most distant).* [9]

The Moon's apogee and perigee distances vary by 3 EAMs

- Maximum variation = 405504 km − 363396 km = 42108 km
- 3 EAMs = 3 × 14036 km = 42108 km

This leads us to a most sensational realization: our Moon's apsidal precession is a perfect 'reflection' of the EAM, as proposed by the TYCHOS. Since the Moon revolves around Earth, while Earth itself advances in space, the lunar trajectory will be a looping geometrical curve known as a trochoid [10]. The longer and shorter loops of this prolate trochoid exhibit a 3:1 ratio and, in fact, we just saw that the Moon's apogee and perigee exhibit just such a 3:1 ratio (42108 / 14036 = 3). One truly couldn't wish for a better confirmation of the TYCHOS' proposed earthly rate of motion. Please make a mental note of that trochoidal 3:1 ratio: we will encounter it again further on in the book.

The conceptual graphic in Fig. 13.12 illustrates the basic geometry of the Moon's apsidal precession. Of course, the Moon doesn't complete just one such trochoid loop in 8.85 years, but the diagram should help envision the peculiar geometrics at play, particularly with respect to the above-mentioned 3:1 ratio.

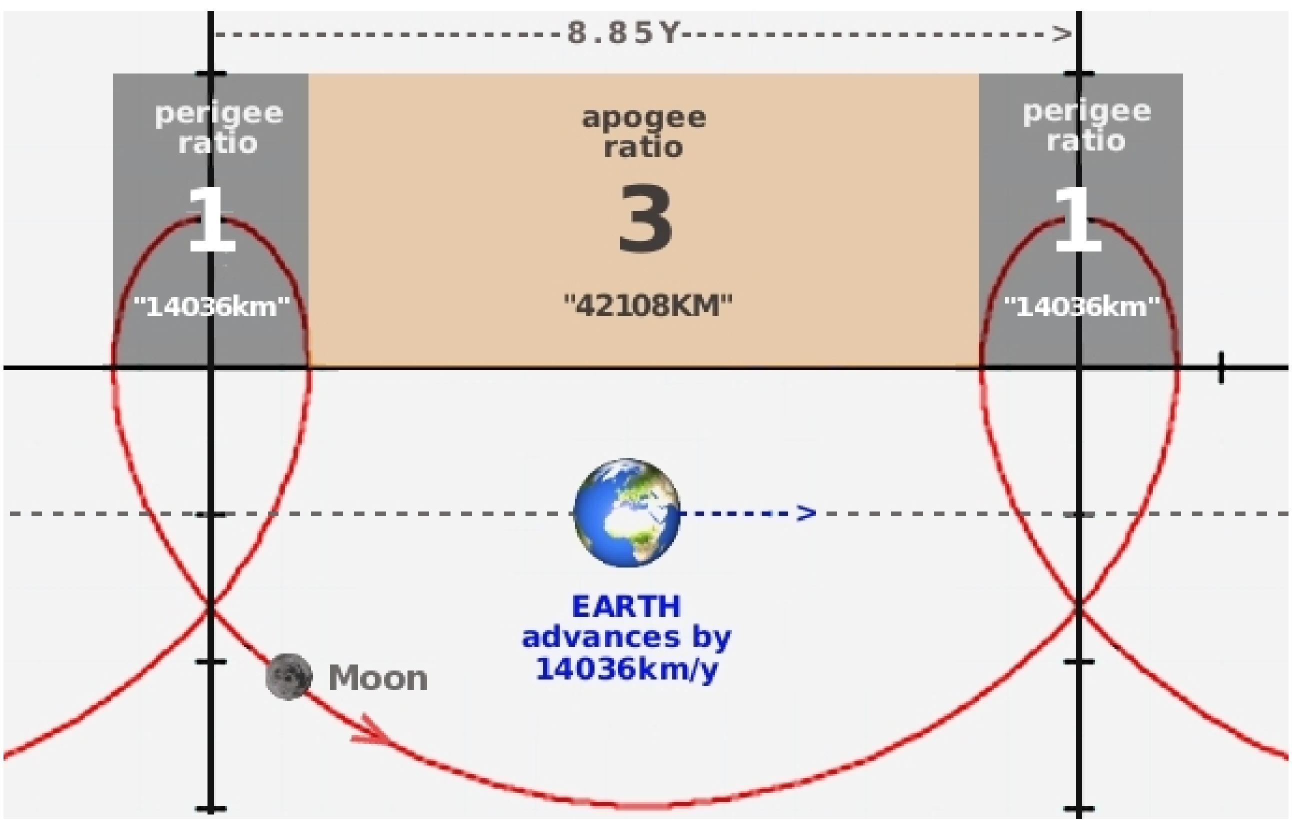


Fig. 13.12 A conceptual diagram illustrating the 3:1 ratio of the Moon's trochoidal path around the moving Earth.

I was then curious to see whether this trochoidal pattern could be reproduced in the Tychosium 3D simulator over an extended period, plotting a hypothetical time-lapse 'picture' of our Moon's long-term orbital progression. I figured that, in order to 'see it', I needed to increase Earth's speed in the simulator by a few orders of magnitude. The result is illustrated in Fig. 13.13.

Summary

In this chapter I have highlighted a number of aspects concerning our lunar satellite:

- Its role as the 'central driveshaft' or 'pacemaker' of our Solar System.
- The synchronicity of its orbital revolutions with the Sun's axial rotations (~27.3 days).
- The absurdity of the sidereal period kinematics proposed by the heliocentric theory.
- The concordance of its exeligmos cycle with the orbital speed of the Earth-Moon system in the TYCHOS.
- The concordance of its Callippic cycle with the TMSP proposed by the TYCHOS (29.22 days).
- The most remarkable commensurability, at a 3:1 ratio, between its apsidal precession and the EAM proposed by the TYCHOS (14036 km).

The Moon's so-called 'librations' in longitude and latitude are also accounted for by the TYCHOS model's geometry, what with the Moon's eccentric (not elliptical) orbit and the 6.7° inclination between the Moon's axis of rotation and its orbital plane around Earth. This is why we can actually observe up to 59% of the lunar surface—an undisputed, empirically observable fact:

> *Over time, slightly more than half (about 59% in total) of the Moon's surface is seen from Earth due to libration.* [11]

However, the complex orbital behaviour of our Moon has never been fully understood or justified, in spite of it being the body closest to our planet. The next chapter will therefore take a closer look at the subtler aspects of our Moon's long-term motions which, notoriously, caused Sir Isaac Newton many a headache. As we shall see, the TYCHOS model can elucidate several other aspects of the Moon's puzzling behaviour which, as famously stated by Pierre-Simon Laplace, *"failed to conform in all respects with the laws of universal gravity"*.

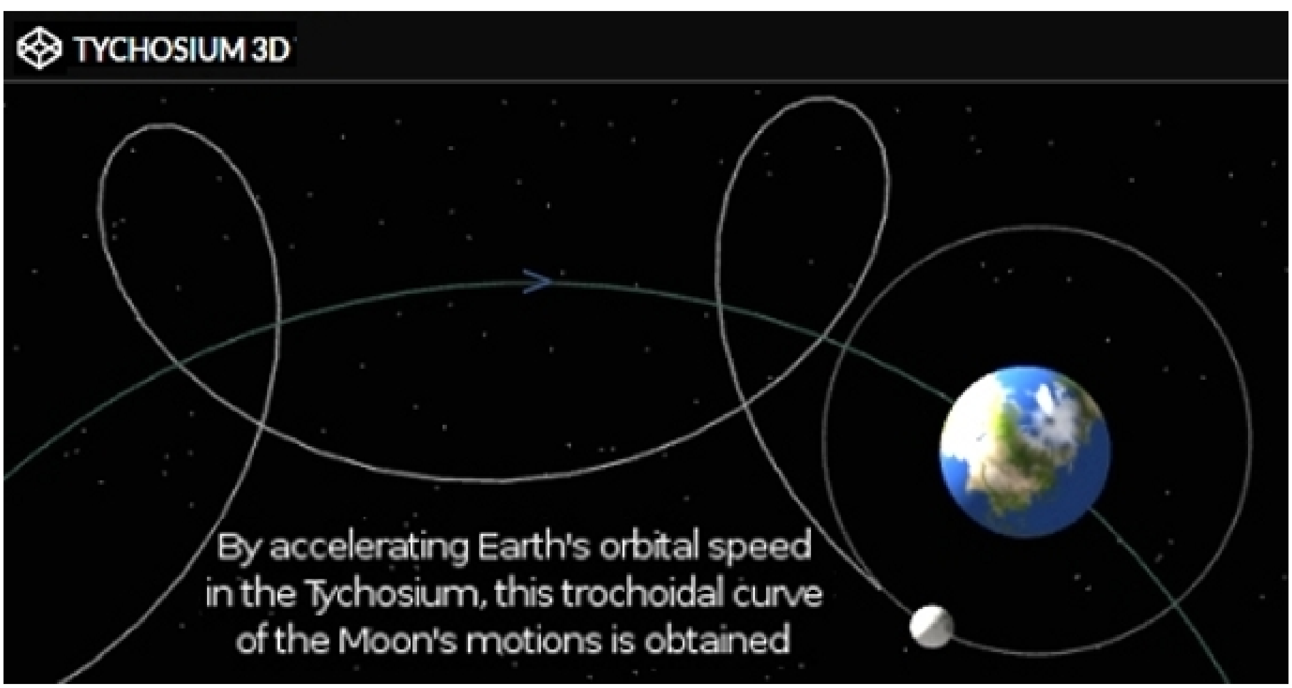


Fig. 13.13

13.8 References

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Did you know that the Moon would not let Sir Isaac Newton sleep at night?

14

Curing Newton's headache: the Moon

14.1 The Moon's bewildering motions

To Sir Isaac Newton, the Moon's motions were notoriously problematic, causing him much misery and sleepless nights. An astronomy essay published by S. M. Alladin and G. M. Ballabh in August 2005 contains the following amusing anecdote regarding Sir Isaac's exasperation with the seemingly intractable motions of the Moon:

> *The motion of the Moon is very complicated. Sir Isaac Newton is supposed to have told his friend Halley that lunar theory "made his head ache and kept him awake so often that he would think of it no more".* [1]

The reason they caused so much torment to Sir Isaac can be gleaned from Fig. 14.1. It is quite ironic that the greatest astronomical controversies revolve around our own Moon's motions. After all, our Moon is the nearmost and most extensively studied celestial body. One would presume the scientific community had fully settled the matter after all this time. How can the Moon's motions still be such a hotly debated question?

> *Lunar theory attempts to account for the motions of the Moon. There are many small variations (or perturbations) in the Moon's motion, and many attempts have been made to account for them.* [2]

Attempts. Just attempts! The Wikipedia entry on 'lunar theory' goes on to say that *"after centuries of being problematic, lunar motion is now modelled to a very high degree of accuracy"*. Well, that is simply untrue since today's scientists are still hard at work trying to wrap their heads around the Moon's inexplicable and

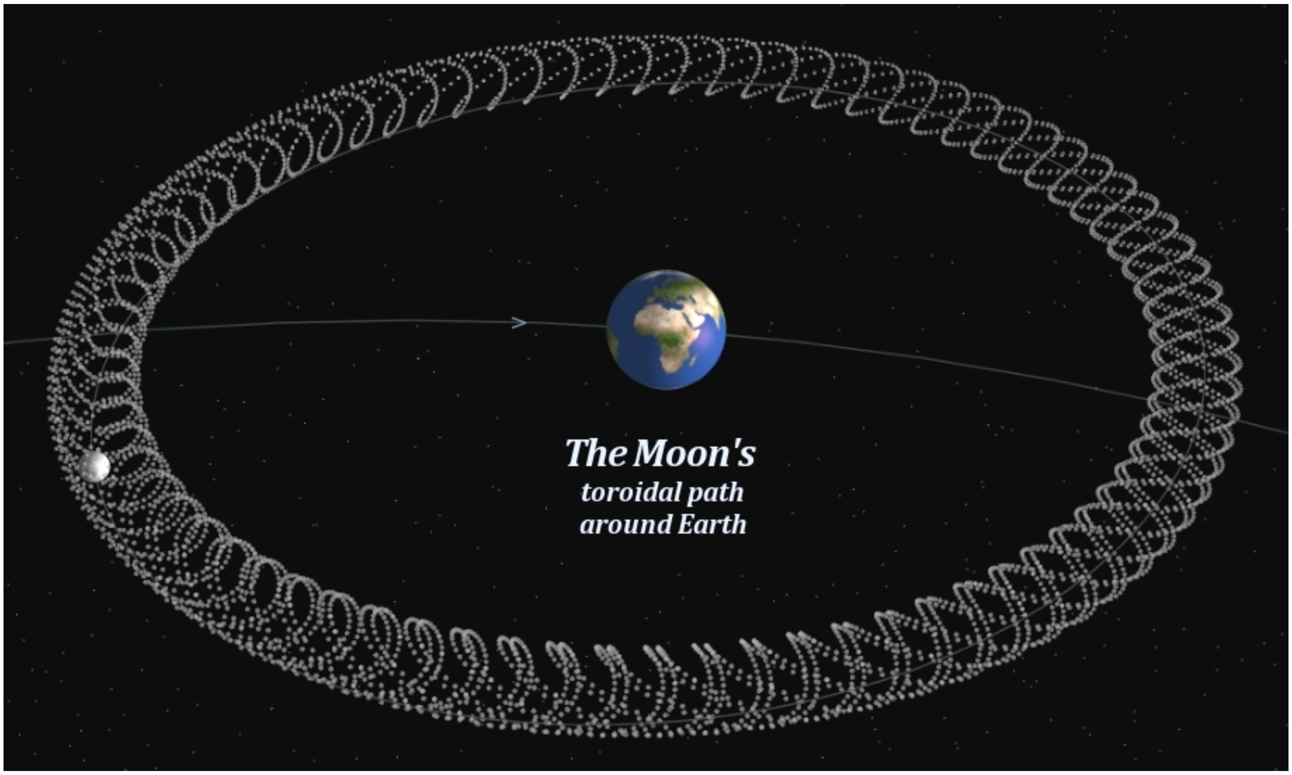


Fig. 14.1 The Moon's motions traced out by the Tychosium 3D simulator.

seemingly anomalous orbital motions, as this abstract from a 2011 scientific paper concludes:

> *Thus, the issue of finding a satisfactory explanation for the anomalous behaviour of the Moon's eccentricity remains open.* [3]

Back in the day, the Moon's baffling motions caused much pain in Newton's brain as they stubbornly refused to comply with his theory of universal gravity. Fig. 14.2 gives us a brief look at what the Moon controversy was all about, as documented in the astronomy literature. [4]

To this day, no consensus has been reached regarding these apparent variations of the Earth's and the Moon's orbital and/or rotational speeds. The astronomy literature offers only frail theories and unending flame wars about 'non-gravitational effects' which are supposed to account for the observed phenomena. A host of whimsical effects have been proposed over time, such as 'tidal forces', 'core-mantle coupling', assorted 'turbulences' and 'planetary perturbations'. Astronomy historian John Phillips Britton remarked in a 1992 essay that the Moon's acceleration...

> *[...] was proving an embarrassment to theoretical astronomers, since no gravitational explanation for this phenomenon could be found.* [5]

Eventually, astronomers turned to geologists for assistance and a provisional 'lunatic' consensus was crafted: 'tidal friction forces' were said to slow down Earth's rotation and at the same time speed up the Moon's motion! However, in the introduction to his 1972 paper *"Non-gravitational Forces in the Earth-Moon System"*, Robert Russell Newton (renowned for his extensive work on the apparent changes of the Earth's

The Controversy Surrounding the Secular Acceleration of the Moon's Mean Motion

DAVID KUSHNER

Communicated by NOEL M. SWERDLOW

To many scientists of the eighteenth and nineteenth centuries there was no higher achievement than the theory of gravitation. While its basic laws may be easily apprehended, the intricacies of its development in accounting for the mutual attractions of even three bodies push analysis to its limits, and nowhere is this dichotomy more evident than in lunar theory, on which many of the best analysts have spent considerable effort. Observation has shown a bewildering array of perturbations, from the relatively straightforward annual equation to the more complex secular variation of the mean motion of the nodes. But one of these secular inequalities has particularly engaged the attention—and enraged the passion—of astronomers: the secular variation of the moon's mean motion. Indeed the international controversy which flared up circa 1860 was one of the largest and most active of the century.

There are several interesting and unusual aspects of this debate which distinguish it from others, and these will be the principal subject of this paper. The controversy superficially breaks down into the observational arguments *versus* the theoretical arguments. At another level are bitter disagreements over the theoretical physical principles. And at yet a third level much heat is generated over the mathematical arguments themselves. Oddly enough, there is no secondary account of this important controversy, but there are several contemporary 'eyewitness' descriptions of the various volleys of the debate.[1] These blow-by-blow narratives and analyses require examination. Finally, the introduction of a new, not wholly gravitational cause to explain the disputed phenomenon has important implications. As the debate uses previous results, I begin with a short examination of the researches up to about 1850.

Although theory could in no way account for it, HALLEY in 1695 was the first to suspect there may be such a thing as a secular acceleration of the moon's mean motion, *i.e.* that the moon has gradually been going faster in its orbit.

Fig. 14.2

rotation rate) curtly states:

> *There are no satisfactory explanations of the accelerations. Existing theories of tidal friction are quite inadequate.* [6]

Further on in his paper, R. R. Newton concludes:

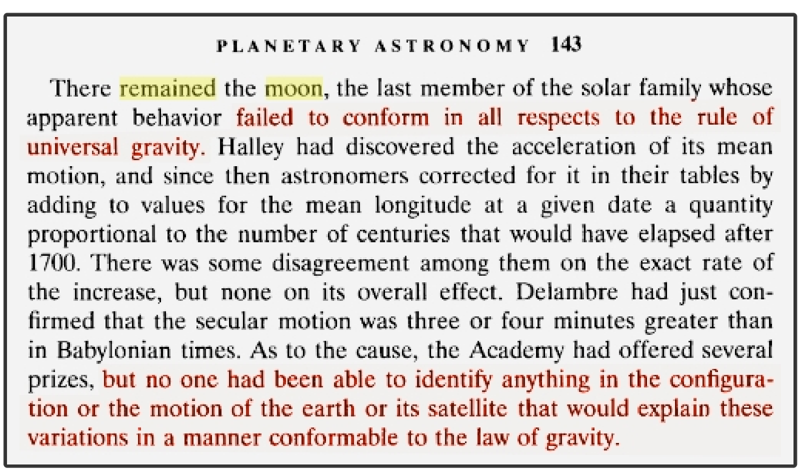
> *We are seriously lacking in mechanisms to explain the non-gravitational forces. The only mechanism of tidal friction (the 'shallow seas' model) that has been evaluated quantitatively provides only one-fourth of the necessary amount of friction, and it does not provide for much change with time within a period as short as historic times.*

In fact, the Moon's motions were—and still are—in serious conflict with Newton's gravitational laws. It is a matter of historical record that his theories were contradicted by the Moon's *"inexplicable, renegade behaviour"*, and that this plain fact ignited a humongous controversy in the scientific community, which, incredibly enough, remains unresolved to this day. The reason why I am stressing this point is that you shouldn't let anyone tell you the old Moon controversy has already been settled. That would be a barefaced lie, flying in the face of what has repeatedly been admitted in the academic literature, past and present, as I am partially documenting here.

Yet, what astronomy students are taught today is that the Moon's utterly bewildering motions were eventually 'figured out' by some of the most revered scientists of our times (e.g., Euler, Horrocks, Lagrange, Laplace, Clairaut, Dunthorne, Mayer, Einstein, to name but a few), all of whom contributed with a plethora of 'terms', 'perturbations' and 'non-gravitational effects' intended to account for the observed anomalies. Eventually, a disjointed hodge-podge of assorted theories was concocted in order to rescue Newton's sacrosanct gravitational laws. The grievous affair is described in the Wikipedia entry on 'lunar theory':

> *The analysts of the mid-18th century expressed the perturbations of the Moon's position in longitude using about 25-30 trigonometrical terms. However, work in the nineteenth and twentieth century led to very different formulations of the theory so these terms are no longer current. The number of terms needed to express the Moon's position with the accuracy sought at the beginning of the twentieth century was over 1400; and the number of terms needed to emulate the accuracy of modern numerical integrations based on laser-ranging observations is in the tens of thousands: there is no limit to the increase in number of terms needed as requirements of accuracy increase.* [2]

As you can see, there is apparently no limit to the number of terms required to explain the Moon's motions within the Copernican framework. The number of terms grows year after year, with no end in sight, and astronomy professors and students are assuredly not encouraged to question the validity of the same, unless they are prepared to be labelled 'heretics' by their respective institutions. To say the least, this Moon business is not the most commendable page in the history of science. Fig. 14.3 is an extract from Charles Coulston Gillispie's book *"Pierre-Simon Laplace, 1749-1827: A Life in Exact Science"* [7]



PLANETARY ASTRONOMY 143

There remained the moon, the last member of the solar family whose apparent behavior failed to conform in all respects to the rule of universal gravity. Halley had discovered the acceleration of its mean motion, and since then astronomers corrected for it in their tables by adding to values for the mean longitude at a given date a quantity proportional to the number of centuries that would have elapsed after 1700. There was some disagreement among them on the exact rate of the increase, but none on its overall effect. Delambre had just confirmed that the secular motion was three or four minutes greater than in Babylonian times. As to the cause, the Academy had offered several prizes, but no one had been able to identify anything in the configuration or the motion of the earth or its satellite that would explain these variations in a manner conformable to the law of gravity.

Fig. 14.3 Extract from *"Pierre-Simon Laplace, 1749-1827: A Life in Exact Science"*, by Charles Coulston Gillispie.

Likewise, the Edinburgh Review or Critical Journal highlighted the fact that the Moon's observed motions, with its 'anomalies' and 'inequalities', contradict Newton's gravitational theories. [8]

The controversies over the Moon's motions ranged from its observed periodic (short-term) motions all the way to its secular (long-term) motions over the centuries. The latter triggered a gigantic and still unsettled debate since studies of the ancient solar/lunar eclipses suggested that the Moon, as viewed from Earth, was continually 'accelerating' over time, despite the fact that its orbital speed was, paradoxically enough, said to be slowing down! Other theories proposed that it was actually Earth's rotation that was decelerating. In short, and to put it bluntly: a sorry mess.

> *Astronomers who studied the timing of eclipses over many centuries found that the Moon seemed to be accelerating in its orbit, but what was actually happening was that the Earth's rotation was slowing down. The effect was first noticed by Edmund Halley in 1695, and first measured by Richard Dunthorne in 1748, though neither one really understood what they were seeing.* [9]

Perhaps the most cringeworthy attempt to salvage Newton's 'inviolable laws' was that of Paul Dirac, hailed as *"one of the most significant physicists of the 20th century"*. F. R. Stephenson published a paper in the Journal of the British Astronomical Association, saying that:

> *The most plausible cause of a non-tidal acceleration is a possible time rate of change of G, as was first proposed by Dirac. Such a change would affect the planets as well as the Moon, producing accelerations (or decelerations) in the exact ratio of the mean motions.*

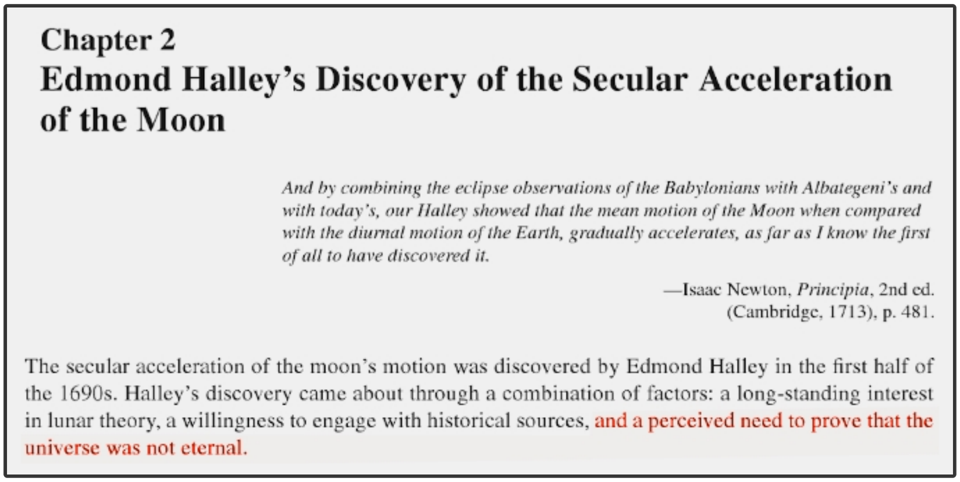
How so? A *"time rate of change of G"*—the all-important 'gravitational constant'? It's like saying, *"Hey, gentlemen, let's just tweak that 'constant' and make it a 'non-constant' et voilà: Newton wins again!"* It is quite comical to read about the countless ad hoc 'remedies' whipped up by the watchdogs of heliocentrism in their feverish travails to patch up the cracks in their crumbling edifice. The time has truly come to clear up this sorry state of affairs. I shall start with these supposed secular 'accelerations' and/or 'decelerations' of the Moon and demonstrate how the TYCHOS can account for them in the simplest manner imaginable. The supplied graphics should help visualize what has caused so much confusion and controversy over our Moon's observed motions.

260 La Place, *Traité de Méchanique Céleste.* Jan.

Thus, the lunar theory was brought to a very high degree of perfection; and the tables constructed by means of it, were found to give the moon's place true to 30″. Still, however, there was one inequality in the moon's motion, for which the principle of gravitation afforded no account whatever. This was what is known by the name of the moon's acceleration. Dr Halley had observed, on comparing the ancient with modern observations, that the moon's motion round the earth appeared to be now performed in a shorter time than formerly; and this inequality appeared to have been regularly, though slowly, increasing; so that, on computing backward from the present time, it was necessary to suppose the moon to be uniformly retarded, (as in the case of a body ascending against gravity), the effect of this retardation increasing as the squares of the time. All astronomers admitted the existence of this inequality in the moon's motion; but no one saw any means of reconciling it with the principle of gravitation. All the irregularities of the moon arising from that cause had been found to be periodical; they were expressed in terms of the sines and cosines of arches; and though these arches depend on the time, and might increase with it continually, their sines and cosines had limits which they never could exceed, and from which they returned perpetually in the same order. Here, therefore, was one of the greatest anomalies yet discovered in the heavens—an inequality that increased continually, and altered the mean rate of the moon's motion.

Fig. 14.4 Extract from the *Edinburgh Review* or *Critical Journal.* [8]

14.2 Is the Moon accelerating? Or decelerating?



Chapter 2
Edmond Halley's Discovery of the Secular Acceleration of the Moon

And by combining the eclipse observations of the Babylonians with Albategeni's and with today's, our Halley showed that the mean motion of the Moon when compared with the diurnal motion of the Earth, gradually accelerates, as far as I know the first of all to have discovered it.

—Isaac Newton, *Principia*, 2nd ed. (Cambridge, 1713), p. 481.

The secular acceleration of the moon's motion was discovered by Edmond Halley in the first half of the 1690s. Halley's discovery came about through a combination of factors: a long-standing interest in lunar theory, a willingness to engage with historical sources, and a perceived need to prove that the universe was not eternal.

Fig. 14.5 Extract from *"Ancient Astronomical Observations and the Study of the Moon's Motion"*, by John M. Steele.

Isaac Newton credited his own mentor and sponsor, Edmond Halley, with having first discovered the 'secular acceleration of the Moon'. Interestingly, as shown in Fig. 14.5, Halley was spurred by *"a perceived need to prove that the universe was not eternal"*...

The diagram in Fig. 14.6 illustrates how and why the Moon will indeed appear to accelerate over the centuries, although this is only an illusion caused by the Earth-Moon system circling around the PVP orbit, as proposed by the TYCHOS model.

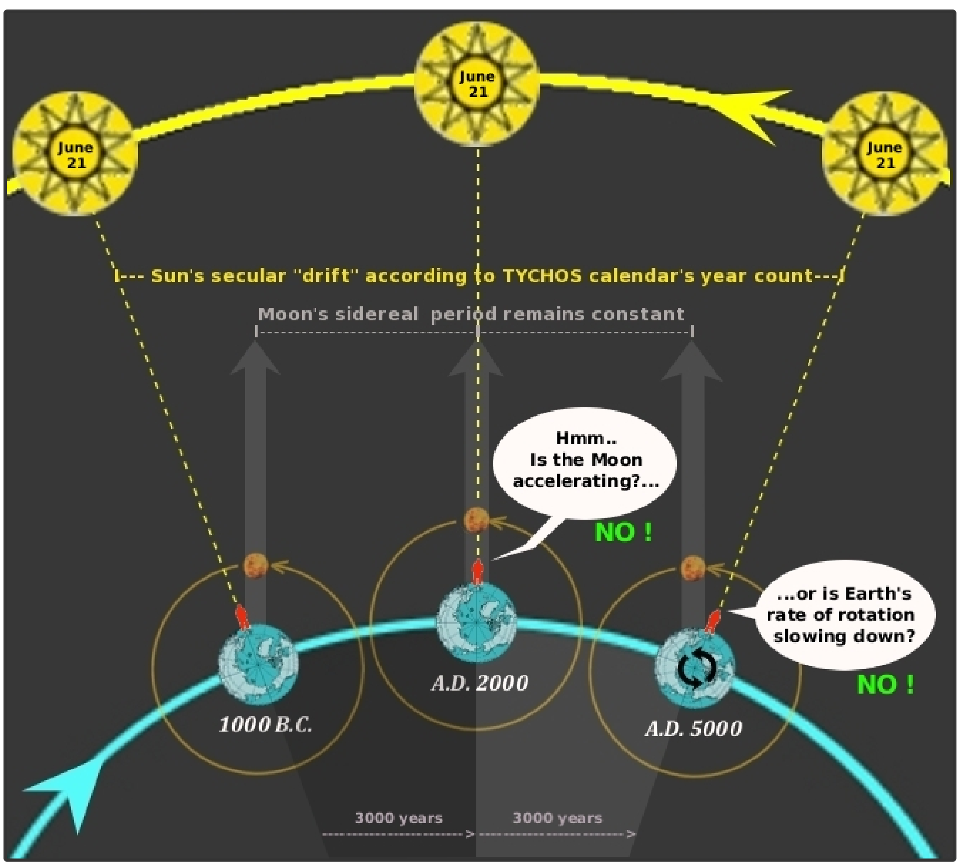


Fig. 14.6 The Moon is not accelerating, nor is Earth's rotation decelerating. What causes these illusory effects is simply explained by Earth's slow motion (~1 mph) around its PVP orbit. The Moon maintains its constant orbital speed at all times.

Once you know that Earth is slowly moving around its PVP orbit, the apparent accelerations and decelerations of the Moon and/or of Earth's rotation are seen for what they are: an optical illusion. Our Solar System is in reality an extremely stable and reliable 'clockwork', with all its components moving in perfectly circular orbits and rotating around their axes at perfectly constant speeds. Ever since the advent of heliocentrism, astronomers and physicists have been busy filling our universe with perturbations and aberrations that simply are not there. The simplicity, harmony and utter regularity revealed by the TYCHOS are not only intuitively gratifying but also provide a cure for the academic cognitive parallax of observing one thing and believing another. So, is the universe eternal? Perhaps not, but it's probably not going to drift apart or grind to a halt anytime soon.

I shall now further demonstrate how the illusion arises that our Moon (or Earth's rotation) is subject to 'accelerations' and 'decelerations'. We are told by mainstream astronomers that the Earth's rate of rotation (axial spin) is gradually slowing down. We are also told that the Moon's orbital motion is slowly speeding up in relation to Earth, and yet, at the same time, slowing down in relation to the stars. It sounds utterly bewildering but it is nevertheless easily explained by the gradually changing perspectives inherent in the Earth-Moon system's slow, clockwise revolution around the PVP orbit.

Imagine a man in London always looking in the direction of Earth's 1.6 km/h motion around the PVP orbit (for the sake of argument, let us assume the man is able to sense this direction at all times). As a Copernican disciple, the man is unaware of Earth's PVP orbit. For 6336 years, our immortal man, in Fig. 14.7, carefully monitors the Moon's celestial positions as it moves against the background stars.

As shown in Fig. 14.7, by the end of that 6336-year period our man in London will find himself at a 90° angle from where he started (year 0) in relation to the universe. Now, 90° is of course ¼ of 360°, and ¼ of Earth's equatorial circumference (40075 km) amounts to 10018.75 km. This means that our man in London has been, so to speak, 'slipping out of synch' with the Moon each year by about 1.6 kilometres of Earth's circumference or, more precisely, by 1.58124 km annually (10018.75 km / 6336 = 1.58124 km).

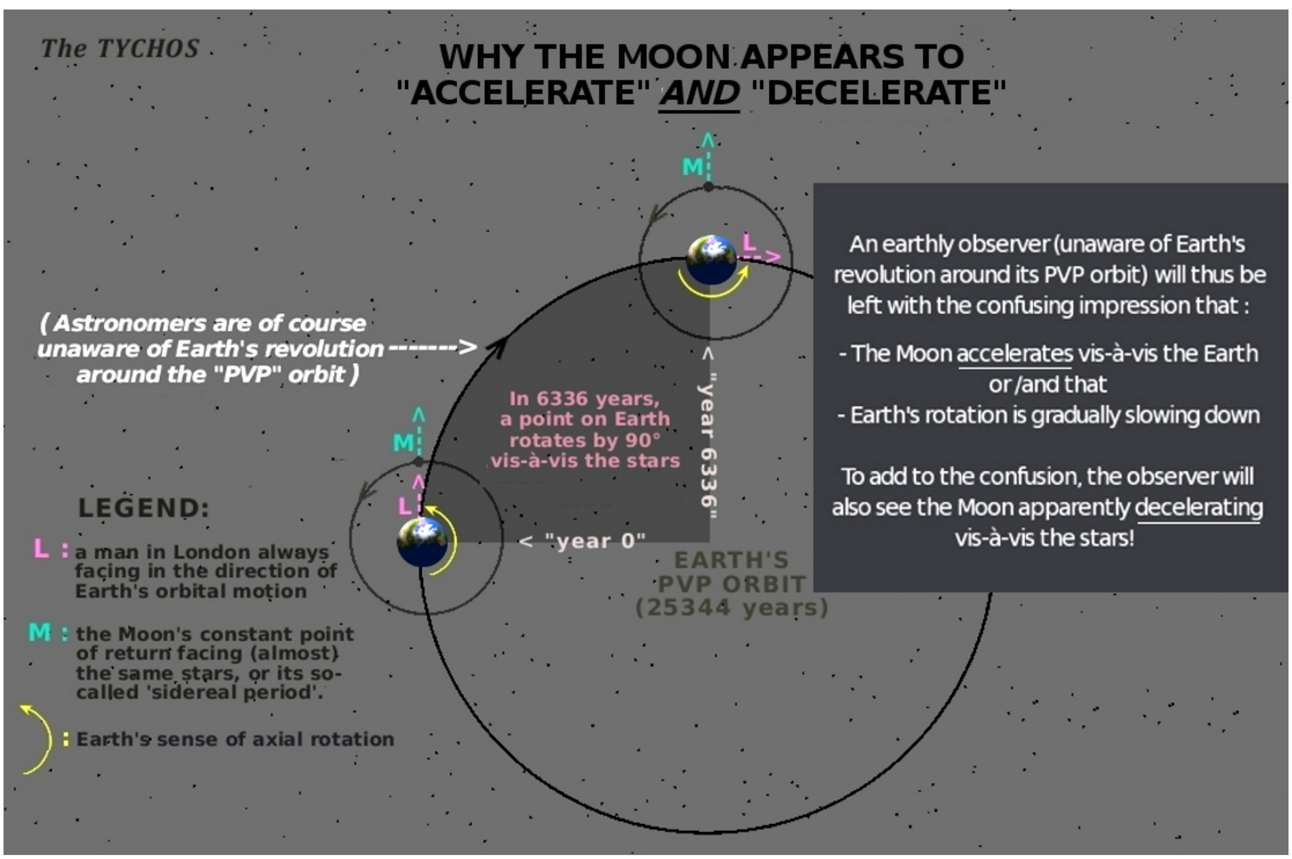


Fig. 14.7 A man in London (L) is always facing in the direction of Earth's orbit. The Moon's constant point of return (M) is (almost) facing the same stars, or its so-called 'sidereal period'.

Well, this is most interesting, because 1.58124 km equals 0.0039457% of 40075 km. As we saw in Chapter 12, the Earth moves annually by 14036 km, corresponding to 0.0039457% of the PVP's orbital circumference of 355 724 597 km. This motion makes us 'meet up' with the Sun at a slightly earlier point of its own orbit: 37088 km 'earlier', or 0.0039457% of the solar orbit's circumference of 939 943 910 km. And remember, 1 solar year equals 0.0039457% of 1 TYCHOS Great Year (25344 years).

At the end of these 6336 years of patient observation, our man in London will probably conclude that Earth's rotation has decelerated by 6 hours of RA (25% of 24 hours) in relation to the Moon. Or he might wonder whether it is the Moon's orbital motion that has accelerated in relation to Earth. However, to his growing puzzlement, the latter hypothesis clashes with the fact that the Moon has, on the other hand, appeared to decelerate in relation to the starry background.

It is easy to see that our man in London will remain stumped at his own observations as long as he believes the Earth scurries around the Sun and is unaware of the PVP orbit. To be sure, under the heliocentric paradigm, the observed secular motions of our Moon are not only bewildering: they are utterly inexplicable from any rational, optical, geometrical or physical perspective.

To cut a long story short, the apparent accelerations and/or decelerations of the Earth and the Moon are completely illusory, as the above diagrams have hopefully clarified. The two bodies move at constant speeds in circular (albeit somewhat eccentric) orbits, much like all the other bodies in our Solar System. Another misconception currently promoted by Copernican astronomers, namely that the Moon is receding from Earth at about 4 cm per year, will be clarified in section 14.5.

14.3 The Moon's evection explained by the TYCHOS

We shall now examine what astronomers define as the largest observed inequality or anomaly of the lunar motion: the so-called 'lunar evection' (or longitudinal oscillation).

> *In astronomy, evection (Latin for "carrying away") is the largest inequality produced by the action of the Sun in the monthly revolution of the Moon around the Earth. The evection, formerly called the Moon's second anomaly, was approximately known in ancient times, and its discovery is attributed to Ptolemy. Evection causes the Moon's ecliptic longitude to vary by approximately ± 1.274° (or ± 4586.45″ seconds of arc), with a period of about 31.8 days. The evection in longitude is given by the expression +4586.45″ sin(2D-L), where D is the mean angular distance of the Moon from the Sun (its elongation), and L is the mean angular distance of the moon from its perigee (mean anomaly). It arises from an approximately six-monthly periodic variation of the eccentricity of the Moon's orbit and a libration of similar period in the position of the Moon's perigee, caused by the action of the Sun.* ["Evection", Wikipedia]

This 'evection' causes the Moon's ecliptic longitude to vary by approximately ±1.274° over a period of about 31.8 days. However, to compare this variation with one annual 360° solar revolution we need to know how much the Moon oscillates during just one of its 27.3-day sidereal orbits around the Earth:

$$\frac{27.3}{31.8} = 0.85848$$

Ergo, the east-west oscillation of the Moon will add up to (in degrees):

$$0.85848 \times 1.274 \approx 1.0937$$

Total 27.3-day east-west oscillation (in degrees):

$$1.0937 \times 2 = 2.1874$$

Viewed from Earth, the Moon subtends $\sim$0.54° on average. We see that 2.1874 / 0.54 $\approx$ 4.05. The diameter of our Moon is 3474 km. Hence, the total east-west displacement of the Moon, or what might be termed the 'kilometric amplitude of the evection', will add up to:

$$3474 \times 4.05 \approx 14069.7$$

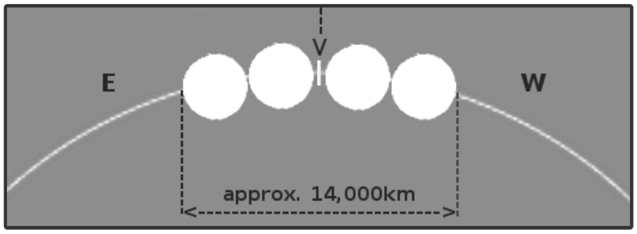


Fig. 14.8 The Moon would always return to the same position if it were equidistant from Earth at all times. However, the Moon is observed to oscillate in relation to its mean position by about two lunar diameters either eastwards or westwards, which is known as the Moon's evection.

This is nearly identical to 1 EAM (Earth's annual 14036-km motion around the PVP orbit).

That is yet another of the Moon's pesky 'inequalities' put to rest by the EAM, this time with regard to longitudinal oscillation. In Chapter 13, we saw that the radial oscillation of the Moon's perigee amounted to about 14044 km and that the radial oscillation between its perigee and apogee amounted to 42108 km (3 × 14036 km). The explanatory power of the TYCHOS model is truly astonishing!

14.4 Computing the apparent velocity variation of the Moon

In section 14.3, we showed that the Moon's evection (longitudinal oscillation) is near-identical to the EAM (14036 km). Let us now verify whether this oscillation—ascribed by Kepler to periodic variations of the Moon's orbital speed and to its orbit's alleged ellipticity—is related to the Earth's orbital speed of ~1.6 km/h. Assuming a constant orbital speed of 3656 km/h, the Moon would employ 230.34 minutes to cover a distance of 14036 km:

$$\frac{14036}{3656} \times 60 \quad = \quad 230.34$$

Our civil calendar year consists of 365 days (or 525600 minutes). This is the timespan against which we gauge the annual lunar oscillations. We see that 230.34 minutes amounts to 0.04382% of 525600 minutes. We have thus obtained the percentage value of the Moon's apparent orbital velocity responsible for the so-called 'lunar evection'.

0.04382% of 3656 km/h (the Moon's constant orbital velocity) equals to 1.602 km/h. This is in excellent agreement with the Earth's orbital speed of 1.601169 km/h, as proposed by the TYCHOS model. The graphic in Fig. 14.9 will help understand why Kepler and his fellow heliocentrists fell for the illusion of velocity variations in our Moon's orbital motions around the Earth:

We see that the variation amplitudes will be 1.6 at the June and December solstices, 0.8 at mid-season and 0 at the March and September equinoxes. Note that, since these are amplitude variations, even the negative values should take the + sign when computing the average amplitude of the Moon's oscillations. Hence, the mean variation coefficient of the Moon's apparent orbital speed—and indeed of all our surrounding planets—will be:

$$\frac{0 + 0.8 + 1.6 + 0.8 + 0 + 0.8 + 1.6 + 0.8}{8} \quad = \quad \frac{6.4}{8} \quad = \quad 0.8$$

This mean variation coefficient (henceforth, MVC) of 0.8 will obviously affect our perception of the motions of all of the bodies of the system in relation to the stars, creating the appearance of alternate acceleration and deceleration. In Chapter 24 we will see how Dayton Miller's interferometer experiments lend support to the MVC. In Chapter 25 we shall see how even the minuscule parallactic behaviour of our nearmost stars can be accounted for by Earth's slow progression around its PVP orbit, thus resolving the 'mystery' of the coexistence of positive and negative stellar parallaxes.

For now, what you'll need to envision and keep in mind is that Earth travels at snail pace (1.6 km/h) around the PVP orbit, like a huge merry-go-round in slow motion, giving the 'short-term impression' of moving in a straight line (it only curves by about 1.42° per century). It is this formerly unknown motion of the Earth-Moon system which gave Sir Isaac Newton so many headaches and sleepless nights.

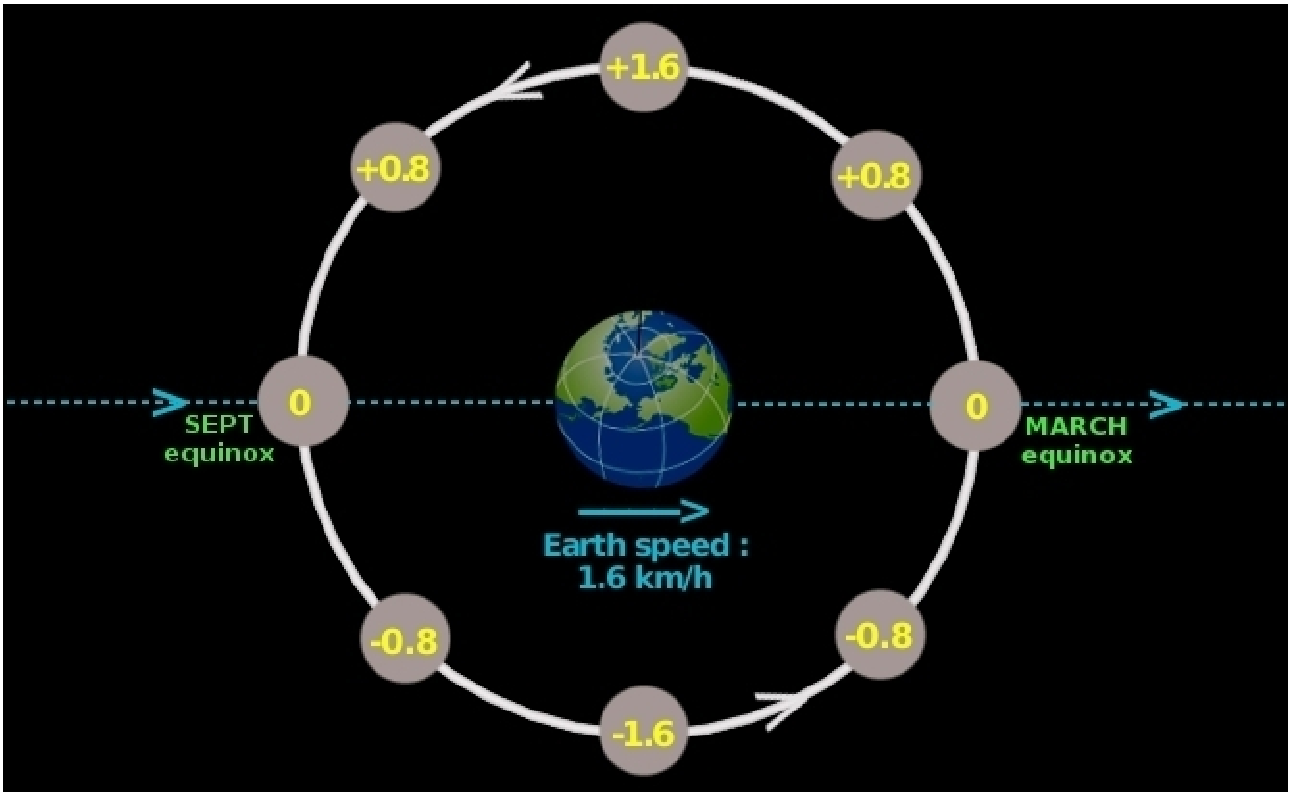


Fig. 14.9 This diagram illustrates why the Moon is observed to alternately accelerate and decelerate by a 0.8 coefficient as it revolves around Earth, which itself travels at ∼1.6 km/h. The Moon travels at constant speed, the true value of which can only be gauged from Earth whenever it transits at the equinoxes (at equal distances).

14.5 Is the Moon waving good-bye to Mother Earth?

Modern astronomers will tell you that the Moon recedes from Earth each year by a little less than 4 centimetres. We shall now see how the TYCHOS model can account for, and thus dismantle, the rather alarming notion that the Moon is slowly 'waving good-bye' to Mother Earth.

> *The Moon is gradually receding from the Earth, at a rate of about 4 cm per year. This is caused by a transfer of Earth's rotational momentum to the Moon's orbital momentum as tidal friction slows the Earth's rotation.* [10]

> *Although the moon's distance from earth varies each month because of its eccentric orbit, the moon's mean distance from Earth is nonetheless increasing at the rate of about 3.8 centimetres (1.5 inches) per year. That's about the rate that fingernails grow.* [11]

According to the TYCHOS, the Moon is not receding from Earth and is not going to vanish in space. As we shall now demonstrate, the Moon's annual '4-cm recession' is yet another illusory effect arising from astronomers' unawareness of the Earth's PVP orbit. Their computations related to the Moon's apsidal oscillations will thus always fail to account for the 'secular revolution' of the Earth-Moon system.

We know that the Moon cyclically approaches and recedes from the Earth. As we saw in Chapter 13, the Moon's orbit oscillates back and forth by 42108 km, a value we shall call the Moon's maximal apsidal oscillation (MMAO). So, could the secular drift of the MMAO along the TGY (25344 solar years) be responsible for what astronomers believe to be an annual '4-cm recession' of the Moon? Let us find out.

If we consider that the Earth-Moon system completes a full 360° revolution in 25344 years, we can envision how the MMAO—the spatial orientation of which remains 'fixed' to the Moon's orbit—will slowly revolve once in relation to the Earth in 25344 years. This makes it possible to calculate by how much the MMAO would appear to 'drift' annually, as viewed from the Earth and in relation to the stars:

- Actual amount of the MMAO's annual precession ≈ 1.66 km

$$\frac{42108}{25344} \approx 1.66$$

Now, astronomers will be using their grossly inflated star distances as a benchmark to gauge the fluctuating Moon-Earth distances since their instruments are calibrated according to heliocentric parameters. However, as will be thoroughly expounded in Chapter 23, the TYCHOS model stipulates that the stars are ~42633 times closer to us than currently believed:

- Amount of apparent annual lunar recession corrected by the TYCHOS reduction factor ≈ 0.0389 metres (3.89 cm)

$$\frac{1.66}{42633} \times 1000 \approx 0.0389$$

In conclusion, the Moon will not be parting with us anytime soon. What astronomers think is a slight annual '4-cm recession' is nothing but the slow 25344-year secular precession of the MMAO, given by the tranquil 1-mph motion of the Earth-Moon system around the PVP orbit. In our current epoch, the oscillation of the MMAO is evidently in its 'receding phase'. Over time though, there will be an 'approaching phase' which will reverse the apparent recession and bring things back to normal, in the good tradition of the wondrously stable and reliable 'Swiss clockwork' that is our Solar System.

14.6 References

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15

Asteroid belts and meteor showers

15.1 About the existence of the Main Asteroid Belt

In this chapter we shall see how the existence of the Main Asteroid Belt, the Kuiper Belt and the periodic meteor showers lends support to the notion of the Sun and Mars being binary companions. The Main Asteroid Belt is located in the celestial region between Mars and Jupiter. Fig. 15.1 shows how this is conventionally illustrated.

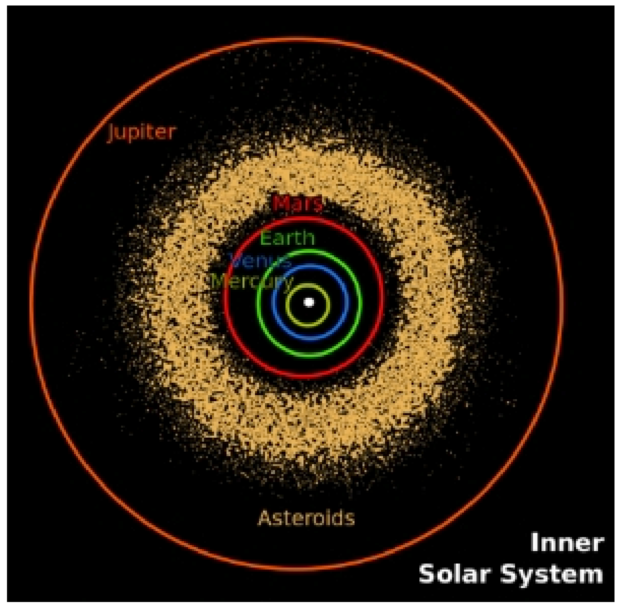

Fig. 15.1 A dense belt of dust and debris revolving between Mars and Jupiter, depicted according to the Copernican model. Image credit: NASA/JPL-Caltech/R. Hurt [1]

Over the centuries, many attempts have been made to explain why and how this belt of dust and debris came to be in the first place. One of the better-known theories posits that the asteroid belt consists of fragments of a large planet that occupied the Mars-Jupiter region many million years ago, before it was shattered by an internal explosion or a cometary impact. According to another theory, the hypothetical extra-Martian planet never actually formed:

> *Why does our solar system have an Asteroid Belt? One theory that astronomers have is that 4.6 billion years ago, when our solar system was being formed, a tenth planet tried to form between Mars and Jupiter. However, Jupiter's gravitational forces were too strong, so the material was unable to form a planet.* [2]

Clearly, these theories are mere vapid conjectures. What's more, they are diametrically opposed: the first speculates that a planet did form in that region and then exploded. The second contends that no planet could ever have formed there due to the gravitational forces of Jupiter. Both fall short of describing any plausible cause or mechanism that would account for the Main Asteroid Belt's formation, and the reason why it would have settled just outside of the orbit of Mars.

Well, here's the thing: asteroid belts are actually a component inherent in binary systems. They come into being as the wakes of dust and debris of the two companion bodies collide and get ejected in all directions, as illustrated in Fig. 15.2.

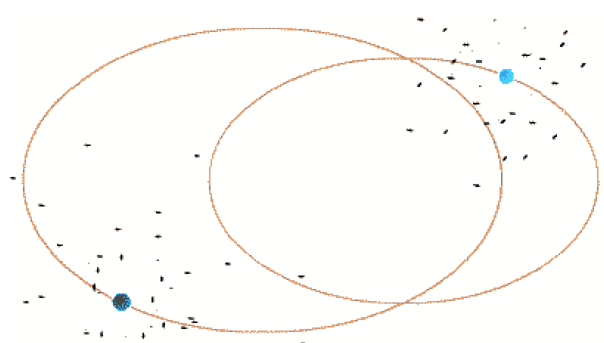

Fig. 15.2 Mechanism of asteroid belt formation. Image found on the website of the Binary Research Institute. To view an animated graphic, scan the QR code with a smart phone.

Now, do we have any evidence that Mars keeps ejecting dust particles into its orbital wake? Yes, indeed: a quite recent astronomy article (March 2021) reported that the so-called 'zodiacal light' may be caused by Martian dust storms. This mysterious light has long been believed to be sunlight reflecting off dust particles moving in the plane of the Solar System. Until the discovery in 2021, the particles were thought to derive from asteroids and comets. Here is a passage from an article at earthsky.org titled *"Do Mars dust storms cause the mysterious zodiacal light?"*:

> *Why are these scientists confident that Mars' dust is the source of the zodiacal light? Their statement explained: The researchers developed a computer model to predict the light reflected by the dust cloud, dispersed by gravitational interaction with Jupiter that scatters the dust into a thicker disk. The scattering depends only on two quantities: the dust inclination to the ecliptic and its orbital eccentricity. When the researchers plugged in the orbital elements of Mars, the distribution accurately predicted the tell-tale signature of the variation of zodiacal light near the ecliptic.*

As binary companions periodically cross paths along their intersecting orbits, fields of dust, particles and debris will be ejected and flung into a wider, circumbinary orbit. In the case of our Sun-Mars system, a structure like the Main Asteroid Belt is therefore expected to form just outside the orbit of Mars, in the celestial region between Mars and Jupiter. In fact, in later years, questions have been raised as to the apparent, yet unexpected, major role that 'tiny' Mars plays in the context of asteroids:

> *Oddly enough, tiny Mars - with only 14 percent of Jupiter's gravity - played a major role in explaining the Earth-crossing asteroids, although as Morbidelli acknowledges, "It may be astounding that Mars is so effective in stimulating chaos in the belt, because it is not massive. Did somebody say 'chaos'? The Why Files is interested [...] Essentially 'chaos' means that small perturbations—astronomese for 'disturbances'— can cause large changes in orbits. Indeed, the improved simulation produced an inner asteroid belt that "is almost entirely chaotic", Morbidelli says.* [3]

Since asteroid belts consist of very small dust particles, they can be very difficult to detect. Nonetheless, more and more so-called 'debris discs' are being discovered and, sure enough, virtually all of them are being found around binary systems suspected of containing one or more planets. Most notably, circumbinary debris discs have been observed around systems such as Fomalhaut, Vega, Tau Ceti, Epsilon Eridani, Beta Pictoris and Copernicus (55 Cancri), all of which rank high on the lists of 'exoplanet hunters' (modern-day astronomers specializing in the detection of potentially habitable planets outside our Solar System).

Fig. 15.3 'Debris disc' around a binary system. [4]

The discovery of an asteroid belt-like band of debris around Vega makes the star similar to another observed star called Fomalhaut. The data are consistent with both stars having inner warm belts and outer cool belts separated by a gap. This architecture is similar to the asteroid and Kuiper belts in our solar system. The gap between the inner and outer debris belts for Vega and Fomalhaut also proportionally corresponds to the distance between our Sun's asteroid and Kuiper belts. This distance works out to a ratio of about 1:10 with the outer belt 10 times farther away from its host star than the inner belt. As for the large gap between the two belts, it is likely there are several undetected planets, Jupiter-sized or smaller, creating a dust-free zone between the two belts. [5]

In other words, today we have empirical evidence of binary systems surrounded by both an inner and an outer asteroid belt, very much like the Main Asteroid Belt and the Kuiper Belt of our own system. Even the proportional distance (1:10) between the two closest and farthest asteroid belts observed in other binary star systems appear to be similar to that of our own Solar System. How much more evidence is needed for astronomers to start entertaining the idea that we live in a binary system?

For what it's worth, mainstream astronomers favour the hypothesis that water was brought to Earth by asteroids. No one really knows, but it is fascinating to read what is currently being hypothesized:

Follow the water: More and more research suggests that asteroids delivered at least some of Earth's water. Scientists can track the origin of Earth's water by looking at the ratio of two isotopes of hydrogen, or versions of hydrogen with a different number of neutrons, that occur in nature. One is ordinary hydrogen, which has just a proton in the nucleus, and the other is deuterium, also known as 'heavy' hydrogen, which has a proton and a neutron. The ratio of deuterium to hydrogen in Earth's oceans seems to closely match that of asteroids, which are often rich in water and other elements such as carbon nitrogen, rather than comets (whereas asteroids are small rocky bodies that orbit the sun, comets are icy bodies sometimes called dirty snowballs that release gas and dust and are thought to be leftovers from the solar system's formation). Scientists have also discovered opals in meteorites that originated among asteroids (they are likely pieces knocked off of asteroids). Since opals need water to form, this finding was another indication of water coming from space rocks. These two pieces of evidence would favor an asteroid origin. [6]

Ironically, the computer simulations rendered by exoplanet-hunting astrophysicists in order to assess the probability of the presence of water on planets in the 'habitable zone' of any given star system suggest that binary systems have a far higher probability (of several orders of magnitude) of containing planets harbouring liquid water. In a single-star system, as that proposed by the Copernican model, there would be far less instability and fewer perturbations causing asteroids to be flung off course, making the delivery of 'asteroid water' to any given planet an unlikely event.

Of course, this leaves the question of whether water transport via asteroids is a viable mechanism for supplying a single star planet system (like our own Earth) with liquid water. There are currently still several competing hypotheses as to how our planet obtained its water supply, but these sorts of simulations should shed light on the feasibility of water transport through impacting bodies. [7]

If these academic studies are anything to go by—and if Earth were part of a single-star system—it follows that the probability of water existing on our planet would be extremely low. Yet, about 71% of the Earth's surface is drenched in water!

In conclusion, asteroid belts are now understood to be a distinctive feature of binary systems. Moreover, the existence of the Main Asteroid Belt just beyond the orbit of Mars appears to corroborate a fundamental premise of the TYCHOS model, as determined by Tycho Brahe over 400 years ago, namely that the orbit of Mars intersects the orbit of the Sun.

15.2 The meteor showers and the Sun-Mars orbits

There's probably no more fascinating celestial spectacle than the so-called shooting stars, as most of us have had the opportunity to witness. Amateur astronomers know where and when to look for even more spectacular events known as meteor showers. These events, which can last for a couple of days or up to several weeks, occur on a regular, annual basis in various parts of our skies and, quite reliably, in the same periods of the year. Most people will have heard of the largest known meteor showers, such as the Geminids, the Perseids, the Orionids and the Aquariids, all of which are named after the constellations or 'radiant points' from which they appear to originate.

But why do these meteor showers occur year after year around the same dates and appear to originate from almost the exact same celestial location? This is, in fact, an excellent question. Astronomers will tell you that these meteor showers occur every year as the Earth crosses the path of comets which leave debris behind. The problem with this theory is that none of our known comets return every single year. Halley's comet, for instance, whose trail is believed to be responsible for two major annual meteor showers, returns only every 76 years or so. So we are actually meant to believe that the dust trails left by Halley's comet somehow linger for decades on end along given tracts of space impacted annually by Earth, causing fairly similar meteor showers every single year.

I trust that anyone can sense the absurdity of the current justification for the annual recurrence of the various meteor showers. Surely, the fact that they occur each year over the same area of our skies must have a better and less fanciful explanation. What follows is a detailed, illustrated demonstration of how the TYCHOS can account for these recurring events. Let me outline the current understanding of the nature of meteor showers by reproducing a few excerpts from the Wikipedia:

> *The actual nature of meteors was still debated during the 19th century. Meteors were conceived as an atmospheric phenomenon by many scientists (Alexander von Humboldt, Adolphe Quetelet, Julius Schmidt) until the Italian astronomer Giovanni Schiaparelli ascertained the relation between meteors and comets in his work 'Notes upon the astronomical theory of the falling stars' (1867). A meteor shower is a celestial event in which a number of meteors are observed to radiate, or originate, from one point in the night sky. These meteors are caused by streams of cosmic debris called meteoroids entering Earth's atmosphere at extremely high speeds on parallel trajectories. Most meteors are smaller than a grain of sand, so almost all of them disintegrate and never hit the Earth's surface. A meteor shower is the result of an interaction between a planet, such as Earth, and streams of debris from a comet. Comets can produce debris by water vapor drag, as demonstrated by Fred Whipple in 1951, and by breakup.* [8]

Fig. 15.4 Radiant point of meteor shower.

In other words, meteor showers are currently assumed to happen when Earth, hurtling around the Sun at 30 km/s, crosses streams of debris left over from comets which periodically visit our Solar System. However, there are a number of problems with this theory:

1. Comets which enter our Solar System rarely, if ever, stray right across (i.e., intersect with) Earth's orbital plane (regardless of which Solar System model is considered). Cometary orbits are almost invariably tilted in relation to Earth's orbital plane and very few, if any, pass right through Earth's celestial path. That is, most comets (which tend to be no larger than a few kilometres) pass either 'above' or 'below' the ecliptic and would thus be unlikely to leave any significant amount of debris for Earth to collide with.

2. Even if some comets intersected Earth's orbit, it would take no longer than a few minutes at most for Earth to pass through the trail of debris, considering its alleged speed of 30 km/s. How then can large meteor showers last for several days or even weeks?

3. Comets have vastly different periods (e.g., 76 years for Halley's comet and 3.3 years for Comet Encke). Indeed, the famous Perseid meteor shower is believed to be caused by the debris left behind by the Swift-Tuttle comet which has a period of no less than 133 years. How could this possibly explain the annual recurrence of the major meteor showers and their fairly regular intensities and durations? Is this cometary debris supposed to linger for years, decades or even centuries on end in the same area of the sky?

The working hypothesis of the TYCHOS model is quite simple: the major meteor showers are caused by the tiny particles continuously shed by the Sun and Mars along their orbital paths. As their slightly (mutually) inclined orbits occasionally intersect in both right ascension (RA) and declination (DECL), the dust trails of these binary companions will collide, sending 'meteorites' in all directions, both 'outwards' (towards the Main Asteroid Belt) and 'inwards' (towards the Earth). In any event, there appears to be ample evidence that several types of meteorites are of Martian origin:

> *The proof of their Martian origin appears to be almost absolutely conclusive, based on the chemical signatures of gases [...]* [9]

The following sections show what the meteor showers known as the Gemenids, the Perseids, the Orionids and the Aquariids would look like in the TYCHOS model, using animations made with sequential screenshots from the Tychosium 3D simulator.

As we shall see, the intersecting orbits of the Sun and Mars actually do have some consequences, namely the recurring spectacles of meteor showers observed at regular, annual intervals around the world.

15.2.1 The Gemenid meteor shower

The famous Gemenid meteor shower recurs every year roughly between December 4th and December 17th, peaking on December 14th. The observed radiant point of this shower is located around 7h30min of RA. According to the Wikipedia, the average speed of the Gemenid meteors is 35 km/s. This means that, since the collision between the Sun's and Mars' orbital debris occurs at a distance of 1 AU ($\sim$150 million km), the Gemenid meteors take about 7 weeks to reach Earth's atmosphere. Hence, we should expect the impact to take place in the last days of October and the shower to occur in mid-December. And, in fact...

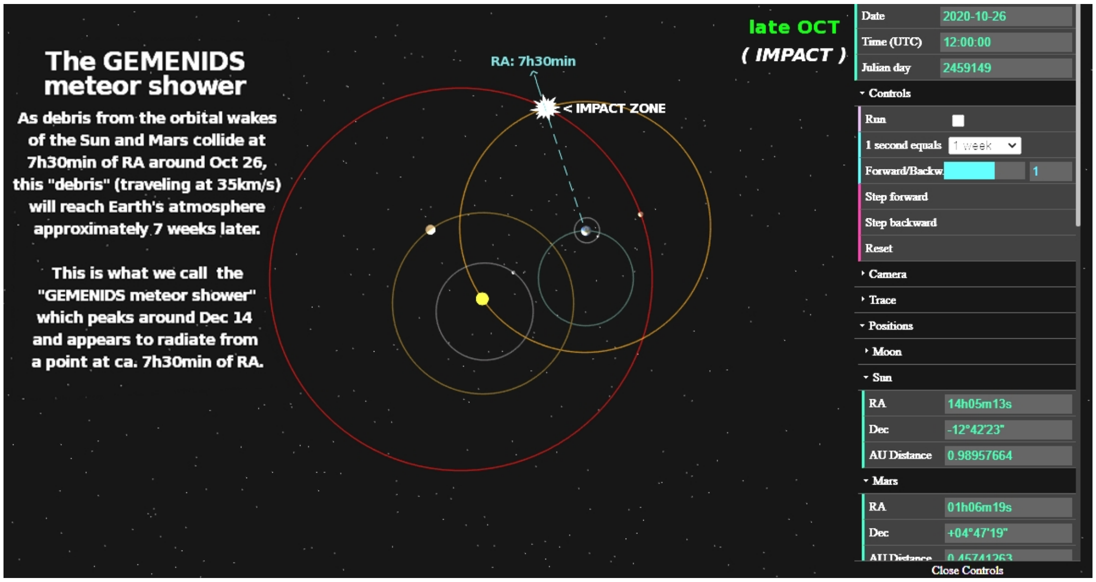

Fig. 15.5 Genesis of the Gemenid meteor shower. To animate the graphic, scan the QR code with a smart phone.

15.2.2 The Perseid meteor shower

The well-known Perseid meteor shower recurs every year roughly between July 17th and August 24th, peaking on August 12th. The radiant point of this shower is located around 3 h of RA. According to the Wikipedia, the average speed of the Perseid meteors is 58 km/s. This means that, if the collision between the Sun's and Mars' orbital debris occurs at a distance of 1 AU, the Perseid meteors will reach Earth's atmosphere after about 4 weeks. Hence, we should expect the impact to take place in the last days of July and the shower to become visible around mid-August. And, in fact…

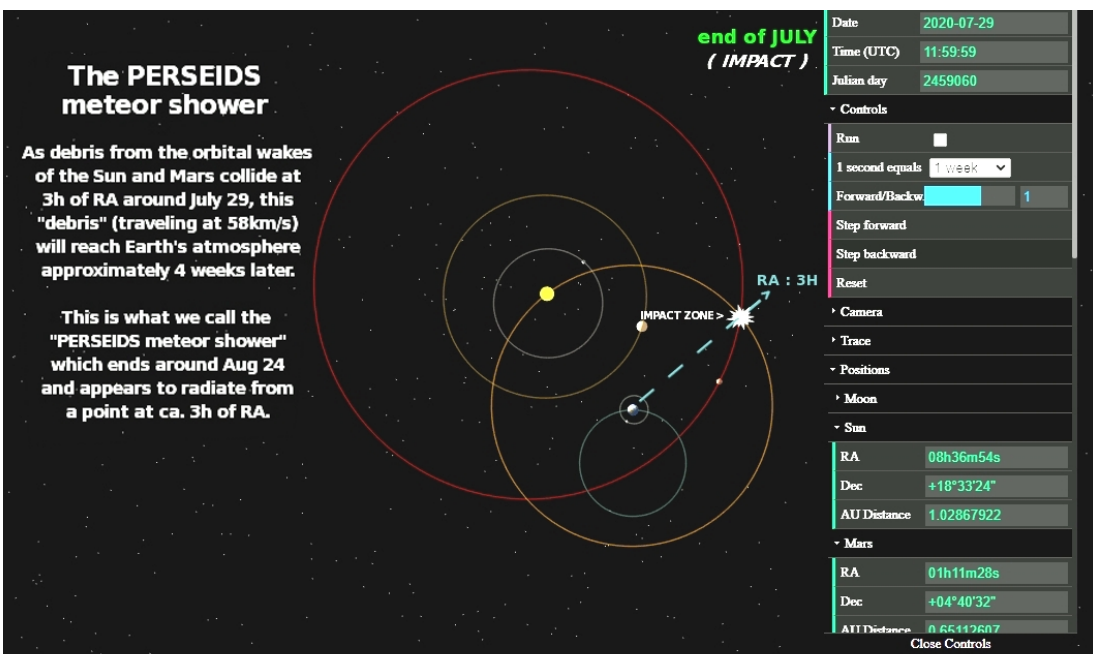

Fig. 15.6 Genesis of the Perseid meteor shower. To animate the graphic, scan the QR code with a smart phone.

15.2.3 The Orionid meteor shower

The Orionid meteor shower recurs every year roughly between October 2nd and November 7th, peaking on October 21st. The observed radiant point of this shower is located around 6h24min of RA. According to the Wikipedia, the average speed of the Orionid meteors is 67 km/s. This means that, if the impact between the

Sun's and Mars' orbital wakes occurs at the distance of 1 AU, the Orionid meteors will employ about 3.7 weeks to reach Earth's atmosphere. Hence, we should expect the impact to take place in early October and the shower to occur at the end of October. And, in fact...

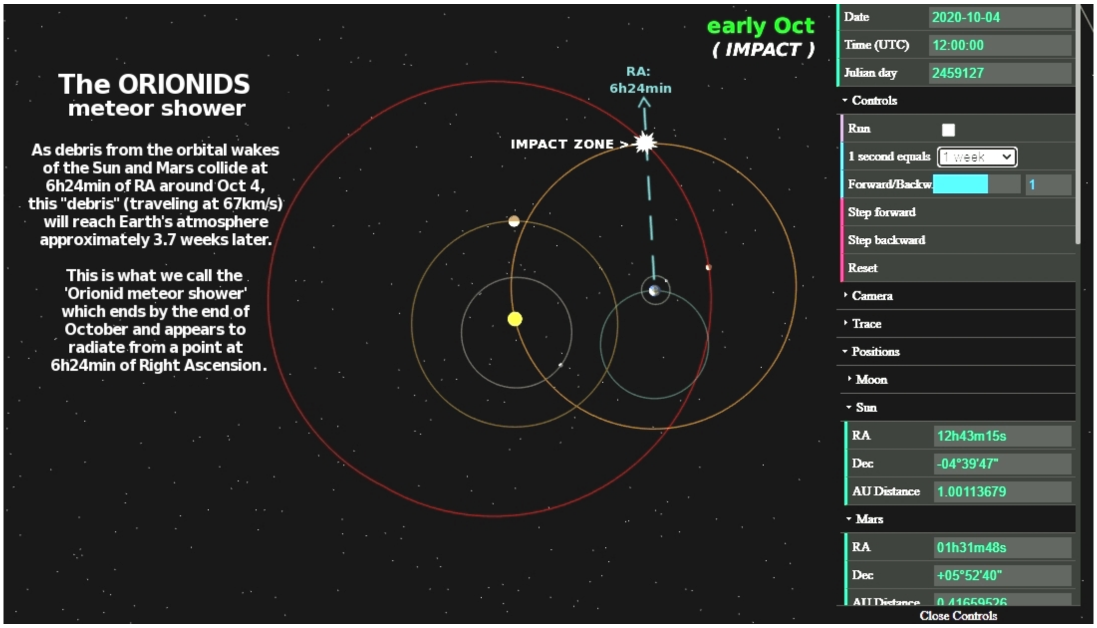

Fig. 15.7 Genesis of the Orionid meteor shower. To animate the graphic, scan the QR code with a smart phone.

15.2.4 The Delta Aquariid meteor shower

The beautiful Delta Aquariid meteor shower recurs every year roughly between July 12th and August 23rd, peaking on July 30th. The radiant point of this shower is located around 23h20min of RA. According to the Wikipedia, the average speed of the Delta Aquariid meteors is 41 km/s. This means that, if the impact between the Sun's and Mars' orbital wakes occurs at the distance of 1 AU, the Aquariid meteors will need about 6 weeks to reach Earth's atmosphere. Hence, we should expect the impact to take place in mid-June and the shower to occur at the end of July. And, in fact...

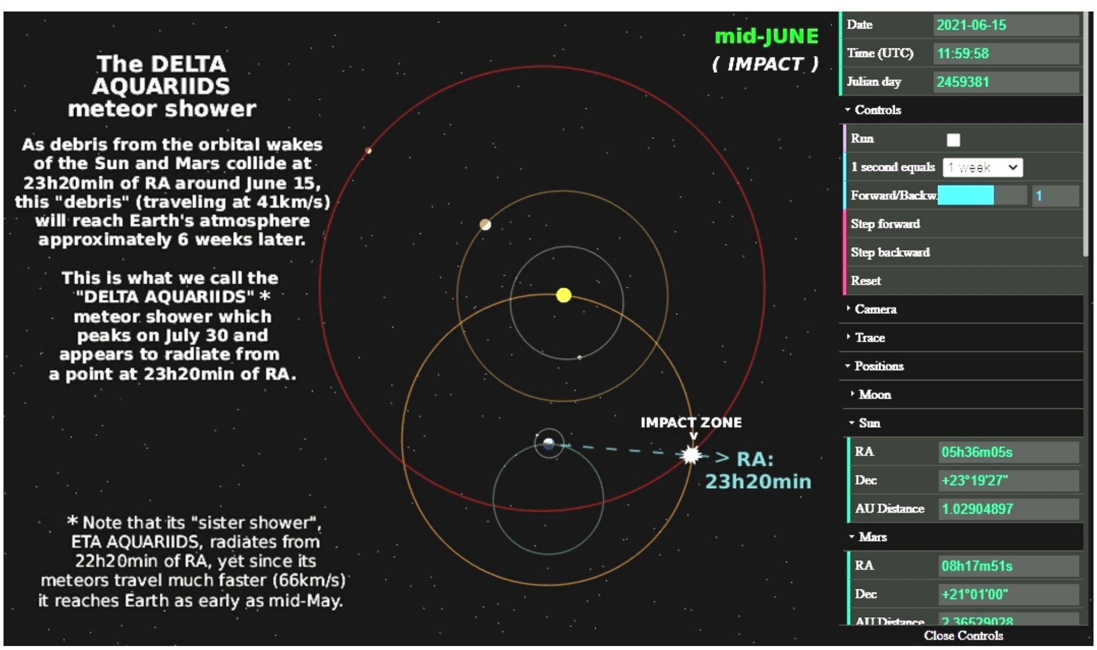

Fig. 15.8 Genesis of the Delta Aquariid meteor shower. To animate the graphic, scan the QR code with a smart phone.

15.2.5 Conclusion

You may now rightly wonder if those impact periods coincide with the actual intersections of the orbits of the Sun and Mars in both longitude and latitude. The answer to that most important question is 'yes'. For instance, the annual impact zone of the Solar and Martian orbits responsible for the Perseid meteor shower is located at about 3h of RA and 15° of DECL, at a point in space where the orbits of the Sun and Mars intersect, as shown by the Tychosium 3D simulator.

In conclusion, I would submit that the TYCHOS model's hypothesis for the occurrence of our major meteor showers holds water in terms of plausibility, logic and empirical observation—something that cannot be said for the current mainstream theories. Let us not forget that no comets are known to transit in our skies on a yearly basis and, thus, it makes little sense that week-long meteor showers would be caused by Earth annually scooting through tiny wakes of lingering cometary dust.

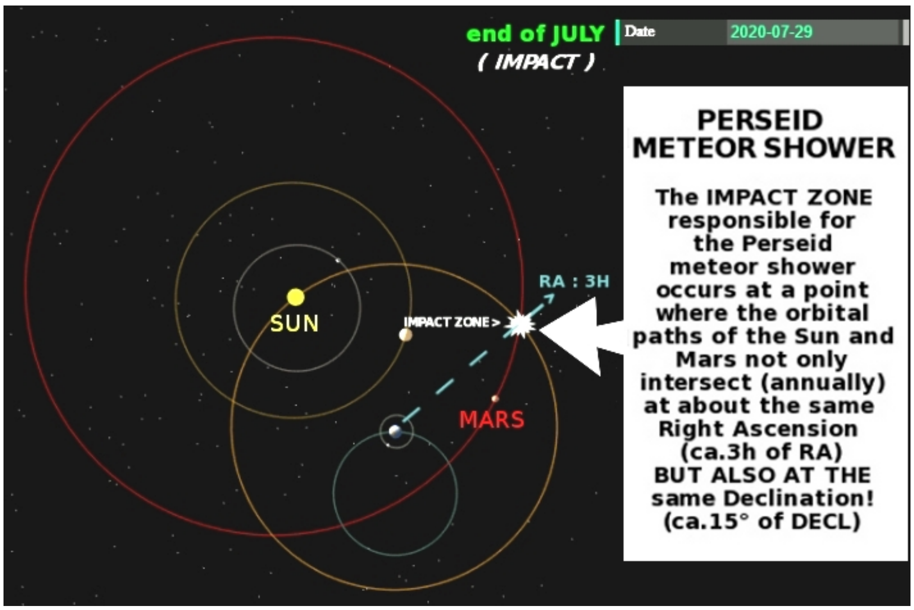

Fig. 15.9

15.3 Are Mars meteors correlated with red rain?

As a speculative addendum to this chapter and a suggestion for further study, let us take a quick look at the possible connection between 'Martian meteor dust' and the controversial phenomenon known as 'red rain'. Before moving on, keep in mind that—for what it's worth—at least some meteorites have been shown to possess a chemical composition consistent with the elements believed to be found on Mars.

> *It has for some time been accepted by the scientific community that a group of meteorites came from Mars. As such, they represent actual samples of the planet and have been analysed on Earth by the best equipment available. In these meteorites, called SNCs, many important elements have been detected. Magnesium, Aluminium, Titanium, Iron, and Chromium are relatively common in them. In addition, lithium, cobalt, nickel, copper, zinc, niobium, molybdenum, lanthanum, europium, tungsten, and gold have been found in trace amounts.* [10]

Red rain (or 'blood rain' as it was called in Antiquity) is a hotly debated phenomenon which still lacks a satisfactory explanation, even though the Wikipedia boldly proclaims that there is now a scientific consensus that the blood rain phenomenon is caused by aerial spores of green microalgae of the species *Trentepohlia annulata*. However, and as admitted by its very proponents, this theory lacks any rational explanation for the uptake (or 'evaporation') of these terrestrial algae into the clouds.

Red rain downpours can in some cases last for several weeks, much like the famous meteor showers treated in this chapter. For instance, a number of red rain showers took place between 2001 and 2012 in India and Sri

Lanka, some of them following suspected and/or subsequently confirmed meteor airburst events. Samples of red rain were analysed for their chemical composition by the Centre for Earth Science Studies (CESS):

> *Some water samples were taken to the Centre for Earth Science Studies (CESS) in India, where they separated the suspended particles by filtration. Sediment (red particles plus debris) was collected and analysed by the CESS using a combination of ion-coupled plasma mass spectrometry, atomic absorption spectrometry and wet chemical methods. The major elements found were Carbon, Silicon, Calcium, Aluminium and Iron. The CESS analysis also showed significant amounts of heavy metals, including nickel (43 ppm), manganese (59 ppm), titanium (321 ppm), chromium (67ppm) and copper (55 ppm).*

The chemical composition found in red rain appears to be fairly consistent with that found in Martian meteorites, but this is where my own musings on this particular subject will end. I will leave you with the abstract of a rather intriguing study published in 2003 by Godfrey Louis and Santhosh Kumar of the Mahatma Gandhi University:

> *Red coloured rain occurred in many places of Kerala in India during July to September 2001 due to the mixing of huge quantity of microscopic red cells in the rainwater. Considering its correlation with a meteor airburst event, this phenomenon raised an extraordinary question whether the cells are extraterrestrial. Here we show how the observed features of the red rain phenomenon can be explained by considering the fragmentation and atmospheric disintegration of a fragile cometary body that presumably contains a dense collection of red cells. Slow settling of cells in the stratosphere explains the continuation of the phenomenon for two months. The red cells under study appear to be the resting spores of an extremophilic microorganism. Possible presence of these cells in the interstellar clouds is speculated from its similarity in UV absorption with the 217.5 nm UV extinction feature of interstellar clouds.* [11]

Then there is of course Prof. Chandra Wickramasinghe's thought-provoking Panspermia Theory, but disquisitions about how life arose on this planet are, as you may appreciate, well beyond the scope of this book. In my humble view, we ought to focus our efforts on getting the configuration of the Solar System right, before engaging in ambitious Promethean quests to unravel the origins of terrestrial life and the inception of the universe.

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16

Our cosmic clockwork and the '16 factor'

16.1 The Antikythera orrery

This first section of Chapter 16 is admittedly somewhat speculative, though no less relevant for that matter. To the likely satisfaction of horologists and aficionados of mechanical contrivances, we will take a fresh look at the wondrous Antikythera mechanism, an ancient orrery retrieved in one lump from a shipwreck off the coast of the Greek island Antikythera in 1901.

> *The Antikythera mechanism is remarkable for the level of miniaturisation and the complexity of its parts, which is comparable to that of fourteenth-century astronomical clocks [...]. There is much debate as to whether the mechanism had indicators for all five of the planets known to the ancient Greeks. No gearing for such a planetary display survives.* [1]

The mechanism is generally presumed to be missing a number of gears although no one can figure out how so many hypothetical parts could possibly have fitted into such a thin casing. But what if there were no missing parts? What if the gears and cogs found in the mechanism were enough for it to do its job?

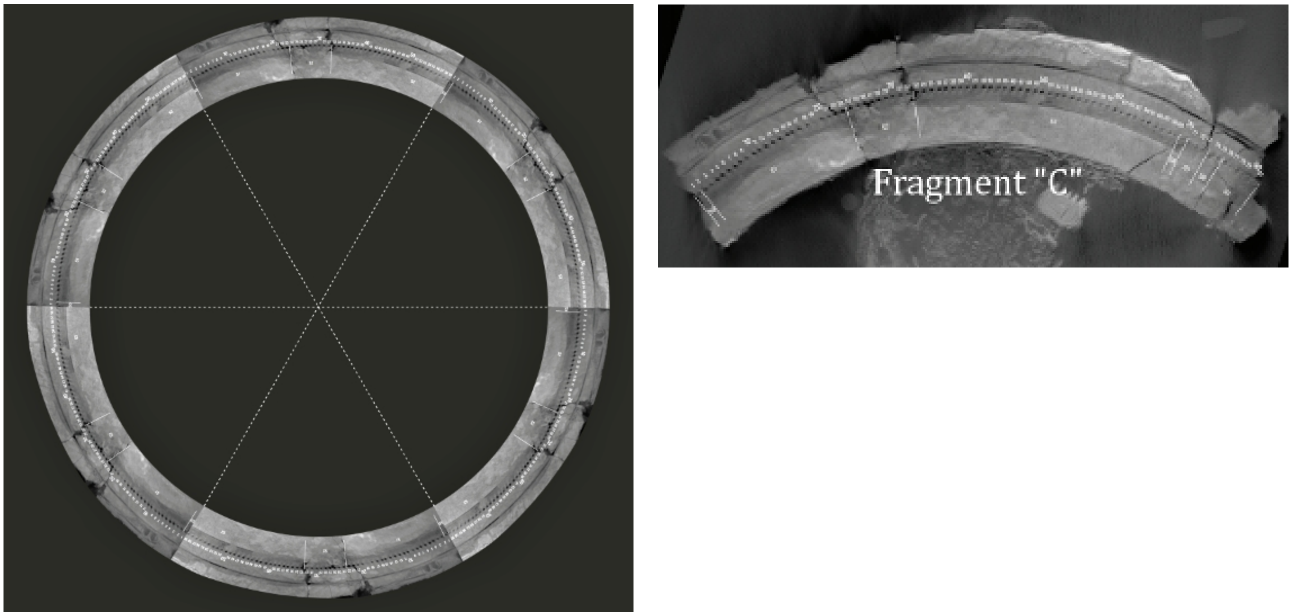
It has been suggested in later years that the Antikythera mechanism is based on a lunar calendar (354 days) rather than a solar calendar (365 days). That is at least the conclusion of a recent study (2020) published by the British Horological Institute:

> *The physical evidence does not support the mechanism having a 365-division calendar ring. Therefore, we must set aside the notion that the front dial calendar ring of the Antikythera mechanism is a representation of the so-called 365-day Egyptian civil calendar [...]. Based on the significant finding for 354 holes matching the extant inter-hole distance, the confirmation of others' measurements, and our own measurements of the calendar and Zodiac rings' markings, we interpret 354 divisions as the most likely of these two division candidates and propose that the front dial calendar ring of the Antikythera Mechanism is a 354 day lunar calendar. [...] In Part 1 of this article, we presented the finding that data we recorded from high resolution computed tomography (CT) images of Fragment C of the Antikythera Mechanism do not support the mechanism having a 365-division front dial calendar ring, and instead the evidence suggests the most likely number of divisions of this feature is 354.* [2]

This is interesting since the TYCHOS model suggests that the Moon plays a central 'arithmetic' or even 'mechanical' role in our Solar System. We saw in Chapter 13 that all our planets' orbital periods are 'round' multiples of the Moon's TMSP of 29.22 days. If the Greek astronomer who engineered the amazing Antikythera orrery was aware of these orbital resonances, the mechanism may have been much less complex than currently assumed.

I spent some time to personally verify the hypothesis of the British Horological Institute, using an image editing program. To do so, I selected a 59-hole section of Fragment C (the largest and most important fragment of the orrery), then 'stitched together' 6 copies of the same into a 360° ring featuring 354 equidistant holes (59×6).

The tentative graphic reconstruction of Fragment C shown in Fig. 16.1 would seem to confirm the 354-day division of the front dial calendar ring, supporting the notion that the Antikythera mechanism was indeed based on a lunar calendar. Seen in light of the discoveries flowing from the TYCHOS model, could it be that the 35 surviving gears and seven displays of the mechanism were sufficient to replicate the motions of all our Solar System's bodies?



(a) *(b)*

Fig. 16.1 ***(a)*** This composite was made using a 59-hole cut-out of ***(b)*** Fragment C, the largest extant piece of the Antikythera's front dial calendar ring. Six copies were assembled to form an exact 360° ring with a total of 354 holes.

This is evidence showing that the ancients were well aware of the central role of the Moon in our Solar System—just as proposed in the TYCHOS model—where the Moon is shown to act as the central driveshaft of our Sun-Mars binary pair and of all the planets orbiting around the Earth-Moon system.

For more details on the Antikythera mechanism, I recommend watching Chris Ramsay's fine video *"The Antikythera Mechanism Episode 10 - Evidence Of A Lunar Calendar"* [3].

16.2 The ubiquitous '16 factor'

Another 'horological aspect' of our Solar System is the curious '16 factor' which underlies the empirically observed orbital periodicities of many if not all of its components. To better understand how this '16 factor' fits into the greater picture, a brief recap of the information given in Chapter 13 is in order:

Table 16.1 –

The resonant periods of our inner solar system's bodies over a 16-year time span.

Sun	365.25	days	→	16	revolutions in 5844 days
Mars	730.5	days	→	8	revolutions in 5844 days
Venus	584.4	days	→	10	synodic periods in 5844 days
Mercury	116.88	days	→	50	synodic periods in 5844 days
Moon	29.22	days	→	200	synodic periods in 5844 days

Common sense is at the root of all science. So, while common sense may not constitute 'proof' in the strictly empirical sense, no theory or model should ever relegate common sense to the back seat. This is precisely what Copernicanism has done by positing that the Earth-Moon system is revolving around the Sun at hypersonic speed, like any other random object, despite the fact that all the components of the system are geared to the Moon's TMSP, as viewed and computed from Earth. In contrast, if the Earth-Moon system is located at the centre of our system, as posited by the TYCHOS model, the existence of such 'resonances' and 'multipliers' becomes a considerably less mysterious affair.

Fig. 16.2 plots the relative orbital periods of the Sun, Mars, Mercury, Venus and the Moon over a 16-year time span. As we have already pointed out, the orbital periods of our system's celestial bodies are all near-exact multiples of the Moon's TMSP of 29.22 days.

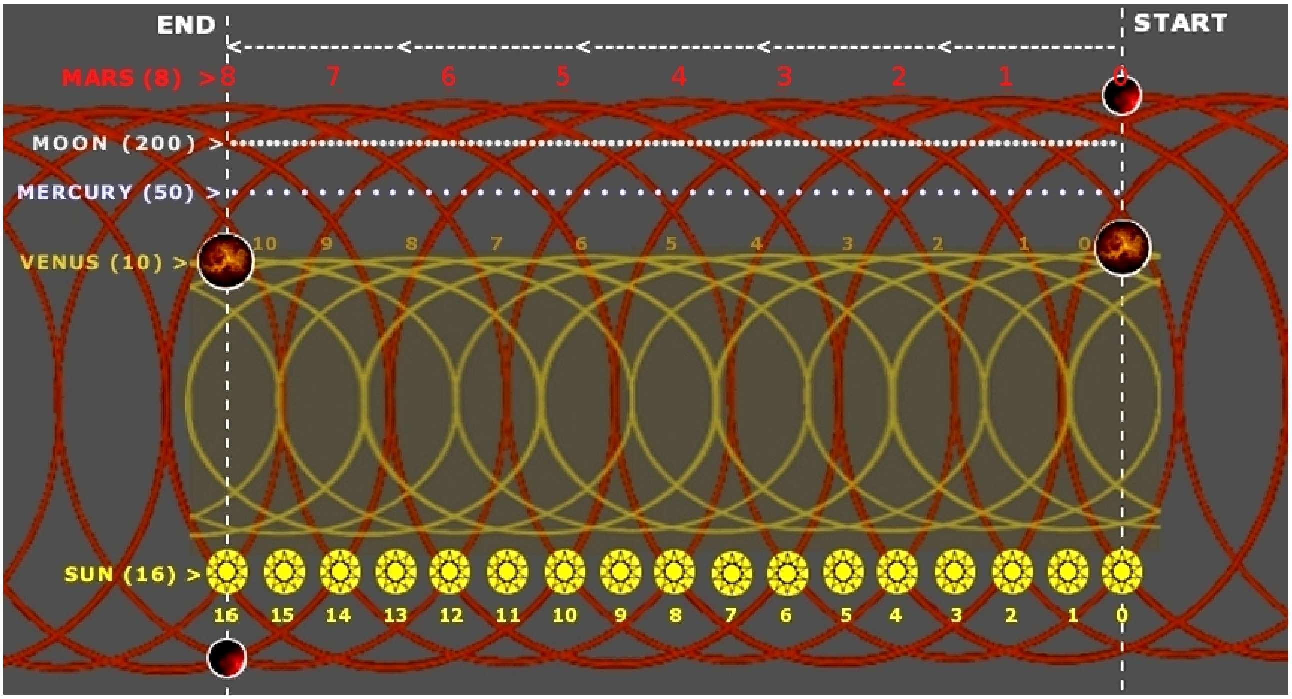


Fig. 16.2 Conceptual diagram illustrating the relative orbital ratios of the celestial bodies in our 'cosmic clockwork' over a period of 16 years or 5844 days (not actual planetary motions or trajectories).

Occurrences in relation to the '16 factor'

The following list of occurrences of the '16 factor' in our Solar System is by no means exhaustive:

- Mars completes a full apogee-to-perigee cycle in ~16 years.
- As Mars completes one of its orbits, it processes by about 1/16 of a solar year (~22.828 days).
- Venus and Mars reconjunct roughly every 16 years on either side of Earth.
- Mercury retrogrades for an average period of 1/16 of a solar year (~22.828 days).
- The Moon's Saros cycle of 6585.3211 days is nearly equal to 16 moon cycles of 411.78433 days.
- The well-known 405500-year eccentricity cycle amounts to 16 × 25344 years (see section 16.4).
- The Sun's orbital speed (107226 km/h) is ~16 times its equatorial rotational speed (6675 km/h).
- The Sun has a distinct, 'partial' 11-year cycle which 'comes full circle' in 176 years (11 × 16).

By now, astronomers should be asking themselves why there are so many indications in the Solar System of clockwork-like harmony and interconnectedness. For the record, I have no pretence of proposing a 'Theory of Everything' or of unravelling the 'celestial mechanics' governing our cosmos. Yet, I do hope the TYCHOS model will encourage more researchers to entertain the prospect that celestial bodies are governed by electromagnetic rather than gravitational forces. In the realm of magnetism, opposites attract and likes repel; interestingly, the same phenomenon is observed in water vortexes spinning in opposite or similar directions, as demonstrated experimentally in a recent video (2020) by Fractal Woman titled *"What is magnetism?"* [4].

Several years ago, while musing over the possible electromagnetic nature of our Solar System, I composed the conceptual graphic shown in Fig. 16.3. Needless to say, the two cogs are merely schematic elements—although, let us not forget, the wondrous Antikythera mechanism was actually put together with cogs and gears.

The big cog may represent the combined magnetic fields of the Sun and Mars, exerting a balanced 'counter-torque' on the barycentric cog (Earth's own magnetic field of opposite polarity), thereby causing our entire system to slowly rotate 'clockwise' around itself once every 25344 years.

In the early days of my TYCHOS research, the idea of a clockwise motion of our planet caused me much perplexity. At the time, I thought no such 'retrograde' orbits had ever been observed.

However, in recent decades, astronomers hunting for Earth-like exoplanets have discovered numerous orbs nestled within binary systems exhibiting retrograde orbits, meaning they revolve in the opposite direction of their host star:

> *Astronomers have discovered nine new transiting exoplanets. Surprisingly, six out of a larger sample of 27 were found to be orbiting in the opposite direction to the rotation of their host star—the exact reverse of what is seen in our own solar system. The new results really challenge the conventional wisdom that planets should always orbit in the same direction as their stars spin, says Andrew Cameron of the University of St Andrews, who presented the new results at the RAS National Astronomy Meeting (NAM2010) in Glasgow this week.* [5]

These discoveries led the scientific community to a massive rethink of their models of planetary formation:

> *In just two decades, we have gone from knowing one planetary system (our own) to thousands, with 3268 exoplanets now known. This has driven a massive rethink of our models of planetary formation. [...] Then came another set of shocking discoveries. Rather than moving in the same plane as their host star's equator, some Hot Jupiters turned out to have highly tilted orbits. Some even move on retrograde orbits, in the opposite direction to their star's rotation.* [6]

Thus, Earth's 'retrograde' (clockwise) orbital motion, as posited by the TYCHOS model, is neither improbable nor exceptional, since several other systems have been empirically observed to have bodies revolving in the opposite direction of their host stars.

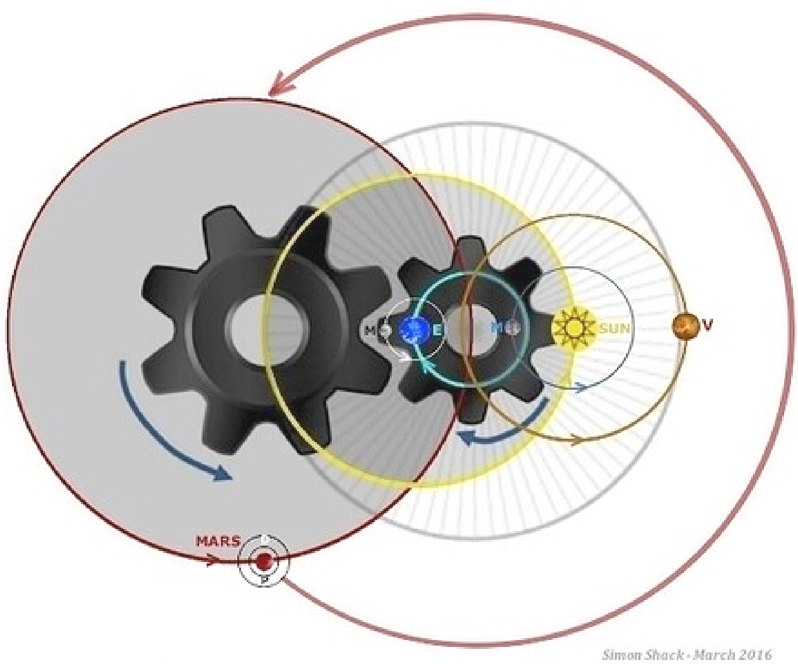


Fig. 16.3 The 'electromechanics' of the TYCHOS system.

The 16-speed gearbox

In 16 years...

- Earth completes 5844 revolutions around its axis.
- The Sun completes 16 orbits.
- Mars completes 1 of its 16-year cycles.
- Venus completes 10 orbits and 2 of its 8-year cycles (and 16 revolutions around Earth).
- Mercury completes 50 orbits (and 16 revolutions around Earth).
- The Moon completes 200 orbits (and one Saros eclipse cycle every 16 full Moon cycles).

16.3 The Sun's 176-year cycle

According to scientists specializing in the study of the Sun, our star exhibits a short period of solar activity of 11 years and a longer one of 176 years. The latter is a well-known cycle discussed in numerous academic papers on the Sun's 'cyclic behaviour' and its effects on our earthly lives.

Interestingly, we see that 176 years amounts to 16 $\times$ 11 years. Once more, the '16 factor' pops up, this time in relation to solar activity. Also note that 176 years is exactly 1/12 of 2112 years, which in turn is exactly 1/12 of the TYCHOS Great Year (25344 years). It really looks like we are on to something here. But there's more.

> In a number of papers by Bonov (1957 and so on) a cycle of 176-year length (16 11-year cycles) was studied. It manifests itself in variations of a number of 11-year cycle pair characteristics: the length ratio even–odd, the sum of the ascending branch length etc. Bonov (1973) comes to the conclusion that such a cycle must begin from an even–odd pair and at the borders of it the solar activity level falls unevenly. Vertlib and Kuklin (1971c) studying the neighboring cycle pair links found the 176-year period also.

Fig. 16.4 Extract from *Basic Mechanisms of Solar Activity* by V. Bumba and J. Kleczek (1976)

16.4 The TYCHOS and the 405-kiloyear cycle

> *The 405,000-year cycle is the most regular astronomical pattern linked to the Earth's annual turn around the sun.* [7]

Few people have ever heard of this Earth-Sun cycle of 405000 years (405 kyr), but it is well known by scientists studying our planet's secular cycles, be they astronomers, geologists or dendrochronologists. The 405-kyr cycle is today considered a significant 'yardstick' which appears to regulate a number of distinct, long-term patterns in various fields of geoscience, including climatology:

> *"The climate cycles are directly related to how the Earth orbits the sun and slight variations in sunlight reaching Earth lead to climate and ecological changes", said Kent, who studies Earth's magnetic field. "The Earth's orbit changes from close to perfectly circular to about 5 percent elongated especially every 405,000 years [...]. The results showed that the 405,000-year cycle is the most regular astronomical pattern linked to the Earth's annual turn around the sun", he said.* [8]

This curious cycle of around 405000 (±500) years is a hotly debated topic within geochronology circles, as it is held to be a particularly accurate and reliable 'geologic metronome' of sorts, although the reasons for its existence remain unclear. Various hypotheses have been put forth, yet no firm consensus has been reached as to the causes of its peculiar duration.

> *Milankovitch cycles identified in sedimentary successions are being used to formulate an 'Astronomical Time Scale' (ATS) for the geologic record, with efforts well underway for the Cenozoic and Mesozoic eras. Back through time, however, ATS resolving power declines due to uncertainties in the orbital solutions and Earth precession model. Prior to 50 Ma, only the modeled 405-kyr orbital eccentricity cycle retains high accuracy, leading to the idea for a '405-kyr metronome' to define the ATS for all geologic time.* [9]

> *Only a few modeled planetary motions are stable enough for use as a metronome, for example, the 405-kyr orbital eccentricity cycle arising from the interaction of the secular frequencies g2-g5. Model stability studies by Laskar et al. (2004) suggest that the uncertainty of the ATS using this term alone will be at most only 0.1% at 100 Ma, and 0.2% at 250 Ma.* [10]

> *The 405-kyr period cycle is related to the gravitational interaction of Jupiter and Venus (g2-g5 cycle) and is the prominent and most stable term in the approximation of eccentricity of Earth's orbital variations on geologic timescales despite chaotic behavior of the Solar System.* [11]

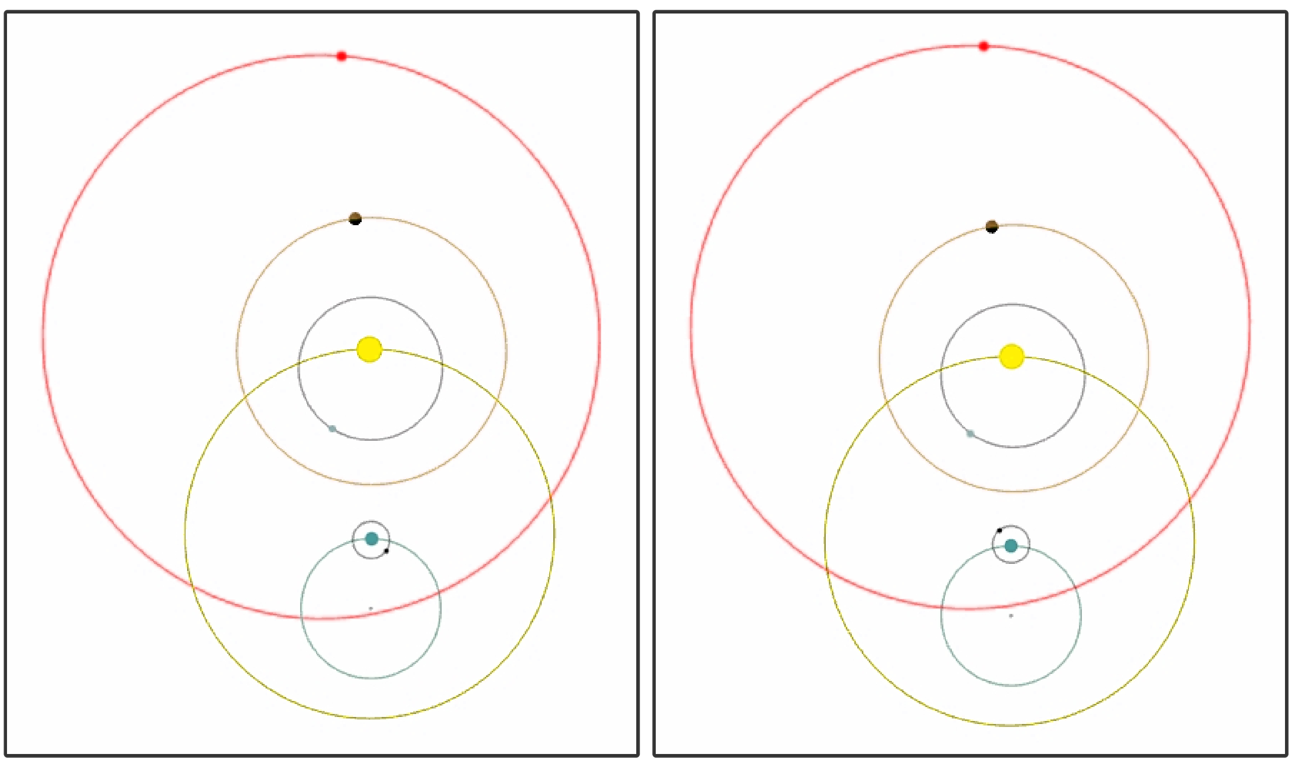
As you can see, numerous scientific papers have addressed this particularly regular 405-kyr cycle. Intrigued by the existence of such a long cycle, I decided to put it to the test in the TYCHOS model. With the ubiquitous '16-factor' in mind, I took the higher bound of the period (405500 years) and divided it by the TGY.

$$\frac{405500}{25344} \approx 16$$

Once again, the ubiquitous '16-factor' popped up! Amazingly enough, as I proceeded to visualise this 405500-year interval in the Tychosium 3D simulator, I found that, at both ends of this long cycle, Mars, Venus and Mercury return to virtually the same place in the firmament, whereas our Moon returns at the opposite side of the Earth, probably because, as you may recall, the Sun-Moon revolution ratio is 1:12.5, according to the TYCHOS. Fig. 16.5 is a double screenshot from the Tychosium 3D simulator comparing the planetary positions on two dates separated by 405500 years.

The sheer size of the 405-kyr cycle got me thinking of grander things, such as the apparent interstellar resonances between the Sirius binary system and our own, as described in Chapter 6. In that chapter, I speculated whether the Sirius system might be our system's 'double-double' binary companion. We also saw that Sirius A and B revolve around each other in about 50 solar years. Thus, in 405500 years, Sirius A and B would revolve around each other 8110 times (405500 / 50 = 8110).

This is a rather interesting finding because, as shown by the Tychosium 3D simulator, after an interval of 811000 years (i.e., 8110 × 100, or 2 × 405500), Mars, Venus and Mercury will again return to the same place in our skies, but this time around, even our Moon will return to virtually the same place. You can verify this remarkable 811000-year cycle for yourself by opening the Tychosium 3D simulator on your computer and proceeding as follows:



(a) *(b)*

Fig. 16.5 Two screenshots from Tychosium 3D showing the Solar System configuration on two dates separated by 405500 years:
(a) on 2000-06-21
(b) on 407500-06-21

1. Set the date of the Tychosium to 1962-02-05 (at 00:00:00 UTC). You will immediately see that this date featured a most spectacular and rare multiple planetary conjunction: Mercury, Venus, Jupiter, the Sun and our Moon were all aligned at around 21h15m of RA and, consequently, a solar eclipse was taking place somewhere east of Indonesia, in the Pacific Ocean. Additionally, Mars and Saturn were conjuncting at around 20h20m of RA. To verify this, open the "Positions" menu and compare the ephemerides (RA and DEC) of each of the bodies of our 'inner' Solar System.

2. Next, toggle the date to 812962-02-05 (i.e., 811000 years later) and compare the positions of Mercury, Venus, Mars, the Sun and our Moon with those of 5 February 1962. You will see that the ephemerides of these bodies are virtually identical and that the Moon will again eclipse the Sun (just a few hours earlier) somewhere in Indonesia. To view a large comparative graphic of the extraordinary 811000-year cycle, scan the QR code with a smart phone. As an extra 'bonus', you may also wish to compare the celestial positions of the asteroid Eros on the above two dates.

You can visualise this 811000-year interval in the Tychosium 3D simulator starting from any date of your choice. Note that 811000 years equals 2 × 405500 years and adds up to just about 32 (2 × 16) TGYs, or 16 'Great Years of Mars' (50688 solar years). Our Solar System is a truly astounding clockwork and, if it stands the test of time, the Tychosium 3D simulator may come to be considered the 'Antikythera of the modern era'. As we shall see in Chapter 20, the 'mega cycle' of 811000 years turns out to be the time employed by our Solar System and the Sirius system to revolve around each other. But for now let us simply add that the Earth's latest 'total' geomagnetic reversal is reckoned to have occurred about 800000 years ago, before which a compass would have pointed to the south pole instead of the north pole:

> *The most recent reversal occurred nearly 800,000 years ago at the start of the middle Pleistocene Chibanian Age. It is called the Brunhes-Matuyama reversal after the first scientists to identify and propose an age for Earth's most recent magnetic reversal.* [12]

Obviously, none of us will be around to verify whether or not the Earth, Mars, Venus, Mercury, the Sun and the Moon will all return to the same place in our skies 811000 years from now, or whether our magnetic poles will be reversed. Yet, if this should be the case, one can only hope this book will survive in whatever shape or form long enough to be recognized by distant future generations as a pioneering work in its own right. I, for one, will be popping a fine bottle of bubbly up in the heavens!

In the next chapter, we shall keep our feet firmly anchored on Earth and see if the TYCHOS can shed light on the puzzling and purportedly 'chaotic' behaviour of Jupiter and Saturn, a pesky issue of astronomy known as 'the Great Inequality'.

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17

'The Great Inequality' solved by the TYCHOS

17.1 Perturbations and 'mathemagics'

Back in the 18th century, the spiny question of the observed behaviour of Jupiter and Saturn ignited a titanic and long-winded debate among our world's most celebrated astronomers and mathematicians, including Halley, Flamsteed, Euler, Lagrange, Laplace and Poincaré. What every astronomy historian will know as 'the Great Inequality' is a scientific saga of epic proportions. In short, the problem was that the motions of Jupiter and Saturn seemed to obey neither the Newtonian gravitational 'laws', nor the Keplerian elliptical 'laws'. Not a trivial problem, you may say. Surely, Newton and Kepler couldn't possibly both be wrong ... or could they?

What had been observed, first by Kepler himself and later by Halley, was that Jupiter appeared to accelerate while Saturn appeared to decelerate. This was truly ominous news for mankind: it meant, according to Newton's 'laws' of gravity, that Jupiter would inevitably end up crashing into the Sun, while Saturn would be driven into the depths of space!

As we shall see, the TYCHOS can show that these apparent accelerations and decelerations are completely illusory and that our Solar System is not threatened by any looming planetary catastrophe. But let us first see how the eminent Astronomical Journal described the alarming discovery of 'the Great Inequality' back in 1895 [1]:

THE

ASTRONOMICAL JOURNAL.

No. 351.

VOL. XV. BOSTON, 1895 AUGUST 15. NO. 15

THE GREAT INEQUALITY OF *JUPITER* AND *SATURN*,

By EDGAR ODELL LOVETT.

The Great Inequality of *Jupiter* and *Saturn* is a long-period inequality depending upon the difference between twice the mean motion of *Jupiter* and five times that of *Saturn*, in virtue of which the line of conjunctions slowly advances, and the planets return to their original configurations after periods of about 929 years.

As early as 1625 Kepler remarked, on comparing the observations of Tycho Brahe with those of Ptolemy, that the observed places of *Jupiter* and *Saturn* could not be reconciled with the admitted values of their mean motions (*Keplerus et Berneggerus, Epistolae mutuae*, p. 70; 12° Argentorati, 1672; also, *Keplerus*, Opera VI, p. 617, 1866). The errors of both planets were found to increase continually in the same direction, with this difference, that the tables made the mean motion of *Jupiter* too slow, and that of *Saturn* too rapid.

In his memoir on the aphelia and eccentricities (*Phil. Trans.*, 1676, p. 683) Halley was led to the belief that the anomalous irregularities of the two planets were due to their mutual attraction. He also attempted to determine the magnitude of the inequality for each planet, and concluded from his researches that in 2000 years the acceleration of *Jupiter* amounted to 3° 49′, and the retardation of *Saturn* to 9° 16′. In his tables of the planets he represented the errors by two secular equations, increasing as the square of the time, the one being additive to the mean motion of *Jupiter*, and the other subtractive from the mean motion of *Saturn* (see Grant's *History of Physical Astronomy*, pp. 47 et seq.; and Houzeau's *Vade-mecum de l'Astronomie*, § 246).

By comparing tables made at different epochs, Flamsteed confirmed the opinion that *Jupiter* was being steadily accelerated, and *Saturn* retarded (Flamsteed, J., *Exact Account of the Three Late Conjunctions of Jupiter and Saturn, London Phil. Trans.*, 1685, p. 244).

The most startling conclusions were drawn from these variations in the planetary motions. It was known that when the angular velocity of a body increases from century to century it must be approaching the center of motion; on the other hand a diminution in this velocity would indicate a recession of the planet from the sun. Hence it was inferred that the solar system would in the course of ages lose two of its most prominent members—that *Jupiter* would fall into the sun, while *Saturn* would be driven away into the depths of space. Euler and Lagrange had searched in vain for the cause of the anomalous behavior of *Jupiter* and *Saturn*, which appeared to be inconsistent with the law of gravitation; but in their researches they had neglected terms of the perturbations depending upon the cubes and higher powers of the eccentricities. In 1785 Laplace discovered from other considerations, that if we assume an acceleration of *Jupiter* a retardation of *Saturn* will necessarily result, and that in the very proportion observed; hence he set himself to examine the terms depending on the cubes of the eccentricities, and at once encountered the argument, $5n't - 2nt + \text{const}$. Taking account of the fact that five times the mean motion of *Saturn* is nearly equal to twice the mean motion of *Jupiter*, and that in virtue of the double integration for the perturbation in longitude, these terms are affected by the small divisor, $5n' - 2n$, in the second power, he did not hesitate to conclude that the long inequality depends on terms having this argument. Computation at once confirmed this hypothesis, and made known the cause and law of the great inequality. From the nature of the cause thus made known Laplace immediately perceived that there would arise in other parts of our system similar long inequalities depending on near approach to commensurability in the mean motions. In the *Mécanique Céleste* and subsequent works on Physical Astronomy these long-period inequalities have been determined. The explanation of these long-period perturbations by the law of gravitation was justly regarded by Laplace as one of the strongest proofs of the exactness of this law. The theorems relative to the stability of the eccentricities, inclinations, and major axes of the planetary orbits previously enunciated, could of course be regarded as valid only after the discovery that the long-period inequalities result from the theory of universal gravitation.

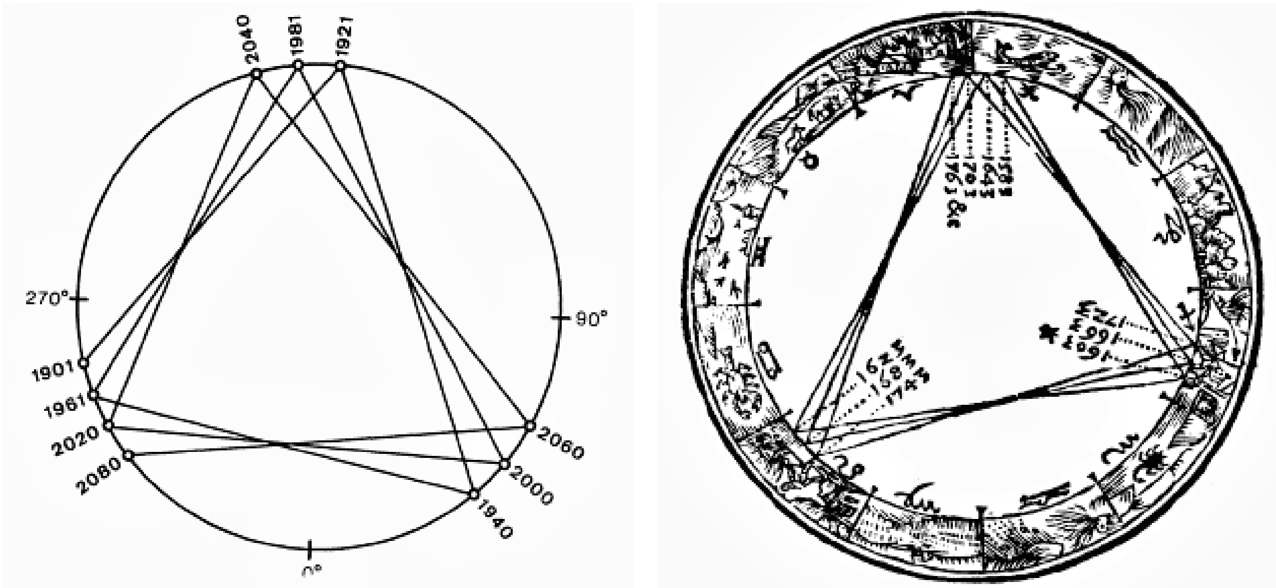
The principal coefficient of the great inequality, as it affects the mean longitude of *Jupiter*, has been determined as follows:

(113)

Fig. 17.1 The highlighted text reads as follows:

"By comparing tables made at different epochs, Flamsteed confirmed the opinion that *Jupiter* was being steadily accelerated, and *Saturn* retarded (Flamsteed, J., *Exact Account of the Three Late Conjunctions of Jupiter and Saturn, London Phil. Trans.*, 1685, p.244).

The most startling conclusions were drawn from these variations in the planetary motions. It was known that when the angular velocity of a body increases from century to century it must be approaching the center of motion; on the other hand a diminution in this velocity would indicate a recession of the planet from the sun. Hence it was inferred that the Solar System would in the course of ages lose two of its most prominent members—that *Jupiter* would fall into the sun, while *Saturn* would be driven away into the depths of space."



(a) *(b)*

Fig. 17.2 The Jupiter-Saturn conjunctions proceed anti-clockwise around our celestial sphere basically every 60 years. Image source: *Les conjonctions triples Jupiter-Saturne* by Jean Meeus (1980) [2]

Make no mistake, this was no petty matter: the very stability of our Solar System was believed to be at stake. In fact, the Paris and Berlin Academies set up special prizes to encourage scientists to resolve this pesky and 'potentially apocalyptic' problem. Leonhard Euler, the most acclaimed Swiss mathematician of all times, was the first awardee, although his calculations showed both Jupiter and Saturn accelerating, contrary to any empirical astronomical observations ever made.

Isaac Newton was also well aware of the problem of the presumed 'instability' of our Solar System, based on the observed behaviour of Jupiter and Saturn, but he never tackled the troublesome matter, preferring to leave it up to God to eventually restore the 'chaotic' planetary motions to order. Kepler also declined the challenge in the hope that future generations would unveil the mystery of our Solar System's apparent instability. For once, Kepler was right about something.

Now, what you need to know is that, as seen from Earth, Jupiter and Saturn appear to conjunct at roughly the same celestial longitude every 60 years or so. Since Jupiter employs 12 years to circle around us, while Saturn employs 30 years to do so, the two will regularly 'meet up' every 60 years ($60 = 5 \times 12$ or 2×30, respectively). However, these 60-year conjunctions of Jupiter and Saturn appear to precess anti-clockwise, as illustrated in Fig. 17.2.

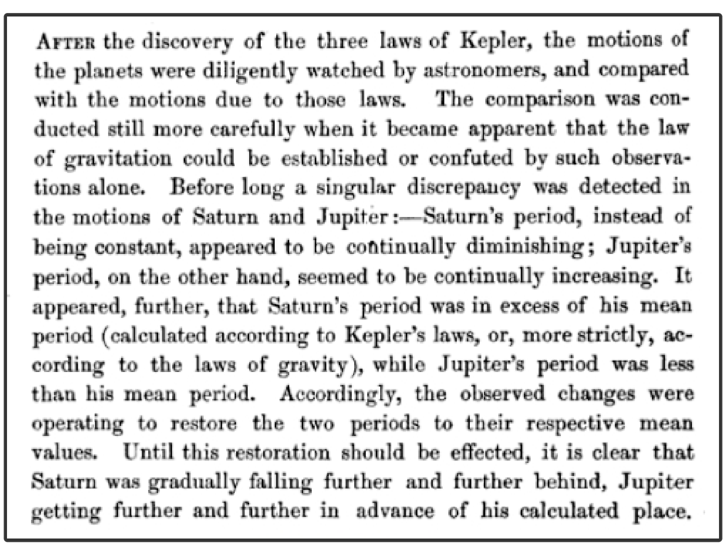

After the discovery of the three laws of Kepler, the motions of the planets were diligently watched by astronomers, and compared with the motions due to those laws. The comparison was conducted still more carefully when it became apparent that the law of gravitation could be established or confuted by such observations alone. Before long a singular discrepancy was detected in the motions of Saturn and Jupiter:—Saturn's period, instead of being constant, appeared to be continually diminishing; Jupiter's period, on the other hand, seemed to be continually increasing. It appeared, further, that Saturn's period was in excess of his mean period (calculated according to Kepler's laws, or, more strictly, according to the laws of gravity), while Jupiter's period was less than his mean period. Accordingly, the observed changes were operating to restore the two periods to their respective mean values. Until this restoration should be effected, it is clear that Saturn was gradually falling further and further behind, Jupiter getting further and further in advance of his calculated place.

Fig. 17.3 Extract from *Saturn and its System*, by Richard Anthony Proctor (1865) [3]

The extract in Fig. 17.3 gives an idea of the utter perplexity caused by 'the Great Inequality' and how it got the entire astronomy establishment of the time on their toes.

Enter Lagrange and Laplace, perhaps the two most renowned French mathematicians of all times. The two 'science icons' engaged in a long struggle to try and resolve the paradox while taking care to uphold the sacrosanct Newtonian gravitational 'laws'. Depending on the source you consult, it was either Lagrange or Laplace who 'solved the problem' by using formidably complex equations to show that the apparently increasing gap between Jupiter's and Saturn's celestial longitudes was a temporary phenomenon which would eventually reverse course.

The gap, it was claimed, would gradually diminish and cancel itself out in the course of about nine hundred years. Our two giant gas planets were not going to bring on the much feared apocalyptic end times after all.

However, it is unclear just how Lagrange and Laplace reached their 'mathemagical' conclusions. In academic text books, we may find some dreadfully abstruse computations based on assumptions of how 'gravitational perturbations' and 'tidal friction effects' might cause those puzzling inequalities.

As it is, the Copernican model allows for no plausible explanation as to why Jupiter's and Saturn's celestial longitudes would oscillate back and forth, as observed. In time though, and to their great relief, Lagrange and Laplace were eventually 'proven right': the apparent, relative accelerations and decelerations of Jupiter and Saturn were observed several decades later to have reversed course:

> *In 1773, Lambert used advanced perturbation techniques to produce new tables of Jupiter and Saturn. The result was surprising. From the mid-17th century the Great Anomaly appeared to go backwards: Saturn was accelerating and Jupiter was slowing down! Of course, such behavior was not compatible with a genuinely secular inequality.* [3]

One of the greatest observational astronomers in those days, William Herschel, had also investigated the apparent back-and-forth oscillations of Jupiter and Saturn:

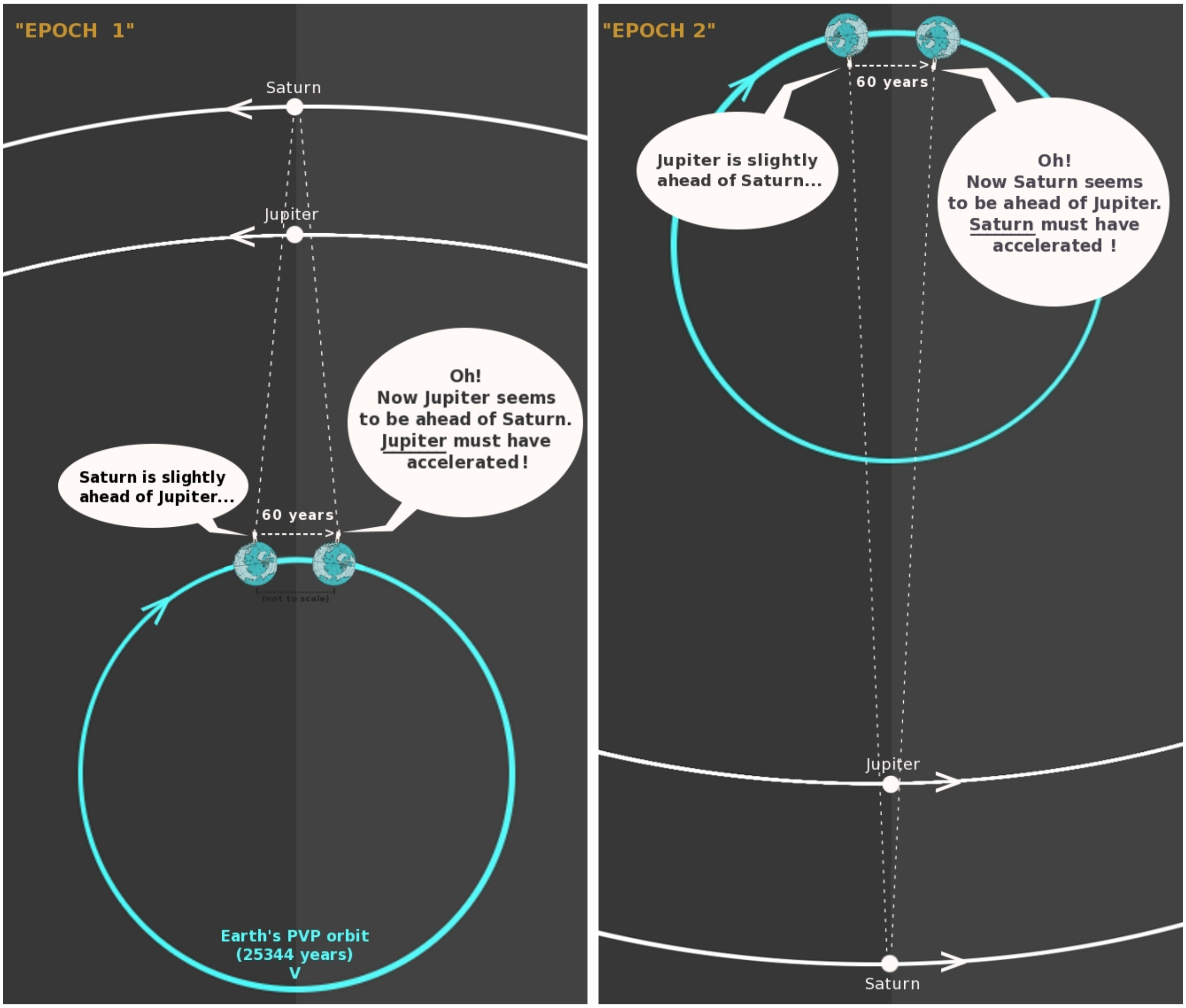
> *Herschel describes Saturn's period as increasing (i.e. Saturn seemed to be slowing down) during the seventeenth century - and Jupiter's period as diminishing (i.e. Jupiter seemed to be speeding up) and he adds—'In the eighteenth century a process precisely the reverse seemed to be going on'.* [4]

This time, no end-of-the-world scenario was proposed. Nonetheless, as pointed out by a number of contemporary independent researchers, 'the Great Inequality' and its corollary, the 'stability of our Solar System', both remain unsolved riddles to this day. For instance, Antonio Giorgilli, a veteran Italian expert in this peculiar area of astronomical studies and the author of *"The Stability of the Solar System: Three Centuries of Mathematics"*, admits to having no answer to the enigma:

> *Su queste basi cercherò di illustrare che significato si possa dare alla domanda: 'il sistema solare è stabile?' Quanto alla risposta, non vorrei deludere nessuno, ma sarà: non lo sappiamo.*
>
> *[Translation: On this basis I will try to illustrate what meaning can be given to the question: 'is the solar system stable?' As for the answer, I do not want to disappoint anyone, but it will be: we do not know.]* [5]

"We do not know". Indeed. And chances of figuring it out are virtually nil as long as we base our reasoning on the wrong configuration of the Solar System. We have looked at some of the historical controversies surrounding the 'mysterious' motions of Jupiter and Saturn; it now remains to be seen if the TYCHOS model can resolve the riddle of 'the Great Inequality' without resorting to gratuitous 'gravitational perturbations' or 'non-gravitational effects'.

As you can see for yourself in Fig. 17.4, the truth, as is often the case, is quite simple—and yes, you guessed it right: it is Earth's slow displacement around its PVP orbit that creates the optical illusion that Jupiter and Saturn are alternately accelerating or decelerating. In reality, the two planets move at perfectly constant speeds, just like all the other components of our Solar System.



(a) *(b)*

Fig. 17.4 A conceptual explanation of 'the Great Inequality'. As viewed from Earth, Jupiter and Saturn will appear to alternately "accelerate and decelerate" depending on the timeframe chosen to measure their periodic '60-year' conjunctions. This, due to Earth's 1 mph orbital motion. Two successive Jupiter-Saturn '60-year' conjunctions: in ***(a)*** the 'upper' and ***(b)*** the 'lower' quadrant of our celestial sphere. The so-called 'Great Inequality' is nothing more than an illusion of perspective.

1. Whenever (in a certain epoch) Jupiter and Saturn are observed, over a 60-year interval, to conjunct in the 'upper quadrant' of our celestial sphere, it will seem as if Jupiter is accelerating.
2. Whenever (in a certain epoch) Jupiter and Saturn are observed, over a 60-year interval, to conjunct in the 'lower quadrant' of our celestial sphere, it will seem as if Saturn is accelerating.

This is because, while Earth moves at snail pace around its PVP orbit, Jupiter and Saturn will alternately conjunct as they proceed in the opposite or in the same direction as Earth. So there it is: another fine mess elegantly cleared up by the TYCHOS in a matter of minutes. You can rest assured that Jupiter and Saturn are not afflicted by any fanciful, chaotic perturbations and will not be crashing into the Sun or migrating to other galaxies.

Before we move on, in his paper on the stability of the Solar System, Giorgilli makes another point of paramount interest to the TYCHOS model:

The first long-term simulations have been carried out since the end of the 1980s by some researchers, including A. Milani, M. Carpino, A. Nobili, GJ Sussman, J. Wisdom, J. Laskar. Their conclusions can be *summarized as follows: the four major planets (Jupiter, Saturn, Uranus and Neptune) seem to move quite regularly even over a period of a few billion years, which is the estimated age of our Solar System. On the other hand, the internal planets (Mercury, Venus, Earth and Mars) present small random orbital variations, in particular of their eccentricity, which cannot be interpreted as periodic movements: we must admit that there is a chaotic component. Not that the orbits change much, at least not in the short term, but there may be, for example, small variations in the eccentricity of the Earth's orbit that have very significant effects on the climate: the glaciations appear to be correlated with these variations.* [5]

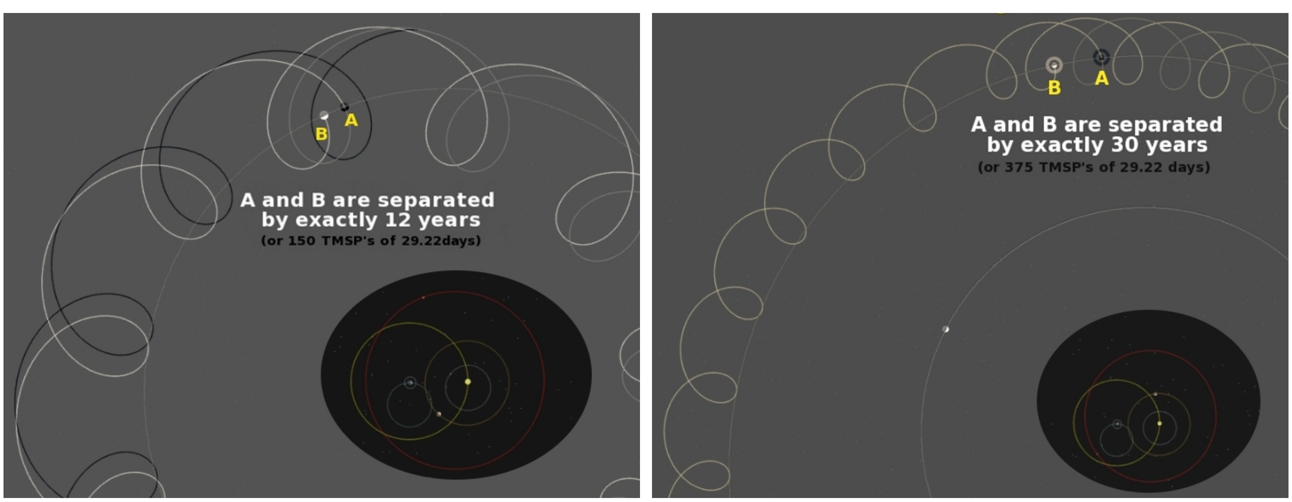
This strongly supports the notion proposed by the TYCHOS that the celestial bodies in our Solar System make up two distinct groups: an 'inner binary family' composed of the Sun, Mars, Mercury, Venus and of course the Earth-Moon system, and an 'outer circumbinary family' composed of Jupiter, Saturn, Uranus, Neptune and Pluto.

17.2 Clarifying the 12-year and 30-year periods of Jupiter and Saturn

At this point I would like to take the opportunity to clarify my contention that Jupiter and Saturn have, technically speaking, 'integer' periods of respectively 12 years and 30 years, which happen to be perfect multiples of our Moon's true synodic period (TMSP). As every astronomer will know though, the orbital periods of the 'Jovian planets' (from Jupiter to Pluto) are all reckoned to be slightly shorter than integer numbers of solar years. Jupiter, for instance, is said to complete one of its orbits in 11.862 years. Saturn is said to complete one of its orbits in 29.4571 years. This means that, after 12 integer years, Jupiter will appear to have precessed 'eastwards' by a small amount. Likewise, after 30 integer years, Saturn will appear to have precessed 'eastwards' by a small amount.

Now, if we go to the Tychosium 3D simulator and activate the 'Trace' function, we can visualize the peculiar configuration that allows to explain why, geometrically speaking, the orbits of Jupiter and Saturn are actually completed in exactly 12 and 30 integer years. As shown by the screenshots in Fig. 17.5, Jupiter will return to the very same point in its characteristic 'teardrop loop' after an exact 12 year-period. In other words, Jupiter's true period is 12 integer years, which corresponds to 150 TMSPs. Likewise, Saturn will return to the very same point in its characteristic 'teardrop loop' after an exact 30 year-period. Thus, Saturn's true period is 30 integer years, which corresponds to 375 TMSPs.

Put differently, since the 'outer' planets, Jupiter and Saturn, do not precess 'clockwise' along with the 'inner binary family' of our system, when seen from Earth their orbital periods will appear to be slightly shorter than they really are. It is therefore correct to say that their true orbital periods are 12 years and 30 years, respectively.

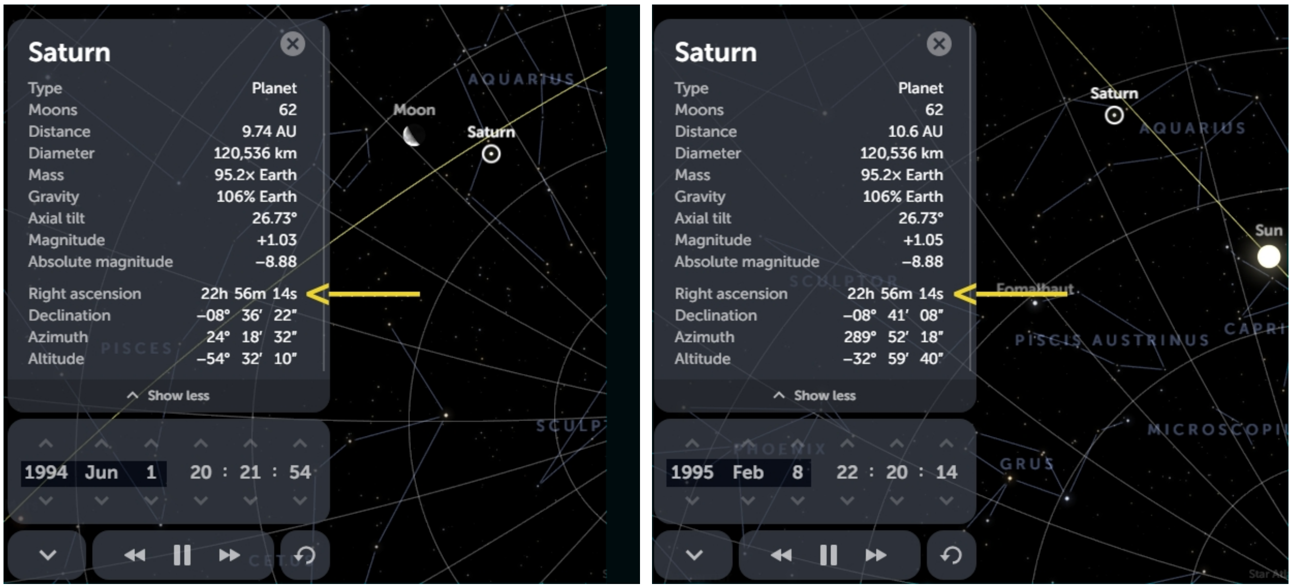


(a) *(b)*

Fig. 17.5 A conceptual explanation of *(a)* Jupiter's 12-year cycle and *(b)* Saturns's 30-year cycle.

17.3 Saturn's motions: another Copernican aberration

Did you know that, although Earth is said by heliocentrists to revolve around the Sun in about 365 days, Saturn can reconjunct with Earth and the same star in only 252 days? This is an observable fact that begs a very good explanation, as I am sure you will agree. For example, in Fig. 17.6, the heliocentric Star Atlas simulator shows Saturn on 1 June 1994 and 8 February 1995 facing the same star in the Aquarius constellation (22h56min14s of RA), only 252 days apart.



(a) *(b)*

Fig. 17.6 Screenshots from the heliocentric Star Atlas simulator, showing that Saturn can return to the exact same celestial longitude in 252 days.

The JS orrery, another heliocentric simulator, confirms these positions for the same two dates. One must wonder how the two parallel lines in Fig. 17.7 could possibly point to the same star in the Aquarius constellation.

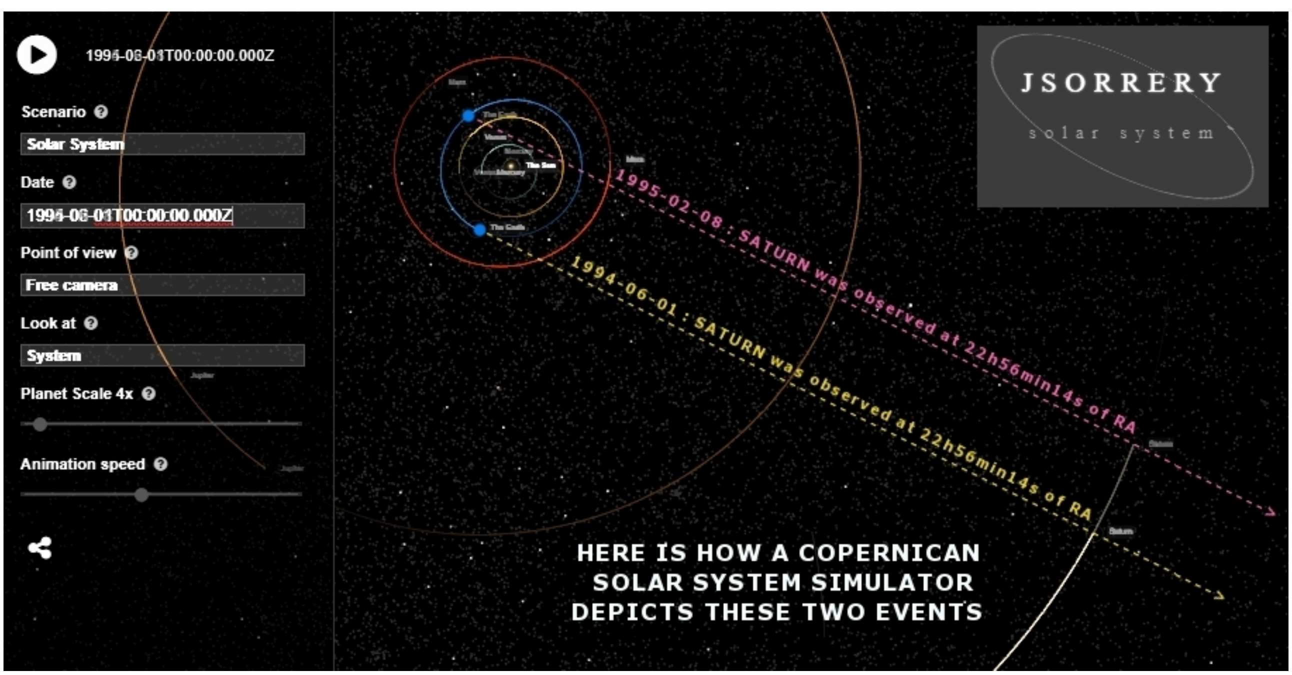


Fig. 17.7 Screenshot from the heliocentric JS orrery.

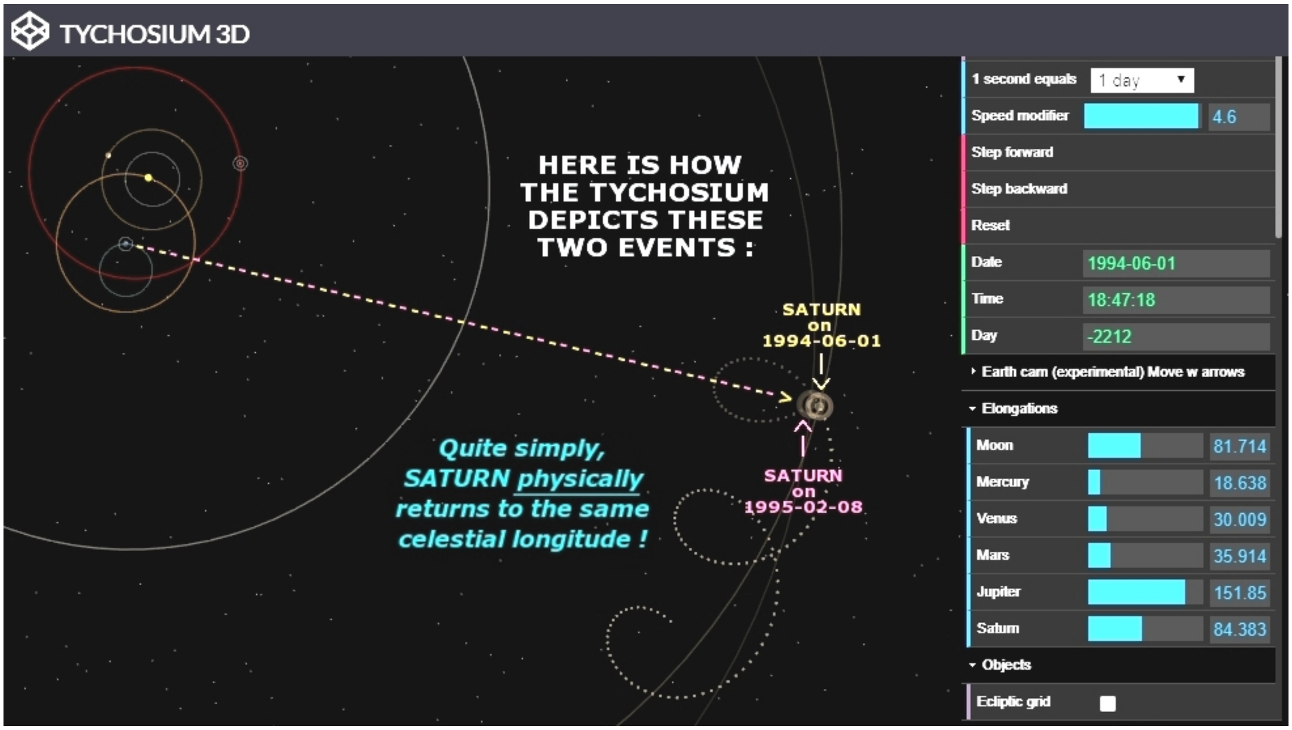


Fig. 17.8 Screenshot from the Tychosium 3D simulator.

In comparison, Fig. 17.8 shows how the Tychosium 3D simulator depicts the same two conjunctions. As you can see, having completed its retrograde loop, Saturn naturally returns to the very same line of sight, facing the same point in the Aquarius constellation.

I will leave it up to the reader to judge which of the simulators provides the most sensible explanation for the observed behaviour of Saturn as it returns to the same point in our skies within a 252-day period. Far from imposing my own world view on others, I think it is time for the scientific community and laymen alike to have a rational and honest debate to determine what configuration of our Solar System best fits observable fact.

17.4 References

[1] *The Astronomical Journal* (1895)
https://adsabs.harvard.edu/full/1895AJ.....15..113L

[2] *Les conjonctions triples Jupiter-Saturne* by Jean Meeus (1980)
https://tinyurl.com/JupiterSaturnMEEUS

[3] *Stability of the Solar System in the 18th century* by Massimiliano Badino
https://tinyurl.com/StabilitySolarSystemBADINO

[4] *Saturn and its System* by Richard Anthony Proctor (1865)
https://tinyurl.com/saturnsystemPROCTOR

[5] *La stabilità del Sistema Solare* by Antonio Giorgilli
http://www.mat.unimi.it/users/antonio/ricerca/papers/sns.pdf

18

Uranus, Neptune and Pluto prove the PVP orbit

18.1 Introduction

According to official astronomy data, Uranus, Neptune and Pluto orbit around us in a trifle less than 84, 165 and 248 years, respectively. The fact that each of these orbital periods fall just short of integer numbers of years may not seem significant at first sight, but there is a very good reason for it.

According to a NASA fact sheet[1] by D. R. Williams:

- Uranus has an orbital period of 30589 days, or ∼83.74 years (a trifle less than 84 years).
- Neptune has an orbital period of 60182 days, or ∼164.77 years (a trifle less than 165 years).
- Pluto has an orbital period of 90560 days, or ∼247.94 years (a trifle less than 248 years).

In the TYCHOS, the true orbital periods of Uranus, Neptune and Pluto can be shown to be precisely 84, 165 and 248 years, respectively. The reason they will appear to an earthly observer to be slightly shorter is the parallax effect caused by Earth's motion around its 25344-year PVP orbit. What follows will demonstrate that these parallax effects neatly reflect, and are commensurate with, Earth's motion.

18.2 Uranus in the TYCHOS

- True orbital period of Uranus in the TYCHOS: 84 solar years exactly
- Displacement of the Earth over 84 years: 14036 km × 84 ≈ 1 179 024 km
- 1 179 024 km amounts to 0.3314% of 355 724 597 km (the PVP orbit's circumference).
- 84 years corresponds to 0.3314% of 1 TGY (25344 solar years).
- 0.3314% of 1440 min (the full celestial sphere) amounts to ∼4.7 min of RA.

And in fact, every 84 years Uranus appears to precess against the stars by about 4.5 min of RA. Hence, we may infer that this is just a parallax effect caused by Earth's motion along the PVP orbit over that same 84-year period. Fig. 18.1 provides an example: in the 84 years between 2016-10-15 and 2100-10-15, Uranus will appear to 'drift eastwards' by 4.5 min (from 1h24min to 1h28.5min of RA).

In other words, Uranus' true orbital period is 84 years exactly, not 83.74 years as officially reckoned. The discrepancy disappears when taking into account the Earth's motion around its PVP orbit.

[1] https://www.tychos.info/citation/128A_Planet-fact.htm

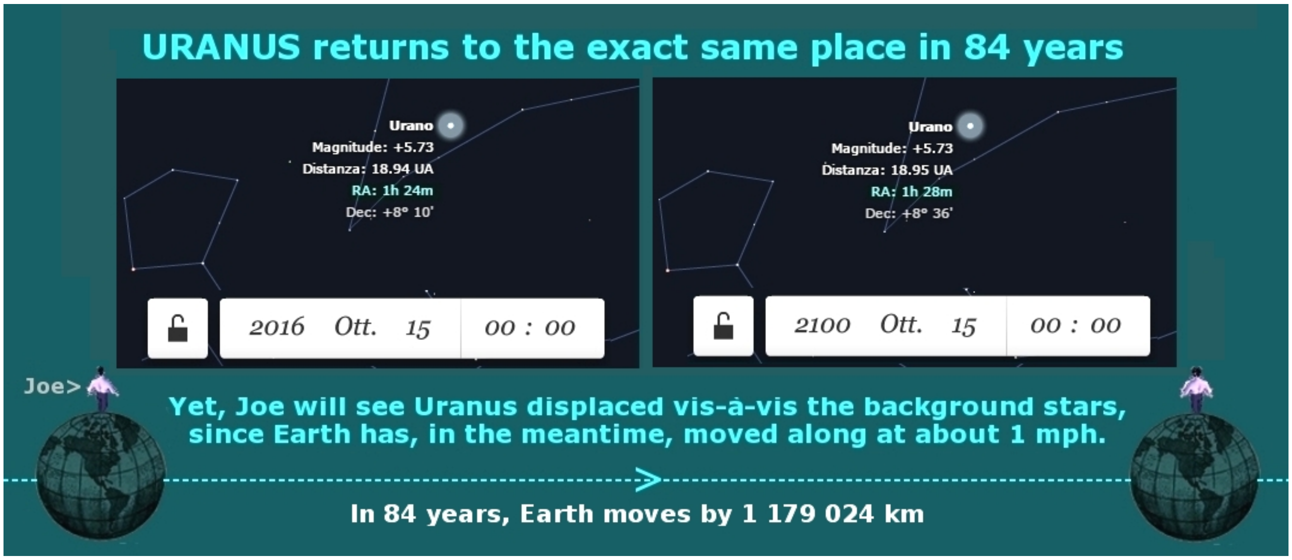


Fig. 18.1 Every 84 years, Uranus returns to virtually the same place in the sky. Yet, due to Earth's 1-mph motion, after 84 years it will appear— as viewed from Earth—to have moved 'eastwards' by about 4.5 min of RA in relation to the stars.

18.3 Neptune in the TYCHOS

- True orbital period of Neptune in the TYCHOS: 165 solar years exactly
- Displacement of the Earth over 165 years: 14036 km $\times$ 165 $\approx$ 2 315 940 km
- 2 315 940 km amounts to 0.651% of 355 724 597 km (the PVP orbit's circumference).
- 165 years corresponds to 0.651% of 1 TGY (25344 solar years).
- 0.651% of 1440 min (the full celestial sphere) amounts to $\sim$9.4 min of RA.

And in fact, every 165 years Neptune appears to precess against the stars by about 10 min of RA. Hence, we may infer that this is just a parallax effect caused by Earth's motion along the PVP orbit over that same 165-year period. Fig. 18.2 provides an example: in the 165 years between 2017-09-05 and 2182-09-05, Neptune will appear to 'drift eastwards' by 10 min (from 22h58min to 23h08 min of RA).

In other words, Neptune's true orbital period is 165 years exactly, not 164.77 years as officially reckoned. The discrepancy disappears when taking into account the Earth's motion around its PVP orbit.

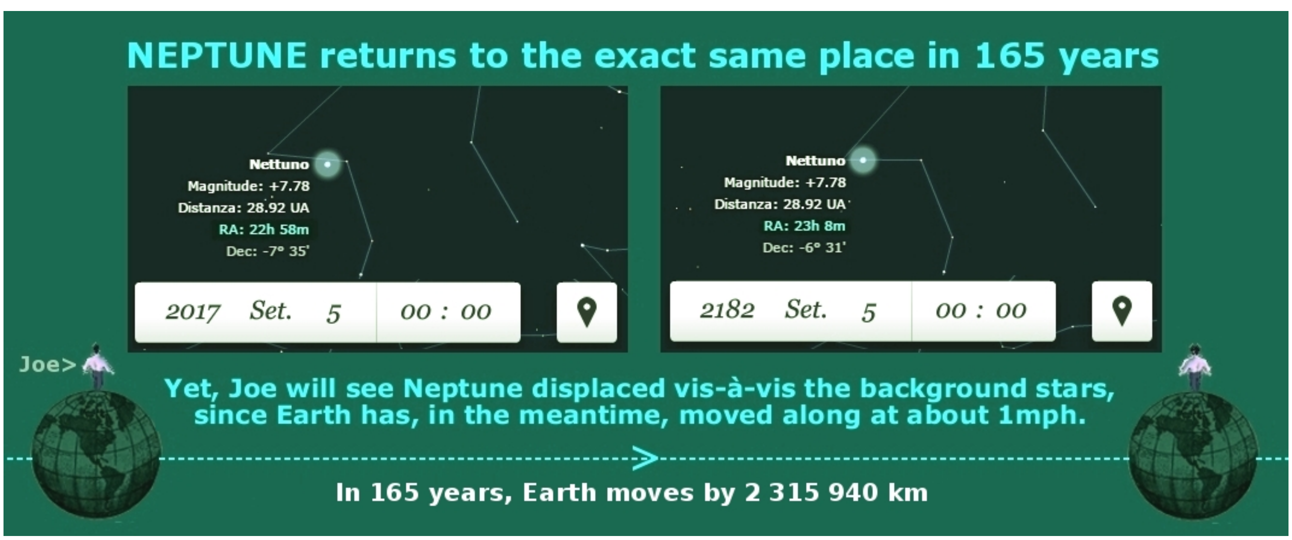


Fig. 18.2 Every 165 years, Neptune returns to virtually the same place in the sky. Yet, due to Earth's 1-mph motion, after 165 years it will appear— as viewed from Earth—to have moved 'eastwards' by about 10 min of RA in relation to the stars.

18.4 Pluto in the TYCHOS

- True orbital period of Pluto in the TYCHOS: 248 solar years exactly
- Displacement of the Earth over 248 years: 14036 km $\times$ 248 $\approx$ 3 480 928 km
- 3 480 928 km amounts to 0.978% of 355 724 597 km (the PVP orbit's circumference).
- 248 years corresponds to 0.978% of 1 TGY (25344 solar years).
- 0.978% of 1440 min (the full celestial sphere) amounts to ~14 min of RA.

And in fact, every 248 years Pluto appears to precess against the stars by approximately 13 ±1 min of RA on average. Hence, we may infer that this is just a parallax effect caused by Earth's motion along the PVP orbit over that same 248-year period. Fig. 18.3 shows that in the 248 years between 1941-10-28 and 2189-10-28, Pluto will appear to 'drift eastwards' by almost 13 min (from 8h37min to 8h49.4min of RA).

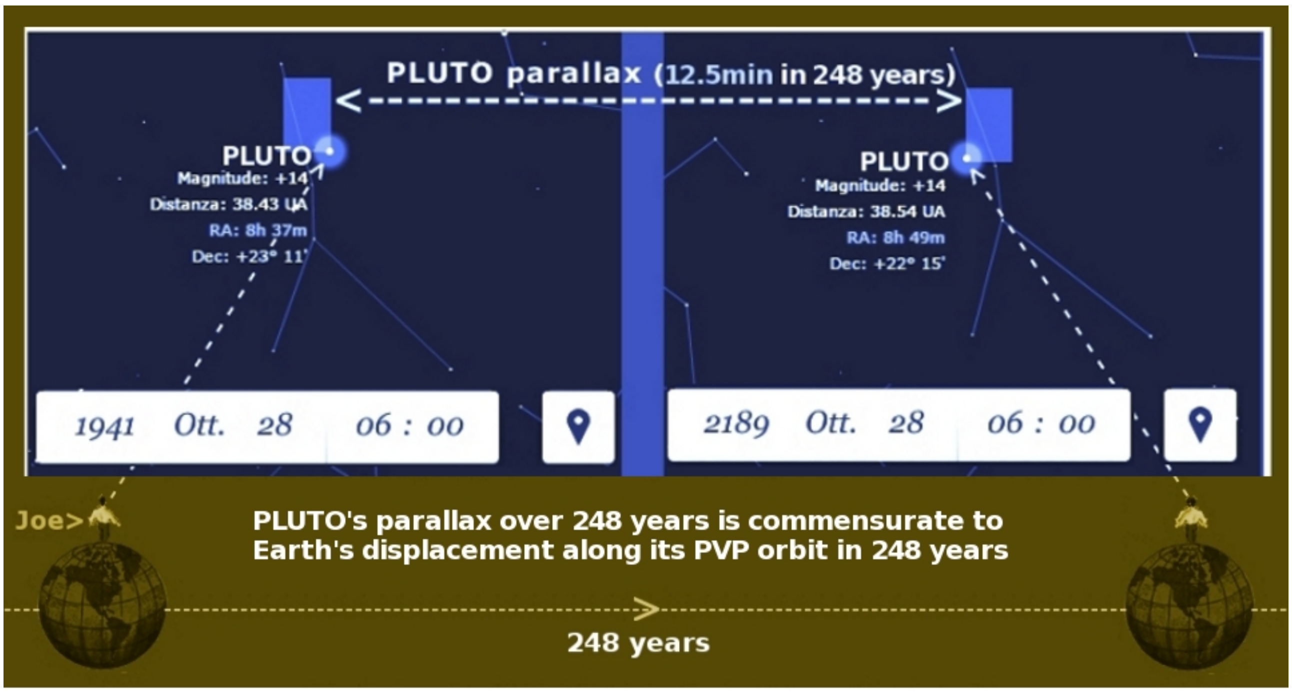


Fig. 18.3 Pluto returns to the exact same place every 248 years. Yet, Joe will see Pluto displaced in relation to the background stars, since Earth has, in the meantime, moved along at about 1 mph, covering a distance of 3 480 928 km. This optical effect is called 'parallax'.

Thus, Uranus, Neptune and Pluto are shown to exhibit parallax values consistent and commensurate with the Earth's displacement along its PVP orbit over a period of 84 years (~1.2 Mkm), 165 years (~2.3 Mkm) and 248 years (~3.5 Mkm). The chances for all this to be coincidental are, you may agree, beyond reasonable contemplation. Hence, the observed parallaxes of the three most distant bodies in our Solar System provide further corroboration of the Earth's orbital speed of 1.6 km/h, as proposed by the TYCHOS model.

As you may recall from Chapter 7, Mars can conjunct with a given control star at both ends of a 546-day period (an interval of ~1.5 years). Under the Copernican model's geometric configuration, a 1.5-year time span would imply a lateral displacement of the Earth and Mars of almost 300 Mkm, equivalent to the width of Earth's Copernican orbit around the Sun. Yet, despite this alleged huge lateral displacement, Mars exhibits no detectable parallax! However, when it comes to Uranus, Neptune and Pluto, Copernicans will fail to notice (or erroneously interpret) their quite noticeable parallaxes in relation to the stars over their respective periods of 84, 165 and 248 integer solar years, and instead conclude that their 'true' periods are a trifle shorter.

18.5 Conclusion

In conclusion, the true orbital periods of Uranus, Neptune and Pluto are, just like those of all the other bodies in our system, exact integer multiples of the TMSP (Chapter 13) and, of course, of the solar year. All the apparent 'secular precession' of these planets in relation to the stars is simply parallax caused by the Earth's 1.6 km/h motion around its PVP orbit, as this chapter has plainly demonstrated.

Our Solar System is a most remarkable 'clockwork'. The orbital periods of all its components are simply multiples of the orbital cycles of the Moon and the Sun. Sadly, this awe-inspiring harmony has gone unnoticed since the adoption of the heliocentric model. What should have been perceived as perfectly predictable motions and natural optical phenomena has been turned into imaginary 'inequalities', 'anomalies', 'perturbations', 'turbulences', 'gravitational or non-gravitational effects', and random 'chaotic' behaviours.

Entire lifetimes have been spent by Copernican astronomers in intricate calculi and numerical integrations, in a hopeless quest to make sense of what is empirically observed in our skies. Clutching onto their heliocentric convictions, their battle has always been a losing one. In light of this, the TYCHOS model should come as a welcome relief to astronomers, cosmologists and astrophysicists alike, were it only for saving them untold amounts of time and toil.

Note

The screenshots used in this chapter are from the now defunct NEAVE planetarium, but the respective ephemerides given for Uranus, Neptune and Pluto can be all verified perusing the online Stellarium simulator as well as the Tychosium 3D simulator.

19

Understanding the TYCHOS Great Year

19.1 Why the stars keep drifting 'eastwards'

Ever since antiquity, astronomers and astrologers have been aware of the so-called Precession of the Equinoxes—the fact that every 2100 years or so our firmament appears to drift eastwards in relation to Earth's equinoxes by 30 degrees, roughly corresponding to one of the twelve 'ages' or constellations of the Zodiac. In our modern times, astrologers are often scoffed at for their allegedly unscientific and emotional approach to the cosmic realm. Ironically, astronomers have not been any more successful at producing a logical and scientific explanation for the Precession of the Equinoxes.

The graphic in Fig. 19.1 shows how the TYCHOS model accounts for what is actually observed, as all the stars are seen to drift 'eastwards' by about 51″ arcseconds every year. As Earth moves clockwise (i.e., 'westwards') around its PVP orbit, it will drift by 30° every 2112 years, which will eventually add up to a full 360° circle in 25344 years ($2112 \times 12 = 25344$).

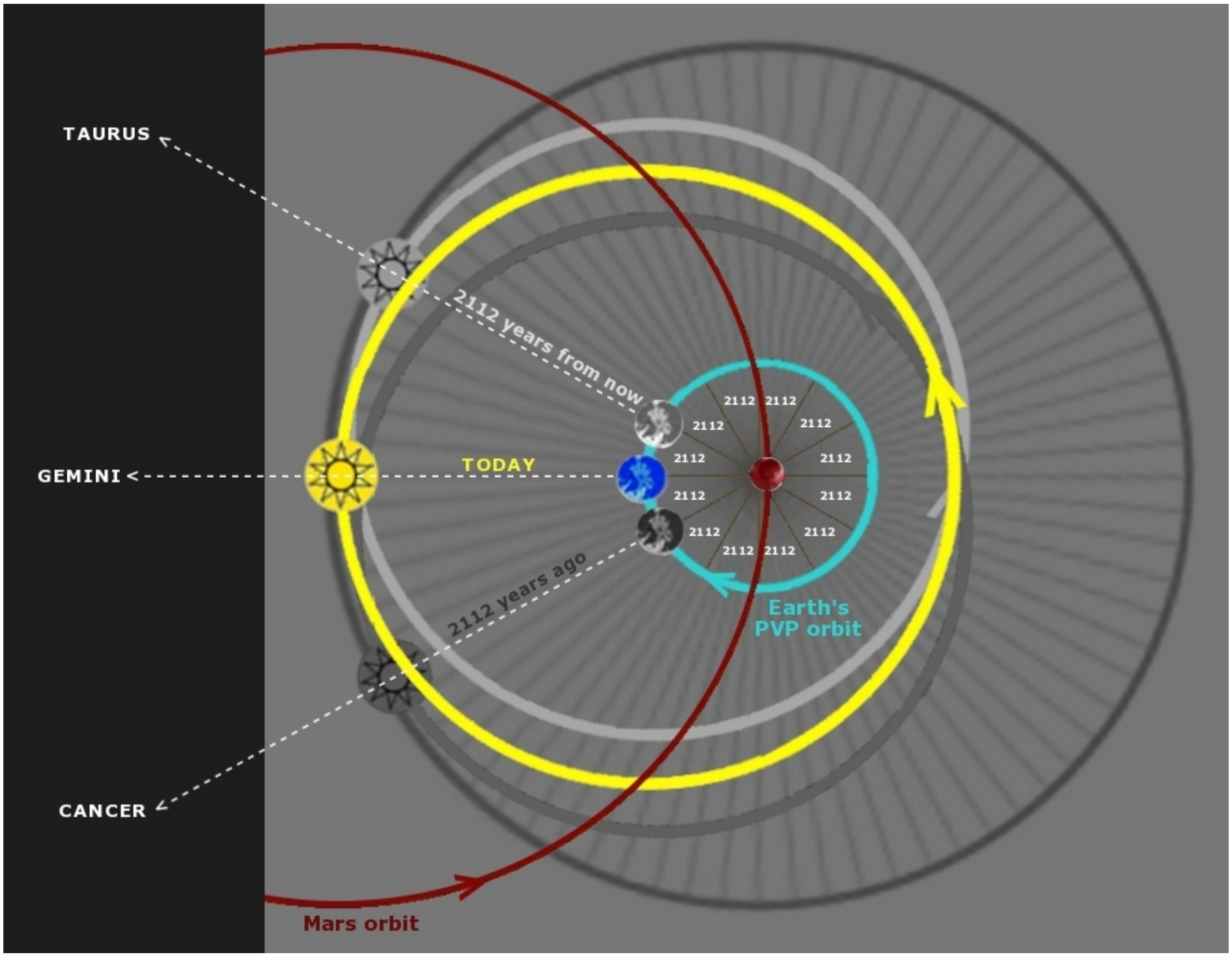


Fig. 19.1 Earth's clockwise 1-mph-motion around its PVP orbit causes our orientation vis-à-vis the stars to drift by 30° every 2112 years. In 25344 years (2112×12), Earth will complete a full 360° revolution around the centre of our system, i.e., a 'Great Year'.

Most attribute what is today called the General Precession to the so-called 'lunisolar wobble', a bizarre theory that has already been thoroughly refuted (see Chapter 10). Why astronomers refuse to acknowledge that heliocentrism lacks a plausible, rational explanation for the Earth's all-important equinoctial precession is a mystery in itself (as well as a major yet unspoken embarrassment). In fact, it sometimes seems like 'astronomers' are no less prone to wishful thinking than their 'astro-logical' counterparts, despite being accused of trivializing the glorious cosmic milestones of human history, as suggested in this extract from Giorgio de Santillana's fascinating 1969 essay, *"Hamlet's Mill"*:

> *For us, the Copernican system has stripped the Precession of its awesomeness, making it a purely earthly affair, the wobbles of an average planet's individual course. But if, as it appeared once, it was the mysteriously ordained behaviour of the heavenly sphere, or the cosmos as a whole, then who could escape astrological emotion? For the Precession took on an overpowering significance. It became the vast impenetrable pattern of fate itself, with one world-age succeeding another, as the invisible pointer of the equinox slid along the signs, each age bringing with it the rise and downfall of astral configurations and rulerships, with their earthly consequences.* [1]

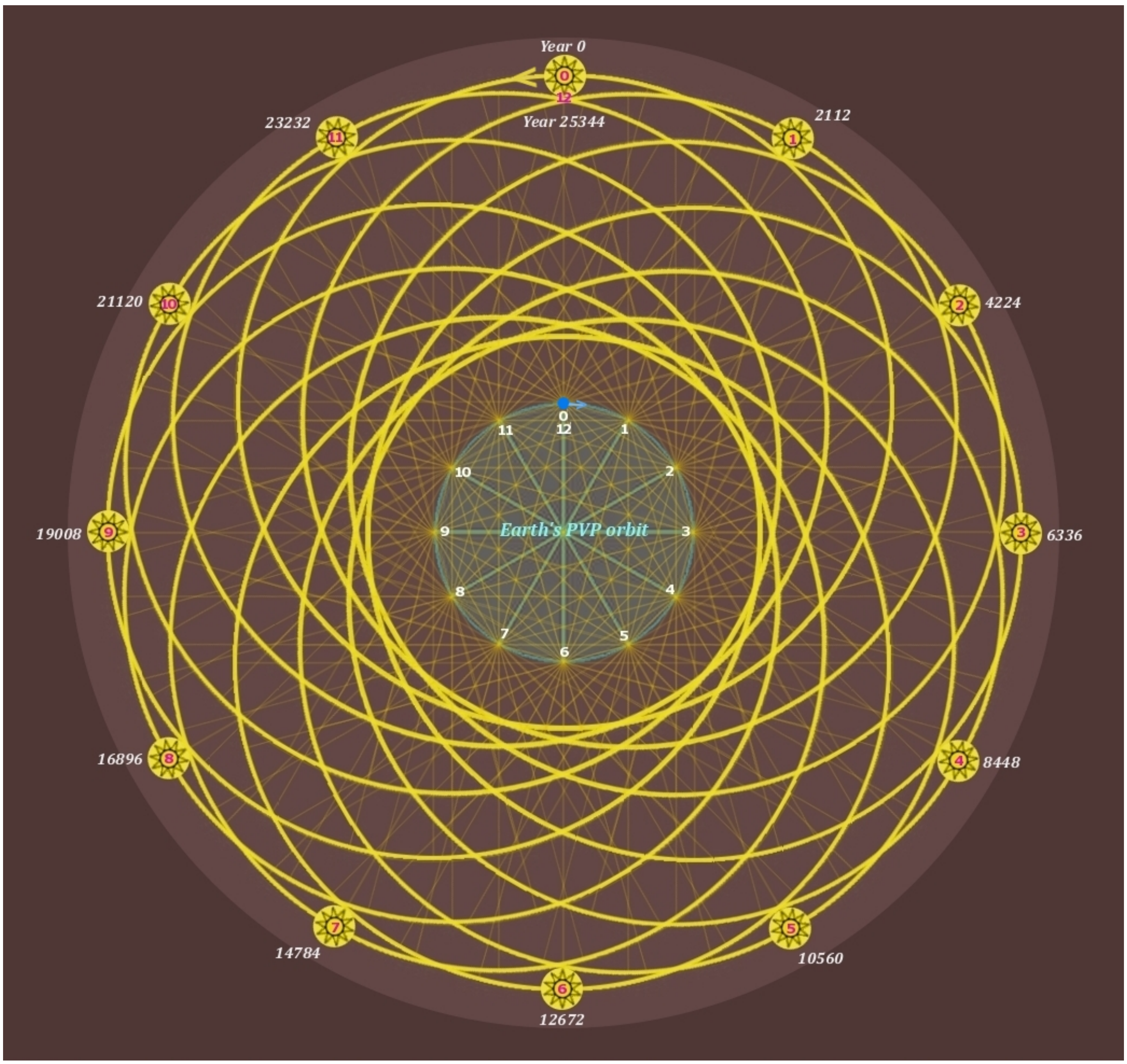


Fig. 19.2 The TYCHOS 'Great Year': Earth completes one revolution around its PVP orbit for every 25344 revolutions of the Sun.

As shown in Chapter 11, the Precession of the Equinoxes can readily be explained and illustrated in the TYCHOS: it is simply the natural consequence of Earth's slow, 'clockwise' revolution around its PVP orbit, which it completes in 25344 years. Fig. 19.2 depicts the Sun's trajectory over a full TGY (TYCHOS Great Year) of 25344 solar years, as the Earth slowly revolves in the opposite direction.

I computed and composed the graphic in Fig. 19.2 several years ago, using pen & paper and basic image editing software. Back then I hadn't met Patrik Holmqvist, the Swedish programmer who made it possible to translate my 2-D drawings into 3-D motion graphics by engineering the wonderful Tychosium 3D simulator. I was obviously thrilled when I saw the exact same spirographic pattern materializing in the Tychosium 3D simulator which I had pored over nights on end in the early stages of my TYCHOS research.

Fig. 19.3 is a screenshot from the Tychosium 3D simulator showing how the Sun will in fact trace a gorgeous spirographic mandala over a 25344-year period. Today anyone can visualize it at the touch of a button, by checking the "Sun" box in the Tychosium's "Trace" menu, selecting "1 second equals 1000 years"—and then clicking the "step forward" box 25 times:

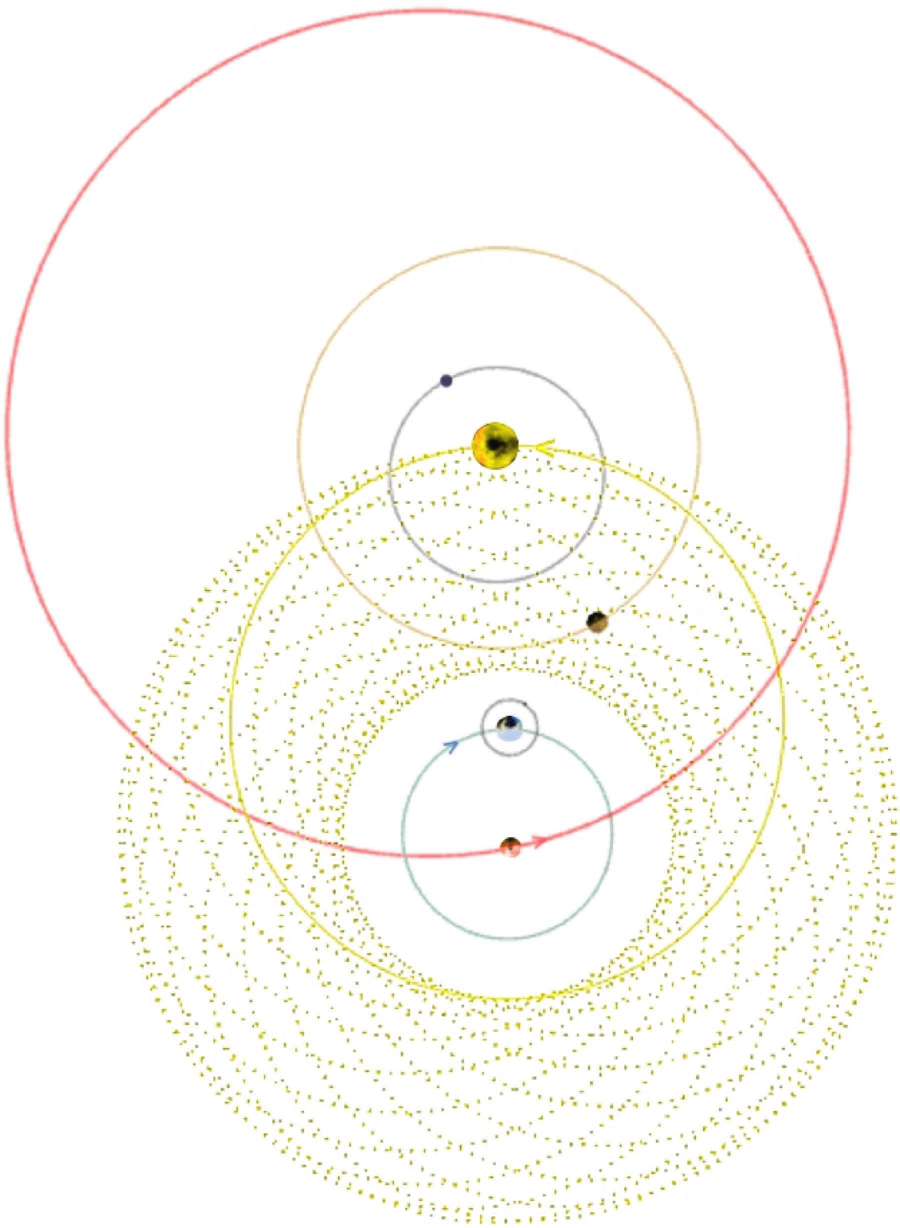


Fig. 19.3 25344 years of the Sun's motion demonstrated in the Tychosium 3D simulator.

19.2 About the Gregorian calendar's solar year count of 365.2425 days

I shall now recount the story of an early blunder of mine which I thankfully realized and corrected in time for the printed release of this 2nd Edition of the TYCHOS book. To be sure, to admit one's own errors should be a laudable act in all fields of scientific endeavour, so I will gladly eat some humble pie here and now—but not without noting that, as it turns out, the correction of my early mistake actually 'scores another point' for the TYCHOS model! All in all, my early slip highlights the difficulty of wrapping our heads around the opposite orbital motions of the Sun and the Earth, coupled with our ever-gyrating, trochoidal frame of reference (which will be illustrated in Chapter 21).

As stated in the Wikipedia, the Gregorian calendar is based on a year count of 365.2425.days:

> *The Gregorian calendar, as used for civil and scientific purposes, is an international standard. It is a solar calendar that is designed to maintain synchrony with the mean tropical year. It has a cycle of 400 years (146,097 days). Each cycle repeats the months, dates, and weekdays. The average year length is 365.2425 days per year, a close approximation to the mean tropical year of 365.2422 days.* [2]

In the 1st Edition of this book [3] released back in 2018, I speculated about the Gregorian solar year count being in error—by as much as 31.5 minutes per year. As of my calculations, this seemed to imply that the Sun would end up, in 25344 years, on the diametrically opposite side of the Earth (thus inverting our summers and winters in relation to our civil calendar). Only in the summer of 2023 did I realize the fallacy of my reasoning. Mind you, my argument (which proposed an 'optimal' count of 365.22057 days for our solar year, i.e., 31.5 minutes less than the Gregorian count) rested on sound logic and geometry and would actually be correct *if* the Earth did not spin around its axis but only moved at 1.6 km/ around its PVP orbit.

In short, I had strangely failed to connect the dots with a previous finding of mine, namely that of the annual 31.44-minute oscillation of the Sun in relation to our clocks (which will also be illustrated further on, in Chapter 21). In fact, probably the greatest difficulty of composing this book has been to arrange its contents sequentially. In astronomy, everything is intimately connected to everything else, yet the book format requires a sort of 'graded approach', from basic premises to specific developments. Frankly, the task is hopeless, but I have tried to the best of my ability. The only remedy I see is to read the book from cover to cover or to read it more than once!

Fortunately, as Patrik Holmqvist and I started building the Tychosium 3D simulator back in 2017, we judiciously chose to adopt the Gregorian solar year of 365.2425 days as the 'constant time unit' around which to construct the simulator—although we had briefly considered using my shorter year count. In hindsight, it was undoubtedly the right decision. For now, make a mental note of that peculiar '31.44-minute' figure which, as we shall soon see, plays a crucial role in validating the tenets of the TYCHOS model.

19.3 The apparent exponential increase of the equinoctial precession rate

The exact duration of the Great Year (or 'Annus Magnus') has never been determined with any degree of accuracy, as admitted by all earnest astronomers. This is because the observed precession appears to grow (at an 'exponential rate of increase') over the centuries, to the utter perplexity of the heliocentrists. Of course, tentative explanations abound, invoking the usual plethora of unfounded and untestable 'gravitational perturbations', 'non-gravitational effects', 'secular turbulences' and 'chaotic states'.

Indeed, astronomers have vainly attempted to quantify and justify the rate of increase of the stars' west-to-east precession rate only to find that it isn't linear, but exponential. For instance, back in the 19th century, Simon Newcomb proposed a constant of 0.00022″ to predict the annual increase. Over time, however, this 'constant of precession' proved to be a misnomer since it wasn't constant at all. In fact, the rate of increase has since then kept inflating, with a mean annual rate of 0.000337″ now being proposed for the past hundred years.

The actual observed change between 1900, when the precession rate was 50.2564" p/y and the year 2000 when the rate was 50.290966" p/y (Astronomical Almanac) was 0.0337, equating to an annual rate of change of 0.000337" p/y over the last 100 years. (...) The constant seems to work for a while until a close examination of the precession observable shows it is increasing at an exponential rate, outstripping the fixed constant. Thus the equation, even with an annual addition falls a little farther behind each year. [4]

Could the TYCHOS model possibly provide a simple and rational explanation for the apparent exponential increase of the equinoctial precession rate, you may ask. On pains of being repetitive, the answer to that question is 'yes'. Fig. 19.4 should readily clarify the issue.

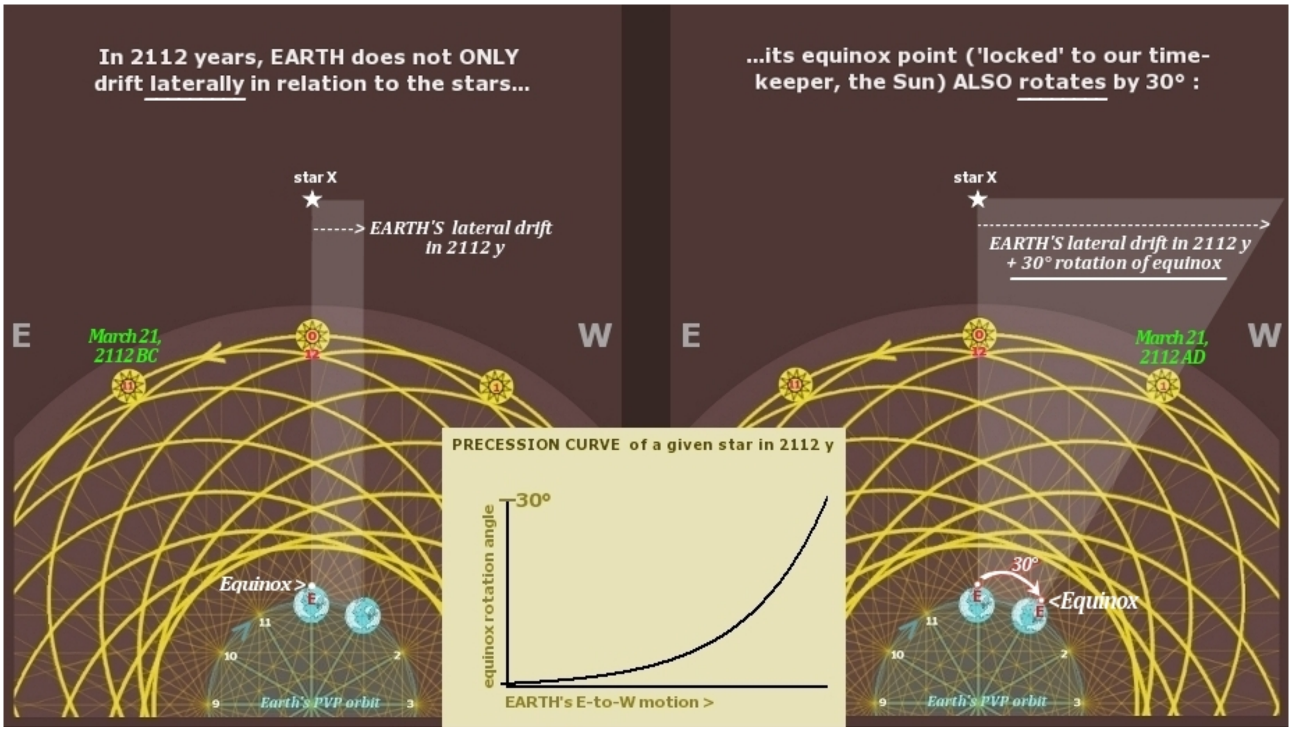


Fig. 19.4 Why the precession rate appears to increase exponentially. The observed secular 'precession' of the stars (from W to E vis-à-vis Earth's equinox) is caused by two separate components:

1. The slow, yet constant, E-to-W motion of Earth.
2. The E-to-W rotation of Earth's equinox vis-à-vis the stars.

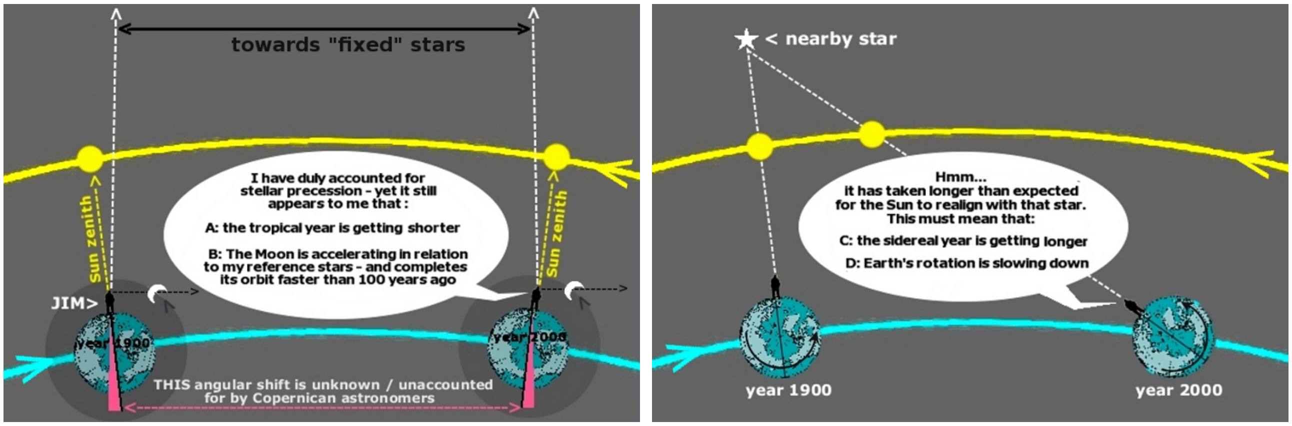
The observed precession rate of a given star will thus follow an exponential curve.

The difficulty of the matter lies in that the exponential increase of the equinoctial precession rate is the result of two separate, cumulative components:

- The east-to-west *lateral displacement* of Earth in relation to the stars.
- The east-to-west *rotation* of planet Earth in relation to the stars.

The observed secular increase of the stellar precession is closely related to the apparent accelerations and decelerations of the motions of the Moon, Sun and Earth, and goes to resolve a string of long-standing and still hotly debated riddles of astronomy, including:

- The apparent secular decrease of the length of the tropical year.
- The apparent acceleration of the Moon's orbital speed.
- The apparent secular increase of the length of the sidereal year.
- The apparent deceleration of Earth's rotational speed.



(a) *(b)*

Fig. 19.5 Why Jim, the Copernican astronomer, will reach the wrong conclusions. If Jim were aware of the Earth's progression around its PVP orbit, all the apparent secular variations in the motions and rotations of the Moon, the Sun and the Earth would vanish.

As should be clear from Fig. 19.5, all these apparent secular variations are part of the same effect of perspective. They are caused by the gradual angular shift of the Earth in relation to the Sun, the Moon and the background stars. Of course, under the heliocentric paradigm, no such angular shift would be expected since the Earth is believed to revolve around the Sun and to return to the 'same place' every solar year. For astronomers who choose to persist in the Copernican error, these apparent variations will forever remain a conundrum and a pretext for the concoction of extravagant hypotheses. Fig. 19.5 illustrates what sort of erroneous conclusions Copernican astronomers may reach as they analyse the relative, secular motions of the Earth, the Sun and the Moon.

In the TYCHOS model, these perceived accelerations and decelerations of the Moon and Earth are illusory and only a matter of inverted geocentric/heliocentric spatial perspectives. The Moon's revolution isn't speeding up, nor is Earth's rotation slowing down. All such assumptions made by Copernican astronomers are illusions that the TYCHOS can demonstrate to be—both qualitatively and quantitatively—a direct corollary of the Earth's (hitherto unknown) motion along its PVP orbit.

In a 1932 astronomy paper, J. K. Fotheringham provided a precious piece of information that can help understand the impasse of the heliocentrists:

> *It should be noted however, that when it was discovered that precession was subject to acceleration, the acceleration of precession was not usually included in the acceleration of the Moon's motion, so that acceleration is generally expressed as if it were a term in the sidereal longitude, not in the longitude as measured from the equinox.* [5]

In other words, the Copernican astronomers who vividly discussed the Moon's puzzling, apparent secular acceleration were measuring the Moon's motion against the starry background and not in relation to Earth's equinoctial points! Thus, they never envisioned the possibility of an illusory acceleration caused by the clockwise motion of the Earth-Moon system, slowly curving in space against the starry background. Nor did they, of course, ever entertain the prospect of the Sun revolving on an external orbit around Earth.

19.4 The Great Year of Mars

As we saw in Chapter 10, Copernican theorists attribute our 'Great Year' (the period required for a complete Precession of the Equinoxes) to a clockwise wobble of the Earth's polar axis—the infamous and roundly disproved lunisolar wobble theory. One might ask: if the wobble theory were correct, why would Mars exhibit a 'Great Year' of its own almost precisely twice as long as ours? Under the heliocentric theory, what could possibly explain the fact that the equinoctial precession rates of Mars and the Earth appear to exhibit a 2:1 ratio? To be sure, Mars is indeed officially reckoned to have a 51000-year equinoctial cycle:

> *The Martian equinoxes also precess, returning to an initial position over a period of about 51,000 years.* [6]

Now, the fact that the Martian equinoxes precess in about 51000 years, equivalent to two of our 'Great Years', would be entirely expected under the TYCHOS paradigm since our two binary companions, the Sun and Mars, are locked in a 2:1 orbital ratio. Mars will thus naturally employ twice as much time to complete its own equinoctial precession.

> *As a combined effect of the precession of the spin axis and the advance of the perihelion, alternate poles of Mars tilt towards the Sun at perihelion every 25,500 years—that is, on a 51,000-year cycle.* [7]

In the TYCHOS model, 1 TGY lasts 25344 years. However, since the Earth 'subtracts' one of the Sun's counter-clockwise revolutions every time it completes one clockwise PVP revolution, the TGY may more adequately be defined as the '25345-year solar cycle'. The Martian Great Year would therefore be expected to last 50690 years (25345 × 2). And, in fact, the Tychosium 3D simulator has Mars transiting in practically the same place in our skies on 21 June 2000 and on 21 June 52690 (a 50690-year interval).

As you can see, the body of evidence in support of Mars having a binary relationship with the Sun is overwhelming. Remarkably enough, as can be verified in the Tychosium 3D simulator, even our Moon exhibits a regular 25345-year cycle and, just like Mars, returns to virtually the same place in our skies every 50690 years (2 × 25345)!

19.5 Why Mars appears to rotate around its axis a little slower than Earth

As of the best astronomical observations, Mars appears to rotate once around its axis about 40 minutes slower than Earth [8]. One may rightly wonder why the rotational periods of Earth and Mars are so similar, but could perhaps even this apparent 40-min discrepancy be illusory? Could Mars's rotation around its axis be, in actuality, perfectly synchronous with Earth's axial rotation rate? Let us see if we can find any indications in support of this interesting hypothesis.

Comparing the orbital sizes of Earth and Mars

- Circumference of Earth's PVP orbit = 355 724 597 km
- Circumference of Mars' orbit = 1 435 079 524 km
- Earth/Mars 'orbital ratio' ≈ 4.03

$$\frac{1\ 435\ 079\ 524}{355\ 724\ 597} \approx 4.03$$

In a two-year timespan, Earth will move along its PVP orbit by 28072 km (14036 km × 2), an 'angular amount' which will correspond to a 113130-km 'slice' (28072 km × 4.03) of Mars' orbit. Hence, Copernican astronomers wishing to determine Mars' exact rate of motion will fail to account for half of this 'slice' (i.e., 113130 km / 2 = 56565 km) as they assess to their best capacities its biyearly return point against the stars.

Since Mars completes one of its long ESIs around the celestial sphere in 707 days (or 16968 hours), its 'perceived orbital speed'—relative to terrestrial time—will be about 84575.6 km/h:

$$\frac{1\ 435\ 079\ 524}{16968} \approx 84575.6$$

Mars would thus employ approximately 40 minutes to 'make up' for the aforementioned 56565 km:

$$60 \times \frac{56565}{84575.6} = 40.13$$

In other words, Mars will only appear to an earthly observer to rotate around its axis slower than Earth because the earthling will be offset by that amount in relation to Mars' celestial position. He will thus wrongly conclude that Mars rotates around its axis about 40 minutes slower than Earth.

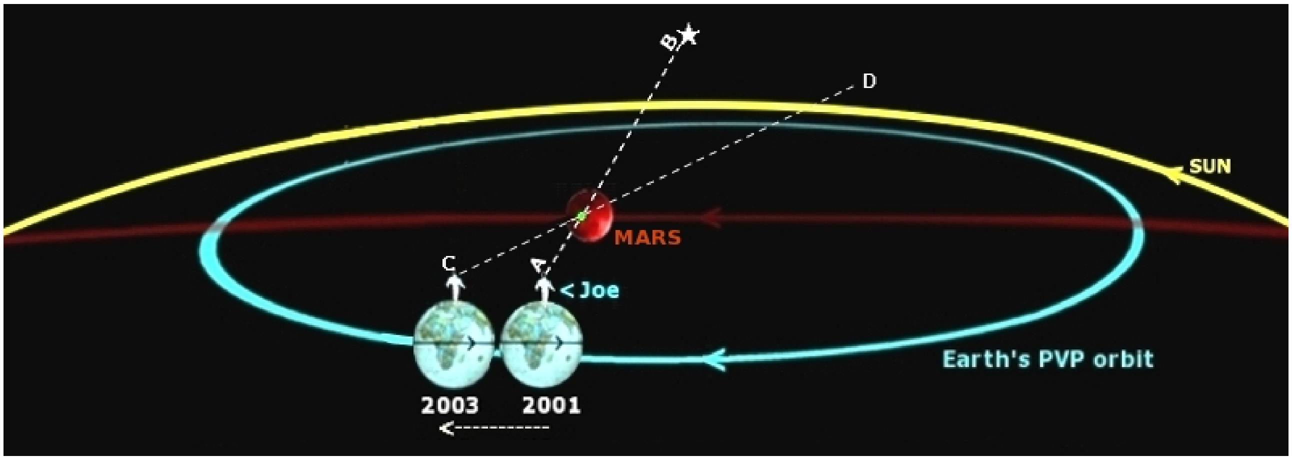


Fig. 19.6 Why Mars' axial rotation appears longer than 24 hours. In 2001, Joe aligns a central spot on Mars (green dot) with a given star (on the A⟶B axis). Two years later, Mars returns in opposition. As Joe again faces the green spot on Mars (on the C⟶D axis, he concludes that Mars needs more time to realign with the A⟶B axis. The problem is: Joe is unaware of Earth's motion along its PVP orbit. He thinks Earth has returned to the 'same place' as it was in 2001, when it has actually moved 28072 km (2 × 14036). Therefore, all of Joe's celestial calculations will be slightly 'off'.

The conceptual graphic in Fig. 19.6 illustrates how an earthly Copernican observer (Joe) will be led to think that Mars rotates around its axis slightly slower than Earth. The green dot marking a given point on the Martian surface will be seen by Joe from another angle after about 2 years, but in reality Mars has returned to the exact same angular orientation in space it had two years earlier.

It may also be worth noting that Mars' rotational speed around its axis would therefore be 891.5 km/h, which is 1.88 times slower than Earth's rotational speed of 1676 km/h. As it is, Mars revolves once around the Sun in 686.9 days on average, or approximately 1.88 × 365.25 days.

Lastly, consider this: the tilt of Mars' polar axis is reckoned to be 25.2°. This is 1.8° more than Earth's current axial tilt of 23.4°. However, the inclination of Mars' orbit in relation to our ecliptic is reckoned to be 1.8°. In other words, the 'absolute spatial orientation' of Mars' polar axis may quite possibly be identical to that of Earth's polar axis.

In conclusion, Mars would appear to rotate around its axis in the very same amount of time as Earth and to be tilted at the very same angle as Earth. The significance of this is unclear, but it is certainly not supportive of the heliocentrists' understanding of Mars and Earth as two independent and largely unrelated bodies randomly revolving around the Sun.

19.6 References

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[2] *Tropical year*, Wiktionary
https://en.wiktionary.org/wiki/tropical_year

[3] *The TYCHOS — Our Geoaxial Binary System*, 1st Edition (2018)
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[4] *Response to The Precession Dialogues* by Walter Cruttenden at BRI blog (2009)
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[5] *The Determination of the Accelerations and Fluctuations in the Motions of the Sun and Moon* by J.K. Fotheringham (1932)
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[6] *A Change in the Weather* by Michael Allaby and Richard Garratt (2004)
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[7] *The Planet Mars: A History of Observation & Discovery* by William Sheehan (1996)
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[8] *Mars rotation*, Universe Today
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20

The 811000-year Mega Cycle

20.1 Introduction

Our Solar System appears to have a very long cycle of 811000 years (or just about 32×25344y), at both ends of which all its components (i.e., the Sun, Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune, the Earth and the Moon) will return to the same locations in 'absolute space'. In any case, this is what the Tychosium simulator 'tells us': if we start the simulator, for instance, at 2000-06-21 and then add 811000 years to that date, all the bodies of our Solar System will return to the same celestial positions. I made this remarkable discovery almost by pure chance as I tested the Tychosium over multiples of 25344 years (i.e., the duration of a TYCHOS Great Year). The chances for this to be a mere coincidence (given the different orbital speeds and eccentric orbits of all our system's bodies) are—as you may agree—beyond any rational argument.

20.2 Agreement between simulators

Before we proceed any further, I would like to address a question I am sure many readers have on their minds: when it comes to very long periods and cycles, does the Tychosium 3D simulator agree with the other simulators 'on the market'? It is not a simple question to answer. The geo-heliocentric layout of the TYCHOS model naturally sets the Tychosium 3D simulator apart from heliocentric simulators but, truth be said, the latter all disagree with one another to some extent. However, one particular simulator—the JS Orrery—is of special interest to the TYCHOS model because of its somewhat similar graphic construct and layout. The man credited with providing the exacting algorithms and ephemeride tables for the JS Orrery happens to be Paul Schlyter, a veteran Swedish astronomer and staunch heliocentrist with whom Patrik Holmqvist (the developer of the Tychosium 3D simulator) and I have had an extensive e-mail exchange. According to Schlyter, the Tychosium will never attain to the level of accuracy of the JS Orrery; it is, in fact, doomed to fail.

To put that dire prediction to the test, let us compare the two simulators for accuracy over a long period. Unfortunately, the JS Orrery does not allow to enter dates as remote as 811000 years, so we shall restrict our test to a time span of some twenty thousand years. Figures 20.1 and 20.2 are screenshots from the respective simulators, comparing the relative positions of the Sun, Mars, Earth, Mercury, Venus and Jupiter on two dates 23429 years apart.

As you can see, the two simulators are in excellent agreement over a period of more than 23000 years. Patrik Holmqvist and I are now satisfied that the Tychosium 3D simulator is at least as reliable at predicting secular planetary positions as any of the most popular heliocentric Solar System simulators. And, more importantly, the Tychosium can do so while fully respecting the optical perspective of the observed conjunctions between our planets and the stars, unlike any existing heliocentric simulator—including the JS Orrery.

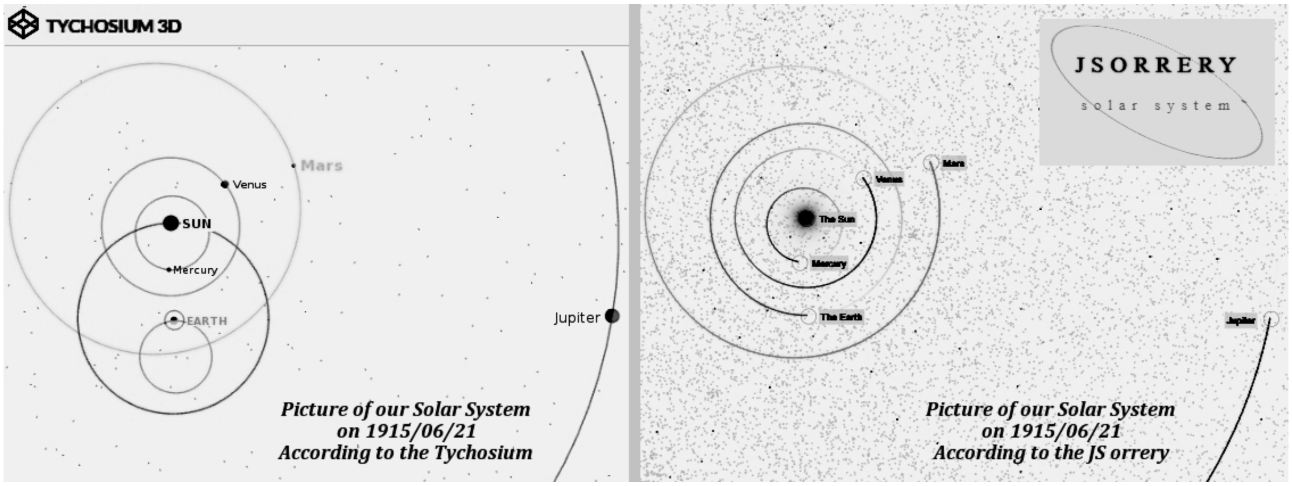


Fig. 20.1 The Tychosium (left) and the JS Orrery (right) showing the positions of our planets on 21 June 1915.

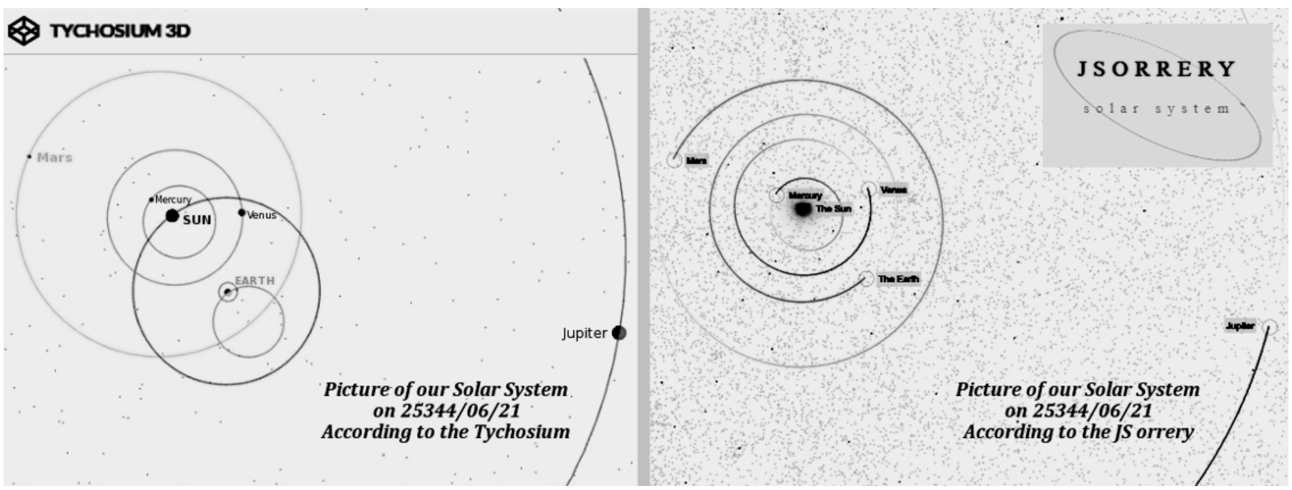


Fig. 20.2 The Tychosium (left) and the JS Orrery (right) showing the positions of our planets on 21 June 25344.

20.3 The 811000-year cycle of our Solar System and the Sirius system

In Chapter 6, I speculated about the possibility that the Sirius system may be the 'double-double' binary companion of our own Solar System. Incidentally, it is probably no fluke that the Sun reaches its apogee in the first days of July, as it aligns longitudinally with Sirius, as seen from Earth. As the 811000-year cycle gradually came to light, I decided to test the hypothesis by using Sirius' currently known observational data and predicted celestial motions. Sirius is reckoned to be approaching our Solar System and, according to the famed mathematical astronomer Jean Meeus, expected to become our south pole star roughly 60000 years from now [1]. The problem with this prediction is that, if—as officially claimed—Sirius were truly 8.6 light years away and were moving towards us at a radial velocity of 5.5 km/s, it would employ a minimum of 469300 years to reach the 'X vector' perpendicular to our system's ecliptic (thus plausibly becoming our south pole star). Clearly, the officially estimated distance to Sirius is in stark conflict with Jean Meeus' predictions and something else must be going on. For the purpose of my research however, I chose to use the ∼60000-year prediction of Sirius as our next south pole star.

Now, if the Sirius system were to be our Solar System's 'double-double' binary companion, we might expect it to have a binary orbit of similar size as ours. Hence, for my geometric experiment, I chose to draw two equally-sized 'wheels' (intersecting in classic binary fashion) representing the binary orbits of Sirius and our Solar System. Assuming their 'full secular cycle' to be 811000 years, I animated their motions in 16 steps of 50688 years, as can be seen in Table 20.1. As you may recall from Chapter 16, 50688 years (i.e. 2 × 25344) is the "Great Year of Mars".

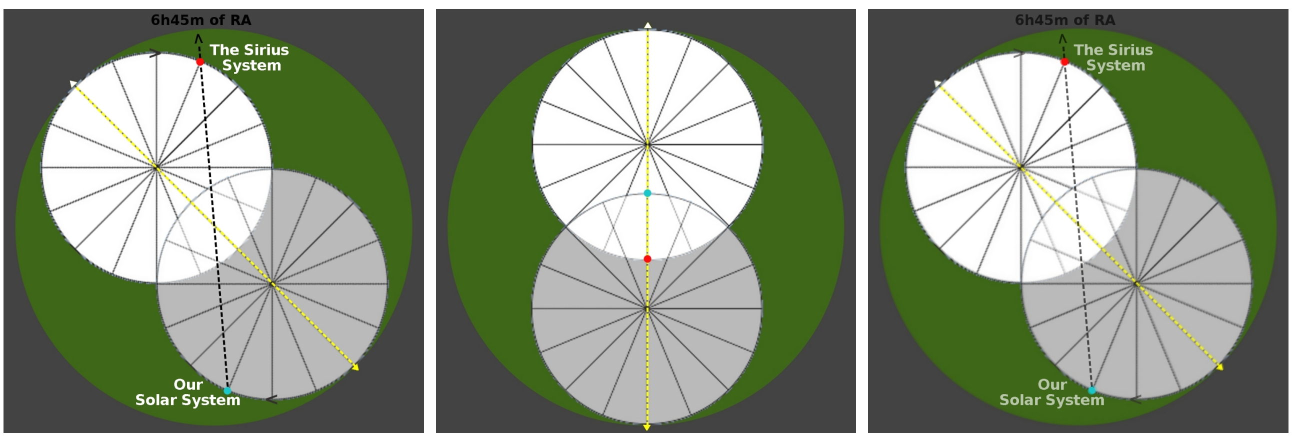
Table 20.1 – Interactive content

To view the full, animated 811000-year 'dance' of our system around the Sirius system, scan the QR code with a smart phone. The animation shows their relative positions over a full 811000-year period divided into 16 intervals of 50688 years.

Frame:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Year:	today	50688	101376	152064	202752	253440	304128	354816	405504	456192	506880	557568	608256	658944	709632	760320	811008

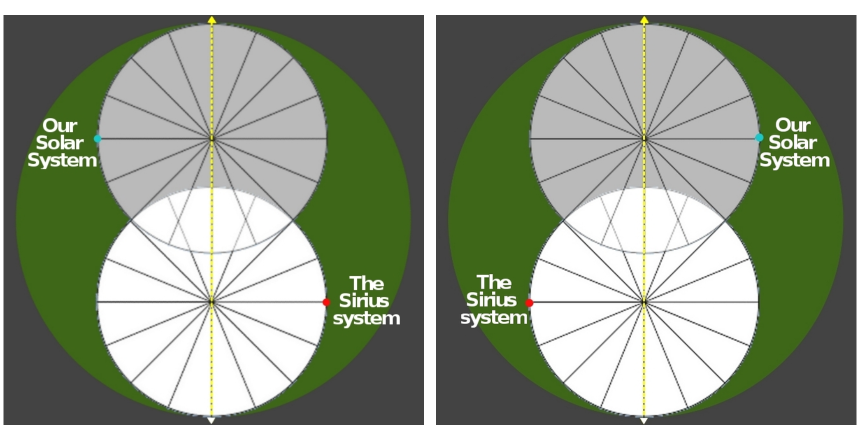
The outcome of this experiment—however speculative it may be [2]—makes for an interesting hypothesis: our Solar System and the Sirius system would complete what we may call a 'mega cycle' and return to the same relative positions in about 811000 years, which is illustrated in Fig. 20.3. Moreover, as predicted by Jean Meeus, Sirius would indeed become our southern pole star roughly 60000 years from now (or somewhat earlier).

The many independent researchers who have proposed that Sirius is the binary companion of the Sun may well have been correct all along. Note also how this may go to elucidate the existence of the mysterious 405-kyr cycle already discussed in Chapter 16. It bears reminding that this peculiar long period (405000 ± 500 years) has been identified by scores of multidisciplinary scientists as a significant 'metronome' regulating a number of cyclical events in the realms of geology, geodynamics, dendrochronology, climatology and paleomagnetism. As we may read in the Wikipedia, the major component of the variations of the eccentricity of the Earth's orbit occurs, interestingly enough, with a period of 405000 years [3]. Fig. 20.4 shows how the Sirius system and our own system will 'swap sides' (at 180°) over a 405500-year period, suggesting that some sort of long-term magnetic reversal might be at play.



(a) (b) (c)

Fig. 20.3 The 811000-year Sirius/Sun Mega Cycle. ***(a)*** Today we see Sirius at 6h45m of RA. ***(b)*** In 50688 years or so, Sirius will become our south pole star. ***(c)*** In 811000 years, the Mega Cycle is completed. Similarly, all the bodies in our Solar System return to the same place in 811000 years.



(a) (b)

Fig. 20.4 The 405500-year interval of the 'double-double' Sirius/Sun binary pair.
(a) Year 253440
(b) Year 658940

In Chapter 16, we saw that, over a 405500-year period :

- Mercury and Venus will return to the almost exact same celestial positions.
- Our Moon will end up (at 180°) on the opposite side of its orbit around the Earth.

Over a full 811000-year period (2 × 405500) however, our entire Solar System will completely 'reset itself'. That's right: as can be verified in the Tychosium 3D simulator, at both ends of an 811000-year period, our Earth, the Sun, Moon, Mercury, Venus, Mars, Jupiter, Saturn, Uranus and Neptune (and even asteroid Eros) will indeed all return to the near-exact same celestial positions! As for Halley's comet (which will be extensively analysed in Chapter 30), it will do so at both ends of a 1 622 000-year period (2 × 811000).

It is hard to fathom the scope and significance of all this; yet it certainly suggests that cosmologists and astrophysicists need to undertake a major rethink of the workings of our Solar System, what with its remarkable Mega Cycle of 811000 years (or 32 × 25344 years). Add to this the fact that—as we saw in Chapter 13—our Moon acts as the 'central driveshaft' of our entire system. The TYCHOS model is therefore set to revolutionize our current understanding of our cosmos while providing demonstrable proof of its non-chaotic and multi-resonant nature.

20.4 The TYCHOS and the magnetic pole reversals of the Sun and Earth

The so-called magnetic pole reversals of the Sun and the Earth are a subject of much debate and popular fascination. Yet, no firm explanation has been proposed to this day as to the causality of these magnetic reversals, let alone the vastly diverse rates at which they occur. The TYCHOS model, short of explaining exactly why these reversals take place, nonetheless provides a compelling proposition which would account, quantitatively, for the enormously different periods of magnetic reversals of the Sun (~11.5 years) and the Earth (~800000 years).

Let us first take a brief look at the Sun's magnetic field reversal period, as of the official reckoning:

> *During what is known as the solar cycle, the magnetic field of the Sun has reversed every 11 years over the past centuries. This flip, where the south magnetic pole switches to north and vice versa, occurs during the peak of each solar cycle and originates from a process called a* dynamo. *Magnetic fields are generated by a dynamo, which involves the rotation of the star as well as convection and the rising and falling of hot gas in the star's interior.* [4]

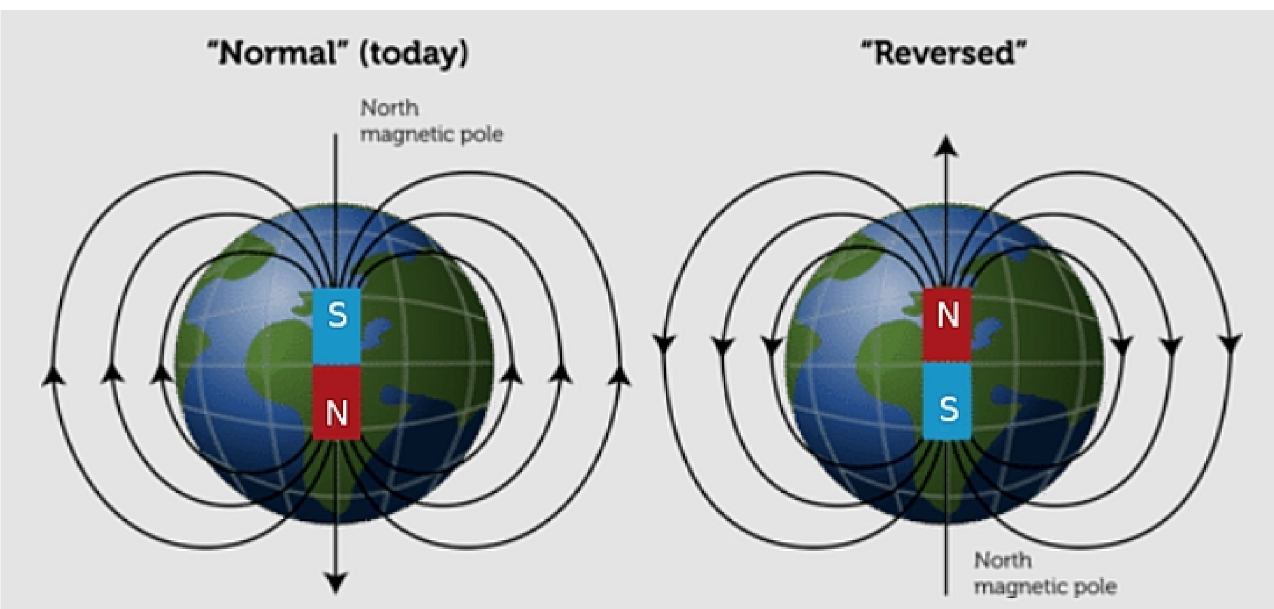


Fig. 20.5 A classic illustration of the magnetic pole reversal concept.

So the Sun's magnetic field, we are told, reverses at very short intervals of 11 years. However, this is not an exact value since the period can vary from 9 to 14 years:

> *Most people think of the solar cycle as having a fixed length of 11 years. This is not strictly true as cycles vary considerably in length from as little as 9 years to almost 14 years.* [5]

One could perhaps more correctly say that this solar cycle lasts on average about 11.5 years ((9 + 14) / 2). But do scientists have any clue as to why this solar cycle exists? Well, no:

> *If you're confused about the sun's impending magnetic field flip, don't feel bad—scientists don't fully understand it, either. The sun's magnetic field will reverse its polarity three or four months from now, researchers say, just as it does every 11 years at the peak of the solar activity cycle. While solar physicists know enough about this strange phenomenon to predict when it will occur, its ultimate causes remain mysterious.* [6]

In Chapter 16, we saw that the most recent geomagnetic reversal of the Earth's poles occurred roughly 800000 years ago. More precisely, what is known as the 'Brunhes-Matuyama reversal' is reckoned to have occurred 781000 years ago.

In the TYCHOS model, the Earth's orbital speed (1.601169 km/h) is a mere 0.00149326% of the Sun's orbital speed (107226 km/h). So let's see how this pans out mathematically with regard to the respective magnetic reversal periods of the Sun and the Earth:

- 0.00149326% of 781000 years amounts to ~11.6624 years

In other words, it would appear that the magnetic reversals of the Sun and the Earth are regulated by and commensurate to their respective orbital speeds. Another way of expressing this astonishing relationship would be:

- Earth's orbital speed is ~66967.3 times smaller than the Sun's orbital speed.

$$\frac{107226}{1.601169} \approx 66967.3$$

- Earth's magnetic reversals occur ~66967.3 times less frequently than the Sun's.

$$\frac{781000}{11.6624} \approx 66967.3$$

Of course, this remarkable harmony only becomes visible when viewed through the lens of the TYCHOS model. To be sure, no heliocentric astronomer has ever attempted to account for the vastly different recurrence rates of the Earth's and the Sun's magnetic pole reversals. In the absence of any official explanation for their respective periodicities, one may say that the TYCHOS model 'wins by default', much like when a basketball team fails to show up at a tournament. In the next chapter we shall take a further look at the motions of the Earth and the Sun and the optical implications of the same, as viewed from an earthly frame of reference.

20.5 References

[1] *Sirius is a future southern Pole Star*, Earthsky.org
https://earthsky.org/tonight/sirius-future-south-pole-star

An interesting calculus: The official distance to Sirius is 8.611 "light years". In the TYCHOS, 1 "light year" translates to 1.4834 AU (see Chapter 23); thus, the distance between us and the Sirius system would be $8.611 \times 1.4834 \approx 12.774$ AU (or 1 910 990 400 km). In the Wikipedia entry for Sirius, we may read that *"Sirius will take its turn as the southern Pole Star, around the year 66270"*, i.e., in about 64250 years (or 563 215 500 hours) from now. We may thus estimate the radial speed (in km/h) at which Sirius is approaching us: 1 910 990 400 km / 563 215 500 h $\approx$ 3.39 km/h. Interestingly, this is just about twice the speed of the Earth around its PVP orbit (1.6 km/h), dictated by the slow, 'clockwise' precession of our Solar System around itself. Perhaps then, what is perceived as the 'radial approach velocity' between our two binary systems may be attributable to the two moving towards each other at the same precessional rate of about 1.6 km/h.

[2] Of course, since we don't know just how and at what speed the Solar & the Sirius systems revolve around each other, the "811000-year" period is entirely speculative. The actual period may just as well be, for instance, 8 times shorter (i.e., 101375 y, which is close to another important Milankovitch cycle). Only time will tell...

[3] *Milankovitch cycles*, Wikipedia
https://en.wikipedia.org/wiki/Milankovitch_cycles

[4] *3D simulations reveals why the Sun flips its magnetic field every 11 years*, Smithsonian
https://tinyurl.com/sunflipSMITHSONIAN

[5] *The Length of the Solar Cycle*, gov.au Edu
https://www.sws.bom.gov.au/Educational/2/3/7

[6] *What Causes the Sun's Magnetic Field Flip?*
https://www.space.com/22310-sun-magnetic-field-flip-mystery.html

A man's yearly path and the analemma

21.1 About trochoidal loops

In the TYCHOS model, the Earth proceeds at 1.6 km/h (∼1 mph), covering an annual distance of ∼14036 km (the EAM), a distance only 1280 km longer than Earth's own diameter of 12756 km. The Earth makes a 360° rotation around its own axis every 23h56min (a sidereal day), but every 24 hours (a solar day) it will rotate by 361°. Hence, over the course of one month, a point on the surface of the Earth will be displaced by ∼30° in relation to the firmament. Due to these combined rotational and translational motions, the path traced by a man standing still in one spot for a full year will be a trochoidal loop or, more precisely, a 'prolate trochoid' as shown in Fig. 21.1.

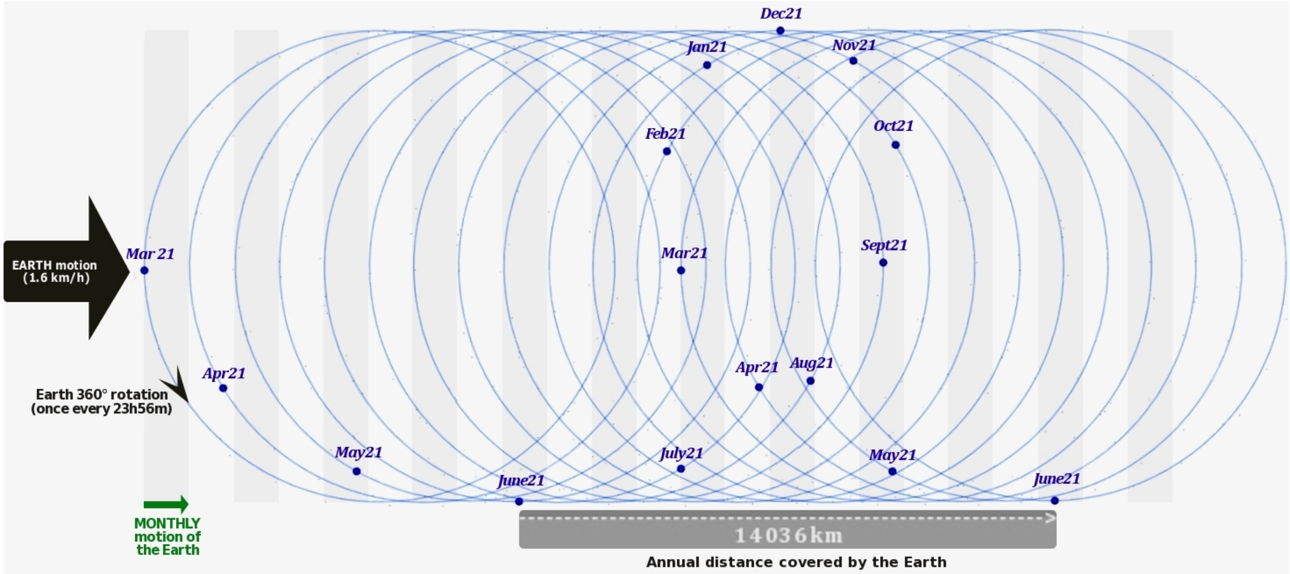


Fig. 21.1 View from above the North Pole. The blue dots represent the actual absolute spatial locations of a man standing at the equator at midnight on the 21st day of any given month. His yearly trajectory will thus be a prolate trochoid.

A *trochoid* [1] is simply a curve traced by a point fixed to a circle as it rolls along a straight line. Thus, an imaginary stationary astronomer in London (let's call him Jim) patiently monitoring the annual motions of the star Vega through his telescope for a full year will be carried around a trochoidal path. This is illustrated in Fig. 21.2.

Of course, unless Jim is aware of his own trochoidal motion (his 'ever-looping frame of reference'), he will be baffled at star Vega's seemingly inexplicable behaviour in the course of a full year: as he records the successive positions of the star on a fixed photographic plate (which, of course, will gyrate in the same manner as himself), its annual motion will appear to trace a peculiar geometric curve known as a prolate trochoid.

Note that the shape and 'height' of these stellar trochoidal loops will vary depending on the celestial latitude of the star and on the observer's earthly location. However, if the star is located along the Earth's equatorial ecliptic, no trochoidal loop will be seen; instead, it will appear to proceed along a straight line while periodically reversing direction (retrograding) whenever Jim is temporarily 'carried backwards' in relation to the Earth's forward motion, as shown in Fig. 21.3.

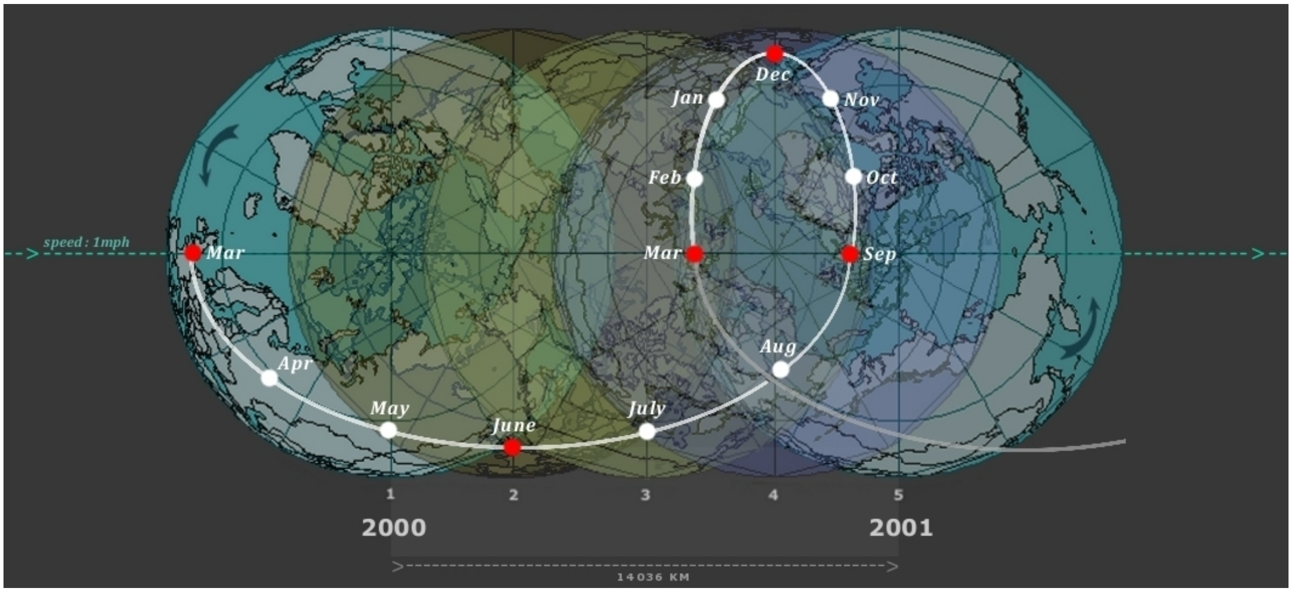


Fig. 21.2 'A Man's Yearly Path': this graphic illustrates the annual path taken by 'Jim' (a stationary astronomer located in London), starting from March 21 at midnight. As the Earth proceeds along its PVP orbit at the speed of ~1.6 km/h, the combined geometric effects of its rotational and forward motions will cause Jim to gyrate annually around this trochoidal trajectory, something which will obviously affect all his celestial observations.

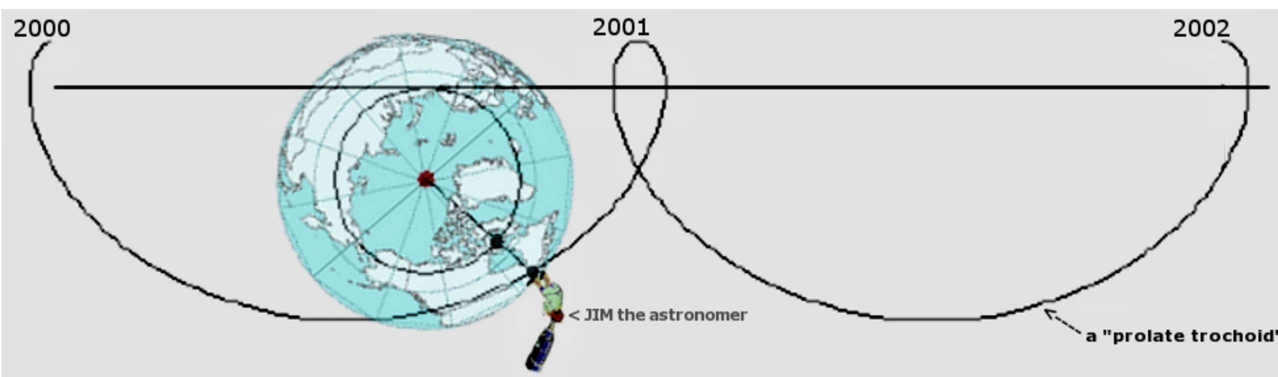


Fig. 21.3 If we could snap a picture (from above the North Pole) of Jim, the observer, every day at midnight for two consecutive years, this is what Jim's path would look like.

Our Jim then decides to monitor another star, then another, and then another. He finally realizes that all the stars in our sky exhibit trochoidal motions and/or short retrograde periods. Jim, who just isn't ready to abandon his long-nurtured convictions, may then come up with all sorts of *ad hoc* hypotheses to 'explain the inexplicable'. This was, in fact, precisely the case with Astronomer Royal James Bradley who famously monitored the star Draconis for extended periods of time and, having later noticed that all the stars exhibit such looping paths, went on to formulate an abstruse theory that he named 'Stellar Aberration', or 'The Aberration of Light'. But more about that in Chapter 22.

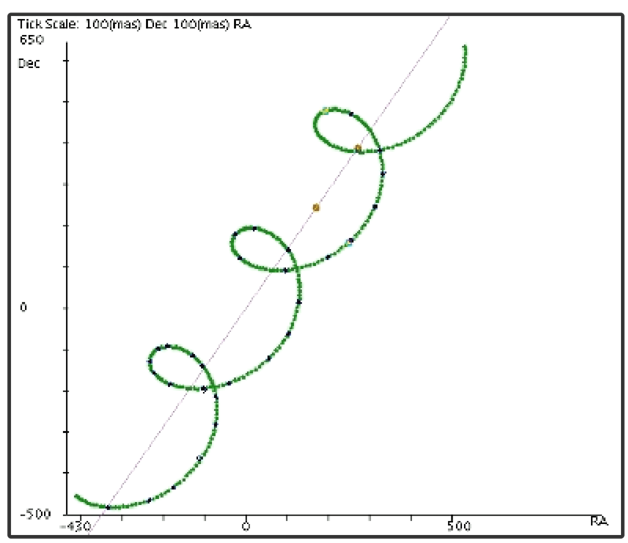


Fig. 21.4 Modern diagram of the observed motions of the circumpolar star Vega over a 3-year period. [2]

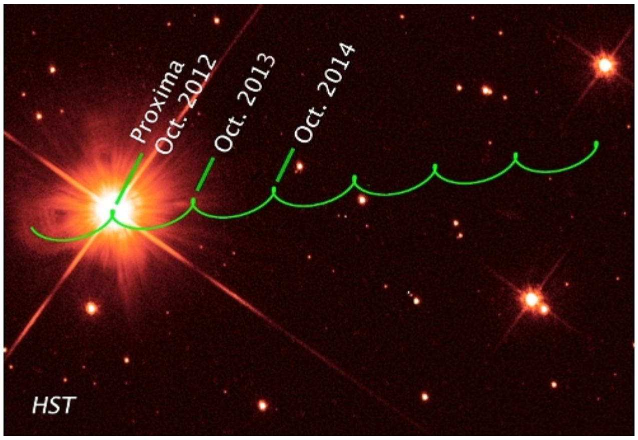


Fig. 21.5 Credited to NASA, this illustration features the following caption: "*The looping action is the result of the Earth's motion around the Sun.*" Source: Hunting for planets around Proxima Centauri, by D. Dickinson [3].

The image in Fig. 21.5 is from a 'mainstream' astronomy website. It shows that even our nearmost star, Proxima Centauri, is seen to proceed along a trochoidal path similar to that of Vega, although the loops are 'flatter' due to Proxima's lower celestial latitude (viewing angle).

Note the absurd, official explanation in Fig. 21.5: "*The looping action is the result of the Earth's motion around the Sun*". Pray tell, how could this be the case? Surely, if our Solar System were moving at 800000 km/h (as officially claimed), thus covering some 7 billion kilometres annually, this looping pattern should be more elongated by several orders of magnitude; to wit, the spaces between the loops should be enormously larger and the loops themselves, which would only represent the 300 Mkm diameter of the Earth's supposed orbit around the Sun, would hardly be noticeable: 300 Mkm is a mere 0.0043% of 7 billion kilometres!

We shall now proceed to show how the annual trochoidal motion of an earthly observer can account for other still unexplained, or dubiously interpreted, celestial phenomena. Perhaps the most curious of them all is the observed annual motion of the Sun, as it traces an elongated '8'-shaped pattern in our skies. This geometric pattern traced by the Sun's yearly motion is known as the 'analemma'.

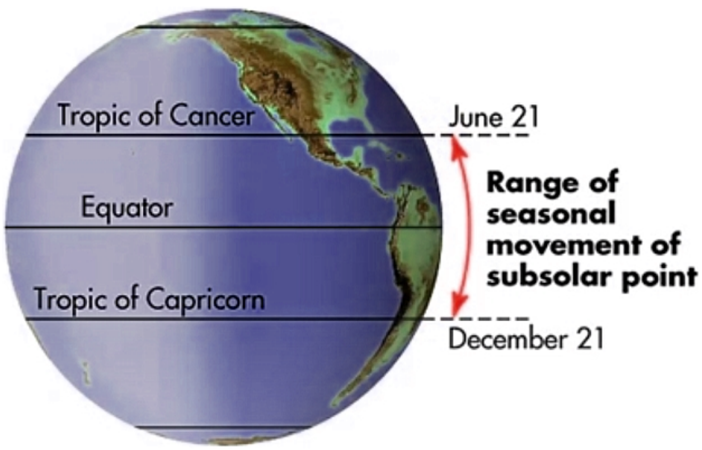
21.2 The analemma: a qualitative analysis

Any patient photographer can empirically verify the existence of the analemma by setting up a tripod and snapping pictures of the Sun at noon (say, every ten days or so) for a full year. What will be obtained is an elongated '8'-shaped curve (wider at the lower end) well-known to astronomers. In the past, the analemma used to be printed on the pretty globes adorning people's living rooms. For some reason though, this is no longer the case.

Fig. 21.6 The analemma pictured on a world globe.

Everyone has heard of the proverbial broken clock which will nonetheless show the correct time twice a day. However, not everyone knows that our earthly clocks are, strictly speaking, almost never on time. In fact, our clocks only agree with the Sun's midday zenith 4 times a year. For the remaining part of the year, our clocks will be slipping in and out of sync with the Sun by as many as $+16.5$ minutes or -14 minutes, depending on the time of year.

But what exactly causes this curious analemma? Of course, the vertical component (December-June) of the analemma is due to the Sun's shifting elevation between winter and summer associated with Earth's axial tilt ($23.4° \times 2 = 46.8°$), so no mystery there. On the other hand, the lateral component of the analemma (i.e., the alternating east/west drift of the Sun) has never been adequately explained. As current theory has it, it is caused by Earth's elliptical orbit and its variable velocity around the same. This, we are told, would explain why the Sun's zenith oscillates in our skies by more than half an hour. What sort of magical forces would cause Earth to speed up and slow down? And why would its orbit be elliptical? No such phenomena have ever been observed in nature. Yet, this has somehow been accepted as scientific fact, in the complete absence of experimental corroboration.



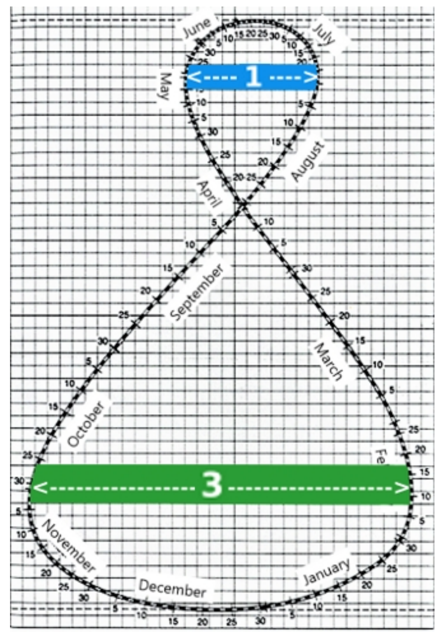
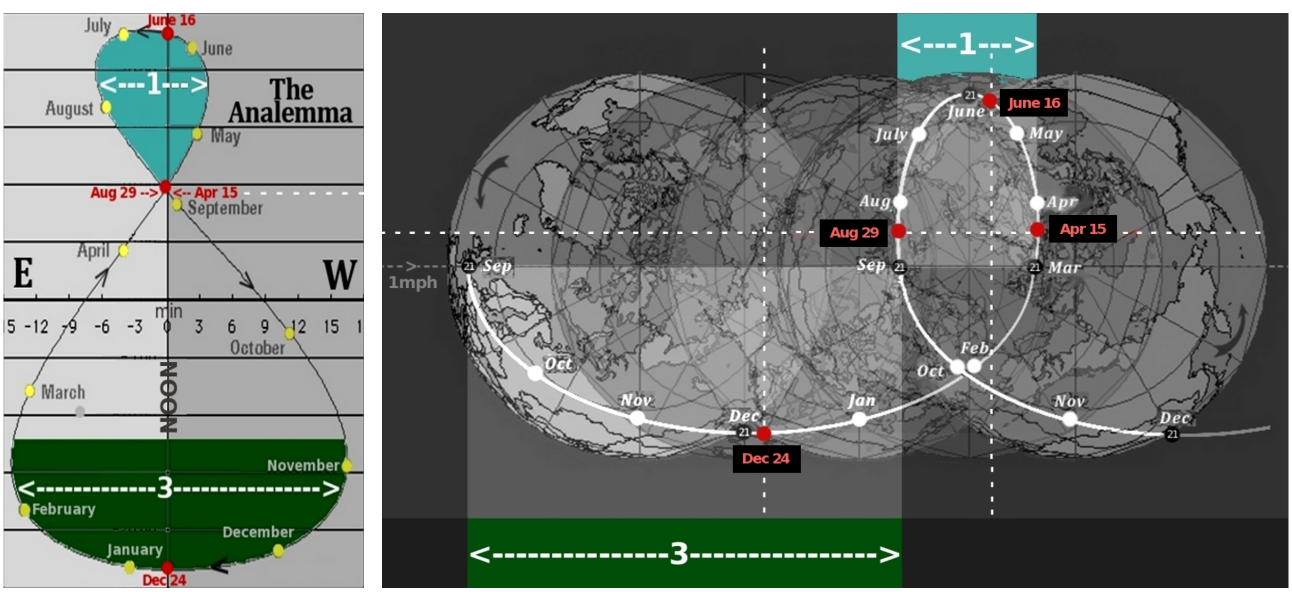


Fig. 21.7 The cause of the analemma's vertical shift is readily explained. But what exactly causes its horizontal 3:1 asymmetry? No rational explanation for this has been submitted to this day.



(a) *(b)*

Fig. 21.8 The reason why our clocks only strike noon correctly 4 times a year. ***(a)*** The analemma 'mirrors' the annual trochoidal path of an earthly observer. ***(b)*** Our clocks—that tick at a constant rate—cannot possibly remain synchronised all year long with the observed motion of the Sun. This, because all earthly observers are carried around a trochoidal path.

Note

Current theory about elliptical orbits and variable orbital velocities is roundly falsified by the observable fact that the Sun appears to 'accelerate' in June and July when the Sun-Earth distance reaches its maximum and a 'deceleration' would be expected. Direct observation is all that is needed to refute Kepler's 'laws'.

Indeed, the most curious aspect of the analemma is its conspicuously asymmetric 8-shape (thinner at the top and thicker at the bottom). Now, what could possibly cause this uneven distribution of the Sun's annual east-west oscillation? Various theories have been advanced, yet none have definitively settled the question. In section 21.1, we saw that a man's yearly path takes the form of a prolate trochoid. Over a full year, this trochoidal motion has a lateral displacement ratio of 3:1 and, in fact, the asymmetry of the analemma exhibits a similar 3:1 ratio (readers may also recall the 3:1 ratio of the Moon's trochoidal apsidal precession demonstrated in Chapter 13). The comparative diagram in Fig. 21.8 should clarify the matter.

Note how the four occasions on which our earthly clocks 'agree with the Sun' (i.e. 16 June, 24 December, 29 August and 15 April) neatly coincide with the observed analemma. At this point, it should be intuitively evident to the reader that the analemma is, at least qualitatively speaking, closely related to what I like to call 'a man's yearly path'. Let's now take a brief look at the math involved.

21.3 The analemma: a quantitative analysis

If in the course of a year our clocks can be 'ahead' by about 16.5 min and 'behind' by about 14 min, the total east-west offset of the Sun in relation to the true zenith would amount to 30.5 minutes. You may now ask: how then can we accurately measure time and calibrate our clocks (which, of course, tick at constant speed) with the solar motion if our celestial timekeeper (the Sun) keeps 'accelerating' and 'decelerating'? Well, the thing is, we can't.

The so-called Equation of Time is a clever man-made convention devised to deal as best as possible with this pesky lateral oscillation of the Sun. In fairness, the Equation of Time has provided an ingenious solution to the problem. Yet, the fact remains: our clocks, as useful as they are for our daily purposes, are cosmically speaking almost always 'offset' in relation to the Sun.

Note that the total observed annual 'lateral drift' of the Sun adds up to 30.5 min (16.5 min + 14 min) of RA. However, this is without accounting for the fact that an extra 3.93 min is added by convention, via the leap-year gimmick, every four years or so. To be precise, the long-term average is 3.76 min since some leap years are skipped. Therefore, 0.94 min (¼ of 3.76 min) must be added to the annual count of the Sun's lateral drift, yielding a total of 31.44 min.

In other words, the full annual east-west oscillation of the Sun around its 'mean zenith' amounts to 31.44 minutes. As you will recall, we already met this peculiar figure in Chapter 19 where I mentioned how one might 'mathematically expect' a TYCHOS solar year to last for 365.22057 days, i.e. circa 31.5 minutes less than the Gregorian solar year of 365.2425 days. However, such a calculation doesn't take into account either the trochoidal path of the terrestrial observer (and time-keeper) nor the alternating Sun-Earth orbital directions and fluctuating Sun-Earth distances, nor the 23.5° tilt of our planet's polar axis.

Now, to find the average rate of oscillation of the Sun over the four quadrants of our celestial sphere (i.e., the four seasons), we must divide our 31.44-minute figure by 4, which amounts to 7.86 min.

Note that it matters not whether this mean figure of 7.86 min takes the minus sign or the plus sign, since the Sun's motion can be either co-directional or counter-directional to Earth's motion. We shall now verify whether this rate might be correlated with Earth's orbital speed.

- Orbital speed of the Sun = 107226 km/h
- Orbital speed of the Earth = 1.601169 km/h
- 1.601169 km/h represents 0.00149326% of 107226 km/h
- Duration of 1 sidereal year = 525969.17 min
- 7.86 min represents 0.00149438% of 525969.17 min

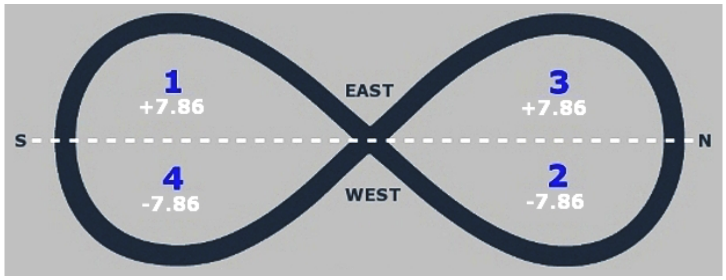


Fig. 21.9

Interestingly, the Sun (travelling at 107226 km/h) will employ just about 7.86 minutes to cover 14036 km, i.e. the annual distance covered by the Earth as it revolves along its PVP orbit.

In conclusion, the analemma could conceptually be envisioned as Earth's 'speedometer' since its mean rate of east-west oscillation reflects our planet's orbital speed of 1.6 km/h. In addition to this important realization, the following should be kept in mind:

- All astronomical observations must necessarily take into account the annual trochoidal motion of our earthly reference frame. This includes all matters pertaining to stellar motions and parallaxes—as well as when optimizing the solar year count for the purpose of perfecting our civil calendar's synchrony with the Sun.
- This trochoidal motion is the main reason why we need the Equation of Time, along with the other factors and variables described above.
- The Sun's annual 31.44-minute east-west oscillation goes to explain why the Gregorian calendar's solar year count (365.2425 days) is about 31.5 minutes longer than that which might be expected in the TYCHOS model (365.22057 days), as discussed in the 1st Edition of this book.

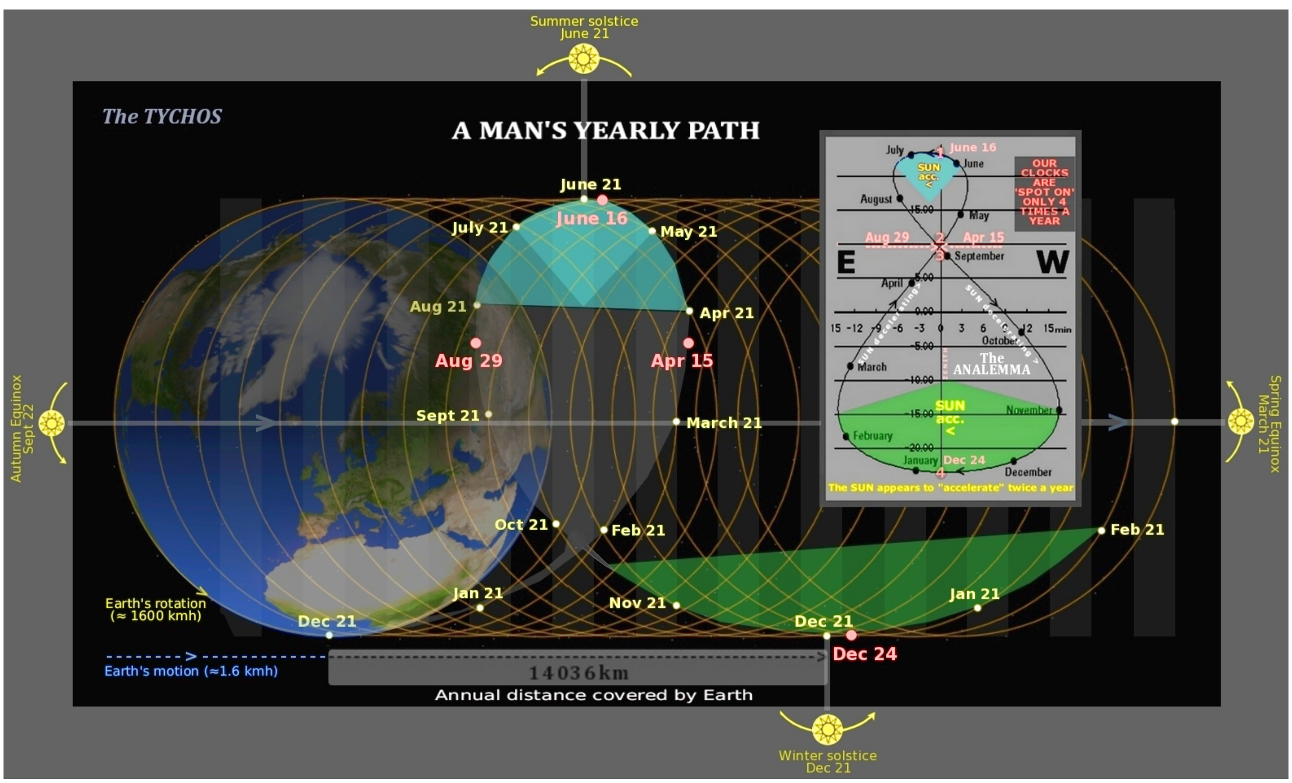


Fig. 21.10 As Earth rotates and moves, a man will be carried around a trochoidal path. As he monitors the Sun's position at noon over a full year, the Sun will appear to speed up and slow down (longitudinally) in relation to his clock. This is due to a combination of factors caused by **(1)** his own asymmetric spatial displacements, **(2)** the seasonally fluctuating relative Sun-Earth speeds, **(3)** the Sun's variable distance from Earth. The man's clock will only 'strike noon' correctly 4 times a year—as the Sun traces in the sky the curious 8-shaped *analemma*.

21.4 The TYCHOS and the 'magic' 137 number

In Chapter 12 we saw that the solar year is shorter than the sidereal year. Our earthly estimates of the average daily distance covered by the Sun are of course based on the shorter solar year. However, a hypothetical observer on the Sun—let's call him Prof. Sunstein—will gauge his own mean daily motion against the full celestial sphere of 1440 min of RA rather than the 1436.024 min of RA against which we gauge what we call 'the solar year' (a 0.2672% difference). In fact, here on Earth we see the Sun moving daily by 3.976 min of RA on average, which amounts to about 0.2672% of 1440 min. Since the Sun revolves around the Earth once a year, it will subtract one day (or a 0.2762% slice) from our earthly calculations. Prof. Sunstein is not subject to this illusion and so will correctly estimate the Sun to move by 0.2672% of its orbital circumference every day.

- Circumference of the Sun's orbit = 939 943 910 km
- 0.2672% of 939 943 910 km amount to ∼2 596 125 km

This 2 596 125 km value represents the 'absolute' daily distance covered by the Sun. Interestingly, it also turns out to be approximately 1/137 of the circumference of the PVP orbit:

- Daily displacement of the Sun = 2 596 125 km
- Circumference of the PVP orbit = 355 724 597 km
- The difference corresponds to a 1/137 ratio:

$$\frac{355\ 724\ 597}{2\ 596\ 125} \approx 137.02$$

Put differently, the distance covered by the Earth in 1 TGY (25344 solar years) is about 137 times longer than the distance covered by the Sun in one day. Or you could say that for each daily rotation of the Earth, the Sun covers a distance corresponding to 1/137 of the Earth's orbital circumference.

But why bother about a seemingly random number like 137? Well, it so happens that this peculiar 1/137 ratio is one of the most hotly debated 'mysteries' in physics:

> *Why the number 137 is one of the greatest mysteries in physics. Does the Universe around us have a fundamental structure that can be glimpsed through special numbers? The brilliant physicist Richard Feynman (1918-1988) famously thought so, saying there is a number that all theoretical physicists of worth should "worry about". He called it "one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by man". That magic number, called the fine structure constant, is a fundamental constant, with a value which nearly equals 1/137. Or 1/137.03599913, to be precise. It is denoted by the Greek letter alpha —* α*. [...] Appearing at the intersection of such key areas of physics as relativity, electromagnetism and quantum mechanics is what gives 1/137 its allure.* [4]

The 'fine-structure constant' has kept the world's most eminent physicists busy for decades, including Nobel Prize winner Wolfgang Pauli (1900-1958) who was obsessed with it his whole life: "*When I die my first question to the Devil will be: What is the meaning of the fine-structure constant?*", Pauli joked. Physicist Laurence Eaves, a professor at the University of Nottingham, would choose the number 137 to signal to aliens as an indication that humanity has some measure of mastery over the planet and is familiar with quantum mechanics. He believes the hypothetical aliens would be aware of the significance of the number as well, especially if they developed advanced sciences. [5]

Without delving too deeply into atomic physics, a domain beyond the scope of this book, it will suffice to remind the reader that electrons have long been thought to revolve around the atomic nucleus "*much like planets orbit the Sun*", as Niels Bohr would have put it when he proposed his famous model of the atom in 1912. Today, the orbital velocity of electrons is believed to be 1/137 the speed of light. Theoretical physicists refer to this perplexing and relatively recently discovered 1/137 ratio as the 'fine-structure constant' or the 'coupling constant' (or simply 'Alpha') of the electromagnetic force that binds atoms together.

> *Perhaps the most intriguing of the dimensionless constants is the fine-structure constant α. It was first determined in 1916, when quantum theory was combined with relativity to account for details or 'fine structure' in the atomic spectrum of hydrogen. In the theory, α is the speed of the electron orbiting the hydrogen nucleus divided by c. It has the value 0.0072973525698, or almost exactly 1/137. Today, within quantum electrodynamics (the theory of how light and matter interact), α defines the strength of the electromagnetic force on an electron. This gives it a huge role. Along with gravity and the strong and weak nuclear forces, electromagnetism defines how the Universe works. But no one has yet explained the value 1/137, a number with no obvious antecedents or meaningful links.* [6]

The 'magic' 137 number is also described as a constant related to an electron's magnetic moment, or the 'torque' that it experiences in a magnetic field. In the TYCHOS, the Sun may be conceptualized as the 'electron' that revolves around, and in the opposite direction of, the spinning 'nucleus', which may be envisioned as 'the central magnetic field' constituted by the Earth's PVP orbit. As shown at the beginning of this section, for every diurnal rotation of the Earth, the Sun moves by a distance corresponding to 1/137 of the PVP orbit's circumference. Could this be entirely accidental? Or could it perhaps be a precious clue towards a better understanding of the 'magic' 137 number? There certainly couldn't be a more fascinating prospect than discovering that the microcosm and the macrocosm are governed by the same universal constant.

The "magic 137 number"

In the TYCHOS, the Sun moves each days by 1/137 of the circumference of the Earth's PVP orbit.

- Earth's orbital circumference ≈ 356 Mkm
- As Earth rotates around its axis each day, the Sun moves by about 2.6 Mkm.
- Thus, a 1/137 ratio exists between the Sun's daily motion and the PVP orbit's circumference:

$$\frac{356}{2.6} \approx 137$$

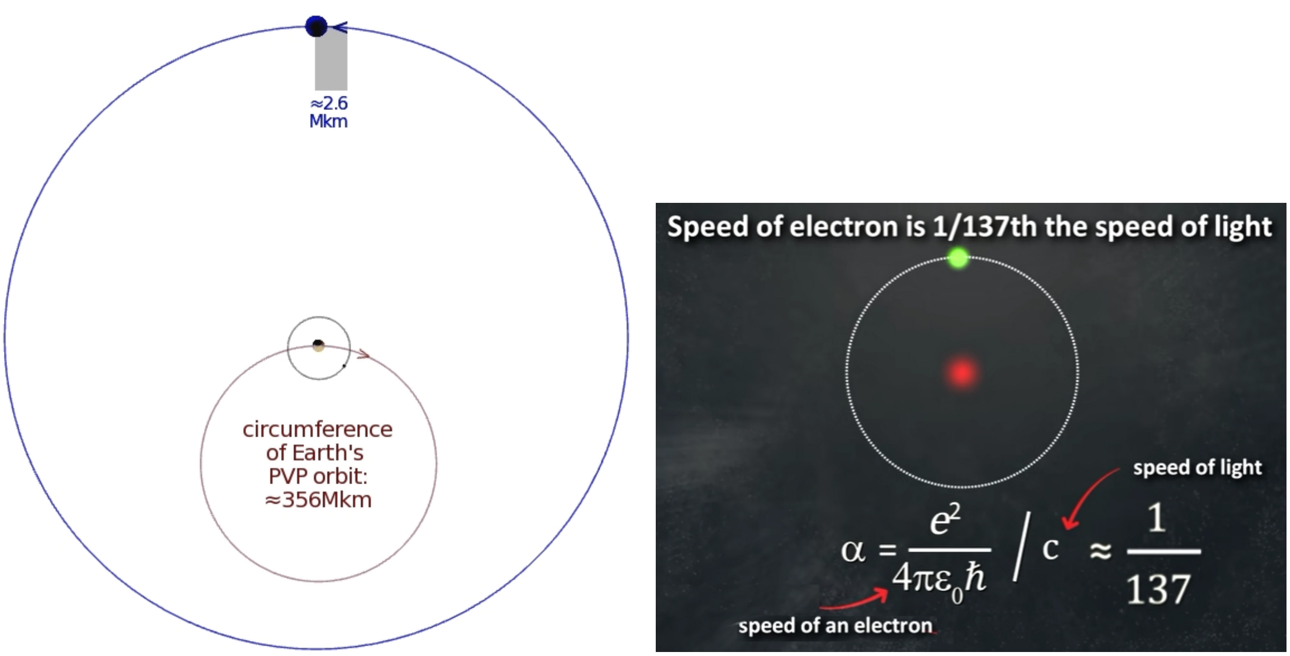


Fig. 21.11 Conceptually, a light beam travelling around the PVP orbit in one day will cover 137 times the distance covered daily by the Sun. In atomic physics, electrons are reckoned to travel 137 times slower than light.

Prof. John K. Webb of the University of New South Wales, Australia, has committed much effort to exploring the secrets of the 'fine-structure constant':

> *There's something strange going on... a spatial variation... because when we look in one direction of the Universe we see Alpha being a little bit smaller - and when we look in exactly the opposite direction it's a little bit bigger.* [7]

In another speech, Webb muses about the perplexing issue of the observed, spatially opposed variations of the constant Alpha. He explains that the two sets of data he uses are collected by two of the world's largest observatories (the Keck Observatory in Hawaii and the VLT in Chile), located practically on opposite sides of the planet: "*Using the Keck telescope, it seems as if Alpha decreases, while using the VLT, it seems as if Alpha increases. Very strange...*" Once more, the TYCHOS model offers a straightforward explanation for this "*very strange*" phenomenon: since the Earth slowly proceeds through space at 1.6 km/h along a virtually straight line rather than around an annual circle, the stars 'to our left' will seem to move in the opposite direction of the stars 'to our right'. This is also why stars exhibit both 'positive' and 'negative' parallax, as will be thoroughly explicated in Chapter 25. But the best is yet to come with regard to Prof. Webb's rigorous research:

The Wikipedia entry on the 'fine-structure constant' [8] informs us that Webb's first, groundbreaking findings (published in 1999) described a minuscule variation in the Alpha constant. This variation in the constant amounted to about 0.0000057 of the 137 value, which allows us to do the following math:

- 0.0000057 is tantamount to 0.0000041% of 137.03599913
- Circumference of the Sun's orbit = 939 943 910 km
- 0.0000041% of 939 943 910 km amount to 38.537 km
- Daily displacement of the Earth in the TYCHOS = 38.428 km

So could this minuscule variation in the constant detected by Webb possibly be related to the Earth's daily motion? If not, we shall just have to chalk this up to yet another extraordinary coincidence, the odds of which you may choose to characterize as 'astronomical' or 'atomical'.

In conclusion, as viewed within the TYCHOS model, the 1/137 ratio would not only be 'reflected' by the Sun's daily motion in relation to the 'nucleus' of the system (represented by the Earth's PVP orbit), but its tiny observed variation can also be shown to be ascribable to the daily motion of the Earth itself. One can only marvel at the explanatory power of the TYCHOS model which, as we progressively test its tenets against empirical observations, would even appear to extend to arcane quandaries of physics, such as the mysterious 1/137 fine-structure constant, a subject matter widely considered to be "*one of the greatest unsolved problems in physics*" [9].

At this juncture, it would appear that we have a solid groundwork with which we can start to dismantle the heliocentric theory once and for all. However, we will first need to demonstrate, in methodical fashion, that the last centuries' most celebrated 'science icons' were ignorant of the true geometric configuration of our Solar System. Some are still hailed today for having "*definitively proven that Earth revolves around the Sun*", despite the absence of any experimental evidence in support of this contention. Two names come to mind: James Bradley and Albert Einstein. In the next chapter, we shall see how the convoluted theories put forth by these two science celebrities were founded upon illusory observations, fallacious interpretations and—quite literally—thin air.

21.5 References

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[7] *Is Our Entire Universe Held Together By One Mysterious Number?*
https://tinyurl.com/JohnWebbQuote

[8] *Fine-structure constant*, Wikipedia
https://en.wikipedia.org/wiki/Fine-structure_constant

[9] An example of how much effort is being deployed by modern-day physicists to make sense of the '1/137 dimensionless ratio': *Why Is 1/137 One of the Greatest Unsolved Problems In Physics?* by PBS Space Time
https://www.youtube.com/watch?v=RCSSgxV9qNw

22

Deconstructing Bradley and Einstein

22.1 Introduction

If there were some sort of 'posthumous Nobel prize' dedicated to the preservation of the heliocentric theory, the award would probably go to James Bradley and Albert Einstein. The latter, of course, needs no introduction, but very few people know that his initial claim to fame was that of having "*convincingly resolved the anomalous precession of Mercury's perihelion*", which was threatening to falsify and invalidate Newtonian physics. In this chapter we shall see how these two 'superstars of science' deluded themselves and the world with their ill-conceived attempts to salvage the unphysical Copernican/Keplerian model.

Fig. 22.1 James Bradley

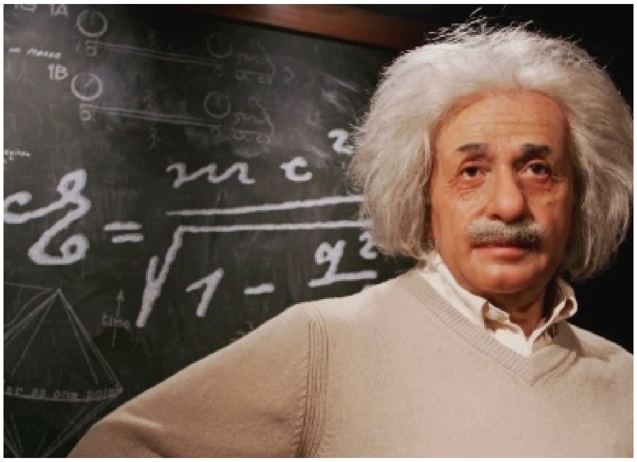


Fig. 22.2 Albert Einstein

22.2 Bradley's illusory 'stellar aberration'

First, I would like to share with you the strange tale behind a phenomenon astronomers refer to as 'stellar aberration', a term coined by Sir James Bradley, Astronomer Royal between 1742 and 1762. Bradley is universally celebrated as the man who provided definitive proof of Earth's alleged motion around the Sun, as it supposedly hurtles along a 300 Mkm-wide orbit at 90 times the speed of sound.

> *James Bradley's discovery of stellar aberration, published 1729, eventually gave direct evidence excluding the possibility of all forms of geocentrism, including Tycho Brahe's.* [1]

Back in 1725, Bradley, soon to become Astronomer Royal, was studying a star called Gamma Draconis with a state-of-the-art telescope crafted by George Graham, London's leading instrument maker. The telescope was fitted into his chimney because the star he had chosen to observe happened to regularly transit just above London where he lived. At 33 years of age, Bradley was already an experienced astronomer and he had duly calculated just how the chosen star should move against the more distant stars. He looked and looked for several weeks, but the star didn't seem to move much in relation to the background stars. However, after a month or so, he finally saw that the star had moved a tiddly weeny bit. As he checked his calculations however, he realized to his dismay that the star had moved very oddly and in an entirely unexpected manner and direction. Together with his assistant, Molyneux (a wealthy man who had funded the ambitious stargazing project), he feverishly checked and re-checked the equipment, but couldn't find anything amiss with it.

The two inquisitive men were vexed and baffled so they decided to undertake a massive survey of the skies over several years. In all, they eventually looked at the motions of 200 other nearby stars and to their growing consternation and distress found all those stars to move in the same strange manner as Gamma Draconis. Sadly, Molyneux passed away early, stepping into his grave without an answer to the upsetting mystery. The task to resolve the pesky puzzle was thus left to Bradley. As the story goes, the solution to the riddle came to him during a boat trip on the river Thames. Here is how astronomy historian Thony Christie of the 'Renaissance Mathematicus' blog recounts Bradley's 'eureka moment':

> *Molyneux died in 1728 before Bradley solved the puzzle. The solution is said to have come to Bradley during a boat trip on the Thames. When the boat changed direction, he noticed that the windvane on the mast also changed direction. This appeared to Bradley to be irrational, as the direction of the wind had not changed. He discussed the phenomenon with one of the sailors, who confirmed that this was always the case. The explanation is that the direction of the wind vane is a combination of the prevailing wind and the headwind created by the movement of the boat, so when the direction of the headwind changes the direction of the windvane also changes.* [2]

One could sum up Bradley's fantastical theory in one sentence: "*The stars are seen to move in the 'wrong' direction—meaning contrary to what would be expected if Earth revolved around the Sun—because the light particles they emit are just like raindrops slanting at an angle towards the face of a walking man*". Incredibly enough, this inane theory has been widely embraced as 'definitive proof' of Earth's supposed revolution around the Sun.

> *Bradley realised that the direction of the light coming from the stars was affected in the same way by the movement of the Earth orbiting the Sun. He and Molyneux had discovered stellar aberration and the first empirical evidence of the Earth's orbit around the Sun. The more common phenomenon used to explain aberration uses rain. When one is standing still the rain appears to fall vertically but when one in walking the rain appears to slant into one's face at an angle. The same happens to starlight falling onto the moving Earth.* [2]

Below is another description of Bradley's arcane concept of 'stellar aberration'. Note for later what is described as 'the most puzzling fact', i.e., that the observed star displacements are "*exactly three months out of phase*":

> *The aberration of starlight was discovered in 1727 by the astronomer James Bradley while he was searching for evidence of stellar parallax, which in principle ought to be observable if the Copernican theory of the solar system is correct. He succeeded in detecting an annual variation in the apparent positions of stars, but the variation was not consistent with parallax. The observed displacement was greatest for stars in the direction perpendicular to the orbital plane of the Earth, and most puzzling was the fact that the displacement was exactly three months (i.e., 90 degrees) out of phase with the effect that would result from parallax due to the annual change in the Earth's position in orbit around the Sun.* [3]

The excerpts reproduced in Figures 22.3 and 22.4 neatly sum up Bradley's observations and fallacious conclusions. As you read them, keep in mind the diagrams in Chapter 21 showing 'a man's yearly path'. Bradley was, of course, wholly unaware of the trochoidal motion of his own position as observer and therefore had no clue why the stars were moving in such a peculiar manner.

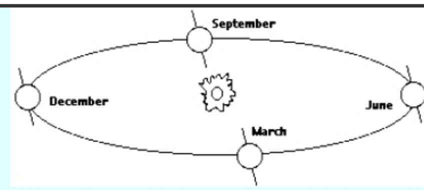
But the real prize would be proof – measurement of the shift in a star's apparent position as we observe it from different parts of the Earth's orbit each year. The quest to see this effect occupied some of the most careful and inventive astronomers for over a century. Among them was James Bradley, who used a long telescope pointing near the zenith (a so-called *zenith sector*, still on view at the National Maritime Museum in Greenwich) near London. This arrangement minimized errors due to atmospheric refraction, and allowed use of very precise scales over shorter angles than other designs. He chose γ Draconis as his quarry, because it was a bright star (hence, possibly close to us) which passed close to the zenith from his latitude. Bradley did find an annual shift in the star's location, as it traced out an elliptical path in celestial coordinates with a major axis of 40 arcseconds. As he soon realized on comparison with other stars, which showed a matching shift, he had found not the expected parallax, but something intellectually just as powerful in demonstrating the motion of the Earth – the aberration of starlight.

Fig. 22.3 Excerpt from "*The Sky at Einstein's Feet*", by William C. Keel (2006). [4]

Apparent Displacement of Stars

This section is about starlight, not about boats and flags. From Newton's days, astronomers have tried to find how far the stars were by the parallax method, using the diameter of the Earth's orbit as a baseline. They carefully measured the positions of stars at times half a year apart--representing two positions of the Earth separated by 300,000,000 km--and then checked whether the positions of stars in the sky changed. They soon found that, indeed, the positions **did** change. The trouble was that the observations did not make much sense.

As discussed in the section on parallax, that might suggest that the distance to Polaris was 1/40 of a parsec or less than 0.1 light year. However, the shifts in position did not occur at the times they were expected . The greatest shift of Polaris in any given direction occured not when the Earth's was at the **opposite** end of its orbit, as it should have been, but 3 months later.



For instance, in the drawing above, the apparent position of Polaris should have been shifted the furthest in the direction of "December" when Earth was in its "June" position, which is as far as it can go in the opposite direction. Instead, it happened in September, when the Earth had moved 90° from its position in June. In hindsight, the important quantity was not the displacement of Earth, but its **velocity**, which in September pointed towards the direction towards which Polaris was displaced.

Bradley's Explanation

Astronomers were greatly puzzled, the more so when it turned out that all other stars near Polaris were shifted the same way. Then in 1729 the British astronomer royal, James Bradley, took a boat trip on the river Thames near London and noted the strange behavior of the flag on top of the boat's mast: it pointed neither downwind nor to the back of the boat, but in some direction in between, and when the boat changed course, that direction changed, too.

Fig. 22.4 Excerpt from "*The Aberration of Starlight*", by David P. Stern (2006). [5]

> *For instance Polaris, the pole star, seemed to travel annually around an ellipse whose width was 40″, 40 seconds of arc. As discussed in the section on parallax, that might suggest that the distance to Polaris was 1/40 of a parsec or 0.1 light year. However, the shifts in position did not occur at the times they were expected. The greatest shift of Polaris in any given direction occurred not when the Earth's was at the opposite end of its orbit, as it should have been, but 3 months later. For instance, in the drawing above, the apparent position of Polaris should have been shifted the furthest in the direction of 'December' when Earth was in its 'June' position, which is far as it can go in the opposite direction. Instead, it happened in September, when the Earth had moved 90° from its position in June.* [5]

That's right: to his amazement, Bradley found that the maximum annual elongation of Polaris from an earthly observer does not occur over the expected 6-month period, but will occur 3 months later, that is, 9 months after the start of a year-long observation. Bradley's 'puzzling' observations are succinctly summarized in an article published in February 2023:

> *The greatest apparent displacement of the star being observed should have been found between observations six months apart, when the locations of the observations were furthest apart. The actual displacements, however, followed a completely different pattern and were clearly not due to parallax. The Pole Star, Polaris, for example, was found to follow a roughly circular path, with a diameter of about 40 arc seconds (40″).* [6]

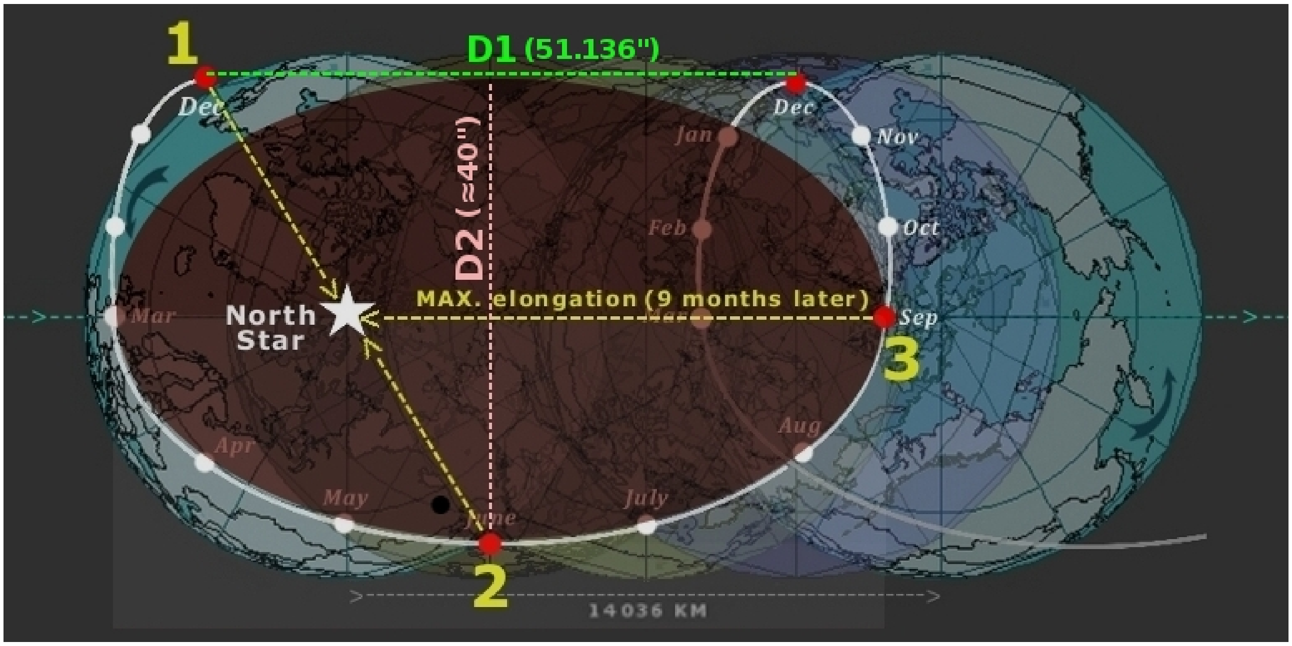


Fig. 22.5

Fig. 22.5 conceptually illustrates why any circumpolar star will reach its maximum elongation, as viewed by an earthly observer, over a 9-month period, rather than a 6-month period. Presumably, Bradley's rough estimate of 40″ was based on the vector D2 which, for an earthly observer, represents about 40″. Vector D1 represents 51.136″, i.e., the observed annual precession of the starfield, which Bradley, however, could not reconcile with the 'lunisolar wobble' theory (see Chapter 10) since it does not imply that stars would move in trochoidal paths.

The obscure 'stellar aberration' concept, which Bradley concocted in his urge to justify otherwise inexplicable observations, has to be among the most contorted attempts at rescuing the Copernican model from its inevitable demise. As a matter of fact, Bradley's theory was subsequently falsified by his illustrious colleague George Airy who filled a telescope with water and showed that, contrary to expectations, no variation of the 'aberration' could be observed (an experiment referred to as 'Airy's Failure'). In spite of this setback, Bradley's thesis has somehow survived to this day and is still widely held as valid in astronomy circles. In hindsight, it is ironic that Bradley's laborious enterprises very nearly ended up demolishing heliocentrism 'from within', so to speak, since his own empirical observations contradicted predictions based on the Copernican model.

The curious statement below is found on the website "*Explaining Science*":

> *In trying to explain his observations Bradley discovered an entirely different effect which came to be known as stellar aberration. His discovery not only confirmed the heliocentric theory but allowed an accurate measurement of the speed of light. [...] The shift in position of a nearby star caused by parallax proved to be very much smaller than the position shift due to stellar aberration, which unlike parallax does not vary with a star's distance.* [7]

Wait... If 'stellar aberration' does not vary with a star's distance, how then could it have any correlation with the speed of light? The logic here, you may agree, is rather flimsy. At the end of the day, the only rational conclusion to draw from Bradley's 'inconvenient' observations is that they revealed a terrestrial motion which affects all the stars equally: namely, the ever-looping frame of reference that we earthly observers are subject to as we journey along in our trochoidal path (see Chapter 21).

22.3 Einstein's spurious 'relativities'

Albert Einstein's Special Relativity Theory (SRT) proposed a different explanation for the pseudo-phenomenon of 'stellar aberration'. However, as pointed out in later years by various authors, when the SRT's tenets and algebraic formulae are applied to 'stellar aberration', they simply fail to account for what is actually observed. In his paper on the Bradley-Einstein controversy, Daniele Russo spells out the embarrassing problem right from the start:

> *Abstract: The classical and relativistic explanations of the stellar aberration are compared, on the basis of the physical models implied by the two interpretations. Our analysis shows that the physical model required by the Special Relativity theory is inconsistent with the observed effect.* [8]

In his conclusions, Russo justly highlights the SRT's "*lack of adequate physical explanations*" for the observed 'stellar aberration':

> *In classical Physics, a mathematical description of a phenomenon always lays on a physical model. In the case of the SRT, in spite of the simple mathematical model involved, the contrary to experience consequences of the light postulate make it often difficult to conceive adequate physical models for the various relativistic effects. Probably because of this reason, most expositions of the SRT are based on algebraic demonstrations, but lack adequate* "physical" *explanations that should instead be the basis of every physical theory about the macrocosmic world, as well as an indispensable element to any possible analysis or confutation. The case of the stellar aberration is emblematic. The algebraic route, consisting in the application of the SRT transformation to the system of the star and to that of the observer, does not apparently lead to contradictions. But the underlying physical model, based on a radial light radiation (light clock model), turns out to be incompatible with the parallel starlight irradiation actually reaching the Earth.* [8]

So much for Einstein's Special Relativity: as expounded by Russo in his paper (which I recommend reading in its entirety), the SRT is "*inconsistent with the observed (empirically verifiable) effect*" and "*incompatible with the parallel starlight irradiation actually reaching the Earth*". Therefore, I would tersely state that the SRT has no place in a book which prioritises empirically verifiable observation over algebraic abstraction. In any case, before saying good-bye to Einstein, let us see how his much-touted theory of General Relativity (GR) fares within the TYCHOS paradigm. Surprisingly enough, Einstein's theory got kick-started by his acclaimed 'resolution' of the purportedly anomalous advance of Mercury's perihelion. The latter was, in fact, considered one of the most compelling proofs of GR:

> *Einstein showed that general relativity agrees closely with the observed amount of (Mercury's) perihelion shift. This was a powerful factor motivating the adoption of general relativity.* [9]

However, a long list of problems have since been pointed out with Einstein's equations and computational methods, as well as with his highly questionable determinations of Mercury's supposedly anomalous apsidal precession. As it is, Einstein himself eventually distanced his subsequent GR research from the dubious argumentation surrounding the supposedly 'anomalous' advance of Mercury's perihelion.

> *Einstein's paper devoted to the GR prediction of Mercury's perihelion advance is the only one among his publications that contains the explanation of the GR effect. [...] Since then, to our knowledge, he never returned to the methodology of the GR perihelion advance problem. [...] As a matter of fact, the GR foundational premises have been subjected to changes and reinterpretations (optional, alternative, or claimed 'correct' ones) by Einstein himself, his advocates as well as today's GR specialists and self-proclaimed 'experts'.* [10]

> *It is thus proven that Einstein's Mercury correction is completely false, and fails for planets as well as black holes! [...] The only possible conclusion to be made is that the Einstein GR correction is completely false. Thus, one of the only proofs that GR is valid has been shown to be incorrect, and invites GR to be discarded as a valid theory!* [11]

I will now do my best to summarize in simple layman's terms and math this historically crucial, worldwide scientific debate, namely the 'mystery' of the 'anomalous precession' of Mercury's perihelion. No less than Newton's sacrosanct 'laws' were at stake, since Mercury was observed to disobey the same. Eventually, the 'victory' went to Einstein, rocketing the little-known patent clerk (and proven plagiarist) to universal stardom, literally overnight. By most academic accounts, Einstein's fledgling Theory of General Relativity was then gloriously confirmed by his dreadfully convoluted 'explanation' of Mercury's seemingly anomalous behaviour. The whole issue revolved around a small 43-arcsecond discrepancy in Mercury's precessional motion around the Sun: Mercury had been observed by Urbain Le Verrier to precess by an 'excess amount' of 38″ per century (re-estimated at 43″ by Simon Newcomb in 1882), a fact which contradicted Newton's 'laws'.

> *In 1859, Urbain Le Verrier discovered that the orbital precession of the planet Mercury was not quite what it should be; the ellipse of its orbit was rotating (precessing) slightly faster than predicted by the traditional theory of Newtonian gravity, even after all the effects of the other planets had been accounted for. The effect is small (roughly 43 arcseconds of rotation per century), but well above the measurement error (roughly 0.1 arcseconds per century). Le Verrier realized the importance of his discovery immediately, and challenged astronomers and physicists alike to account for it.* [12]

At the time of the debate prompted by Le Verrier, the General Precession was observed to be about 5026″ per century. Since Mercury's perihelion was observed to precess by 5600″ per century (43″ more than the 5557″ astronomers expected and could account for), the whole controversy revolved around these observed, yet supposedly anomalous, additional 43 arcseconds per century exhibited by Mercury. Kevin Brown put in a nutshell the issues surrounding Mercury's 'anomaly':

> *When we observe the axis of the elliptical orbit of a planet such as Mercury (for example) over a long period of time, referenced to our equinox line, we must expect to find an apparent precession of about 0.01396 degrees per year, which equals 5025 arc seconds per century, assuming Mercury's orbital axis is actually stationary. However, astronomers have actually observed a precession rate of 5600 arc seconds per century for the axis of Mercury's orbit, so evidently the axis is not truly stationary. This might seem like a problem for Newtonian gravity, until we remember that Newton predicted stable elliptical orbits only for the idealized two-body case. When analyzing the actual orbit of Mercury we must also take into account the gravitational pull of the other planets, especially Venus and Earth (because of their proximity) and Jupiter (because of its size). It isn't simple to work out these effects, and unfortunately there is no simple analytical solution to the n-body problem in Newtonian mechanics, but using the calculational techniques developed by Lagrange, Laplace, and others, it is possible to determine that the effects of all the other planets should contribute an additional 532 arc seconds per century to the precession of Mercury's orbit. Combined with the precession of our equinox reference line, this accounts for 5557 arc seconds per century, which is close to the observed value of 5600, but still short by 43 arc seconds per century.* [13]

We shall now see how the TYCHOS model can readily account for these allegedly 'anomalous' 43 arc-seconds of precession. As we go along, keep in mind that the Copernican model has Earth revolving around Mercury's orbit once every year, whereas the TYCHOS model has the Sun-Mercury-Venus trio revolving around Earth once every year. Since Copernicans assume that Earth revolves yearly around the Sun and its junior moon Mercury, they will expect Mercury to return to its perihelion earlier than it does in reality. Why? Because if the Earth truly revolved around the Sun, it would be 'subtracting' annually from Mercury an amount corresponding to '1 unit of spatial revolution' (or, if you will, 1 Earth-vs-Mercury rotation). In the TYCHOS, of course, no such subtraction occurs. Now, since we know that Mercury's synodic period is 116.88 days (which is the interval between two Sun-Mercury conjunctions, as viewed from the Earth) all we need to do is multiply:

$$0.43 \times 116.88 \approx 50.26$$

⇒ Annual General Precession rate observed in the early 20th century ≈ 50.26″

Mercury's perihelion precession

Evidently, Mercury's perihelion precession just reflects the General Precession of our Solar System, and those 'anomalous' 0.43 arcseconds simply represent 1 Mercurian day (i.e., the aforementioned '1 unit' which the Earth would subtract from Mercury if we were revolving around the Sun). So, to recapitulate:

- Equinoctial precession observed in the early 20th century $\approx 5026''$ per century
- Mercury's synodic period = 116.88 days
- Precession of Mercury considered anomalous by heliocentrists = $43''$ per century $\quad \frac{5026}{116.88} \approx 43$

$\Rightarrow$ Actual anomalous precession of Mercury = $0''$

Venus' perihelion precession

Even Venus was thought to precess in anomalous fashion:

- Equinoctial precession observed in the early 20th century $\approx 5026''$ per century
- Venus' synodic period = 584.4 days
- Precession of Venus considered anomalous by heliocentrists = $8.6''$ per century $\quad \frac{5026}{584.4} \approx 8.6$

$\Rightarrow$ Actual anomalous precession of Venus = $0''$

In other words, the perceived 'anomalies' are nothing but the natural precession rates of Mercury and Venus, as related to their revolutions around the Sun and commensurate with our system's General Precession. Heliocentric astronomers erroneously add '1 unit' to Mercury's and Venus' precessional motions because they believe the Earth revolves around the Sun.

Mathematical demonstration

Here is another mathematical demonstration of the same fact:

- Equinoctial precession observed in the early 20th century $\approx 5026''$ per century
- Duration of the Sun's revolution around Earth = 365.25 days
- Duration of the Sun's revolution around Earth per century = 36525 days
- Earth's daily equinoctial precession in the early 20th century $\approx 0.1376''$ $\quad \frac{5026}{36525} \approx 0.1376$
- Annual revolutions of Mercury around the Sun = 3.125 $\quad \frac{365.25}{116.88} = 3.125$
- Annual precession of Mercury = $0.43''$ $\quad 3.125 \times 0.1376 = 0.43$

$\Rightarrow$ $0.43''$ amounts to 1/100 of the alleged $43''$ 'anomaly' estimated per century

- Annual revolutions of Venus around the Sun = 0.625 $\quad \frac{365.25}{584.4} = 0.625$
- Annual precession of Venus = $0.086''$ $\quad 0.625 \times 0.1376 = 0.086$

$\Rightarrow$ $0.086''$ amounts to 1/100 of the alleged $8.6''$ 'anomaly' estimated per century

This has got to be the simplest falsification of Einstein's theories ever performed! In what must be the funniest twist of this whole affair, the purported 'anomalies' actually prove that the Sun, Mercury and Venus all revolve around the Earth, and not the other way round. Once this is realized and accounted for, there are no vexing anomalies to explain away.

I am by no means the first person to have concluded that the 'anomalous' precession of Mercury's perihelion is spurious and that, consequently, Einstein's first 'proof' of his nebulous theory of General Relativity was based on thin air. For instance, here is what the eminent professor Roger A. Rydin wrote about the subject:

> *There are significant arguments that General Relativity has not been proven experimentally, and that it contains mathematical errors that invalidate its predictions. Vankov has analyzed Einstein's 1915 derivation and concludes that when an inconsistency is corrected, there is no perihelion shift at all!* [14]

I will spare you the full account of the 1919 expeditions to Africa and South America led by Sir Arthur Eddington in order to photograph a solar eclipse which purportedly provided the 'ultimate proof' of Einstein's theory of General Relativity. Suffice it to say that, as incredible as it may sound, the proclaimed 'victory' was founded upon two out of three data sets, the third set having been discarded as 'defective' (rather like the proverbial 'minority report'). In any case, the observational data collected by Eddington's 1919 expeditions have been shown to be anything but conclusive in numerous subsequent analytical reviews.

> *Einstein became world famous on 7 November 1919, following press publication of a meeting held in London on 6 November 1919 where the results were announced of two British expeditions led by Eddington, Dyson and Davidson to measure how much background starlight is bent as it passes the Sun. Three data sets were obtained: two showed the measured deflection matched the theoretical prediction of Einstein's 1915 Theory of General Relativity, and became the official result; the third was discarded as defective. At the time, the experimental result was accepted by the expert astronomical community. However, in 1980 a study by philosophers of science Earman and Glymour claimed that the data selection in the 1919 analysis was flawed and that the discarded data set was fully valid and was not consistent with the Einstein prediction, and that, therefore, the overall result did not verify General Relativity.* [15]

All the same, these highly questionable experimental results established Albert Einstein as the 'champion scientist' of our times, though not without substantial help from the solicitous media.

In conclusion, there never were any anomalies in either Mercury's or Venus' precessional motions. They are simply a by-product of the erroneous belief that the Earth revolves around the Sun. Likewise, there never was any 'aberration of starlight'. Bradley's and Einstein's proposed explications thereof were not only contradictory: they were both flawed at their core and must be definitively abandoned.

In the next chapter, we shall see why the stars may well be considerably closer to us than posited by mainstream astronomers—just as Tycho Brahe steadfastly maintained throughout his lifetime, and with very good reason.

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23

ARE THE STARS MUCH CLOSER THAN BELIEVED?

23.1 What is a 'light year'?

The most indigestible aspect of the heliocentric theory is undoubtedly its implications for the remoteness and sizes of the stars. The idea that perfectly visible stars would be located several thousand light years away is, on the face of it, outlandish. Let's pause for a moment to consider what exactly a light year (LY) is and how it translates into astronomical units (AU) and kilometres.

- 1 AU (average Earth-Sun distance) = 149 597 870.7 km (~149.6 million kilometres)
- 1 LY = 63241.1 AU = 9 460 730 472 580.8 km (~9.46 *trillion* kilometres)

Since the advent of heliocentrism, the apparent angular diameter of the stars as perceived from Earth by the human eye has been one of the most controversial issues of astronomy. The new theory implied that the stars were hugely more distant than previously thought, making it imperative to find some justification for the apparent size of the stars. In fact, the stars, especially the largest or closest stars of first magnitude, appear to be far too big to the naked eye to support the Copernican notion of formidable remoteness. Common sense tells us visible stars are not all grotesquely large and remote, but can we back this natural perception up with rational arguments? The answer to this question is firmly in the affirmative, and the TYCHOS model can help us formulate it.

23.2 The '42633 reduction factor'

Copernican astronomers have always measured and computed star distances under the assumption that Earth moves around the Sun in an orbit 299 200 000 km wide. To do so, they 'take a picture' of a nearby star on two dates six months apart (say, on 21 June and 21 December). Comparing the two pictures will show how much the observed star appears displaced in relation to the 'fixed stars' (i.e., the far more distant background stars), and by using simple trigonometry the distance between the Earth and the star can be estimated.

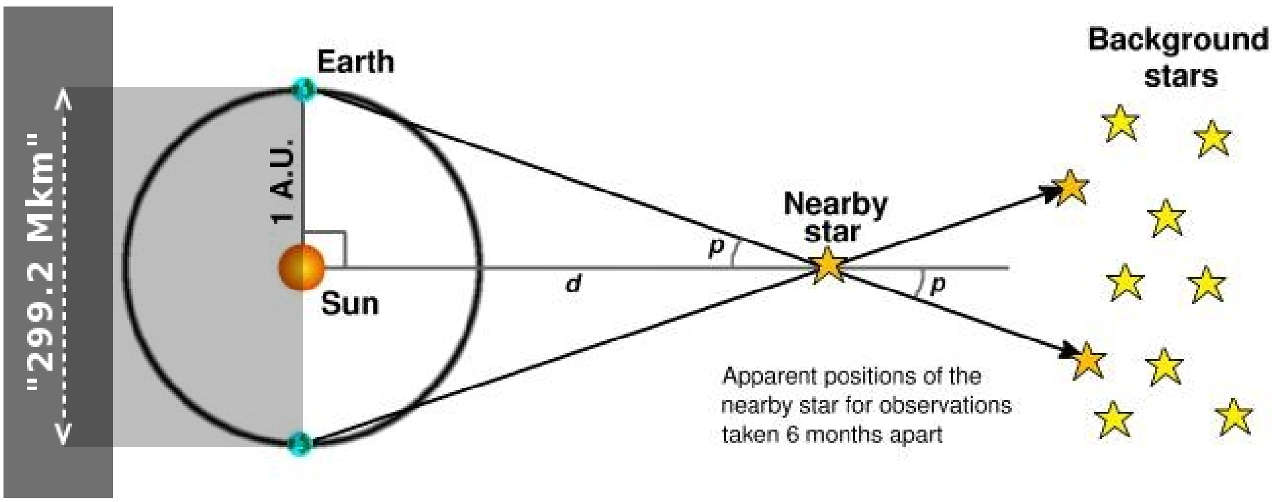

Fig. 23.1 The current principle of how star distances are measured.

Now, if Earth does not revolve around the Sun in a 300 Mkm wide orbit, the current basis for calculating star distances is completely wrong. As we have seen, in the TYCHOS model, Earth only moves by 14036 km every year, or by 7018 km every 6 months. Based on the 7018 km figure, the currently accepted star distances should be reduced by a factor of 42633. This will be our TYCHOS reduction factor for all the stellar distances listed in the official star catalogues.

- The TYCHOS reduction factor = 299 200 000 / 7018 ≈ 42633
- 1 'TYCHOS LY' = 63241.1 / 42633 ≈ 1.4834 AU

Note that the 'TYCHOS LY' is a unit of distance, with no implication for the speed of light. But talk is cheap, so let us test the TYCHOS reduction factor in a couple of real-life scenarios, starting with the well-known star Proxima Centauri (our nearmost star). Proxima is said to be about 4.25 LY away. In the TYCHOS model, this would translate into 6.3 AU (4.25 × 1.4834).

This is rather interesting. At a distance of 6.3 AU, Proxima Centauri would be roughly halfway between Jupiter (4.2 AU) and Saturn (8.5 AU) if it were not for the fact that it is not located in the same plane as the Solar System, but some 62° 'below' it. Also, consider that Proxima is reckoned to be a 'red dwarf'. As we saw in Chapter 2, this dim type of star is by far the most common in the universe.

Undoubtedly, Tycho Brahe would be most satisfied with this finding, since his primary objection to the Copernican model was that the stars would have to be absurdly large and distant and that there would be an immense void between Saturn and our nearmost stars. In fact, Brahe's expert opinion was that the stars were *"located just beyond Saturn and of reasonable size"*.

> *It was one of Tycho Brahe's principal objections to Copernican heliocentrism that in order for it to be compatible with the lack of observable stellar parallax, there would have to be an enormous and unlikely void between the orbit of Saturn (then the most distant known planet) and the eighth sphere (the fixed stars).* [1]

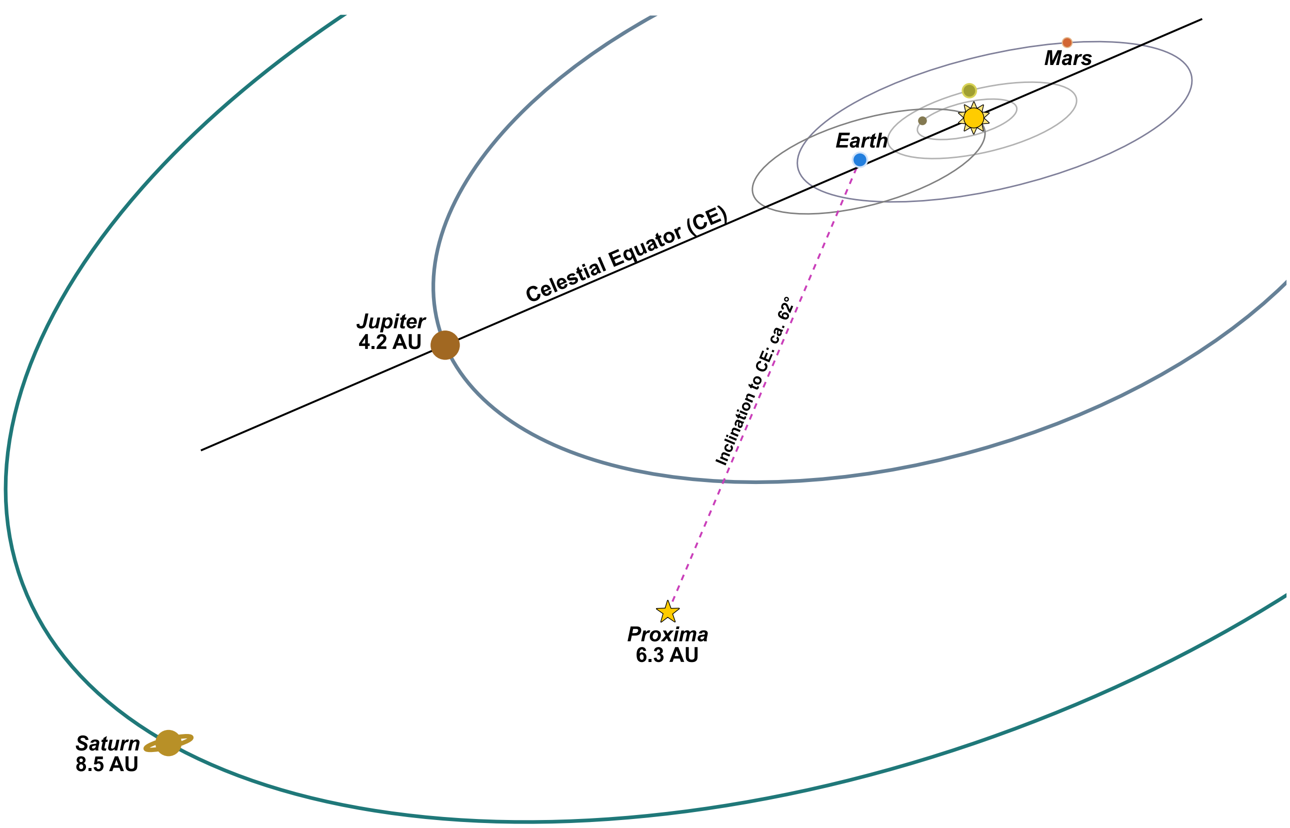

Fig. 23.2

We shall now use Proxima Centauri as a 'test bed' to explore another controversial issue, namely that of the perceived telescopic size of stellar disks. As all astronomers will know, the perceived angular diameters of the stars, as viewed either telescopically or with the naked eye, are commonly believed to be spurious due to a peculiar diffraction phenomenon (known as the 'Airy disk') which would cause the stars to appear far larger than they are in actuality. More on that further on.

Proxima is not visible to the unaided eye. Its officially estimated 'true' angular diameter is 0.001 arcseconds, though it certainly appears much larger in our telescopes. Since the Sun's observed angular diameter is 1920 arcseconds, this means that Proxima's 'actual' angular diameter is officially purported to be 1 920 000 times smaller than the Sun's. That's almost 2 million times smaller! To put this into perspective, Fig. 23.3 shows how an object only a hundred times smaller than the Sun would look like in the sky. Now, if the tiny dot in the figure was not just a hundred times but 2 million times smaller, I think we can all agree it would be utterly invisible. Let that sink in.

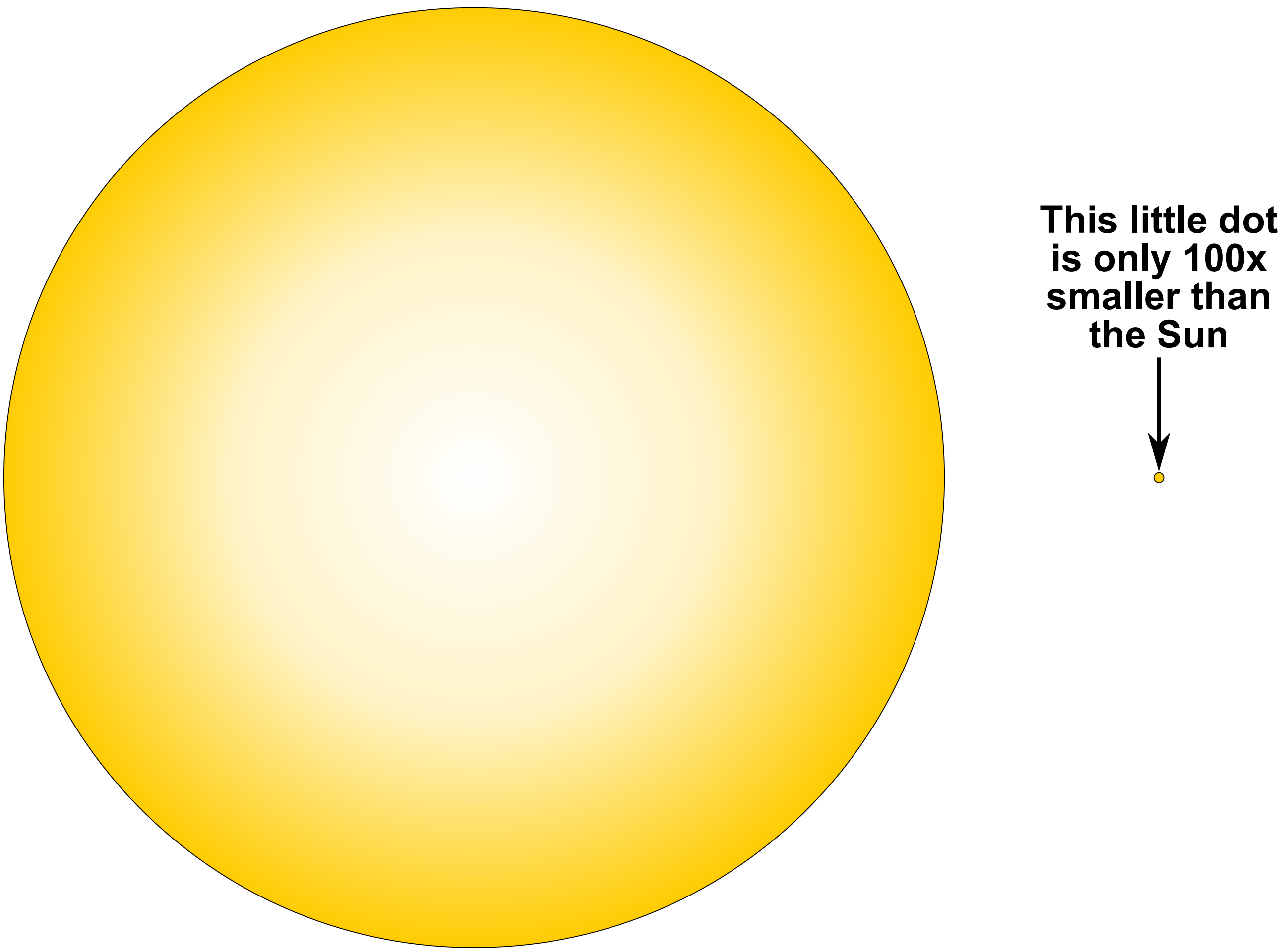

Fig. 23.3 The angular diameter of the Sun subtends just about 0.53° (or 1920″) in our skies.

According to their heliocentric computations, mainstream astronomers estimate our nearmost star to be located 40 trillion km away ($4.25 \times 9\,460\,730\,472\,580.8$ km)—or 268775 times more remote than our Sun—and to have an actual physical diameter 1/7 that of our Sun. As they apply the reduction for 'Airy disk diffraction' they conclude that Proxima's 'true' (yet unmeasurable) angular diameter must be 0.001″, an absurdly small value, whichever way you look at it.

- Angle subtended by Proxima if it were as big as the Sun $= 1920'' \,/\, 268775 \approx 0.007''$
- Officially claimed 'true' angular diameter of Proxima $= 0.007'' \,/\, 7 \approx 0.001''$

Now, is Proxima perhaps an exceptionally bright star? Well no, not according to officialdom. Here is what the Wikipedia has to say about Proxima's luminosity:

[Proxima's] total luminosity over all wavelengths is 0.17% that of the Sun, although when observed in the wavelengths of visible light the eye is most sensitive to, it is only 0.0056% as luminous as the Sun. [2]

In other words, we are told that Proxima, our very nearmost star...

- is about 7 times smaller than our Sun.
- is located 268775 times farther away than our Sun.
- has a far lower luminosity than our Sun (0.17% or less).
- has a 'true' angular diameter almost two million times smaller than our Sun.

Any sensible person will know, even without performing practical tests, that Proxima Centauri would not be visible to the naked eye under such circumstances. On the other hand, assuming the TYCHOS reduction factor for star distances is correct, Proxima's true angular diameter would amount to a more reasonable 42.633 arcseconds ($42633'' \times 0.001 = 42.633''$), making its angular diameter only 45 times smaller than the Sun's mean angular diameter of 1920″ ($1920'' / 42.633'' \approx 45$). Note that 42 arcseconds is well below the angular resolution of the human eye (60″), so applying the TYCHOS distance-reduction factor does not imply Proxima would be visible to the unaided eye from a distance of 6.3 AU. Yet, if it were placed next to our Sun, at a distance of only 1 AU, it would indeed be seen to be about 7 times smaller than the Sun ($45 / 6.3 \approx 7.1$).

Let us now see how this same line of reasoning works out when applied to Sirius, the brightest and visually largest star in the firmament.

At 8.6 light years distance, Sirius is one of the nearest stars to us after the sun. [3]

If we apply our 42633 reduction factor (1 'TYCHOS LY' = 1.4834 AU) to the Earth-Sirius distance, we get about 12.76 AU ($8.6 \times 1.4834 \approx 12.76$). Officially, the 'true' angular diameter of Sirius is taken to be a mere 0.005936″, again an incredibly small value. This would mean that the 'actual' size of the disk of light we call Sirius is 323450 times smaller than that of the Sun ($1920'' / 0.005936'' = 323450$). Now, Sirius is officially estimated to be 1.7 times larger than the Sun; so let us see what the Earth-Sirius distance would be under the TYCHOS model's proposed 42633 reduction factor. First we divide 323450 by 42633 to obtain the hypothetical Earth-Sirius distance if Sirius were the same size as the Sun, then we multiply the result by 1.7, assuming the officially estimated ratio between the physical diameters of the Sun and Sirius (1:1.7) is correct.

- Distance to Sirius if it were the same size as the Sun = $323450 / 42633 \approx 7.5868$ AU
- Distance to Sirius assuming it is 1.7 times larger than the Sun = $7.5868 \times 1.7 \approx 12.89$ AU

Again, Tycho Brahe would likely have been satisfied with the notion that the brightest star in our skies might be located some 3.4 AU farther away than Saturn, itself located some 9.5 AU away (while being a considerably fainter object in the sky than Sirius).

So could Sirius be located at about 12.8 AU, yet still be 1.7 times larger than the Sun? It is not possible to say with certainty at this point, not without further study. However, take a minute or two to consider the heliocentrists' absurd claim that Sirius is located a whopping 550000 times farther away than the Sun, or 88000 times farther away than Jupiter. A photograph of the night sky will help illustrate the issue at hand. Note the fairly similar sizes of Sirius and Jupiter to the naked eye.

The Sun subtends about 0.53° (or 1920 arcseconds) in the sky, roughly the same as the Moon. Now, take a good look at the photograph in Fig. 23.4 and compare the sizes of the Moon and Sirius. Does Sirius appear to be several hundred thousand times smaller than the Moon?

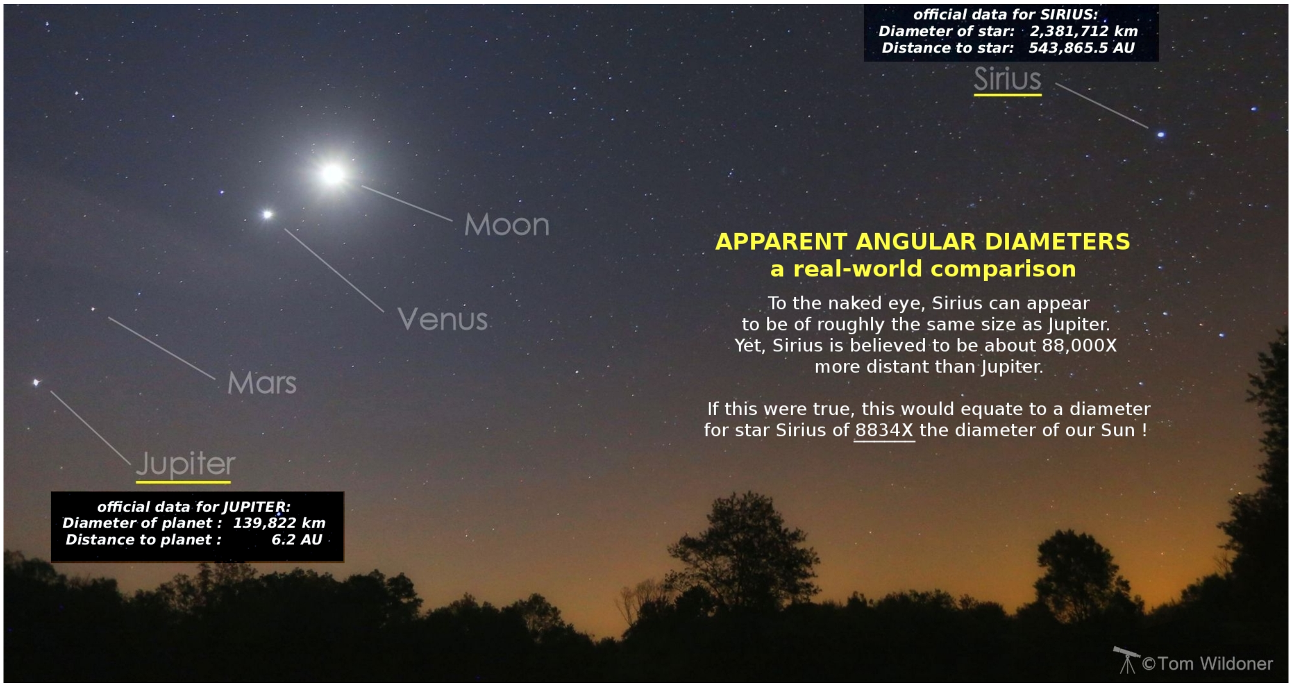

Fig. 23.4 A visual comparison between the observed sizes of Jupiter and Sirius. Keep in mind that Saturn (unfortunately absent in this photograph) is about 13 times fainter than Jupiter. Sirius thus outshines Saturn by a considerable amount. Photograph by Tom Wildoner, 8 October 2015. [4]

Astronomers have been debating the thorny subject of the observed star sizes for centuries. Ironically, it was that epochal technological advancement, the telescope, that provided the Copernicans with some 'optical justification' (another excuse of the 'stellar aberration' type) for this seemingly intractable issue, courtesy of Astronomer Royal George Airy—yes, the very same fellow who were to falsify James Bradley's nebulous 'stellar aberration' theory. Mind you, the so-called 'Airy disk' theory is hardly any less of an obscure and contentious affair. Here it is described by the Wikipedia:

> *Airy Disk: The resolution of optical devices is limited by diffraction. So even the most perfect lens can't quite generate a point image at its focus, but instead there is a bright central pattern now called the Airy disk, surrounded by concentric rings comprising an Airy pattern. The size of the Airy disk depends on the light wavelength and the size of the aperture. John Herschel had previously described the phenomenon, but Airy was the first to explain it theoretically. This was a key argument in refuting one of the last remaining arguments for absolute geocentrism: the giant star argument. Tycho Brahe and Giovanni Battista Riccioli pointed out that the lack of stellar parallax detectable at the time entailed that stars were a huge distance away. But the naked eye and the early telescopes with small apertures seemed to show that stars were disks of a certain size. This would imply that the stars were many times larger than our sun (they were not aware of supergiant or hypergiant stars, but some were calculated to be even larger than the size of the whole universe estimated at the time). However, the disk appearances of the stars were spurious: they were not actually seeing stellar images, but Airy disks. With modern telescopes, even with those having the largest magnification, the images of almost all stars correctly appear as mere points of light.* [5]

In short, Airy proclaimed that we cannot trust neither our eyes nor our telescopes when it comes to gauging the angular diameters of the stars, since *"the resolution of optical devices is limited by diffraction"*. Moreover, naked-eye assessments of star sizes would be entirely spurious and utterly useless because starlight would be greatly inflated by 'atmospheric diffraction' as it traverses Earth's atmosphere. However, there is an obvious problem with this theory: why isn't the light emanating from the Sun and our planets similarly affected? Light is light regardless of how remote the source is and should suffer the same amount of distortion upon traversing our atmosphere. The notion that atmospheric diffraction would hugely inflate the apparent sizes of the stars—but not those of our planets—is one of the most bizarre axioms of heliocentrism.

(a) *(b)*

Fig. 23.5 ***(a)*** If you hold an LP vinyl record at arm's length towards the Sun, our star will fit into the record's 7 mm hole. ***(b)*** Tycho Brahe estimated the angular diameter of Vega to be about 16 times smaller than that of the Sun. Today's astronomers, on the other hand, consider the 'actual' angular diameter of Vega to be 622000 times smaller!

Tycho Brahe's estimate of the angular diameter of Vega—a so-called 'first-magnitude star'—was 120 arcseconds, which is 16 times smaller than the angular diameter subtended by the Sun (1920 arcseconds). Now, before you start scoffing at Brahe's 'generous' estimate of the angular size of Vega, consider the following easily verifiable facts: if you hold an old LP vinyl record at arm's length in front of the Sun, the Sun's disc will just about fit into the 7-mm hole in the middle. Ergo, the Sun's angular diameter subtends about 7 millimetres at arm's length. In Tycho Brahe's expert judgement, Vega's angular diameter is only 16 times smaller than that of our Sun. Fig. 23.5 may help determine how realistic his reckoning was.

The tiny dot in Fig. 23.5 does not look too different from what we see in reality. In light of this, Tycho Brahe's contention that 'first magnitude stars' like Vega are only about 16 times smaller than the Sun seems quite reasonable. Nevertheless, much like Groucho Marx, mainstream astronomers insist that we reject the evidence of our own eyes and that the angular diameter of Vega is in reality 622000 times smaller than the Sun's.

Vega, one of the brightest stars in our skies, is currently believed to be 25 Copernican LY away, i.e. over 1.5 million times more distant than our Sun. Yet, Vega's physical diameter is officially estimated to be only about 2.3 times larger than the solar diameter. Now, if we take the Sun in Fig. 23.5 and enlarge it 2.3 times, then scale it down 1.5 million times, it would not be visible from Earth with any sort of telescope, let alone to the naked eye.

Vega's intrinsic luminosity (or 'wattage', if you will) is officially estimated to be 37 times stronger than our Sun's. This is most interesting because Vega—considered by astronomers to be *"the next most important star in the sky after the Sun"*—is probably the most studied of all stars and has been used as a baseline for calibrating the photometric brightness scale. As it happens, according to the TYCHOS model's tenets, Vega is just about 37 times more distant than the Sun. It may thus be reasonably inferred that the luminosities of the Sun and Vega are, in actuality, alike: what astronomers interpret as a 1:37 luminosity ratio between the two stars may only be due to their different remoteness from the Earth. In any event, the problems posed by the alleged ginormous stellar distances implied by the Copernican model should now have become painfully clear.

Tycho Brahe's main objection to the Copernican model was that the stars could not be so formidably distant unless they were, without exception, hugely larger than our Sun. Brahe reckoned instead that the respective diameters of the visible stars were more homogeneous, i.e. only somewhat larger or smaller than that of our Sun, as opposed to dozens, hundreds, or even thousands of times larger. One must admit that, from a purely statistical viewpoint, this makes perfect sense, for why would there be so many 'giant stars' and 'supergiant stars' in our galactic neighbourhood? To be sure, the Wikipedia tells us that *"giant stars have radii up to a few hundred times the Sun and luminosities between 10 and a few thousand times that of the Sun, whereas the radii of supergiant stars can be in excess of 1,000 solar radii [with] luminosities from about 1,000 to over a million times the Sun."*

Now, if the TYCHOS reduction factor is correct, does that mean Vega is 42633 times smaller than the official estimate of 2.3 times the size of the Sun? No, Vega may actually still be about 2.3 times larger than the Sun. Here is why:

- Vega's angular diameter according to Tycho Brahe = 120″ (1/16 of the Sun)
- Vega's angular diameter according to Copernican astronomers = 0.0029″
- Apparent size ratio = 120 / 0.0029 ≈ 41380 (i.e., fairly close to the 42633 TYCHOS reduction factor)

⇒ Remember: 1 Copernican LY = 63241.1 AU, and 1 'TYCHOS LY' = 1.4834 AU

- Earth-Vega distance in the Copernican model = 25.04 LY
- Earth-Vega distance in the TYCHOS model = 25.04 × 1.4834 = 37.144 AU
- Size ratio of Vega relative to the Sun = 37.144 / 16 ≈ 2.32

So perhaps Tycho Brahe was right all along about star sizes and distances. In any event, his estimate for Vega's angular diameter would seem to agree with the TYCHOS model's proposed reduction factor (42633), but keep in mind that even if the stars are 42633 times closer than believed by heliocentrists, it doesn't necessarily follow that their actual diameters are 42633 times smaller than current estimates. Today, Brahe's reckonings of the angular diameters of 'first magnitude stars' (2 arcminutes or 120 arcseconds) would seem wildly exaggerated. Yet, in his time, a number of eminent astronomers estimated them to be even larger than that. Kepler, for instance, estimated the angular diameter of Sirius to be 4 arcminutes (or 240 arcseconds):

> *Magini took the stars of the first mag. to be 10′ in diameter; Kepler made the diameter of Sirius 4′ (Opera, ii. p. 676); the Persian author of the Ayeen Akbery put the diameter of stars of the first mag. = 7′ (Delambre, Moyen Age, p. 238), so that Tycho's estimates were more reasonable than any of these.* [6]

As we have seen, the modern estimate for the 'true' angular diameter of Vega is 0.0029″, or about half that of Sirius (0.005936″). This is most interesting since it would mean that Brahe (whose known estimate for Vega was 120″) and Kepler (whose known estimate for Sirius was 240″) were actually in excellent agreement with regard to the observed angular diameter of the stars.

23.3 How can we see so many stars with our naked eyes?

An inescapable question for the world's astronomers: how can so many stars, reputedly hundreds or thousands of light years away, be visible to the unaided eye? How large would they have to be?

> *In the absence of any observed stellar parallax, Tycho scoffed for example at the absurdity of the distance and the sizes of the fixed stars that the Copernican system required: Then the stars of the third magnitude which are one minute in diameter will necessarily be equal to the entire annual orb (of the earth), that is, they would comprise in their diameter 2284 semidiameters of the earth. They will be distant by about 7850000 of the same semidiameters. What will we say of the stars of first magnitude, of which some reach two, some almost three minutes of visible diameter? And what if, in addition, the eighth sphere were removed higher, so that the annual motion of the earth vanished entirely (and was no longer perceptible) from there? Deduce these things geometrically if you like, and you will see how many absurdities (not to mention others) accompany this assumption of the motion of the earth by inference.* [7]

Let us consider the distance currently claimed for one of our brighter stars, Deneb (also called Alpha Cygni). Deneb is said to be about 200 times larger than our Sun, but we are also told it is a whopping 2600 LY (~164 426 800 AU, or 24 598 249 280 000 000 km) away from our eyes. That's over 164 million times more remote than the Sun! And yet:

Deneb is one of the brightest stars we can see with the naked eye. [8]

A blue-white supergiant, Deneb is also one of the most luminous stars. However, its exact distance (and hence luminosity) has been difficult to calculate; it is estimated to be somewhere between 55,000 and 196,000 times as luminous as the Sun. [9]

Pardon me? *"Between 55000 and 196000 times as luminous as the Sun"*? With such a large error margin, it sounds more like guesswork. Besides, these formidable luminosity levels may very well be a way of justifying the unthinkable stellar distances that the Copernican model requires for its survival. What sort of otherworldly physics would cause a star to shine 196000 times brighter than our Sun? Didn't Sir Isaac tell us that the laws of physics are the same throughout the universe?

One 2008 calculation using the Hipparcos data (gathered by ESA's Hipparcos satellite) puts the most likely distance (to Deneb) at 1550 light-years, with an uncertainty of only around 10%. [9]

Some modern planetariums have Deneb at a distance of 3227 light years, i.e. over twice the distance estimated by the European Space Agency (ESA). Do the stellar distance estimates of mainstream astronomers ever agree with each other? Is Deneb 1550 or 2600 or 3227 light years away? Evidently, no one seems to know with any reasonable degree of precision. I, for one, grew up with the notion that the science of astronomy was far more exacting than this. Virtually none of these claimed star distances and luminosities add up. They are all, as TV celebrity Carl Sagan liked to say, *"extraordinary claims that require extraordinary evidence"*. It should thus come as no surprise that, as we shall see further on, several independent astronomers have in later years vigorously questioned NASA and ESA over the star distances published in their official catalogues.

In any event, should the stars be much closer than currently believed, this would certainly help explain why we can see very distant stars like Deneb with the naked eye and why 'first magnitude stars' like Sirius can appear to be of roughly the same size as Jupiter. To be sure, much more study is needed in the field of optical astronomy, a branch of human knowledge rife with controversy still today. The long-debated question of the perceived telescopic star disk sizes and how they are affected by assorted optical phenomena is far from settled. The same goes for the use of blueshift and redshift Doppler effects to determine whether stars are approaching or receding from our Solar System. But more on that in Chapter 26.

23.4 About our relative speed in relation to the stars

The velocity value of 19.4 km/s keeps popping up all over the astronomy literature. As shown by the quotes below, there appears to be some sort of consensus regarding this velocity value, although its actual meaning is rather nebulous. What is this speed measured against? It appears this value is meant to represent the 'perceived average relative speed' of our Solar System in relation to the stars, as computed within the Copernican framework, with its grossly inflated Earth-star distances.

The solar system itself has a velocity of 20 km/s with respect to the local standard of rest of nearby stars. [10]

The average radial velocity of the stars is of the order of 20 km per second. [11]

The Sun's peculiar velocity is 20 km/s at an angle of about 45 degrees from the galactic centre towards the constellation Hercules. [12]

The Sun is moving towards Lambda Herculis at 20 km/s. This speed is in a frame of rest if the other stars were all standing still. [13]

The speed of the Sun towards the solar apex is about 20 km/s. This speed is not to be confused with the orbital speed of the Sun around the Galactic centre, which is about 220 km/s [or 800.000 km/h] and is included in the movement of the Local Standard of Rest. [14]

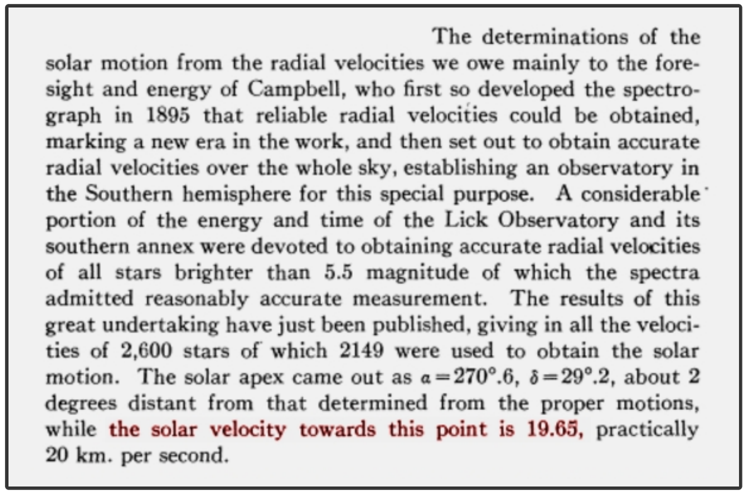
The determinations of the solar motion from the radial velocities we owe mainly to the foresight and energy of Campbell, who first so developed the spectrograph in 1895 that reliable radial velocities could be obtained, marking a new era in the work, and then set out to obtain accurate radial velocities over the whole sky, establishing an observatory in the Southern hemisphere for this special purpose. A considerable portion of the energy and time of the Lick Observatory and its southern annex were devoted to obtaining accurate radial velocities of all stars brighter than 5.5 magnitude of which the spectra admitted reasonably accurate measurement. The results of this great undertaking have just been published, giving in all the velocities of 2,600 stars of which 2149 were used to obtain the solar motion. The solar apex came out as $\alpha = 270°.6$, $\delta = 29°.2$, about 2 degrees distant from that determined from the proper motions, while the solar velocity towards this point is 19.65, practically 20 km. per second.

Fig. 23.6 Extract from *"The Motion of the Stars"*, by J. S. Plaskett (April 1928).

The Paris Observatory provides the more exacting figure of 19.4 km/s, or a displacement of *"about 4 AU/year"*:

> *Solar apex: The point on the celestial sphere toward which the Sun is apparently moving relative to the Local Standard of Rest. Its position, in the constellation Hercules is approximately R.A. 18h, Dec. +30°, close to the star Vega. The velocity of this motion is estimated to be about 19.4 km/sec (or about 4 AU/year). As a result of this motion, stars seem to be converging toward a point in the opposite direction, the solar antapex.*
>
> *Solar antapex: The direction in the sky away from which the Sun seems to be moving (at a speed of 19.4 km/s) relative to general field stars in the Galaxy.* [15]

In the interest of accuracy, we should probably use this 19.4 km/s value as it appears to be the most widely accepted estimate today. This velocity is essentially described as representing the motion of the Solar System relative to the stars. Hence, if the stars are in fact much closer to us than currently believed, their perceived (heliocentric) velocity should be divided by our 42633 reduction factor

- 19.4 km/s $\times$ 3600 $=$ 69840 km/h, and 69840 km/h / 42633 $\approx$ 1.638 km/h
- Orbital velocity of the Earth in the TYCHOS model $=$ 1.601169 km/h

Next, let us apply our 42633 reduction factor to the *"4 AU/year"* displacement estimate of the Paris Observatory:

- 4 AU $\approx$ 598 400 000 km, and 598 400 000 km / 42633 $\approx$ 14036 km
- Annual displacement of the Earth along its PVP orbit $=$ 14036 km

In conclusion, the general velocity perceived to exist between the stars and our Solar System ($\sim$19.4 km/s) would seem to support two of the TYCHOS model's most fundamental assertions:

- Earth moves at the very tranquil speed of 1.6 km/h.
- The stars are about 42633 times closer than currently estimated.

23.5 About the solar apex and the solar antapex

Untold efforts have been made to determine the spatial progression and direction of the Sun in relation to the surrounding stars. Astronomers have coined the term ‘solar antapex’ to indicate the point in the sky from which the Sun appears to be receding, and the term ‘solar apex’ to indicate the point in the sky towards which the Sun appears to be moving. It has now finally been determined that the Sun is receding from the celestial ‘longitude point’ of 6h28m RA (roughly in the direction of the Sirius system) and approaching the celestial ‘longitude point’ of 18h28m RA (roughly in the direction of Vega). [16]

This turns out to be in most excellent accordance with the TYCHOS model. The below screenshots from the Tychosium 3D simulator show that the Sun will indeed be moving in such manner in the next 12672 years (½ TGY). In this respect, the TYCHOS model is fully consistent with the observed and computed secular progression and direction of the Sun as it proceeds away from the solar antapex and towards the solar apex.

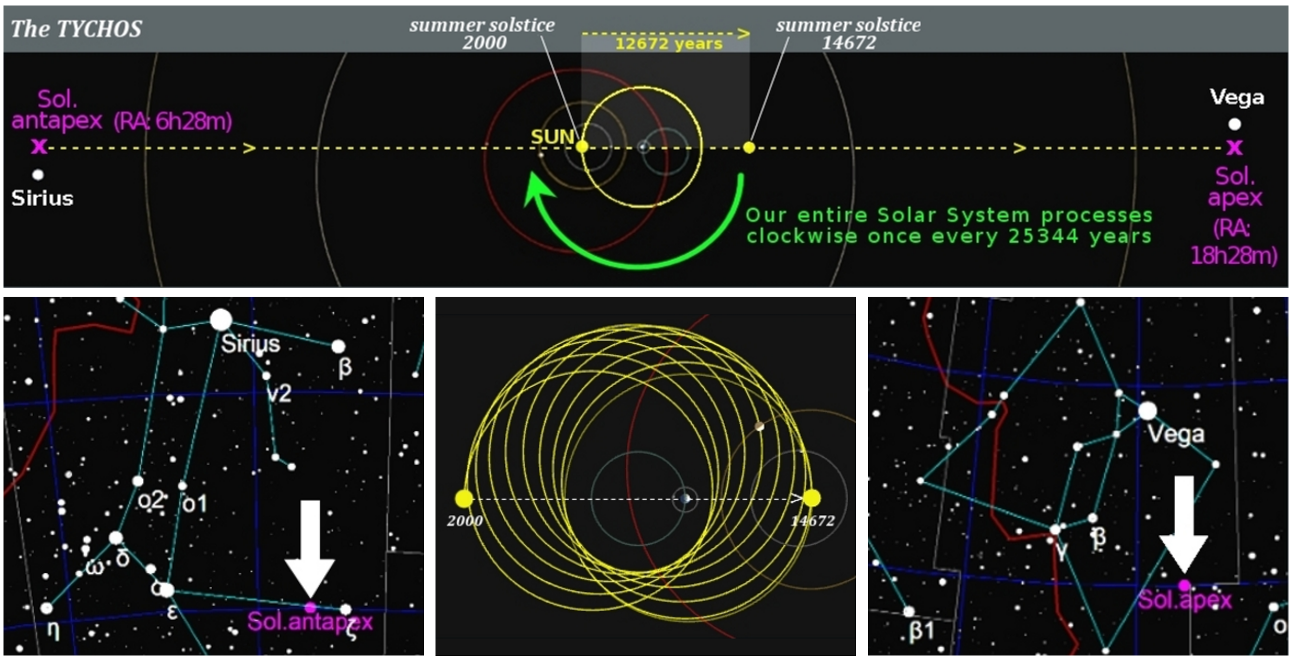

Fig. 23.7 Screenshots from the Tychosium 3D simulator. The TYCHOS model agrees with the observed direction of the Sun’s secular motion, from its antapex (RA: 6h28m) to its apex (RA: 18h28m).

Exercise

The parallax of a star is defined by its observed angular displacement (δ) over 6 months divided by 2. We can then verify our previous findings using a standard formula. Note: $1'' = 1°/3600$

Star	Parallax
Proxima	$0.7680665''$
Sirius	$0.37921''$
Vega	$0.13023''$

Distance formula

$$D = d \,/\, 2tan(\theta) \qquad \begin{cases} D = \text{distance} \\ d = \text{displacement} \\ \theta = \text{parallax } (\delta/2) \end{cases}$$

- Displacement of Earth over 6 months = 7018 km $\qquad \frac{14036}{2} = 7018$
- Distance of Proxima ≈ 942 344 452 km ≈ 6.30 AU $\qquad \frac{7018}{2tan(0.7680665/3600)} \approx 942\,344\,452$
- Distance of Sirius ≈ 1 908 660 650 km ≈ 12.76 AU $\qquad \frac{7018}{2tan(0.37921/3600)} \approx 1\,908\,660\,650$
- Distance of Vega ≈ 5 557 730 209 km ≈ 37.15 AU $\qquad \frac{7018}{2tan(0.13023/3600)} \approx 5\,557\,730\,209$

In the next chapter, we shall see how Earth's purported translational velocity of 107226 km/h has never been experimentally verified nor confirmed. This is a hard fact which no earnest astronomer can deny, yet relativists will unfailingly roll their eyes and tell you that *"Einstein has long explained why the Earth's translational velocity is impossible to verify!"*

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24

Dayton Miller and the speed of Earth

24.1 Miller's 'milling' of Einstein's relativity

Dayton Miller has to be one of the most tenacious experimental astronomers of the past century. His relentless quest to measure the translational speed of the Earth is second to none. As a Copernican, he believed that Earth revolved around the Sun at about 30 km/s (90 times the speed of sound), yet over and over again his sophisticated interferometer yielded apparent velocities he could only interpret as somewhere between 9 and 10 km/s.

> *Dayton Miller performed over 326,000 turns of interferometer with 16 readings each one, (more than 5,200,000 measurements). They showed what appeared to be a small amount of drift (about 9 km/s, 1/3 of the velocity of the Earth around the Sun).* [1]

Fig. 24.1 Dayton Miller (1866-1941)

The full story of Miller's tireless experiments is far too extensive to be reproduced in this book, and so is the ensuing epic and still ongoing controversy over the existence of the ether, involving none other than Albert Einstein. To those interested I warmly recommend a 2014 publication by James De Meo which does a fine job summarizing these matters. In the introductory paragraph we learn that...

> *The author reviewed the experimental ether-drift experiments and publications of Michelson-Morley, Dayton Miller, Michelson-Pease-Pearson, and more recent others, from the late 1800s through the present. Many of these historical studies presented positive results in detecting a cosmic ether, and ether-drift through space. Among these experiments, the most widely cited Michelson-Morley experiment of 1887, which did show a slight positive result, was found to be the least significant or robust in terms of experimental procedures and actual data collected, as compared with the far more important 1920s' study by Miller on Mount Wilson near Los Angeles, California.* [2]

Oddly enough, Miller's far more important and exhaustive interferometer experiments are rarely cited or debated in the modern literature. Most people will only have heard of the famed Michelson-Morley 'null results' which were said to confirm Albert Einstein's hallowed theories. The true story behind the various interferometer experiments is, however, quite different. Suffice it to say that Einstein was seriously worried about Miller's findings. He famously made the following statement:

> *If Dr. Miller's results should be confirmed, then the special relativity theory, and with it the general theory in its present form, fails. Experiment is the supreme judge. Only the equivalence of inertia and weight remain, which would lead to an essentially different theory.* [3]

As you may know, Einstein had basically decreed that the ether does not exist, that the speed of light is independent of the observer, and that the orbital speed of Earth is therefore undetectable and unmeasurable. Miller's repeated and consistent non-null results of 9 or 10 km/s were thus perceived as a threat to Einstein's relativity theory which was gaining popularity in the scientific community of the time. But let us take a closer look at Dayton Miller's findings through the lens of the TYCHOS model.

In Chapter 23, we saw that 'the speed of our Solar System in relation to the stars' is officially estimated at 19.4 km/s (or 69480 km/h). We also saw that if the TYCHOS reduction factor is applied to this figure, it translates into $\sim$1.6 km/h (69480 / 42633), i.e., the orbital speed of Earth in the PVP orbit, as proposed by the TYCHOS model.

At the end of chapter 14, we saw that the mean variation coefficient (MVC) of Earth's orbital speed is 0.8 km/h. The slow advance of Earth along the PVP orbit implies a curvature of only 1.42° per century, making it appear to our senses as if we were travelling along a straight line. However, the MVC will oscillate differentially in relation to each octant of the firmament. The oscillation will be ±1.6 km/h at the solstices, ±0.8 km/h at the 'cross-quarters' and 0 km/h at the equinoxes. Therefore, in the TYCHOS, if the Earth's motion were monitored over a full day or a full year, an MVC of 0.8 km/h is just what would be expected.

Dayton Miller was adamant that his interferometer findings consistently indicated an orbital speed in the range of 9 to 10 km/s. As we have seen, this amounts to about one third of the translational velocity required by the Copernican model. In fact, several of Michelson-Morley's experiments yielded velocities in that same range, as stated by Reg Cahill of Flinders University: "*They reported, based upon only 36 rotations, the observation of fringe shifts and inferred a light speed anisotropy of 8-10 km/s*". If we average Miller's minimum and maximum values we obtain a mean value of 9.5 km/s (34200 km/h). At this point it would be interesting to apply the TYCHOS reduction factor of 42633 to see what happens.

$$\frac{34200}{42633} = 0.802$$

This is almost identical to the MVC proposed by the TYCHOS model. In other words, Dayton Miller may well have unwittingly detected Earth's true translational speed of 1.6 km/h!

24.2 The 'diurnal speed-of-light variation'

We shall now fast-forward in time to a most fascinating French paper published in 2007 by Pierre Fuerxer under the title: "*Les expériences optiques et la relativité*" [4]. Fuerxer is a radar engineer and signal processing specialist who worked closely with the eminent physicist and economist Maurice Allais (1911-2010) who pitilessly dismantled Einstein's theory of relativity.

When Maurice Allais performed a statistical examination of Dayton Miller's data, he found that the sheer coherence and statistical consistency of Miller's vast body of observations was such that it could not be dismissed as 'spurious' or 'systematically flawed', as Miller's opponents had argued, eventually throwing his entire body of work into disrepute. In short, Miller's data had shown that there was a regular diurnal dissymmetry between civil time and sidereal time and that this dissymmetry also manifested over a six-month periodic sinusoidal curve, peaking at the equinoxes (21 March and 21 September).

Now, as highlighted in Fig. 24.2, Dayton Miller was seeing "*diurnal variations in the speed of light of an amplitude of about 8 km/h*". Could this '8 km/h' variation in the diurnal speed of light possibly be 'off' by one decimal? Was that 'diurnal variation' perhaps 0.8 km/h instead of 8 km/h? At the end of Fuerxer's paper on Dayton Miller's experiments is the fascinating statement reproduced below. To appreciate its full significance keep in mind that past interferometer experiments such as those of Michelson and Morley are generally claimed to have yielded 'null' results. This is simply not true: in reality, many interferometer experiments yielded positive and comparable results. The only 'problem' was that none of them confirmed the 30 km/s speed expected by heliocentrists.

> *Tous les interféromètres de Michelson dont le schéma optique est celui de l'interféromètre initial ont donné des résultats comparables [All Michelson-type experiments using the optical scheme of his original interferometer have yielded comparable results].* [4]

The results of most of the various Michelson-type experiments performed over the years have, as shown by Fuerxer, detected a 'speed-of-light variation' of around 8×10^{-10}, whereas other rigorous experiments (e.g., Kennedy-Thorndike and Ernest Esclangon) have yielded a marginally smaller value of 7×10^{-10}. Fuerxer concluded that the experiments pretty much agreed with each other. This contradicts the widely believed notion that the interferometer experiments conducted by different scientists have mostly yielded inconsistent or 'null' results or have been afflicted with systematic errors associated with temperature variations or whatnot.

1 – The interferometric observations of Dayton C. Miller

1-1 Their crucial importance.

▪ Of all the interferometric observations conducted since Michelson's historic observation of 1881, those of Dayton C. Miller, in 1925-1926 have been the most complete.

Their findings were published by Dayton C. Miller ("*The Ether-Drift experiment and the determination of the absolute motion of the Earth*" - Dayton C. Miller, Review of Modern Physics, vol. 5, July 1933).

The most remarkable point was the existence of sidereal diurnal variations (period 23 h 56 min) in the speed of light, of amplitude of about 8 km/h. **< 8km/h? - or perhaps 0.8 km/h? (Simon Shack)**

This invalidated the postulate of the invariance of the speed of light which is the basis of the theory of special relativity and therefore cast doubt on that theory, as indeed Albert Einstein himself admitted in a communication to the magazine *Science* of 31^{st} July 1925:

"If Dr. Miller's results should be confirmed, then the special relativity theory, and with it the general theory in its present form, fails. Experiment is the supreme judge. Only the equivalence of inertia and weight remain, which would lead to an essentially different theory." (Albert Einstein - Science - New Series, Vol. 62, n° 1596, 31^{st} July 1925, p. viii)

▪ This is why these observations were so sensitive, and gave rise at the time to heated debates, in the course of which Miller was able to refute all the arguments advanced by his gainsayers. Yet this did not lead to a reassessment of the theory of relativity, for its hold was already too strong.

Fig. 24.2 Extract from the website of the Fondation Maurice Allais. [5]

d'autres questions mériteraient une analyse aujourd'hui impossible. Le décalage des franges observé par les autres interféromètres de Michelson est de l'ordre de $8x10^{-10}$.

- L'interféromètre de Roy et Kennedy a un chemin optique de l'ordre de seulement 500.000 longueurs d'onde. Un déplacement des franges de 0,35 millièmes de frange correspond alors à une variation relative de vitesse de la lumière de $7x10^{-10}$. Contrairement aux apparences, ses résultats sont tout à fait comparables à ceux des interféromètres de Michelson.
- La valeur des déviations optiques journalières observées par Maurice Allais en 1959 était pour le cycle de 12h de l'ordre de $2{,}4x10^{-7}$ radians. Les premières mesures de Vincent Morin sont tout à fait comparables. Par contre, les mesures faites par Esclangon à Paris ne seraient que de l'ordre de $7x10^{-10}$, mais le dispositif fonctionne sur un aller-retour et non sur un trajet unique comme les dispositifs précédemment étudiés.

Fig. 24.3

In scientific annotation, 8×10^{-10} simply means 0.0000000008, while 7×10^{-10} means 0.0000000007. For the sake of the following calculus, I will use the averaged value of these two figures to represent the purported 'speed-of-light variation' detected by various experiments.

- Speed of light = 299792.5 km/s
- Average variation factor = 0.00000000075
- Average variation = 0.000224844375 km/s
- Average variation = 0.80943975 km/h

$$\frac{0.0000000008 + 0.0000000007}{2} = 0.00000000075$$

$$299792.5 \times 0.00000000075 = 0.000224844375$$

$$0.000224844375 \times 3600 = 0.80943975$$

So what was interpreted as the average 'speed-of-light variation' in several unrelated interferometer experiments is nearly identical to the MVC of 0.8 km/h posited by the TYCHOS. Another spectacular strike of luck perhaps? As you will have noticed by now, the 'coincidences' are piling up in this book. In any case, it would certainly appear that a number of potentially significant and mutually compatible interferometer experiments subsequent to the 'triumph' of Einstein's theories have been 'overlooked' by the scientific community.

Summarizing the current state of affairs of the measurement of Earth's translational speed:

- None of the various interferometer experiments produced 'null' results. Hence, Einstein's theory of general relativity was experimentally falsified.
- None of the results obtained was anywhere near the hypersonic speed of Earth required by the Copernical model (30 km/s).
- The 'diurnal speed-of-light variation' measured by various interferometer experiments may be reasonably interpreted to support the translational speed of 1.6 km/h proposed by the TYCHOS.

If Earth only moves at 1.6 km/h, covering only 7018 km every six months and 14036 km annually, it is easy to see why it has been so difficult to measure its orbital speed and detect stellar parallaxes. As it is, almost all astronomy debates and controversies over the last few centuries have been centred around minuscule variations or 'inequalities'. The TYCHOS suggests these infinitesimal celestial motions are quite simply due to the snail-paced motion of the Earth. Moreover, the leisurely stroll of our planet along the PVP orbit may well be an essential prerequisite for the existence of life on Earth.

24.3 Addendum dedicated to assorted sceptics

To round off this chapter, I would like to address some basic issues concerning Earth's motions. This section is dedicated to Copernicans, Geocentrists, Concave Earthers and Flat Earthers, all of whom will naturally have objections to the motions modelled in the TYCHOS. We are all entitled to our own world view, but if rationality is your cup of tea, you will likely appreciate what follows.

Firstly, we need to make a clear distinction between the translational and rotational motions of the Earth. Countless experiments have successfully proven the rotational motion of our planet around its axis. The same cannot be said for the translational motion. The many attempts to measure the Earth's presumed hypersonic translational speed around the Sun have failed miserably. So, let us draw a sharp line between these two wholly different secular experimental endeavours:

- The experiments conducted to confirm heliocentrists' claim that Earth hurtles around the Sun at 30 km/s (107226 km/h) have invariably failed. There is simply no scientific, experimental or empirical evidence in support of the Earth's purported revolution around the Sun.
- The experiments performed to measure Earth's diurnal rotation have for the most part been successful. The body of evidence in support of Earth's daily rotation around its polar axis at the sluggish rate of 0.000694 rpm is overwhelming and ranks among the most robust experimental results ever produced (whether Flat Earthers like it or not). All the visible planets and moons in our system can be empirically observed to rotate around their axes—a fact beyond dispute.

As mentioned in Chapter 1, it was Tycho Brahe's assistant and successor, Longomontanus, who in his voluminous treatise "*Astronomia Danica*" eventually allowed for the diurnal rotation of Earth. His master had for some reason held on to the idea that Earth was completely motionless, yet some text books suggest that by the end of his life he had in fact accepted that Earth's polar axis, rather than the entire firmament, revolved once every 24 hours. Geocentrists, on the other hand, still hold on to the notion that all the stars revolve in unison around the Earth each day—something I find rather unlikely, to say the least.

In 2013, Mr Marsh, one of the members of the ResearchGate.net science discussion forum, submitted the following relevant question:

> *Why can a Sagnac Interferometer see the rotation of the earth, but a Michelson Interferometer can't see orbital speed? Could someone with knowledge of Relativity explain why a Sagnac Interferometer can plainly see the rotation of the earth (or at least a rotating reference frame of 1 day), yet the Michelson Interferometer can not detect the earth's translational motion around the sun. There seems to be a paradox here and I can't see a mathematical or theoretical way out of it. If there is no Aether [...] then how can the Sagnac Interferometer see the earth's rotation and at the same time the Michelson Interferometer can't see translational motion?* [6]

It is an interesting experience to read the answers Mr Marsh has received over the years on the ResearchGate.net forum. As far as I can tell, none of these answers provide any sort of intelligible or meaningful explanation as to why it has proved impossible to this day to demonstrate that the Earth revolves around the Sun at breakneck speed, whereas its diurnal axial rotation can be experimentally detected in a number of ways. [7]

I can now hear someone ask: "*If the Earth spins once daily around its axis, why don't we get flung out in space by the resulting centrifugal force?*" In fact, I well remember asking myself this very same question as a child. Later in life I realized that the centrifugal force I could feel in a children's merry-go-round was due to the small diameter of the same in relation to its rotational speed. To dispel the childish and commonplace notion of the 'massive centrifugal force' that our Earth's rotation would exert on us, here is a simple experiment you may perform in the comfort of your own home:

Place an orange on a table and put your hand on top of it. Then slowly rotate it around its axis once in 24 hours (if you can stay awake that long). Now, imagine a mosquito sitting on the side of the orange. Would it be flung violently off the peel and into the room as a result of the centrifugal force? In plain physical terms, Earth revolves around its axis at the extremely sluggish rate of 0.000694 rpm. The math is simple enough: 1 rotation every 1440 min $= 1/1440 = 0.000694$ rpm.

To put this into perspective, if you take a ride on a children's merry-go-round with a diameter of 12.756 meters (that's one million times smaller than the Earth's diameter of 12 756 000 meters), the merry-go-round would have to spin one million times slower than the Earth to match the centrifugal force exerted upon your body by the Earth's rotation. Since the Earth's rotational speed at the equator is about 1674 km/h, your merry-go-round would have to move at 1674 km/h / 1 000 000 = 0.001674 km/h, or 1.674 meters per hour. That's roughly 30 times slower than your average snail's top speed. I hope this will put to rest, once and for all, the notion that the centrifugal force of the Earth's rotation should cause people to be flung out in space.

We shall now proceed and see how the TYCHOS model can readily demystify one of the best concealed (and poorly excused) aberrations of heliocentric astronomy, namely the 'mystery' of the regularly observed negative stellar parallax. Under the Copernican model, negative stellar parallax is a theoretical impossibility. In the TYCHOS, on the other hand, it is to be fully expected.

24.4 References

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[5] *Fondation Maurice Allais*
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[6] *Waverly Marsh*, ResearchGate.net
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[7] For a better understanding of how Earth's rotation around its axis can be detected and measured experimentally, see: *Detecting Earth's Rotation Through Space Using a Large Area Sagnac Interferometer* by Doug Marett (2011)
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25

The negative stellar parallax demystified

25.1 The calamitous history of stellar parallax measurement

The concept of parallax is fairly simple: it is the appearance of lateral displacement of a nearby object in relation to a more distant one as viewed by someone in motion. For instance, imagine driving down a highway and looking at the scenery through your righthand window. As you pass a tree by the roadside, it will seem to drift from left to right in relation to the background scenery. Of course, the tree is not moving in relation to the background: it is just an optical effect caused by your own motion. In astronomy, the tree and the background scenery are represented, respectively, by a layer of nearby stars and a layer of distant, so-called fixed stars. Stellar parallax is the appearance of lateral displacement of the nearby stars in relation to the distant stars due to Earth's movement. Naturally, the effect is extremely small and difficult to observe.

> *Hipparchus of Nicaea (2nd century BC) is the first known astronomer to have made careful observations and compared them with those of earlier astronomers to conclude that the fixed stars appear to be moving slowly in the same general direction as the Sun. Confirmed by Ptolemy (2nd century AD), this understanding became common in medieval Europe and the Near East, although a few astronomers believed that the motion periodically reversed itself.* [1]

> *The annual parallax is the tiny back-and-forth shift in the direction of a relatively nearby star, with respect to more-distant background stars, caused by the fact that Earth changes its vantage point over the course of a year. Since the acceptance of Copernicus's moving Earth, astronomers had known that stellar parallax must exist. But the effect is so small (because the diameter of Earth's orbit is tiny compared with the distance of even the nearest stars) that it had resisted all efforts at detection.* [2]

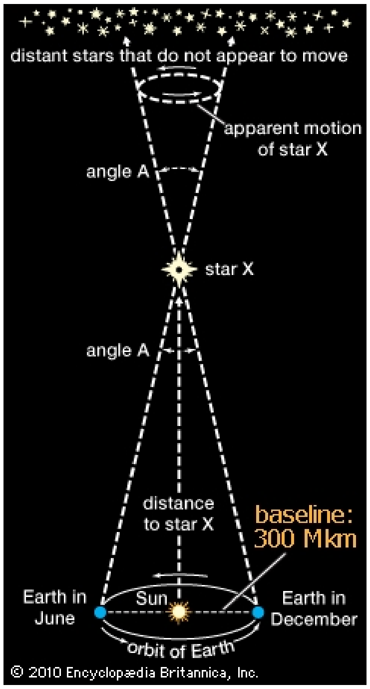

Fig. 25.1 "*Stellar parallax*" from the Encyclopaedia Britannica.

Since Copernican astronomers believe our planet orbits around the Sun in a 300-million-km wide circle (see Chapter 23), they will choose a star and determine its position 6 months apart. According to their reasoning, the Earth will then have moved from one side of its orbit to the other, and so will have been displaced by its maximum elongation in relation to the stars. As they compare the two observations of the chosen star, they will calculate its parallax trigonometrically, using a baseline of 300 Mkm.

In the TYCHOS model, however, the Earth only moves by a mere 7018 km every six months. The fact that this is a quite small displacement with respect to the distant stars helps explain why detecting stellar parallaxes was impossible in Brahe's times and is still a formidable challenge for modern-day astronomers.

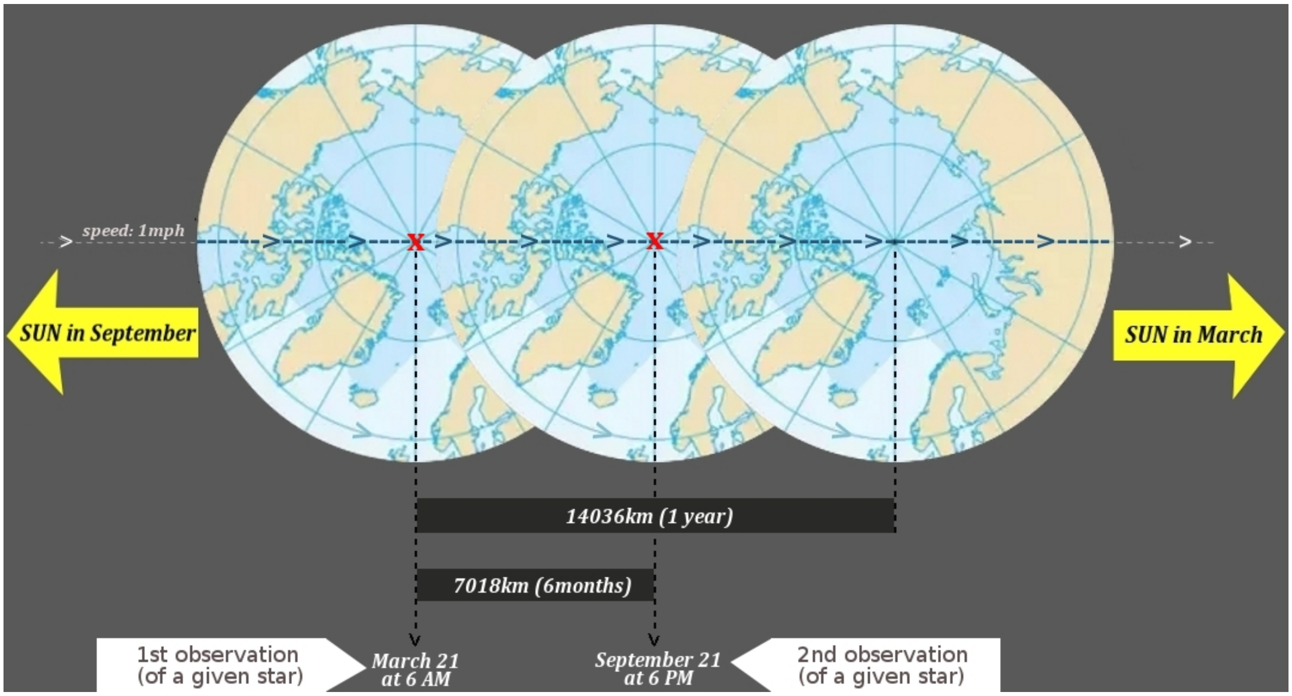

Fig. 25.2 The Earth's motion in one year (14036 km) and in six months (7018 km). Note that north stars observed from the North Pole will still be moving around slightly trochoidal paths, due to the 23.5° tilt of the Earth's axis.

Before we move on, an important point concerning the history of stellar parallax measurements needs to be clarified:

> *It is important to notice that the early attempts were at measuring what today would be called absolute parallax, rather than relative parallax, which is the parallax of a nearer star with respect to that of a distant star.* [3]

For centuries after the so-called 'Copernican Revolution', the failure of our world's top astronomers to detect any relative stellar parallax remained a critical problem for the heliocentric theory. It was logically thought that, if Earth travels around the Sun in a 300-Mkm wide orbit, some amount of relative stellar parallax should be detectable. Yet, it wasn't until 1838 when Bessel detected some minuscule parallax for a star called 61 Cygni (a confirmed binary system). Bessel's observation was then triumphantly hailed as a robust confirmation of the Copernican postulate that Earth revolves around the Sun!

> *At the end of 1838, Bessel announced that over a period of one year 61 Cygni made a small ellipse in the sky. The greatest displacement from the average position was just 0.31" with an error of 0.02". This tiny motion of 61 Cygni was a direct consequence of Earth's motion around the Sun. Bessel had finally discovered an annual parallax.* [4]

Today, the two major official stellar parallax catalogues, 'Hipparcos' and 'Tycho', published by the European Space Agency (ESA), include the values of a few million stars. Indeed, ESA now proudly proclaims that their current 'Gaia' enterprise will soon provide the celestial positions and distances of a billion stars.

Now, here is the problem: in later years, a number of independent researchers patiently scouring ESA's largest database of about 2 million stars have pointed out a seemingly inexplicable aberration: roughly 25% of the stellar parallaxes are negative, 29% are positive, and 46% are 'assumed zero'. In other words, nearly half the stars listed in the 'Tycho' catalogue exhibit no observable parallax. It turns out that the confirmed existence of negative stellar parallax is a veritable death blow for the Copernican model. The reason for this should become clear by examining Fig. 25.3 and Fig. 25.4.

Imagine travelling in a car orbiting 'counterclockwise' around the Sun, imitating the motion assigned to Earth by the Copernican theory. For the sake of simplicity, let us assume the car does not spin around itself

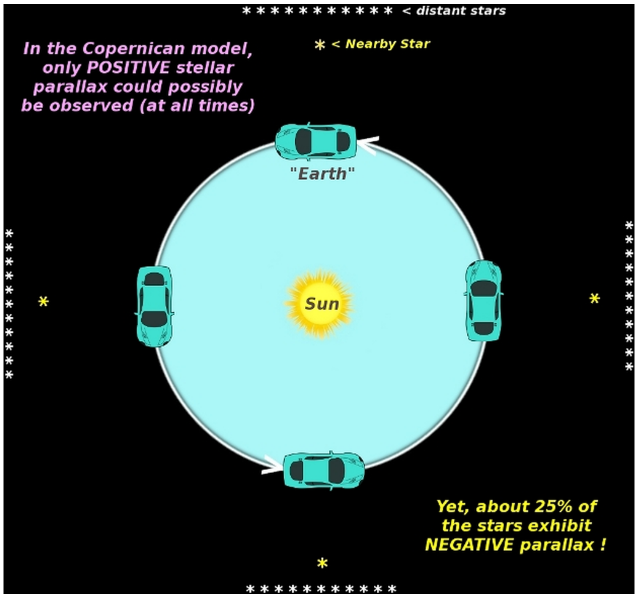

Fig. 25.3

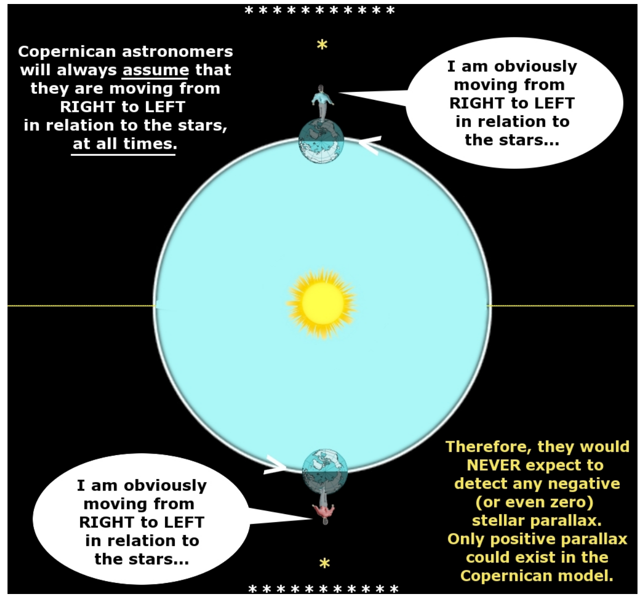

Fig. 25.4

every 24 hours. The Sun will always be shining through your lefthand window, whereas to see the stars you will always have to look out your righthand window. Thus, if you were to measure the optical effect of the nearby stars 'moving' in relation to the distant stars, the parallax would at all times be positive, meaning that the nearby stars would invariably seem to move from left to right (or from east to west) in relation to the background.

Yet, about one fourth of all the stellar parallaxes listed in ESA's 'Tycho' catalogue have negative values, essentially meaning that they were observed to move from right to left (or from west to east) in relation to the more distant background stars. How can this possibly be?

We shall now see why the TYCHOS model provides the simplest and most logical solution imaginable to this most troublesome affair. In short, since Earth's PVP orbit is entirely inside the Sun's orbit, stars will actually be observable not just through the 'righthand window' of the orbital car in the example above, but on all sides. Depending on which 'window' of the cosmic car you are looking through, stellar parallaxes will be positive (∼25%) on the 'right side', negative (∼25%) on the 'left side', and zero (∼50%) in front of and behind the car (no parallax of a nearby star can be detected if you are moving either directly towards or away from it).

Obviously, Earth does not reverse direction, so heliocentrists can only conceive of positive parallax. Negative and zero stellar parallaxes, though empirically verified by their own partisans, constitute a physical impossibility and an utterly insurmountable problem for their model.

As a matter of fact, astronomers have for centuries been observing negative parallaxes in nearby stars drifting in the opposite direction of what the Copernican model predicts. Strangely, there is practically nothing to be found regarding this very serious problem in modern astronomy literature. The question of negative stellar parallaxes has eluded any rational explanation to this day and appears to be 'taboo' among today's astronomers. Back in 1878, the famous astronomer Simon Newcomb briefly commented on this thorny issue, concluding that "*such a paradoxical result can arise only from errors of observation*".

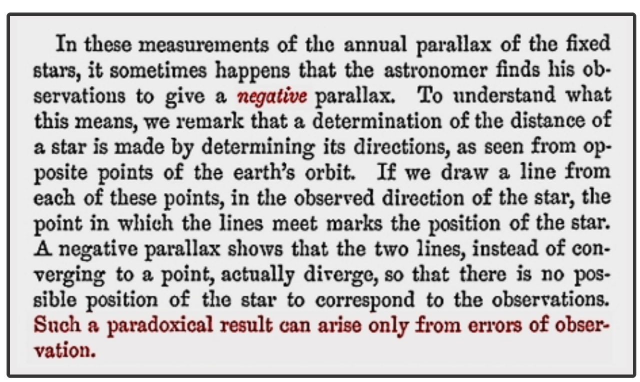
In these measurements of the annual parallax of the fixed stars, it sometimes happens that the astronomer finds his observations to give a *negative* parallax. To understand what this means, we remark that a determination of the distance of a star is made by determining its directions, as seen from opposite points of the earth's orbit. If we draw a line from each of these points, in the observed direction of the star, the point in which the lines meet marks the position of the star. A negative parallax shows that the two lines, instead of converging to a point, actually diverge, so that there is no possible position of the star to correspond to the observations. Such a paradoxical result can arise only from errors of observation.

Fig. 25.5 Extract from Simon Newcomb's "Popular Astronomy" (1878).

Perhaps the most ironic twist of the entire history of stellar parallax detection (and as very few will know) is the fact that Bessel—the man credited with making the first "*indisputable stellar parallax determination that finally proved Earth's motion around the Sun*"—had initially detected and reported a number of negative star parallaxes, not only for the star 61 Cygni, but also for Cassiopeiae, while Sir James Bradley had even observed negative parallax for our north star, Polaris! Here follows an extract from one of the more inquisitive, fact-filled papers by earnest astronomy historians I have come across over the years:

> *But Bessel was to be disappointed again: when he had finished the reduction of the position of 61 Cygni relative to the six different stars he was forced to the conclusion that its parallax was negative! The paper in which this result was announced took the form of a report only, with no explanation of why a negative answer might have been obtained. Bessel gave tables of observations, and results of the application of the method of least squares to these observations for each comparison in turn; he followed this with exactly the same information for μ Cassiopeiae which he had compared with θ Cassiopeiae. For this star also he had a negative, though numerically smaller result. In volume III of the Konigsberg observations Bessel gave another set of observations, this time of the difference of right ascension between α and 61 Cygni from which he deduced an even larger negative result for the parallax of 61 Cygni. A different account may be constructed from Bessel's private correspondence. In a letter to Olbers written at about the time that the first set of negative results for 61 Cygni was published, Bessel stated that: "The negative parallax which one found here and there and which he had in fact found for the Pole Star from Bradley's observations was of course the result of observational errors".* [5]

Before proceeding any further, you should know that the entire history of stellar motion measurements reads like an almost kafkaesque novel of dire, tragicomical confusion. Since virtually all the most acclaimed astronomers of recent centuries have been 'Copernican disciples', they simply couldn't make any sense of their own, conflicting stellar parallax measurements. As they compared the data of their various star observations, performed during different annual seasons, they couldn't even make up their minds about the actual direction of a given star's proper motion (the term 'proper motion' refers to a star's own displacement in any given direction in Euclidian space). Sir Francis Baily, co-founder and four times president of the Royal Astronomical Society, was well aware of the embarrassing state of the parallax affair:

> *For, in many cases, some of the greatest names have differed even as to the direction of the motion of particular stars: one making it positive whilst in the same star another considers it as negative.*

In a footnote to his "*Catalogue of Stars*" [6] (Fig. 25.6), Sir Francis Baily mentions a disconcerting argument between Baron Zach and Nevil Maskelyne over the parallax measurements of ten stars. Zach reported positive parallaxes for all ten stars, whereas Maskelyne insisted all the parallaxes were negative!

* Baron ZACH compared MASKELYNE's observations of the right ascensions of these stars, as reduced to 1802, with those of BRADLEY reduced to 1760. The result of this examination is given in his *Tabulæ Speciales*, page 67: but, it differs in many respects from the deductions of MASKELYNE himself. To mention only a few cases; the proper motions (in right ascension) of *γ Pegasi, α Ceti, Rigel, Sirius, Spica, γ* and *β Aquilæ, α Cygni, α Aquarii,* and *α Pegasi*, are *all positive* according to Baron ZACH: but Dr. MASKELYNE (whilst he differs as to the *amount* of the proper motions in each of these respective stars) considers them as *all negative*. See also, *passim*, the Notes annexed to PIAZZI's Catalogue of Stars.

Fig. 25.6 Sir Francis Baily's footnote in his *"Catalogue of Stars"* [6].

The comedy of stellar parallax errors extends far and wide if you are patient enough to dig it up in the specialized literature. Fig. 25.7 reproduces two extracts from a paper by Eichelberger published in the famed journal *Science* on 7 April 1916 under the title "*The Distances of the Heavenly Bodies*":

Probably the most extensive piece of stellar parallax work in existence is that with the Yale heliometer. The results to date were published in 1912 and contained the parallaxes of 245 stars, the observations extending over a quarter of a century, the entire work having been done by three men, Elkin, Chase and Smith. In selecting a list of stars for parallax work an effort is made to obtain stars which give promise of being nearer than the mass of stars. At first the brighter stars were selected, and then those with large proper motions. The Yale list of 245 stars contains all stars in the northern heavens whose annual proper motion is known to be as much as 0″.5. Of these 245 stars, 54 are given a negative parallax. A negative parallax does not mean, as some one has expressed it, that the star is "somewhere on the other side of nowhere," but such a result may be attributed to the errors of observation or to the fact that the comparison stars are nearer than the one under investigation. It is safe to say, however, that somewhat more than half of the 245 stars have a measurable parallax.

Another series of stellar parallax observations, comparable in extent with the one just mentioned, is that of Flint at the Washburn Observatory. This series includes 203 stars and extended from 1893 to 1905. These observations were made with a meridian circle, but not after the method of a century ago. The observations were strictly differential, the general plan being to select two faint comparison stars, one immediately preceding and the other immediately following the parallax star, and to determine the difference in right ascension, the observation of the three stars occupying about 5 minutes. Here as in the case of the Yale heliometer work a large proportion of the resulting parallaxes are negative; somewhat more than half, however, were found to have a measurable parallax. The average probable error of a parallax was the same in each of these two pieces of work, about 0″.03.

Fig. 25.7 Extracts from "The Distances of the Heavenly Bodies" by W. S. Eichelberger (April 7, 1916).

So let's see, if only "*somewhat more than half*" of those 245 stars (perhaps some 125 stars) had a measurable parallax, that means no parallax was detectable for "*somewhat less than half*". And among the approximately 125 measurable parallaxes, as many as 54 were negative. This is supported by a 1912 paper published in the *Astronomical Journal* under the title "*Results for parallax from meridian transits at the Washburn Observatory*". In it is a table (Fig. 25.8) showing a roughly 50:50 ratio between observed positive and negative stellar parallaxes.

TABLE XII. COUNT OF RESIDUALS COMPARED WITH THE ERROR CURVE.

Limits of Residuals	Absolute Parallaxes: Number of Residuals Positive	Negative	Total	Residual Parallaxes: Number Positive	Negative	Total	Error Curve: Total
″ ″ 0.000 to 0.050	40	32	72	33	43	76	83
0.050 to 0.100	10	21	31	18	15	33	28
0.100 to 0.150	8	3	11	2	3	5	3
Total	58	56	114	53	61	114	114

Fig. 25.8

But, you may now ask, hasn't technology progressed since the early 20th century? Of course it has, so let us move on and take a look at a 1966 paper by Stan Vasilevskis (of the famous Lick observatory) titled "*The Accuracy of Trigonometric Parallaxes of Stars*" which shows how the four most important American observatories were puzzled and bewildered by the disturbing disagreements between their respective, meticulously gathered stellar parallax data:

> *Parallaxes of the same stars determined by different observers and instruments often disagreed to such an extent that the reality of some parallaxes were in doubt. Although the homogeneity has high statistical merit, the absence of various approaches makes it difficult to investigate and explain discrepancies between various determinations of parallaxes for the same stars. There are disturbing differences, and many investigations to be reviewed later have been carried out on these discrepancies. The present paper is a review of the present material, and a consideration of the possibilities of modifications in the technique of parallax determination in view of past experience and the present status of technology.* [7]

So, as recently as 1966, the main American observatories were mystified as to the "*disturbing discrepancies*" between their respective stellar parallax measurements to the point that "*the reality of some parallaxes were in doubt*". Curious, isn't it? But let us fast-forward to the present. As every professional astronomer will know, ESA claims to have attained 'pinpoint accuracy' in the stellar motion and parallax values given in their star catalogues. The latter are allegedly based on data collected with a telescope installed aboard the 'Hipparcos satellite' and, still more recently, with the help of their new 'Gaia satellite', at the cost of USD 1 billion.

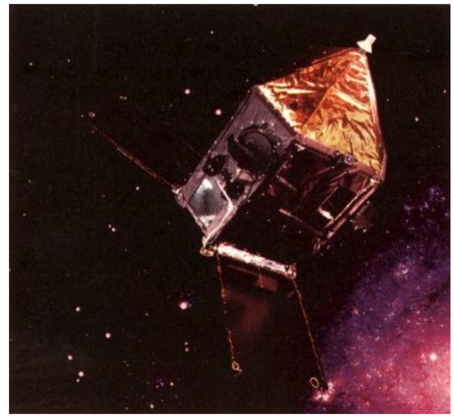

Fig. 25.9 The "*Hipparcos satellite*" as depicted at official NASA website. [9]

> *Observationally, the objective was to provide the positions, parallaxes, and annual proper motions for some 100,000 stars with an unprecedented accuracy of 0.002 arcseconds, a target in practice eventually surpassed by a factor of two.* [8]

> *The Hipparcos and Tycho Catalogues are the primary products of ESA's (the European Space Agency's) astrometric mission, Hipparcos. The satellite, which operated for four years, returned high quality scientific data from November 1989 to March 1993.* [10]

In later years, a number of independent researchers have seriously questioned ESA's catalogues of stellar parallax data, allegedly collected with a midget 29-cm telescope mounted on a tinfoil-hatted, remote-controlled satellite circling the Earth at hypersonic speeds, around an eccentric orbit ranging from 500 km (perigee) to 36000 km (apogee). We mere mortals can only wonder just how that's supposed to work, but the more fundamental question is: since stellar parallaxes are, by definition, microscopic perspective shifts between closer and more distant stars *as viewed from Earth*, what purpose would it serve to collect such data from a satellite hurtling at breakneck speed in a highly eccentric orbit around our planet? Hopefully, one day ESA will deign to answer these questions. In any case, the 'Hipparcos telescope' was declared by ESA to be a 'roaring success', with their claimed accuracy of stellar parallax data down to 1 milliarcsecond (0.001″). An extraordinary feat of technology or of belief? That is up to each astronomer to decide.

Whether ESA's data were collected the way they claim or not, the most interesting fact is that their largest stellar parallax catalogue—curiously enough named 'Tycho'—lists the parallax data for more than 2 million stars, of which about 1 million are *negative*! This glaring absurdity was noticed several years ago by a distinguished Italian astronomer, Vittorio Goretti, who passed away in 2016. In the last years of his life, Goretti vigorously demanded clarifications from ESA but, unsurprisingly, his demands were met with deafening silence. Goretti pointed out that:

> *As a matter of fact, about half the average values of the parallax angles in the Tycho Catalogue turn out to be negative! The parallax angle, which is one of the angles of a triangle, is **positive** by definition.*

Aside from the issue of negative parallaxes, Goretti also had some serious questions concerning ESA's evident cherry-picking of the stars and stellar parallax data selected for publication in their far smaller showcase 'Hipparcos' catalogue of about 118000 stars. The 'Hipparcos' catalogue contains far fewer negative star parallaxes and so is claimed to be 'more accurate' than the larger 'Tycho' catalogue. Goretti also questioned how a 29-cm telescope could possibly have achieved the formidable accuracy advertised by ESA:

> *The Hipparcos Catalogue stars, about 118,000 stars, are a choice from the over 2,000,000 stars of the Tycho Catalogue. As regards the data concerning the same stars, the main difference between the two catalogues lies in the measurement errors, which in the Hipparcos Catalogue are smaller by about fifty times. I cannot understand how it was possible to have such small errors (i. e. uncertainties of the order of one milliarcsecond) when the typical error of a telescope with a diameter of 20-25 cm is comprised between 20 and 80 milliarcseconds (see the Tycho Catalogue). When averaging many parallax angles of a star, the measurement error of the average (root-mean-square error) cannot be smaller than the average of the errors (absolute values) of the single angles.* [11]

Short of denouncing ESA for outright fraud, Goretti nonetheless suggested that the scientific community should urgently address the many issues raised by ESA's catalogues, such as the flagrant cherry-picking and the evident misrepresentation of stellar parallax data, ostensibly aimed at concealing the high incidence of stars exhibiting negative parallax.

As we have shown, there is no room for negative stellar parallax in the Copernican model. The hypothesis that Earth is revolving around the Sun implies that all stellar parallaxes must be positive. So what mathematical devices have heliocentrists resorted to to account for the existence of officially observed negative parallax so far? A senior lecturer in astronomy at UCL London submits this 'statistical explanation':

> *If you have a list of parallaxes of very distant objects, so that their parallaxes are on average much smaller than your limit of detection, then the errors of parallax are distributed normally, with a bell-shaped curve plotting the likely distribution of values around a mean of nearly zero. Hence we expect there to be approximately half of those published parallaxes with values less than zero and half with values more. Negative values are unphysical, but form the part of the statistical distribution of values that happen to lie below zero when the mean is close to zero.* [12]

According to this reasoning, since most stellar parallax angular measurements are minuscule ("*even smaller than the optical limits of detection*"), the fact that half of them are negative can be predicted by a bell-shaped curve of statistical distribution. If this were the case, why would ESA even go to the trouble of publishing stellar parallax figures? If the published negative parallax figures are allegedly useless 'false negatives' imputable to the error margins of the instruments being larger than the observed parallax itself, why would the positive parallax figures be any less useless or any more trustworthy? If, as proudly announced, ESA has achieved the stunningly small error margin of only 1 milliarcsecond, none of their excuses for the abundance of negative parallaxes in their catalogues makes any sense.

In later years, a number of geocentrists have also commented on the negative parallaxes published by ESA. While they can give no alternative explanation for the occurrence of both positive and negative parallax values, being on the 'other side' of the debate gives geocentrists a certain valuable perspective:

> *I believe that conventional astronomical community are in open fraud because they completely ignore negative parallax readings, explaining them away as measurement errors, at the same time as they happily use positive parallax readings to 'prove' their theories in opposition to geocentrism. That is intellectual skulduggery of the worst kind in my view and is basically a lie. If negative parallax readings are 'errors' then what cause do we have to assume that positive parallax readings are not themselves also 'errors'.* [13]

> *The Hipparcos satellite recorded that 50% of the parallax readings were negative which is not possible. In one of the biggest cover ups in scientific history the readings were 'adjusted' (or I would call it cooked) to make them all positive.* [14]

25.2 Positive, negative and zero stellar parallax in the TYCHOS

Many researchers have pointed out that ESA's 'Tycho 1' catalogue actually features three distinct categories of stellar parallaxes: positive, negative and 'assumed zero'. The latter category actually makes up nearly half the sample (46%).

> *Over 1 million objects are listed in the Tycho Main Catalogue, and they state: 'The trigonometric parallax is expressed in units of milliarcsec. The estimated parallax is given for every star, even if it appears to be insignificant or negative (which may arise when the true parallax is smaller than its error). 25% have negative parallax, 29% positive parallax and 46% assumed zero parallax.* [15]

ESA's massive 'Tycho 1' catalogue distributes stellar parallaxes into three distinct groups:

- Positive parallax: 29%
- Negative parallax: 25%
- 'Assumed zero' parallax: 46%

Anyone blessed with the gift of patience and basic math skills should be able to verify for themselves what Vittorio Goretti and others discovered, namely that the stellar parallaxes recorded in ESA's 'Tycho 1' catalogue are indeed distributed as described above.

We shall now see that the coexistence of positive, negative and zero parallax makes perfect sense within the spatial perspective of the TYCHOS model. Fig. 25.10 shows not only why these three different categories of stellar parallax must occur, but also why they should be distributed approximately as given in ESA's 'Tycho 1' catalogue.

As shown in Fig. 25.10, the existence of about 1 million non-positive stellar parallaxes in ESA's 'Tycho 1' catalogue is compatible with the TYCHOS model's cosmic configuration. Astronomers will measure the parallax of any given nearby star against clusters of fixed stars as Earth slowly moves from 'left to right' by 7018 km every six months. Depending on which of the four quadrants is observed, nearby stars will appear to drift by different amounts and directions, if at all. In all logic, nearby stars located in the lower quadrant of Fig. 25.10 will exhibit positive parallax, whereas nearby stars in the upper quadrant

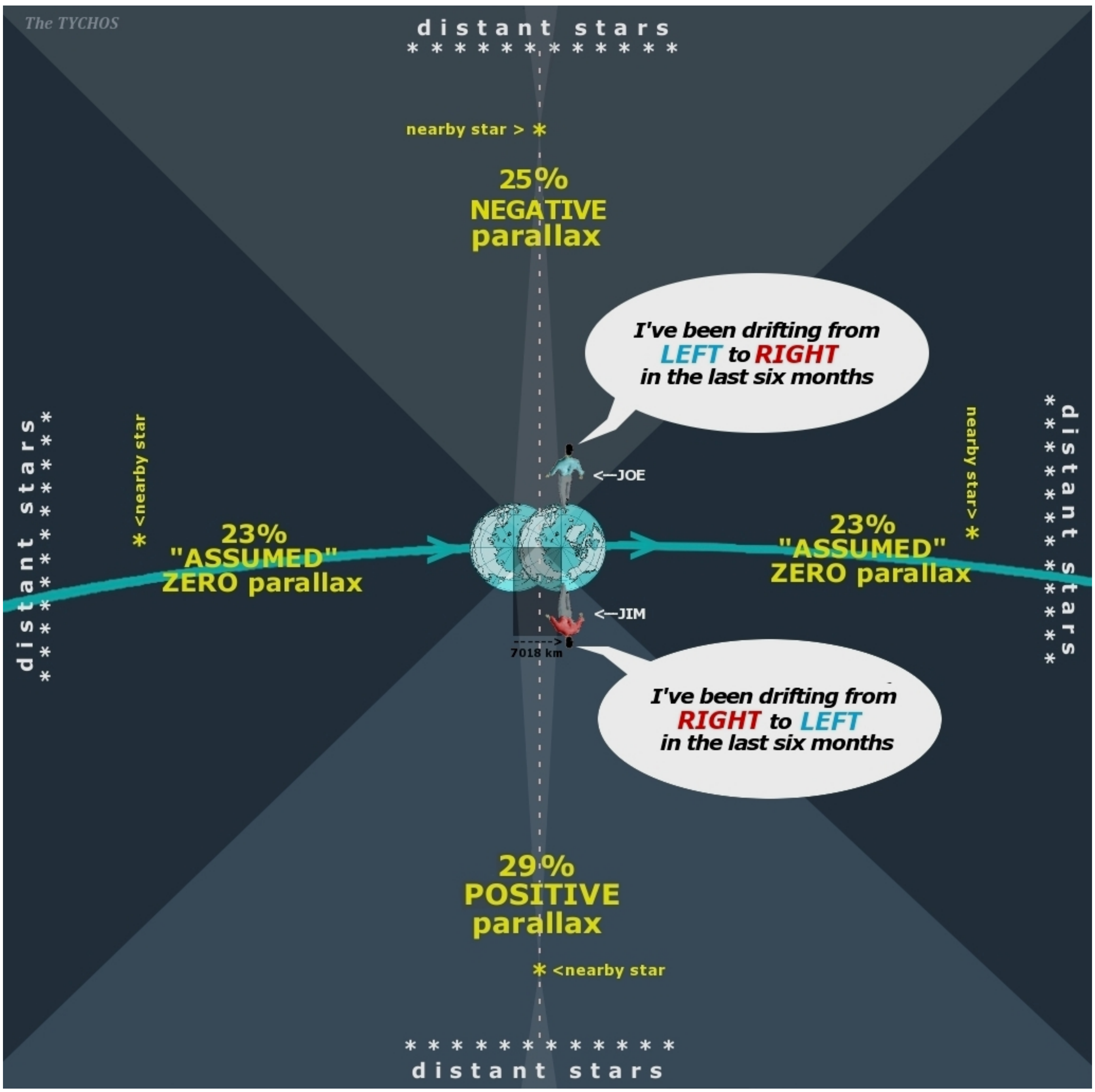

Fig. 25.10 Expected distributions of stellar parallaxes in the TYCHOS model.

will exhibit negative parallax. On the other hand, nearby stars located in the left and right quadrants of Fig. 25.10 will exhibit little or no parallax because Earth is moving either away from or directly towards them. Actually, as we shall soon see, it gets a little more complicated than that since parallax measurements will also depend on the time frame chosen for the observation.

The biggest question elucidated by the TYCHOS model is perhaps why almost half the stars listed in ESA's main catalogue exhibit little or no parallax (what ESA refers to as 'assumed zero' parallax). Fig. 25.11 makes it clear why this would be fully expected under the TYCHOS model.

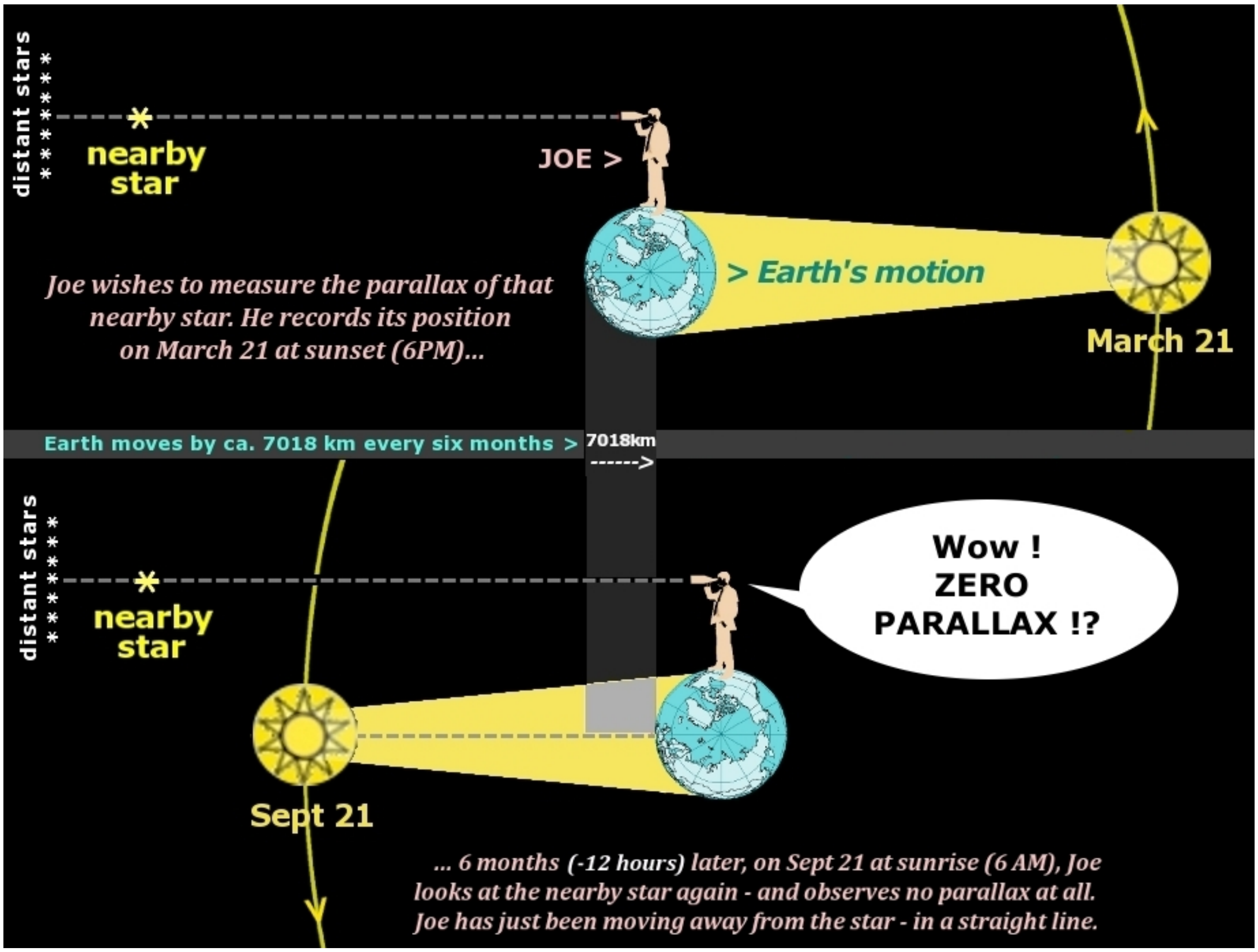

Fig. 25.11 The TYCHOS model explains why almost 50% of the stars exhibit no parallax.

Provided the 6-month time window chosen to observe star parallaxes spans from March to September (or vice versa), nearby stars located in the two opposite 'equinoctial quadrants' will exhibit no detectable parallax for the simple reason that Earth will be either approaching or receding from them. In the TYCHOS model, the 'equinoctial quadrants' will invariably be in front of and behind Earth's direction of travel along the PVP orbit. This can be readily verified and understood by perusing the Tychosium 3D simulator.

Fig. 25.12 should clarify why the whole question of stellar parallax depends on the time window chosen to measure a given star's lateral drift against the more distant stars and thus why the history of stellar parallax measurements has been haunted by confusion and polemic. To give a practical example, let us assume that two astronomers (Joe and Jim) want to measure the parallax of Sirius. Joe chooses period 'A' (21 March 2000 at 00:00 > to 21 Sept 2000 at 00:00) and Jim chooses period 'D' (21 Sept 2000 at 00:00 > to 21 March 2001 at 00:00). This is what each one would conclude:

- Joe: Sirius has moved in a given direction by a 'factor' of 4.
- Jim: Sirius has moved in the opposite direction by a 'factor' of 1.

Note that if Joe and Jim had instead chosen to measure the parallaxes of the stars Zavijava and Kruger60, they would probably have agreed that those two stars exhibit no parallax at all. Yet, if they had chosen to observe Zavijava and Kruger60 in different time frames, such as B (August > December 2000) or C (December > April 2001), they would both have detected some amount of parallax for these two stars. In fact, depending on the time window chosen, endless combinations of parallax discrepancies are possible, causing Joe and Jim constant torment and head-scratching.

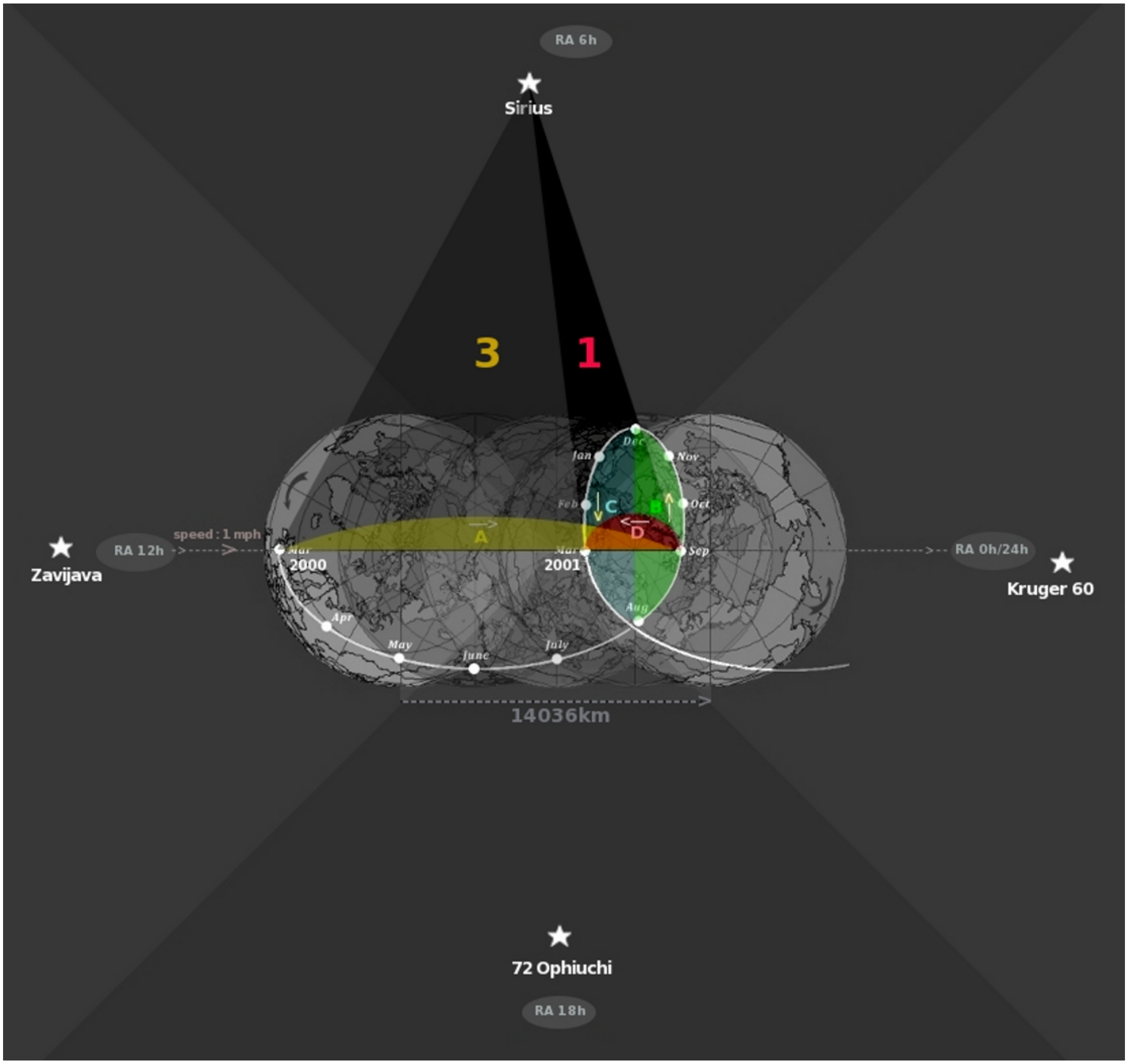

Fig. 25.12 Stellar parallaxes will vary depending on the time window chosen for their determination.

Also, note that the above Joe vs Jim example (with its 4:1 ratio) is an extreme case, and that the *average* rate of variation between different measurements should probably be closer to 3:1 or so. Well, it so happens that, back in the days when stellar parallax detection was the most vividly debated topic among astronomers like Bessel, Hooke, Bradley, Struve, Huygens, Herschel, Cassini, Maskelyne, Lacaille and Lalande, their first obvious choice of a star to measure was Sirius due to its brightness. All their parallax measurements were in fact conflicting, as documented in the literature, but of special interest to us here is their stated maximum and minimum values for Sirius: 8″ and 2.5″ (although the latter was said to be 'in the wrong direction'!).

In the early 1760s the vexing problems of parallax were tackled once more, this time by Nevil Maskelyne in England and Jerome Lalande in France. Both based their work on observations made at various times by the French observational astronomer the Abbe de Lacaille, who published in 1758, in his Fundamenta astronomiae, the observations he had made of Sirius from the Cape of Good Hope during 1751 and 1752. [...] The star in which he was especially interested was Sirius, the brightest star in the heavens. From Lacaille's observations he calculated that its annual parallax could be as much as 8″, a surprisingly high value for Maskelyne to consider likely in the light of Bradley's conclusion in 1728. [...] He finished his brief "history" with some remarks about Lacaille's observations both from the Cape and from Paris. Of the observations used by Maskelyne he said: "... but these observations of Sirius only go from the Summer of 1751 to the following Winter; and there could have been some local cause which had produced in these observations the differences of 8″." After thus disposing of Lacaille's Cape observations, Lalande referred to a series of observations made at Paris between the summer of 1761 and early 1762, during which time Sirius appeared to have been displaced by a more realistic 2.5″; but this displacement could not be owing to parallax because it was in the wrong direction. [5]

The highest value (8″) recorded by these eminent astronomers was roughly three times greater than the smallest value (2.5″), in good accordance with the TYCHOS model‘s expected discrepancies that would arise depending on the time windows chosen for their observations. It is no wonder that stellar parallax measurements have caused so much confusion and controversy among observational astronomers since the adoption of the heliocentric paradigm.

25.3 Negative stellar parallaxes are not going away

So where are we today with regard to the spiny question of negative stellar parallax? Has ESA finally resolved this vexing problem with their latest 'GAIA' space telescope, which they now claim has a most formidable astrometric accuracy of 0.000025 arcseconds?

Gaia is able to record simultaneously several 10000s images mapped on its focal plane. About one billion stars, amounting to $\approx$ 1 percent of the Milky Way stellar content, are expected to be repeatedly observed during the nominal 5-year mission, with a final astrometric accuracy of 25 μas at $G = 15$ mag. (1 μas $=$ 0.001 mas $= 10^{-6}$ arcsec). [16]

Apparently not. The extract below from the 'GAIA data release 2' report discusses at length the issue of negative parallax and how to 'deal with it':

As discussed in Sect. 3.1, negative parallaxes are a natural result of the Gaia measurement process (and of astrometry in general). Since inverting negative parallaxes leads to physically meaningless negative distances we are tempted to just get rid of these values and form a "clean" sample. This results in a biased sample, however. [17]

Clearly, negative stellar parallax is still today a major torment, even for the world's best-funded astronomy institutions. One can only imagine the headaches and sleepless nights this must give the earnest astronomers and astrophysicists employed by ESA and NASA as they try to 'justify' or 'explain away' this persistent and inconvenient aberration which keeps producing "*physically meaningless negative distances*".

The below screenshot from the 'GAIA data release 2' report bears testimony to the fact that the exasperating negative stellar parallax 'mystery' that has haunted astronomers for the last few centuries is not going away.

3.3 Sample truncation

In addition to the potential sources of trouble described in the previous sections, the traditional use of samples of parallaxes includes a practice that tends to aggravate these effects: truncation of the used samples.

As discussed in Sect. 3.1, **negative** parallaxes are a natural result of the *Gaia* measurement process (and of astrometry in general). Since inverting **negative** parallaxes leads to physically meaningless **negative** distances we are tempted to just get rid of these values and form a "clean" sample. This results in a biased sample, however.

On the one hand, removing the **negative** parallaxes biases the distribution of this parameter. Consider for instance the case illustrated in Fig. 1 for the quasars from the AllWISE catalogue. These objects have a near zero true parallax, and the distribution of its observed values shown in the figure corresponds to this, with a mean of − 10 μas, close to zero. However, if we remove the **negative** parallaxes from this sample, deeming them "unphysical", the mean of the observed values would be significantly positive, about 0.8 mas. This is completely unrealistic for quasars; in removing the **negative** parallaxes we have significantly biased the observed parallax set for theseobjects. With samples of other types of objects with non-zero parallaxes the effect can be smaller, but it will be present.

On the other hand, when by removing **negative** parallaxes the contents of the sample are no longer representative of the base population from which it has been extracted since stars with large parallaxes are over-represented and stars with small parallaxes are under-represented. This can be clearly illustrated using a simulation. We have generated a sample of simulated stars mimicking the contents of the full *Gaia* DR2 (see Appendix A) and truncated it by removing the **negative** parallaxes. In Fig. 6 we can compare the distribution of the true distances of the original (non-truncated) sample and the resulting (truncated) sample; it is clear that after the removal of **negative** parallaxes we have favoured the stars at short distances (large parallaxes) with respect to the stars at large distances (small parallaxes). The spatial distribution of the sample has thus been altered, and may therefore bias any analysis based on it.

A stronger version of truncation that has traditionally been applied is to remove not only **negative** parallaxes, but also all the parallaxes with a relative error above a given threshold k, selecting $\frac{\sigma_\varpi}{\varpi} < k$. This selection tends to favour the removal of stars with small parallaxes. The effect is similar to the previous case, but more accentuated as can be seen in Fig. 7. Again, stars at short distances are favoured in the sample with respect to distant stars.

Even worse, as in the previous case the truncation not only makes the distribution of true distances unrepresentative, but it also biases the distribution of observed parallaxes: stars with positive errors (making the observed parallax larger than the true one) tend to be less removed than stars with **negative** errors (making the observed parallax smaller than the true one). By favouring positive errors with respect to **negative** errors, we are also biasing the overall distribution of parallaxes. Figure 8 depicts this effect. The plots show the difference $\varpi - \varpi_{\mathrm{True}}$ as a function of ϖ_{True}. We can see in the middle and bottom figures how the removal of objects is non-symmetrical around the zero line, so that the overall distribution of $\varpi - \varpi_{\mathrm{True}}$ becomes biased. From an almost zero bias for the full sample (as expected from *Gaia* in absence of systematics) we go to significant biases once we introduce the truncation, and the bias is dependent of the cut value we introduce.

Fig. 25.13 Extract from the 'GAIA data release report' (2018).

In the introduction of the report in Fig. 25.13, we may read the following recommendation:

This paper is highly recommended in order to gain a proper understanding of how to use and how not to use the astrometric data. As a simple and striking example: a small number of sources with unrealistic very large positive and very large negative parallaxes are present in the data. Advice on how to filter these sources from the data analysis is provided in the Gaia DR2 documentation.

In other words, astronomers are being 'highly recommended to filter out any unrealistic data' to be found in the modern stellar parallax catalogues compiled with astrometric measurements allegedly performed by the 'ultra-precise', multi-million-dollar GAIA satellite. One could compare this to a gambler striking "0" on the roulette wheel and being told by the croupier: "*Sorry Sir, in this casino we don't consider zero a realistic number. You lose!*".

We can only hope that knowledge of the TYCHOS model will some fine day put the staff at ESA and NASA out of their misery. The longstanding 'mystery' of negative stellar parallax is fully elucidated by the Solar System configuration of the TYCHOS model, which predicts the coexistence of positive, negative and zero stellar parallaxes distributed at a ratio of 1:1:2, just as has been empirically observed in the last few centuries by astronomers all over the world.

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26

Probing Kapteyn, Hubble and Esclangon

26.1 Kapteyn, my Kapteyn!

Over the past century, a number of remarkable discoveries by highly competent astronomers have been solemnly ignored by the scientific community for reasons that should become clear as we take a look at the thorough investigations of Jacobus Kapteyn, Edwin Hubble and Ernest Esclangon. When viewed through the lens of the TYCHOS model, the true significance of their findings comes to light and their work can readily be retrieved from the dustbin of history to which it has been unjustly consigned. Let us begin with Jacobus Cornelius Kapteyn and how he interpreted the vexing issue of negative stellar parallax:

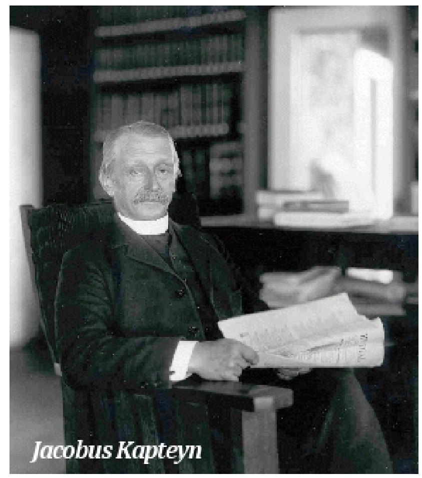


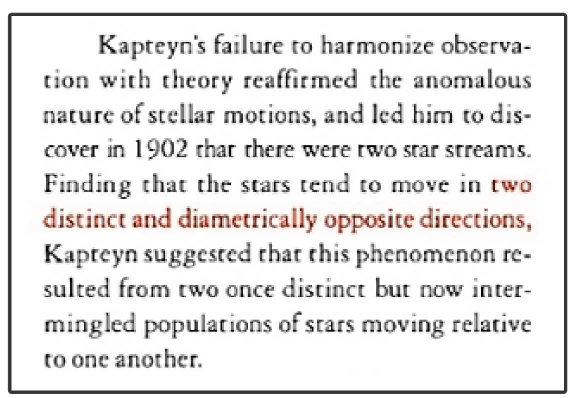
Fig. 26.1 Jacobus Kapteyn

> *Jacobus Cornelius Kapteyn, (born Jan. 19, 1851, Barneveld, Neth. - died June 18, 1922, Amsterdam), Dutch astronomer who used photography and statistical methods in determining the motions and distribution of stars. While recording the motions of many stars, he discovered the phenomenon of star streaming—i.e., that the peculiar motions (motions of individual stars relative to the mean motions of their neighbours) of stars are not random but are grouped around two opposite, preferred directions in space.* [1]

Jacobus Kapteyn's conspicuously short Wikipedia entry contains the following summary of his work:

> *In 1904, studying the proper motions of stars, Kapteyn reported that these were not random, as it was believed in that time; stars could be divided into two streams, moving in nearly opposite directions. In 1906, Kapteyn launched a plan for a major study of the distribution of stars in the Galaxy, using counts of stars in different directions. The plan involved measuring the apparent magnitude, spectral type, radial velocity, and proper motion of stars in 206 zones. This enormous project was the first coordinated statistical analysis in astronomy and involved the cooperation of over forty different observatories.* [2]

I feel compelled to express my warmest gratitude for the stellar work of Jacobus Kapteyn whose gargantuan lifetime efforts were largely neglected and misunderstood, much like those of Dayton Miller and Tycho Brahe. If Kapteyn were still alive today, he would have been my first choice of peer reviewer for the TYCHOS model. In his day, he was considered the world's foremost expert in stellar motions and distributions due to his rigorous and exhaustive statistical surveys. His "*Plan of Selected Areas*" involved a multitude of observatories worldwide focusing on selected stellar regions, and his astronomy laboratory was well harnessed for the analysis and synthesis of the collected data. His American colleague and friend Frederick H. Seares famously stated that:



Kapteyn's failure to harmonize observation with theory reaffirmed the anomalous nature of stellar motions, and led him to discover in 1902 that there were two star streams. Finding that the stars tend to move in two distinct and diametrically opposite directions, Kapteyn suggested that this phenomenon resulted from two once distinct but now intermingled populations of stars moving relative to one another.

Fig. 26.2 Extract from *"History of Astronomy : An Encyclopedia"*, by John Lankford (p.496).

"Kapteyn presented the figure of an astronomer without a telescope. More accurately, all the telescopes of the world were his."

In other words, Jacobus Kapteyn had at his disposal a unique wealth of observational data, such as no past or present astronomer could ever dream of. So what exactly did Kapteyn ultimately conclude after decades of methodical studies of the stellar motions? Well, he found that the stars tend to move in two distinct and diametrically opposed directions, a phenomenon he dubbed 'star-streaming'.

Kapteyn's discovery obviously caused great astonishment and controversy in the global scientific community, but at the time no one (including Kapteyn himself) was able to grasp the world-shattering, 'copernicidal' implications of his findings.

The well-known Dutch astronomer, Professor Kapteyn, of Groningen, has lately reached the astonishing conclusion that a great part of the visible universe is occupied by two vast streams of stars travelling in opposite directions. [3]

Conclusion reached by Jacobus Kapteyn after decades of painstaking study: "*There are two vast streams of stars travelling in opposite directions.*"

So what could possibly have led Professor Kapteyn to reach such an astonishing conclusion? And did he submit a theory or justification for the existence of these "*two vast streams of stars travelling in opposite directions*"? Unfortunately not. In the absence of a rational explanation of his findings, Kapteyn's lifetime work became easy prey for the gatekeepers of the Copernican belief system. As one might have expected, his work was promptly attacked and 'discredited', especially by a bizarre character by the name of Harlow Shapley.

Star Streaming

In 1871, the Swedish astronomer H. Gyldén had analysed the proper motion of stars and found that, in one part of the sky they tended to have a maximum movement across the sky in one direction, while in the opposite part of the sky they moved in the opposite direction. At positions half way between these two places there was no general drift. He correctly interpreted this as showing that the Milky Way was rotating.

Thirty years later, Kapteyn undertook an extensive analysis of the proper motion and radial velocity of stars and found, in 1904, that they appeared to be streaming in two different directions, in a manner similar to that discovered earlier by Gyldén. Kapteyn had, unlike Gyldén, been able to use radial velocity measurements, giving him a three-dimensional picture of stellar movements, and when he corrected for the movement of the Sun, he found that the vertices of the two star streams were in opposite parts of the sky, with the line joining these two points being in the plane of the Milky Way. Kapteyn thought that these results showed that there were two groups of stars streaming in opposite directions, and that this was probably true of the Milky Way as a whole, and not just for that part near the Sun that he had been able to measure. Arthur Eddington and Frank Dyson extended Kapteyn's studies to the proper motions of more distant stars and showed, in 1908, that Kapteyn's results were still valid at these greater distances. Then, in 1915, Campbell, Walter Adams and Kapteyn confirmed the streaming for even more distant stars by measuring their radial velocities.

Fig. 26.3 Extract from *"A History of Astronomy: from 1890 to the Present"*, by David Leverington.

Within a short time after publishing his velocity theory in 1900, Kapteyn rejected his theory and by 1902 had disovered star-streaming. Finding that the stars tended to move in two distinct and diametrically opposite directions, Kapteyn suggested that this phenomenon resulted from two once distinct but now intermingled populations of stars moving relative to one another.

Kapteyn first announced his new theory of stellar motions before the St. Louis World Exhibition in 1904, and again more importantly before the 1905 meeting of the British Association for the Advancement of Science. In both cases Kapteyn argued that without exception all the stars belong to one of the two streams. The over-riding consideration, in Kapteyn's opinion, was not a reevaluation of the reality of the phenomenon, but the necessity to confirm the theory, that is, that there exist two independent streams of stars passing through one another in opposite directions with different mean motions relative to the sun.

Fig. 26.4 Extract from *"Kapteyn and Statistical Astronomy"*, by Erich Robert Paul (1985) [4]

26.2 The TYCHOS model elucidates Kapteyn's 'star streaming'

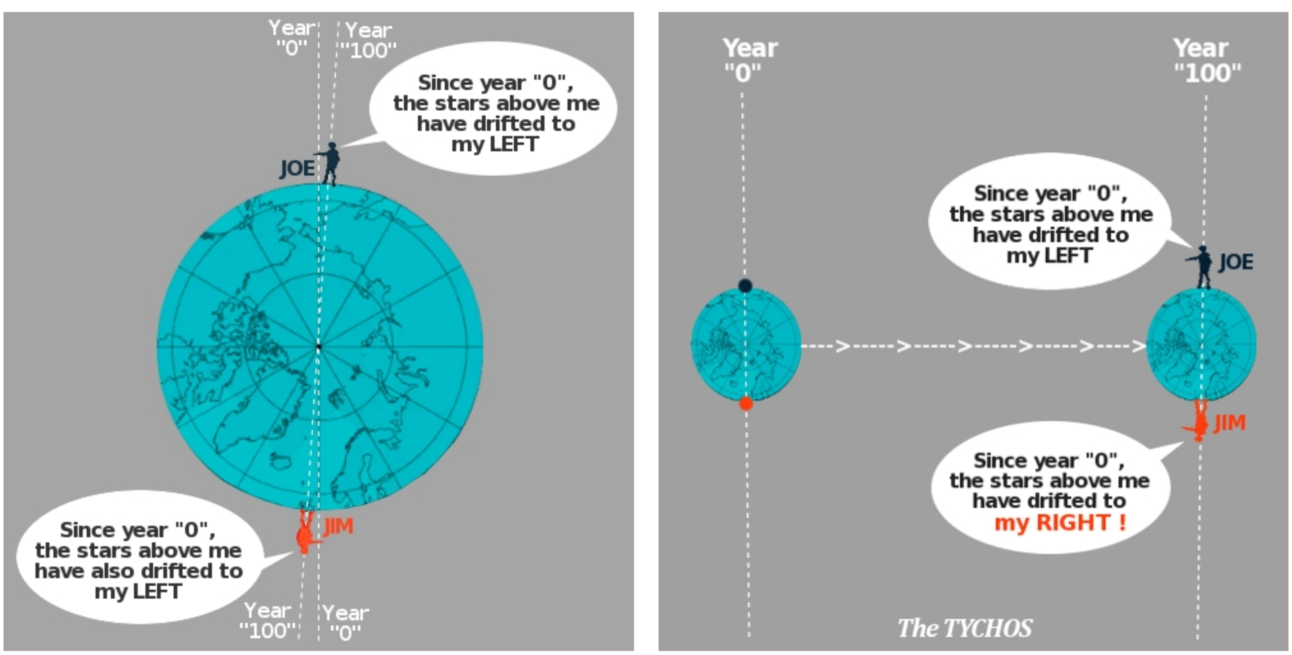
We shall now see how the TYCHOS model can readily account for what came to be known as 'Kapteyn's Universe'. Like so many other conundrums elucidated in this book, the 'star streaming' effect derives from Earth's slow motion around its PVP orbit, something Jacobus Kapteyn, himself a Copernican devotee, could not have been aware of. The diagram in Fig. 26.5 compares the stellar motions expected by the Copernican model with those actually observed and predicted by the TYCHOS model. It is crucial to understand the fundamental difference between the two scenarios, so please analyse them attentively.

We saw in Chapter 10 that the General Precession is not caused by a fanciful 'wobble' of Earth's polar axis, but simply by the Earth's motion around its PVP orbit, which in short time periods may appear like a virtually straight line, especially if you are unaware of it. A Copernican astronomer might therefore conclude that there are two distinct streams of stars moving in opposite directions. In fact, this is precisely what Jacobus Kapteyn did.

Now, as you may recall, Chapter 23 quotes various astronomy papers regarding the speed of our Solar System relative to the 'fixed stars'. Initially estimated at approximately 20 km/s, more recent testing has refined the value to 19.4 km/s (69840 km/h). By dividing 69840 km/h by the TYCHOS reduction factor (42633) we obtain $\sim$1.638 km/h, which is nearly identical to Earth's orbital speed of 1.601669 km/h, as proposed by the TYCHOS model. Kapteyn also had a word or two to say about the speed of 'stellar displacement':

> *Kapteyn continued with the more literal interpretation in constructing his Universe and interpreted the two streams as two systems rotating in opposite directions. The velocity of the two streams would be around 20 km/s, but in opposite directions.* [5]

One couldn't wish for a better confirmation of the core concept illustrated in Fig. 26.5, showing how Joe and Jim will see the stars moving in opposite directions. Evidently, Kapteyn's statistical analyses of the observed motions of our surrounding stars yielded precisely what is predicted by the TYCHOS model. Of course, his two opposite 'star streams' are an optical illusion, yet his unjustly sidelined work can now finally be vindicated by the TYCHOS model. But to truly reinstate Kapteyn as one of the foremost astronomers of the early 20th century, we need to take a good look at the shady character who 'discredited' his inconvenient 'star streaming' theory.



(a) *(b)*

Fig. 26.5 Joe and Jim are depicted as standing with their backs facing the viewer and looking at stars located above their respective southern horizons. The two illustrations show ***(a)*** what Copernicans will expect and ***(b)*** what is observed in reality.

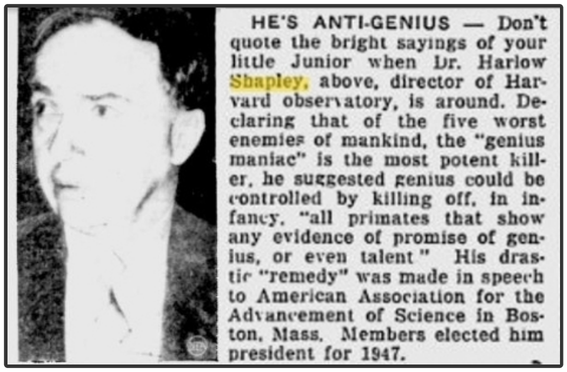
26.3 About Harlow Shapley, Kapteyn's 'hangman'

Who exactly was this fellow who almost seems to have been commissioned to disenfranchise Jacobus Kapteyn? Let us start by reading from the entry for Harlow Shapley on the Wikipedia:

> *Harlow Shapley (November 2, 1885 - October 20, 1972) was a 20th-century American scientist, head of the Harvard College Observatory (1921-1952), and political activist during the latter New Deal and Fair Deal. He used RR Lyrae stars to correctly estimate the size of the Milky Way Galaxy and the Sun's position within it by using parallax. Shapley was born on a farm in Nashville, Missouri, to Willis and Sarah (née Stowell) Shapley, and dropped out of school with only the equivalent of a fifth-grade education. After studying at home and covering crime stories as a newspaper reporter, Shapley returned to complete a six-year high school program in only two years, graduating as class valedictorian. In 1907, Shapley went to study journalism at the University of Missouri. When he learned that the opening of the School of Journalism had been postponed for a year, he decided to study the first subject he came across in the course directory. Rejecting Archaeology, which Shapley later explained he couldn't pronounce, he chose the next subject, Astronomy.* [6]

Remarkably enough, our failed-journalist-turned-astronomer eventually managed to make a name for himself at the highest levels of astronomy—and politics. In Fig. 26.6 he is happy as a clam, being received in the Oval Office by none other than President Roosevelt.

Fig. 26.6 Members of the Independent Voters Committee of the Arts and Sciences for Roosevelt visit FDR at the White House (October 1944). From left: Van Wyck Brooks, Hannah Dorner, Jo Davidson, Jan Kiepura, Joseph Cotten, Dorothy Gish, Dr. Harlow Shapley.



HE'S ANTI-GENIUS — Don't quote the bright sayings of your little Junior when Dr. Harlow Shapley, above, director of Harvard observatory, is around. Declaring that of the five worst enemies of mankind, the "genius maniac" is the most potent killer, he suggested genius could be controlled by killing off, in infancy, "all primates that show any evidence of promise of genius, or even talent" His drastic "remedy" was made in speech to American Association for the Advancement of Science in Boston, Mass. Members elected him president for 1947.

Fig. 26.7

Shapley is reported to have pronounced the following words in a speech at the American Association of Science in Boston, to which he was elected president: "*Of the five worst enemies of mankind, the 'genius maniac' is the most potent killer*". He then suggested that "*genius could be controlled by killing off, in infancy, all primates showing evidence or promise of genius, or even talent*".

This dubious individual then went on to denigrate Kapteyn's discoveries basically by claiming the Milky Way is far larger than previously imagined. At the time, Shapley was assisted by a team of theoretical astrophysicists who came up with purely conjectural ideas ('stellar speed differentials around the galactic centre', or something to that effect) to explain why some stars are seen to move in the opposite direction of other stars.

In fact, it appears that we have to 'thank' Shapley for having further inflated the size of our galaxy and further belittled the 'cosmo-philosophical significance' of Carl Sagan's paltry 'pale blue dot'. The credibility deceptively attributed to Shapley's claims was instrumental in sweeping Kapteyn's threatening 'star streaming' theory under the rug, once more postponing the inevitable demise of heliocentrism.

26.4 The 'assault' on the notion that all stars are binaries

There was, however, an even greater menace jeopardizing the heliocentric world view, namely the notion that all stars are locked in binary systems. As should now be crystal clear to the reader, if it should eventually emerge that *all* stars—without exception—have one or more binary companions, heliocentrism will be toast. As mentioned in Chapter 3, it was Jacobus Kapteyn who famously stated that:

> *...if all stars were binaries there would be no need to invoke 'dark matter' in the Universe.*

Once again, the devious Harlow Shapley led the assault on the growing evidence pointing to the very distinct possibility that all star systems are binaries. The circumstances of this other effort by Shapley to salvage heliocentrism are recounted in a book by John B. Hearnshaw titled "*Analysis of Starlight: Two Centuries of Astronomical Spectroscopy*" (1990). At the beginning of the 20th century, a heated debate had broken out concerning the so-called 'Cepheid variables':

> *A Cepheid variable is a type of star that pulsates radially, varying in both diameter and temperature and producing changes in brightness with a well-defined stable period and amplitude. The number of similar variables grew to several dozen by the end of the 19th century, and they were referred to as a class as Cepheids.* [7]

'Cepheids' are claimed to heftily grow and shrink periodically in the form of 'radial pulsations' and most Cepheids are said to be hundreds or thousands of light years away. If the stellar distances calculated by heliocentrists were anything near realistic, this would rule out the possibility that these 'Cepheids' are simply binary stars periodically eclipsing each other as they revolve in intersecting orbits. Why? Because they would have to be orbiting at utterly implausible speeds. Hearnshaw's book also documents the fact that it was Shapley who first suggested to completely abandon the idea that Cepheids were simply binary stars.

In the abstract of his 1914 paper titled "*Of the Nature and Cause of Cepheid variation*" [9], Shapley made his intentions clear—albeit disguised under a disingenuous 'appeal to investigate the question':

> *The purpose of the present discussion is to investigate the question of whether or not we should abandon the usually accepted double-star interpretation of Cepheid variation.*

Eventually, none other than Sir Arthur Eddington—the man who propelled Einstein to universal stardom—joined the fray in support of Shapley's novel and bizarre thesis that Cepheids were not eclipsing binaries, but rather some sort of 'pulsating staroids' that somehow grew physically larger and smaller at regular intervals (Fig. 26.8). To be sure, neither Eddington nor Shapley ever explained just what kind of exotic physics would cause such stars to dramatically shrink and grow, yet their weird 'Cepheid variable' concept was eventually embraced by most astrophysicists around the world. The few researchers who argued against it, providing data showing that 'Cepheids' could very well be eclipsing binaries, were cold-shouldered.

Fig. 26.9 is another tell-tale extract from Hearnshaw's book, showing that Eddington was standing on thin ice in his defence of Shapley and that his ideas about the nature of 'Cepheids' were vigorously rejected by a number of his international peers.

All in all, one is left with the impression that the scientific establishment is seriously allergic to the notion that *all* stars are binaries. Moreover, it would appear that practically anything goes when it comes to rescuing the heliocentric model from its many fallacies and aberrations. This is hardly a constructive attitude towards the advancement of human knowledge, nor is it a good example of the dialectic required by objective scientific discourse.

This problem grew into one of the biggest ones of stellar astrophysics in the early twentieth century. The evidence was reviewed by the distinguished English meteorologist David Brunt (1886–1965) in 1913 [120] (he had a keen interest in astronomy), but neither he nor John Duncan could find satisfactory solutions. The breakthrough to this initially intractable problem came in 1914, when Harlow Shapley presented his ideas to the American Astronomical Society in a paper 'On the nature and cause of Cepheid variation' [121]. He reviewed the evidence and wrote:

> The main conclusion is that the Cepheid and cluster variables are not binary systems, and that the explanation of their light-changes can much more likely be found in a consideration of internal or surface pulsations of isolated stellar bodies... In the face of all these difficulties, it seems appropriate to abandon completely the attempts to interpret Cepheids on the basis of a binary-star assumption.

Fig. 26.8 Extract from "*Analysis of starlight*", by John B. Hearnshaw [8]

Eddington's theoretical interpretation appeared in the *Monthly Notices of the Royal Astronomical Society* the following year. He wrote:

> Although variable stars of the Cepheid type show a periodic change of radial velocity, it is improbable that they are binary stars. The theory which now appears the most plausible attributes the light-changes to the pulsation of a single star; and accordingly the varying radial velocity measures the approach and recession of the surface in the course of pulsation. [131]

However, Eddington at the time had no clear idea of how the pulsations could be maintained.

Still, not all astronomers were immediately convinced. Sir James Jeans (1877–1946) objected to the pulsation theory, and proposed that the Cepheid phenomenon arose from explosions on the surface of a rotating elongated body [132]. And Father Joseph Hagen (1847–1930) at the Vatican Observatory still proposed a binary hypothesis in 1920. He postulated the eruption of light caused by an orbiting satellite, something like what occurs for a comet in orbit around the Sun [133]! And he complained as late as 1925 that his papers (written in German) had not had a fair hearing amongst the flood of papers on this topic in English [134].

Charles Perrine (1867–1951) in Córdoba, Argentina, was another protagonist who favoured the binary theory of Cepheids. He looked at the distribution of supposed Cepheid orbits, and in spite of the large values obtained for the quite short periods, he believed the values were in accord with the binary model [135, 136]. In 1921 he published a lengthy rebuttal of the pulsation hypothesis presented initially by Henry Plummer [137], but curiously he did not cite Eddington in his paper. Few of his arguments were rigorously presented. For example, by integrating the radial-velocity curves of 14 Cepheids, he deduced a mean change in radius resulting from pulsation of 1.28×10^6 km, nearly two solar radii; not realizing that Cepheids were supergiants (some two orders of magnitude larger than the Sun in radius), he reasoned that such large changes in dimension were inadmissable.

Fig. 26.9 Extract from "*Analysis of starlight*", by John B. Hearnshaw [8]

26.5 The great Hubble misconception

Incredibly enough, 'Big Bang' theorists have somehow seized upon Edwin Hubble's work to back up their models of a constantly expanding universe. This, in spite of the fact that Hubble himself eventually stated that his findings did not suggest that our universe is continuously expanding, i.e. the higher redshift detected in ever more distant galaxies does not equate to accelerating rates of recession (the supposed drifting away of galaxies from our Solar System). In any event, the expanding universe theory has been refuted in later decades by scores of eminent researchers and is a long shot from being universally accepted.


Fig. 26.10 Edwin Hubble

> *In December 1941, Hubble reported to the American Association for the Advancement of Science that results from a six-year survey with the Mt. Wilson telescope did not support the expanding universe theory.* [10]

In his paper titled "*Misconceptions about the Hubble recession law*" (2009), Wilfred H. Sorrell made these important points:

> *Almost all astronomers now believe that the Hubble recession law was directly inferred from astronomical observations. It turns out that this common belief is completely false. Those models advocating the idea of an expanding universe are ill-founded on observational grounds. This means that the Hubble recession law is really a working hypothesis. One approach is to use a simple deductive argument with only one basic premise. This premise states that the universe is static and stable. Here static means that the whole universe is undergoing no large-scale expansion or contraction. The past eight decades of astronomical observations do not necessarily support the idea of an expanding universe. This statement is the final answer to the question asked in Sect. 1 of the present study. Reber (1982) made the interesting point that Edwin Hubble was not a promoter of the expanding universe idea. Some personal communications from Hubble reveal that he thought a model universe based upon the tired-light hypothesis is more simple and less irrational than a model universe based upon an expanding space-time geometry.* [11]

It is therefore most ironic that the 'Big Bang' proponents are, still today, referring to Hubble's lifelong work as supportive of their hypothesis of an explosive coming into being of the universe out of nothing. Fear not, though: the TYCHOS model does not pretend to propose an alternative to the awkward 'Big Bang' narrative, but merely to correctly interpret the empirical observations painstakingly gathered over the centuries by competent and level-headed astronomers in their quest to understand our cosmic environment.

Having said that, the TYCHOS model does offer a rational explanation as to why the components of distant galaxies appear to violate Newton's gravitational 'laws' by revolving far too fast around their nuclei. In Chapter 21, we saw that, according to the TYCHOS model, the stars are 42633 times closer to Earth than currently believed by the mainstream astronomy establishment. If they are in fact at the distance estimated with the aid of the TYCHOS framework, there would be nothing exorbitant about their orbital velocities. Consequently, none of that elusive 'dark matter' currently thought to make up most of our universe and to be responsible for inordinate orbital speeds would need to exist.

26.6 The 'double nucleus' of the Andromeda galaxy

You will most likely have heard of Andromeda, the Milky Way's closest 'galactic' neighbour, said to be some 2.5 million light years away (that's 24 000 000 000 000 000 000 km)! It is easily visible to the naked eye on dark nights and we are told that it is expected to collide directly with the Milky Way in about 4 billion years as it is supposedly approaching us at the formidable speed of 301 km/s (that's over 1 million km/h)! Now, one must wonder how these predictions can be harmonized with the idea of an ever-expanding universe, but the National Radio Astronomy Observatory assures us:

> *The Andromeda and Milky Way galaxies are moving toward each other due to mutual gravitational attraction. This mutual gravity force is stronger than the force which causes the expansion of the Universe on the relatively short distances between Andromeda and the Milky Way.* [12]

In other words, they are actually telling us that, yes, the universe as a whole is expanding, yet if two 'galaxies' are close enough to each other, their 'mutual gravitational attraction' will prevail over the primal forces (supposedly released by the 'Big Bang') that govern the universe. Good Lord, does any of this make sense?

Let us leave it at that and instead take a look at a far more interesting aspect of the Andromeda system, also named 'M31'. As few people will know, back in 1991 M31 was discovered to possess a distinct double structure: a larger and brighter component, and a far smaller and dimmer component. Still more interestingly, on the official ESA website we may read that "*the true center of the galaxy is really the dimmer component*". Incidentally, in the TYCHOS the larger and brighter component (the Sun) is also not the centre of the system.

When viewed through the lens of the TYCHOS model, this little-known 1991 discovery credited to Tod R. Lauer of the National Optical Astronomy Observatory becomes quite interesting: if even 'galaxies' are observed to exhibit double structures (the smaller component of which is located at the centre), we have a clear parallel to the binary structure of our own system, in which the smaller component (Earth) orbits near the barycentre. Now, even if we apply the TYCHOS reduction factor (see Chapter 23), Andromeda would still be a hefty (though far more reasonable) 3 763 000 AU away from us (i.e., about 3.7 million times farther away than our Sun).

Binary or multiple systems appear to be the rule in the universe. A paper published recently (June 2022) in the Astrophysical Journal looks at the various discoveries of binary systems within the Andromeda system itself:

> *In this paper, we report the discovery of two massive binaries with twin components (identified as massive twin binaries) in M31. These two twin binaries were reported in the catalog of Vilardell et al. (2006). […] A large number of EBs (eclipsing binaries) have been discovered in M31 by ground-based surveys, e.g., DIRECT (Kaluzny et al. 1998, 1999; Stanek et al. 1998, 1999; Mochejska et al. 1999; Bonanos et al. 2003), Pan-STARRS 1 (PS1; Lee et al. 2014), and other photometric observations (Todd et al. 2005; Vilardell et al. 2006). So now we have the opportunity to test stellar evolutionary models by analyzing the evolutionary stages of these EBs (eclipsing binaries) in M31.* [14]

Incidentally, the fact that Andromeda is currently observed to approach our Solar System would make sense in the TYCHOS model since Earth is currently moving towards 00h42min of RA, which is almost straight in the direction of Andromeda. If we apply the TYCHOS reduction factor to the officially estimated approach velocity, we obtain 25.4 km/h (1 083 600 km/h / 42633), or what we might call a 'bicycle speed'. This relatively tranquil displacement does not necessarily imply that the two systems are on a cataclysmic collision course, but could be due to some cyclical dynamic involving our system and Andromeda.

In conclusion, it may reasonably be posited that:

- Andromeda may just be a particularly large binary system.
- Its larger component revolves around its smaller component, much like the Sun revolves around the Earth.
- The 'bicycle speed' (25.4 km/h) at which it approaches our Solar System does not mean the two systems will eventually collide.

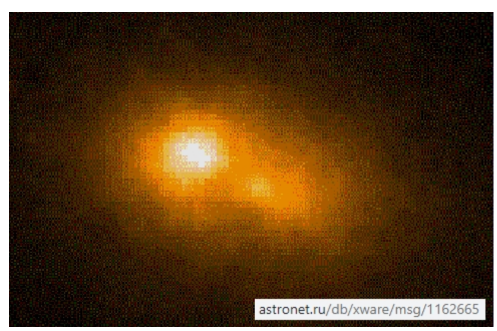


Fig. 26.11 Original caption: "*The center of M31 is twice as unusual as previously thought. In 1991 the Planetary Camera then onboard the Hubble Space Telescope pointed toward the center of our Milky Way's closest major galactic neighbour: Andromeda (M31). To everyone's surprise, M31's nucleus showed a double structure.*" [13]

26.7 Esclangon's 'dissymmetry of space'

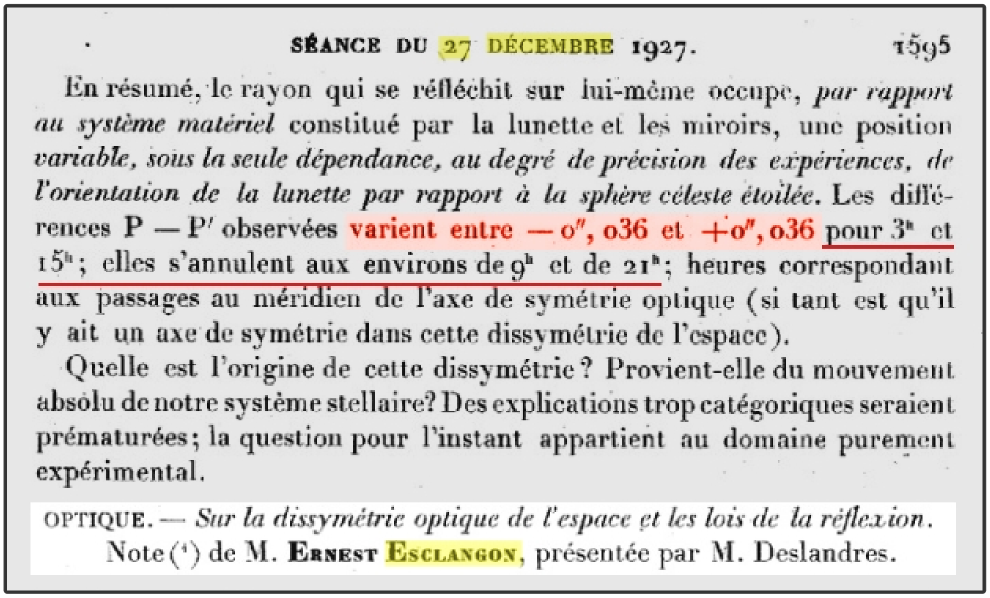
I never cease to marvel at the amazingly precise observations made by some of the best astronomers of yesteryear. Their relentless commitment to the noble quest of unveiling the secrets of our cosmos has not been in vain, even if it has sometimes remained hidden from the public eye. I am glad to have been able to help renew interest in their fine contributions. Professor Ernest Esclangon is one such 'unsung hero'.

Ernest Esclangon (1876-1954) was the director of the Strasbourg Observatory and the Paris Observatory before becoming the president of the Société Astronomique de France. In France, he is acknowledged as one of the most rigorous and exacting astronomers of his time. In his Wikipedia entry we can read that "*Esclangon was attached to the establishment of the Chart of the Sky; it improved the precision of measurements in the fields of astronomy: measurement of time, variation of longitudes, variation of gravity*". In short, Esclangon was certainly a major authority in astrometry, even though most people will never have heard of him.

Fig. 26.12 Ernest Esclangon

I came across his work while navigating a website dedicated to Maurice Allais—the man who effectively disproved Einstein's theory of relativity. The following extract from the website of the Maurice Allais Foundation describes Esclangon's most peculiar observational program carried out in 1927-28:

> *The observations of Ernest Esclangon*
>
> *Between 25th February 1927 and 9th January 1928 Ernest Esclangon carried out, at the Strasbourg Observatory, a programme of optical observations following a very different procedure from that which had been almost exclusively used until then in interferometric observations. It was as follows:*
>
> *a) A refracting telescope placed in the horizontal plane facing north-west, autocollimation is used to cause a horizontal thread located at the focus of the telescope to coincide with its image reflected on a mirror that is integrated with the telescope. The angular displacement required for this coincidence is denoted by c.*
>
> *b) Turning the device to face north-east, the operation is repeated. The angular displacement required to obtain the coincidence this time is denoted by c′. The magnitude whose evolution has been monitored over time is (c-c′).*
>
> *These observations comprised 40 000 sightings carried out by day as well as by night and divided into 150 series. The published reports included, in addition to a detailed description of the equipment used, the values for (c-c') for each series and the average temperature during each series as well as temperature evolution over each series.*
>
> *By adopting the standpoint of sidereal time, Ernest Esclangon had detected a sidereal diurnal periodic component, whereas nothing in particular emerged when solar time was adopted.*
>
> *He published his findings in a communication to the Académie des Sciences: "Sur la dissymétrie optique de l'espace et les lois de la réflexion" (On the optical dissymmetry of space and the laws of reflection - December 27, 1927) in the April 1928 issue of the "Journal des Observateurs", in which he also provided the experimental data collected: "Sur l'existence d'une dissymétrie optique de l'espace" (On the existence of dissymmetry of space). In making use of these data, Maurice Allais established the presence, in addition to the sidereal diurnal component, of at least one long periodic component (estimated on the basis of a rapid analysis to be half-yearly).* [15]



SÉANCE DU 27 DÉCEMBRE 1927. 1595

En résumé, le rayon qui se réfléchit sur lui-même occupe, *par rapport au système matériel* constitué par la lunette et les miroirs, une position *variable, sous la seule dépendance, au degré de précision des expériences, de l'orientation de la lunette par rapport à la sphère céleste étoilée.* Les différences P — P′ observées varient entre — 0″, 036 et +0″, 036 pour 3^h et 15^h; elles s'annulent aux environs de 9^h et de 21^h; heures correspondant aux passages au méridien de l'axe de symétrie optique (si tant est qu'il y ait un axe de symétrie dans cette dissymétrie de l'espace).

Quelle est l'origine de cette dissymétrie? Provient-elle du mouvement absolu de notre système stellaire? Des explications trop catégoriques seraient prématurées; la question pour l'instant appartient au domaine purement expérimental.

OPTIQUE. — *Sur la dissymétrie optique de l'espace et les lois de la réflexion.* Note (1) de M. ERNEST ESCLANGON, présentée par M. Deslandres.

Fig. 26.13 Extract from: "*ESCLANGON — Séance du 27 décembre 1927*" [16]

To the layman, this may sound like a dreadfully complex affair and it certainly took me a while to wrap my head around what exactly Esclangon's observational program was all about. What could 'an optical dissymmetry of space' possibly signify? Well, allow me to illustrate the physical cause of this 'dissymmetry' observed by Esclangon. Believe it or not, it is yet another confirmation of the main pillar of the TYCHOS model, namely the Earth's orbital speed of 1.6 km/h around its PVP orbit. Fig. 26.13 reproduces the conclusion of Esclangon's paper describing his observational program of Earth's daily motions.

In short, Esclangon's extensive telescopic observations from Strasbourg established that:

- Between 3 am and 3 pm (a 12-hour interval), the star quadrants at either side of Earth (looking north and south) appear to be 'offset' by -0.036″ and +0.036″, totalling 0.072″.
- Between 9 am and 9 pm (a 12-hour interval), the star quadrants at either side of Earth (looking east and west) display no dissymmetry in relation to the meridian.

These were Esclangon's concluding thoughts:

What is the origin of this dissymmetry? Does it come from the absolute movement of our star system? Categorical explanations would be premature. The question for now belongs to the experimental domain.

Before proceeding, keep in mind the following key parameters stipulated by the TYCHOS model:

- Earth moves at 1.6 km/h in its PVP orbit, covering 38.428 km per day and 14036 km per year.
- This yearly motion of Earth causes stars located perpendicularly to Earth's motion to appear to 'precess' by 51.136 arcseconds annually.
- In 12 hours, Earth will move by approximately 19.2 km (1.6 × 12). This amounts to 0.1368% of 14036 km.

Thus, the distance covered by Earth in 12 hours (19.2 km) represents 0.1368% of the distance covered by Earth in one year (14036 km). Now, Esclangon's observed 'dissymmetry' amounted to 0.072″, although he slightly reduced this value to 0.070″ in a subsequent paper from 1928 [17]. And, lo and behold, 0.070″ amounts to ∼0.1368% of 51.136″, the precession value of the TYCHOS model! It may therefore be concluded that the minuscule 'dissymmetry' detected by Esclangon was caused by the Earth's 19.2-km displacement between 3 am and 3 pm. In fact, what he witnessed, to his great puzzlement, is fully consistent with Fig. 26.5.

Figures 26.14 and 26.15 should help illustrate the point: if we assume stars "X" and "Y" to be Esclangon's referential points on either side of Earth, he would have expected both of them to be displaced towards the right of his meridian (or 'line of sight') following each of his 12-hour measurements. This, because he believed that the Earth revolves around the Sun.

Instead, to his great surprise, Esclangon saw his control stars "X" and "Y" moving in opposite directions in relation to his meridian. He therefore concluded that there must be some "*dissymmetry of space*" at play. Needless to say, Esclangon could not have realized the crucial significance of his observations or identified their underlying cause. But, if it is any consolation so belatedly, his expert observations may now be given the merit they deserve.

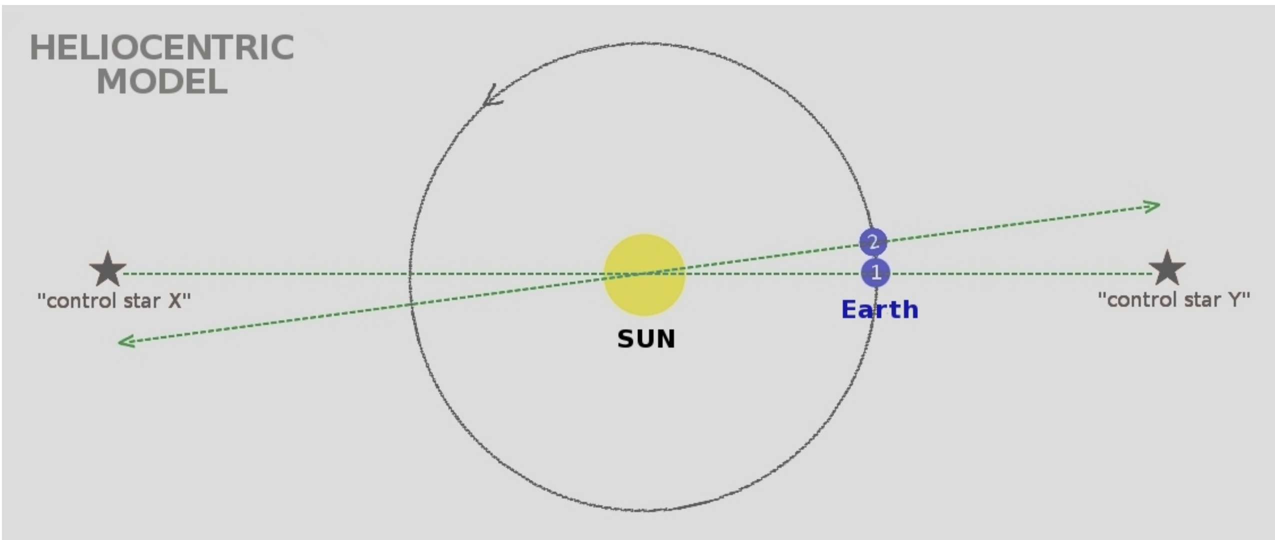


Fig. 26.14 From one observation to the next (positions 1 and 2), Esclangon would have expected both control stars X and Y to always drift towards the right of his meridian (or 'line of sight').

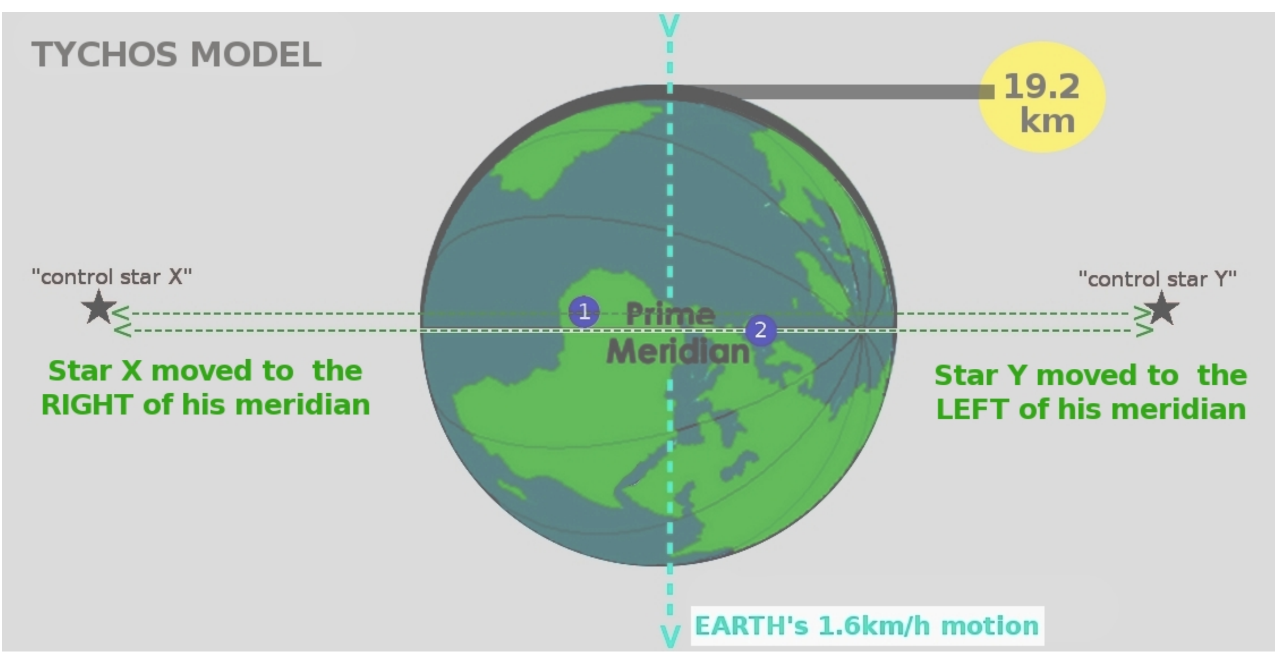


Fig. 26.15 Instead, he found that control stars X and Y, located perpendicularly to Earth's motion, drifted in opposite directions (unlike stars located 'behind or in front' of Earth's motion) for a total of 0.07″ every 12 hours. In the TYCHOS, Earth moves annually by 51.136″ (or 14036 km) and will thus move by 0.07″ (or 19.2 km) every 12 hours.

As a final note, the optical illusion of dissymmetry described by Esclangon is most probably what led Kepler to propose his bizarre theory of elliptical orbits. This is supported by a fascinating paper by Laurence Hecht titled "*Optical Theory in the 19th Century—and the Truth about Michelson-Morley-Miller*". The entire paper is well worth the read, but the following statement stands out:

> *The difference between the major and minor axis of the ellipse, which, as every school child is taught, constitutes the Earth's orbit around the Sun, is about one part in one thousand.* [18]

One part in one thousand? Well, in the TYCHOS model the Earth moves across space at about 1.6 km/h and rotates at 1670 km/h at the equator. In other words, its orbital velocity is approximately 1/1000 of its rotational velocity. Similarly, the Earth's daily motion along the PVP orbit amounts to approximately 1/1000 of its equatorial circumference. Let us perform the calculation with the most precise figures at our disposal:

- 1670 km/h / 1.601169 km/h (Earth's equatorial rotational speed / Earth's orbital speed) = 1042.98
- 40075 km / 38.428 km (Earth's equatorial circumference / daily distance covered by Earth) = 1042.86

In other words, the "*one part in one thousand*" mentioned by Hecht is commensurate with the ∼1/1043 ratio observed between the rotational speed and orbital speed of the Earth, and between its equatorial circumference and its daily motion. It begins to make sense why Kepler erroneously concluded that Earth's hypothesized orbit around the Sun would have to be slightly elliptical rather than uniformly circular. In fact, the Wikipedia entry for Johannes Kepler clearly states that he never explained how elliptical orbits could be derived from observational data and that the concept was really extrapolated from his work on Mars. Later on, in his "*Epitome of Copernican Astronomy*", he arbitrarily applied the assumption to all the other planets.

> *Finding that an elliptical orbit fit the Mars data, Kepler immediately concluded that all planets move in ellipses, with the Sun at one focus—his first law of planetary motion. Because he employed no calculating assistants, he did not extend the mathematical analysis beyond Mars. [...] The Epitome contained all three laws of planetary motion and attempted to explain heavenly motions through physical causes. Although it explicitly extended the first two laws of planetary motion (applied to Mars in Astronomia nova) to all the planets as well as the Moon and the Medicean satellites of Jupiter, it did not explain how elliptical orbits could be derived from observational data.* [19]

For those with advanced knowledge of Kepler's and Newton's theorems, I would warmly recommend a paper by Gopi Krishna Vijaya, the conclusions of which are summarized below:

> *Since Newtonian celestial mechanics is dependent on a proper understanding of Kepler's Third Law, and its application, the wording of the law has been studied in its entirety in this paper. It has been shown that the form of Kepler's Harmonic Law that is used in the literature, with reference to the semi-major axis alone, is primarily Newtonian – and ignores the constraint introduced by Kepler that the Law works in the way he had presented it only for small eccentricities [...]. The implicit application of the Newtonian version of Kepler's Harmonic Law in order to make it suitable for rectilinear ascents and descents is shown to be fundamentally flawed.* [20]

In any event, it is safe to say that Kepler's and Newton's theories, despite their near-universal acceptance, have been shown to be mutually contradictory. They cannot therefore be invoked as evidence against the tenets of the TYCHOS model or in support of heliocentrism. In the next chapter, we shall take a look at what may be the gravest and most 'momentous' incongruity of Newtonian physics, namely the 'missing' (or 'near-zero') angular momentum of the Sun implied by the heliocentric paradigm.

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27

The 'momentous' incongruity

27.1 The glaring angular momentum problem

Perhaps the greatest problem posed by heliocentrism is that of the minuscule angular momentum (AM) of our Sun, which would amount to only 0.3% (or less) of the entire system's combined AM, according to the currently favoured paradigm, which has the Sun completing one orbit in 240 million years or so. The issue has been debated for decades by scores of cosmologists and astrophysicists since it constitutes a flagrant contradiction of the laws of conservation of momentum unanimously accepted in academic circles, and is like an impasse 'silently' haunting the scientific community. In fact, no one has ever put forth a sensible resolution to the 'angular momentum problem', as it is known in astronomy circles.

> *The angular momentum problem is a problem in astrophysics identified by Leon Mestel in 1965.* [1]

This persisting riddle is widely recognized and of paramount importance among cosmologists who occupy themselves with the so-called 'formation theories' which attempt to model the evolution of celestial bodies.

> *Angular momentum problem: The fact that the Sun, which contains nearly all of the mass of the solar system, accounts for just 0.3 percent of the total angular momentum of the solar system. This is an aspect of the solar system that any acceptable formation theory must address.* [2]

I would argue that any model or theory of our Solar System that fails to account for the Sun's ludicrously small angular momentum is futile and unacceptable. Thus, Newtonian advocates looking to falsify the TYCHOS model should first submit an explanation for this momentous incongruity which afflicts Newtonian physics and the heliocentric model.

> *Solar System — The Angular Momentum Problem: Perhaps the most important issue to be resolved in future versions of the solar nebula model is that of the distribution of angular momentum. The problem for the solar nebula theory is that it predicts that most of the mass and angular momentum should be in the Sun. In other words, the Sun should spin much more rapidly than it does. A mechanism is therefore required to transport angular momentum away from the central proto-sun and redistribute it in the outer planetary disk. One proposed transport mechanism invokes the presence of magnetic field in the nebula, while another mechanism proposed the existence of viscous stresses produced by turbulence in the nebular gas.* [3]
>
> *The Angular Momentum Problem: A possible weak link in the condensation theory is sometimes known as the angular momentum problem. Although our Sun contains about 1000 times more mass than all the planets combined, it possesses a mere 0.3 percent of the total angular momentum of the solar system. Jupiter, for example, has a lot more angular momentum than does our Sun—in fact, about 60 percent of the solar system's angular momentum. All told, the four jovian planets account for well over 99 percent of the total angular momentum of the solar system. By comparison, the lighter (and closer) terrestrial planets have negligible angular momentum. The problem here is that all mathematical models predict that the Sun should have been spinning very rapidly during the earliest epochs of the solar system and should command most of the solar system's angular momentum, basically because it contains most of the mass. However, as we have just seen, the reverse is true. Indeed, if all the planets' orbital angular momentum were transferred to the Sun, it would spin on its axis about 100 times as fast as it does at present.* [4]

> *The Planet-X and Angular Momentum Problem: Many hypotheses have been formulated to justify the missing angular momentum, such as the loss of solar mass due to solar radiations, solar wind and solar magnetic field. However, as we will see below, the ejection mass due to these phenomena can not compensate for the missing angular momentum, which remains an unsolved problem to this day, as are the anomalies detected in the TNOs orbits. (...)The Sun only accounts for about 0.6% of the total angular momentum of the solar system! This result is really unexpected since nebular model predicts that most of the mass and angular momentum should be in the Sun. The problem is known as ≪angular momentum problem≫. Several hypotheses have been advanced to explain this problem, but there is still no convincing theory.* [5]

As shown by the academic citations above, no one knows why the currently computed angular momentum of our Sun, which is believed to have 1000 times the mass of all the planets combined, could possibly amount to less than 1% of the system's total angular momentum. Moreover, it makes no sense under the heliocentric paradigm that our Sun would rotate around its axis as slowly as it does (6670 km/h, near-exactly 4 times Earth's rotational speed), whereas Jupiter, for instance, rotates at a brisk 43000 km/h. Besides, the Sun's rotational speed is also said to be decreasing, but nothing but wild speculation has been offered to explain this observation. One fantastic theory even posits that the Sun's spin rate is *"slowed down by its own photons"*! [6]

As illustrated conceptually in Fig. 27.1, the TYCHOS model can readily show that the apparent deceleration of the Sun's axial rotation is yet another optical illusion confounding heliocentrists unaware of the Earth's motion around the PVP orbit.

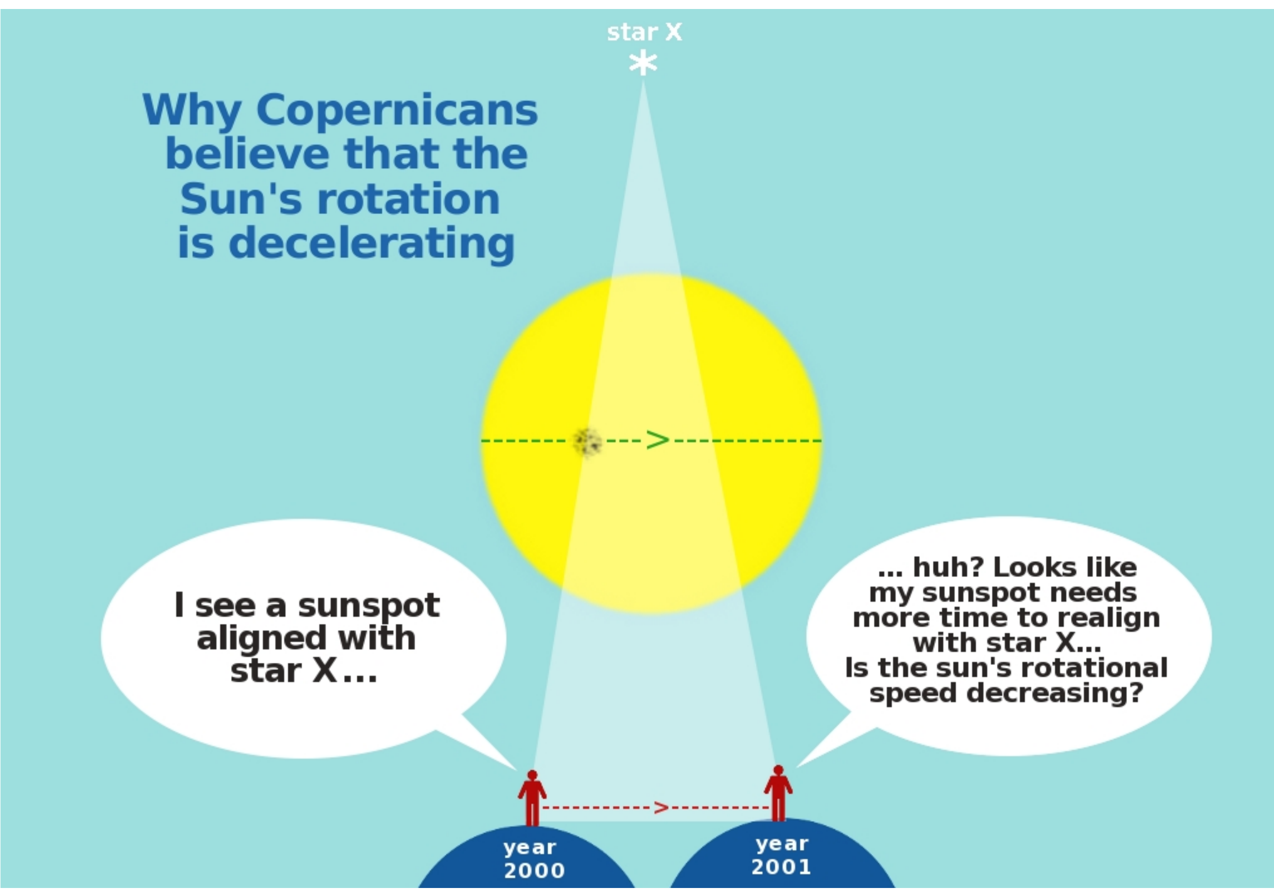


Fig. 27.1 As Copernican astronomers use sunspots, some of which can last for weeks or even years, as 'reference markers' to determine the Sun's rate of rotation, the one factor they will fail to account for is the Earth's translational motion in the opposite direction of the Sun. A given sunspot observed over time will thus appear to return to its celestial alignment slightly later than expected, leading astronomers to erroneously conclude that the Sun's rotational speed has decreased.

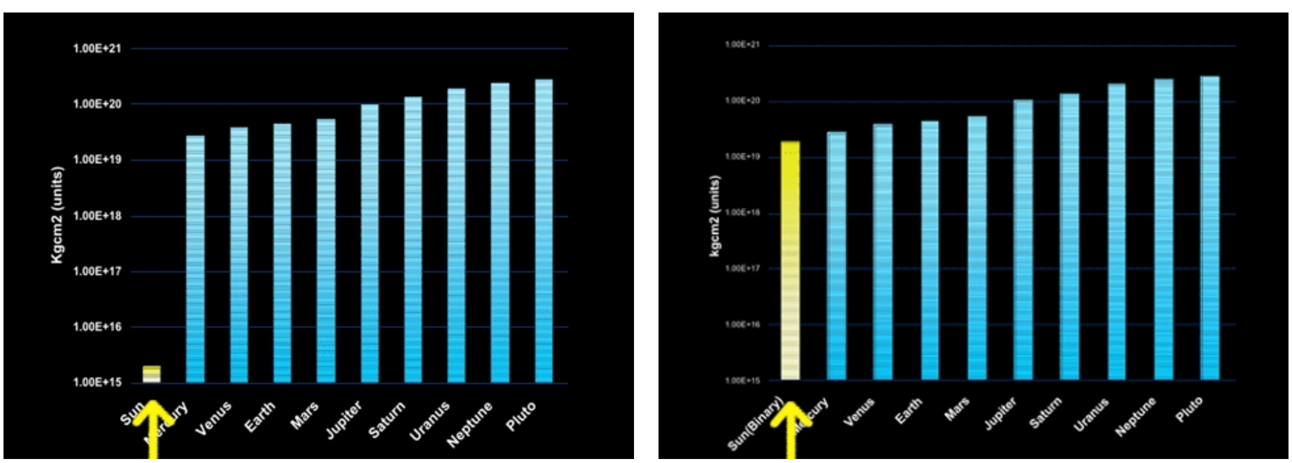
27.2 The TYCHOS model puts an end to the AM problem

But, returning to the AM problem, one truly cannot exaggerate the gravity of this Newtonian predicament (pun intended). Is all gravitational physics in error? Can we throw out the dirty bathwater and still keep the Newtonian baby? Perhaps. According to the Binary Research Institute (BRI), the 'mystery' of the Sun's missing angular momentum would essentially vanish *"if only the Sun were moving in a binary orbit with a period of 24000 years"*. In the TYCHOS model, the Sun revolves around Earth in an orbit of 25344 years, which is fairly close to the figure used in the BRI's calculations.

> *Angular Momentum — Evidence: The angular momentum issue is a well documented problem that has baffled solar system formation theorists for many years. The Sun contains 99.9% mass, but only 1% of the total Angular Momentum. Most of the remainder is typically associated with the Jovian Planets. Theoretical Physicists developing Formation Theories are thwarted by this anomalous distribution. The Binary Model provides allocations of Angular Momentum to Mass for Planets and Stars in line with common expectations. [...] Our proof here is rather compelling. We first looked at the angular momentum distribution charts (see here 60 percent of angular momentum lies with Jupiter). We then ran the formulas ourselves with existing inputs to make sure the textbook data was correct. Everything checked out (see chart at BRI website - Ed). Next, is the same chart in an "Angular Momentum to Mass ratio" formula. You can see all the bodies in our solar system have ratios in line with their mass except for the Sun. We then added one input into the existing formula: we assumed the Sun was moving in a binary orbit with a period of 24,000 years (see chart at BRI website - Ed). As you can see, the Sun came right into line. This indicates the Sun may indeed have its proper angular momentum (proportional to its mass) providing another indication our sun is part of a binary or multiple star system.* [7]

The BRI's working thesis concerning the missing angular momentum of the Sun can be summarized thus: if the Sun were moving in a binary orbit with a period of around 24000 years, its observed angular momentum would be compatible with, or at least far less disproportionate to, its estimated mass. Consequently, critics claiming that "the TYCHOS model violates Newtonian physics" should first provide a congruent solution to the widely acknowledged AM conundrum. Failing that, the only honest and truly scientific thing to do is to discard the unphysical Copernican model.

The vexing issue of the Sun's missing angular momentum is not going away, no matter what excuses are dreamed up or how hard heliocentrists try to make us believe the matter was settled long ago. Interestingly, the TYCHOS paradigm not only completely dissipates this pesky 'mystery' but may even help rescue Newtonian physics from its own contradictions. In the TYCHOS, the Sun has just about the amount of angular momentum



(a) *(b)*

Fig. 27.2 Diagrams comparing the standard heliocentric model to the Binary Research Institute's binary model with regard to the angular momentum of the Sun and the planets. The yellow arrow (one in each picture) points to the angular momentum of the Sun. ***(a)*** The standard model. ***(b)*** Assuming that the Sun is moving in a binary orbit of 24000 years.

predicted by Newtonian physics, considering its reasonably short 'local' orbit, rather than the gigantic, 240 million-year orbit posited by heliocentrists. The Sun's orbit intersects that of its binary companion, Mars, as observed in all binary systems, but this essential fact is not even remotely considered by astronomers entrapped in the Copernican belief system.

The following three chapters will be concerned with three different types of celestial bodies: stars, asteroids and comets. As we shall see, their observed motions in our skies are not only perfectly consistent with the TYCHOS model but can also be used to falsify heliocentrism. In fact, all three types of celestial bodies corroborate the tenets of the TYCHOS model, each one in its own way.

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28

Barnard's star confirms the TYCHOS

28.1 Stellar zig-zagging explained

Barnard's star is the fastest-moving star in our skies. Viewed from Earth's northern hemisphere, it is observed to briskly 'ascend' by as much as 10.36 arcseconds every year. It is also the second-closest star to Earth after the Alpha Centauri binary system. Due to its speed and proximity, it is of particular interest to the study of the so-called 'proper motion' (visual displacement) of the stars. As recently as November 2018, Barnard's star was discovered to have a companion and so is very likely part of a binary system. On the summer solstice it may be seen at midnight 'due south' (17h47m of RA) and fairly close to the equatorial ecliptic (04°41′ of Declination). We shall now see how the observed motion of Barnard's star provides further support for the TYCHOS model's tenets, especially the concept of trochoidal loops (see Chapter 21).

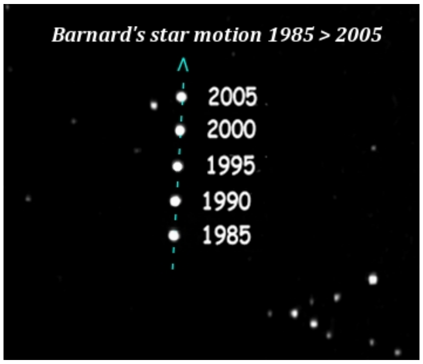

Fig. 28.1 Motion (visual displacement) of Barnard's star between 1985 and 2005.

An experienced amateur astronomer, Dennis di Cicco [1] (a hat tip to him), carefully monitored and photographed Barnard's star's motions for at least 16 months between 1994 and 1996, making it possible to plot the diagram shown in Fig. 28.2.

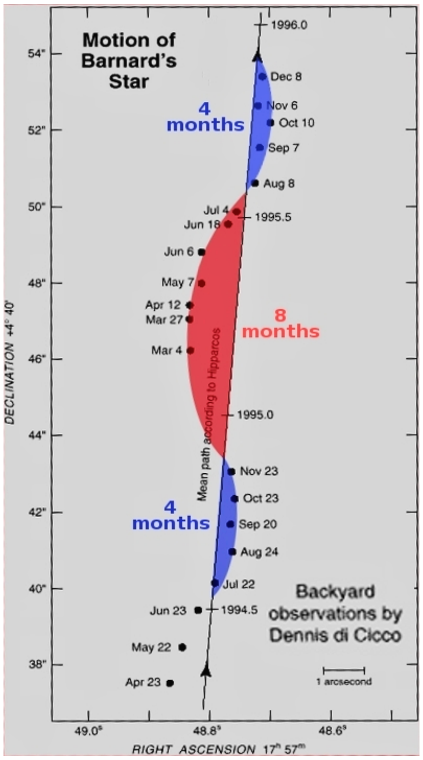

Fig. 28.2 Dennis di Cicco's observations of Barnard's star's motions, with colour highlights added.

Di Cicco's diagram shows how Barnard's star is observed to swiftly rise in our skies, from south to north, at a slight east-west angle, tracing an asymmetric zig-zag pattern with a distinct 4-month/8-month frequency (highlighted in pink and blue in Fig. 28.2). So what could possibly cause this peculiar oscillation? Certainly, no one will claim Barnard's star is actually zig-zagging in space, but does the Copernican model have any rational explanation for the asymmetric east-west oscillating motion of Barnard's star? No, it does not. Does the TYCHOS model? Yes, indeed.

In Chapter 21, we saw how 'a man's yearly path' along a trochoidal loop affects our observations of the Sun and the Moon at a lateral displacement ratio of 3:1. In this case, however, since Barnard's star does not circle around us like the Sun and displays a 4-month/8-month frequency, we will have to consider a 2:1 ratio. In fact, an earthly observer revolving around his annual trochoidal path and patiently monitoring for a full year a star located close to the equatorial ecliptic (such as Barnard's star) will see it oscillating east and west at a 2:1 ratio. This can be a rather tricky matter to conceive and visualize, but the diagram in Fig. 28.3 should help clarify the spatial perspectives at play.

If the visual behaviour of Barnard's star, as expertly recorded by di Cicco, is not entirely clear in the reader's mind at this point, Fig. 28.4 should do the trick.

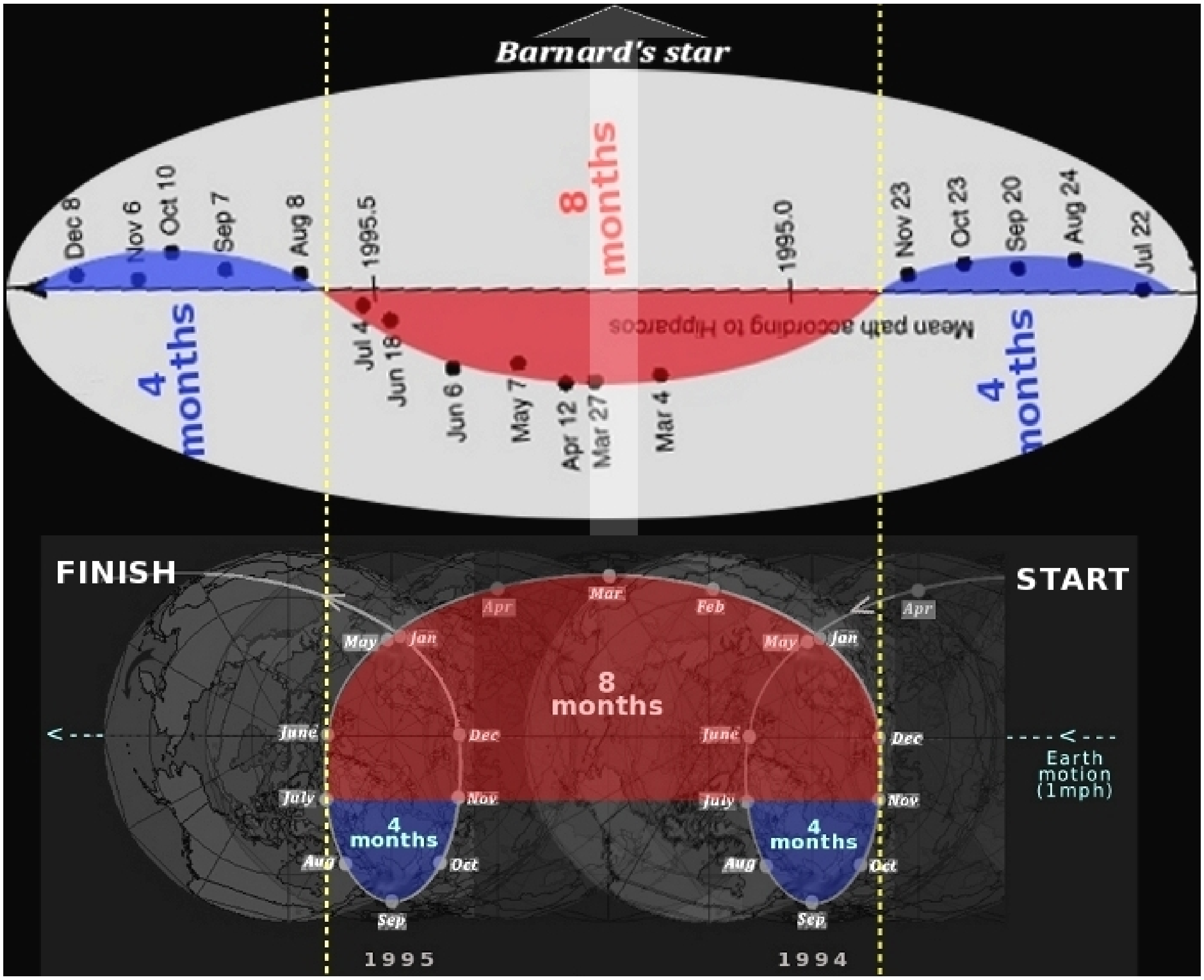

Fig. 28.3 Why Barnard's star is observed to zig-zag.

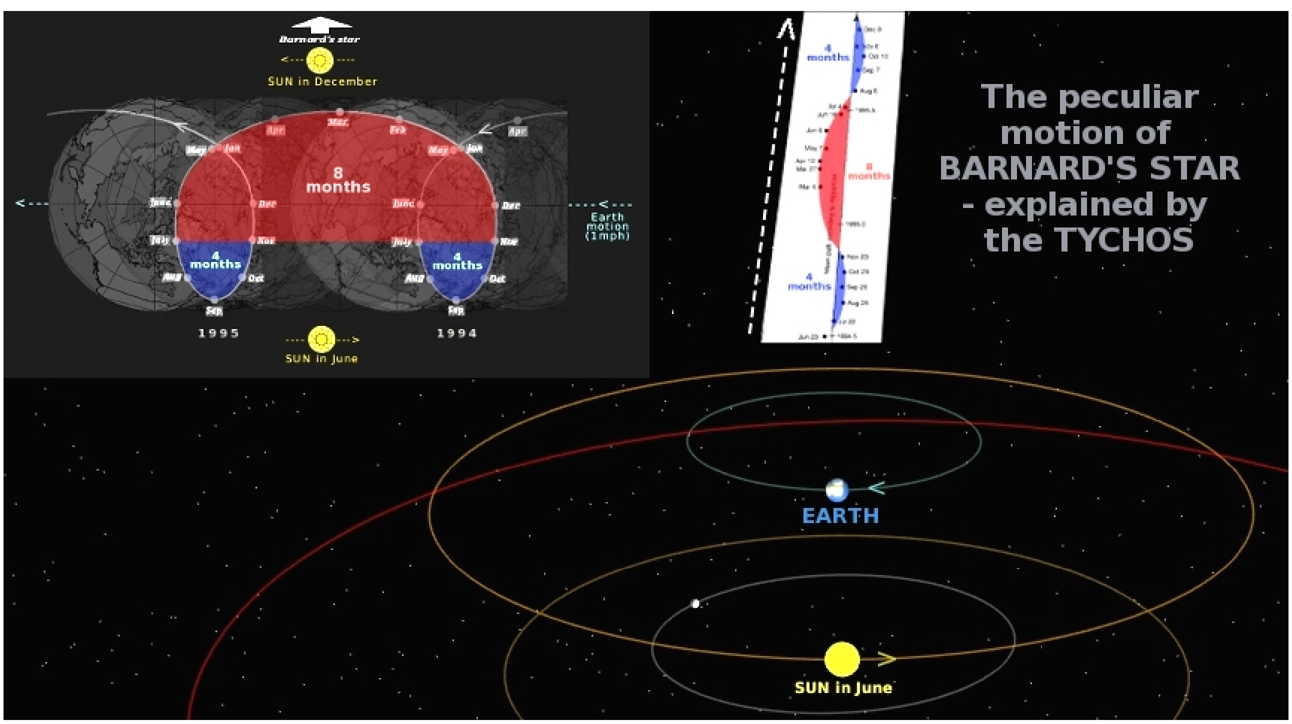

Fig. 28.4

28.2 A philosophical note

Of course, the observed zig-zagging motion of Barnard's star is the natural consequence of our constantly fluctuating terrestrial frame of reference. As we have seen on several occasions in this book, 'a man's yearly path' goes to explain a great many of the 'irregularities' and 'aberrations' endlessly debated by astronomers, cosmologists and astrophysicists throughout the centuries. For example, we saw in Chapter 17 that Jupiter was once thought to be on a collision course with the Sun, while Saturn was believed to be floating away into the depths of space. All the apocalyptic scenarios prognosticated by renowned astronomers in the early 20th century turned out to be entirely spurious. As shown by the TYCHOS model, they were simply misconceptions arising from the errors inherent in the heliocentric paradigm, combined with an alarmist mindset.

It seems to be a hallmark of modern intellectuals to view Mother Nature and the universe as a whole in an ominous and self-destructive light. This ideological gloominess may well have its eschatological underpinnings, but it is not particularly helpful to the advancement of objective scientific inquiry and human peace of mind. Hopefully, the serene regularity and perfect 'celestial mechanics' unveiled by the TYCHOS model will contribute towards a closer and less paranoid relationship with our cosmic environment. Scientists should spend less time conjecturing about assorted 'chaotic states' and 'planetary collisions' and start appreciating the wondrous harmony and stability of our world. We really don't need to worry about our resplendent geo-heliocentric binary system exploding into a pyroclastic supernova or dissolving into a nebula anytime within the next few billion years.

28.3 'Dying stars' are observed to be binary systems

Having shooed away a pack of academic Doomsday prophets, there is nothing wrong with peeking out into the universe and observing the stages stars apparently go through in their eonic evolution. As we just saw, a companion was discovered for Barnard's star as recently as November 2018, a fact that would certainly go to support the notion that all stars, without exception, are locked in binary or multiple systems. In Chapter 3, we reproduced new evidence from science journals to the effect that *"all stars are born in pairs"*. It turns out that, according to a study from 2022, stars also die in pairs!

The following three extracts are from an article published on the BBC website covering recent research projects (2020-2021), which basically conclude that the 'exploding stars" we see in our skies (sometimes referred to as 'supernovas' or 'planetary nebulas') invariably have binary companions. This has become known as the 'binary hypothesis'.

> *What happens when a star dies? At the end of their lives, sunlike stars metamorphose into glowing shells of gas — perhaps shaped by unseen companions. The galaxy is studded with thousands of these jewel-like memorials, known as planetary nebulae. They are the normal end stage for stars that range from half the Sun's mass up to eight times its mass. (More massive stars have a much more violent end, an explosion called a supernova.) Planetary nebulae come in a stunning variety of shapes, as suggested by names like the Southern Crab, the Cat's Eye and the Butterfly. But as beautiful as they are, they have also been a riddle to astronomers. How does a cosmic butterfly emerge from the seemingly featureless, round cocoon of a red giant star?*
>
> *Observations and computer models are now pointing to an explanation that would have seemed outlandish 30 years ago: most red giants have a much smaller companion star hiding in their gravitational embrace. This second star shapes the transformation into a planetary nebula, much as a potter shapes a vessel on a potter's wheel.*
>
> *The binary hypothesis accounts very well for the first stage of metamorphosis of a dying star. As the companion pulls dust and gases away from the primary star, they do not immediately get sucked into the companion, but form a swirling disk of material known as an accretion disk in the orbital plane of the companion. That accretion disk is the potter's wheel. (...) New and innovative telescopes have revealed that some red giants are surrounded by spiral structures and accretion disks before they turn into planetary nebulae — just as expected if there were a second star pulling material off the red giant. In a couple of cases, astronomers may have even spotted the companion star itself.* [2]

Fig. 28.5 BBC's own caption reads: *"A mid-infrared image easily distinguishes the dying star at the nebula's centre (red) from its companion star (blue)"*. Yet, the embedded caption for the same image says: *"NASA's new James Webb Space Telescope has revealed extraordinary details in the Southern Ring Nebula (Credit: NASA/ESA/CSA/STSCI)"*. Regardless of whether the image was captured from a 'space telescope' or from a large ground-based observatory, it corroborates the contention that all stars are part of binary or multiple systems.

Note that the article credits this most recent discovery to *"new and innovative telescopes"*, without mentioning any of the much vaunted, multimillion-dollar 'orbiting space telescopes'; instead, it is specified that the research team behind this remarkable new finding *"especially relied upon the Atacama Large Millimeter/-submillimeter Array (Alma) in Chile, which came online in 2011"*. Alma consists of 66 radio telescopes that work together to produce images of astronomical objects.

In the next chapter, we shall take a good look at Eros, the first near-earth asteroid to be discovered, and appreciate the curious coincidence between its name and its 'orbital dance', as viewed in the Tychosium 3D simulator. An old and famous pop song springs to mind: *"love is in the air..."*

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29

EROS AND TYCHOS: LOVE AT FIRST SIGHT

29.1 The discovery of Eros

In Greek mythology, Eros is the Greek god of love and sex. His Roman counterpart was Cupid ('desire').

One of my most cherished moments during the course of my ardent TYCHOS research was when I started exploring Eros, a tiny planet or, if you will, near-earth asteroid (NEA). As we shall see, not only does Eros corroborate the TYCHOS model's tenets, it also demolishes the heliocentric theory of periodic retrograde motion. Firstly though, a summary of the history of the scientific endeavours to measure the distance between the Sun and the Earth is in order.

The discovery of Eros on 13 August 1898 aroused enormous excitement among the leading astronomers of the day. In the preceding decades, much effort had been invested in determining the all-important Earth-Sun distance, which is used today as a unit of length (AU). For example, for the sake of observing the 1874 Venus transit across the solar disk, France, England and the US organized as many as 19 official expeditions around the globe, some of which cost the lives of several sailors and astronomers. [1]

Why all these titanic efforts, you may ask. Well, since Venus is the largest celestial body transiting close to Earth, the idea was to measure its parallax in relation to the Sun and thereby determine the exact Earth-Sun distance. In fact, both Mars and Venus had been used for this purpose, but the observations made up to that point were deemed inaccurate. The difficulty of the task is described in an essay by Edmund Ledger titled *"The New Planet Eros"*, published in 1900:

> *It was at one time hoped that this [the Earth-Sun distance] might be accurately determined in the case of Venus by observations made on those rare occasions when it passes in transit across the sun's disk. But the glare of the sun's light, the ill-defined edge of the sun's disk, and the atmosphere of Venus itself, combine to deprive such observations of the necessary accuracy. Apart from some other methods, involving long periods of time and highly complicated theoretical investigations in their use, attention was therefore next given to an attempt to obtain the distance of the planet Mars when it makes its nearest approaches to the earth. It was, however, found to be difficult to measure the exact position of the centre of its disk.* [2]

Enter Eros, the first known NEA. When Eros was discovered by German astronomer Carl Gustav Witt at the Berlin Observatory, it was soon realized it would pass much closer to Earth than either Mars or Venus. Two years after its discovery, Edmund Ledger wrote:

> *But in the case of Eros we meet with something utterly different and unexpected. A new planet has been discovered whose average distance from the sun is less than that of Mars; a planet which at times comes within a distance from the earth not much more than one third of the nearest distance within which Mars ever approaches it.*

Today, Eros' closest passages to Earth (~0.17 AU) are estimated to be roughly 2 and 3 times closer than the closest passages of Venus (~0.3 AU) and Mars (~0.45 AU), respectively. Eros is the largest member of a group of NEAs referred to as 'the Amor asteroids' [3]. In Latin, 'amor' means 'love', and 'Eros' was the Greek god of love. Why this peculiar nomenclature is interesting will soon become clear.

As I was entering the available data on Eros (orbital size, speed, ephemerides, etc.) into the Tychosium 3D simulator, I noticed that its closest near-Earth passages occur approximately every 81 years and at virtually the same place in the sky. This is somewhat reminiscent of Mars' 79-year cycle. But when I activated the

Table 29.1 – Eros' closest Earth passages in 'opposition', at intervals of ∼81 years

Simulator	Date	Coordinates		
JPL/NASA	1850-Jan-31	RA 10h12m	DEC −04°05	AU 0.1701
Tychosium	1850-Jan-31	RA 10h13m	DEC −01°59	AU 0.1705
JPL/NASA	1931-Jan-31	RA 10h24m	DEC −04°02	AU 0.1741
Tychosium	1931-Jan-31	RA 10h23m	DEC −03°13	AU 0.1743
JPL/NASA	2012-Jan-31	RA 10h33m	DEC −04°48	AU 0.1786
Tychosium	2012-Jan-31	RA 10h33m	DEC −04°17	AU 0.1788
JPL/NASA	2093-Jan-31	RA 10h40m	DEC −06°30	AU 0.1824
Tychosium	2093-Jan-31	RA 10h41m	DEC −05°15	AU 0.1837
JPL/NASA	2174-Jan-31	RA 10h50m	DEC −06°17	AU 0.1889
Tychosium	2174-Jan-31	RA 10h51m	DEC −06°19	AU 0.1885

simulator's Trace function for Eros and pushed "play" my jaw dropped: incredibly, Eros—named after the Greek god of love—traces a huge heart around Mother Earth!

I then proceeded to adjust Eros' closest near-Earth passages in the Tychosium 3D simulator by perusing the data on the JPL/NASA website. Within a few hours of toggling, I was pleased to see an excellent agreement between the Tychosium 3D simulator and the JPL/NASA ephemeride tables for Eros. Table 29.1 provides a back-to-back ephemeride comparison between the JPL and the Tychosium 3D simulator for five very close passages of Eros (1850, 1931, 2012, 2093, 2174). They make for a most spectacular match.

On closer scrutiny, I realized that Eros' 'short' cycle is more precisely 81.1 years. This piqued my curiosity, since 81.1 years is exactly 1/10000 of our Solar System's 'mega cycle' of 811000 years (see Chapters 16 and 20). As may be verified in the Tychosium 3D simulator, Eros will be at almost the exact same place at both ends of any 811000-year period. For example, on the date 1-06-21, Eros was at RA 10h33m and DECL +1°5″, while on the date 811001-06-21 (i.e., 811000 years later), Eros will return to RA 10h36m and DECL +1°3″.

At this point, it would be interesting to see how the JPL/NASA simulator and the Tychosium 3D simulator depict the most recent super-close passage (at only 0.17 AU) of Eros on 31 January 2012 (as shown in Fig. 29.1).

The comparison in Fig. 29.2 should help visualize just why the TYCHOS model, in spite of its radically different geometric configuration, can perfectly account for the observations recorded by astronomers working under the heliocentric paradigm.

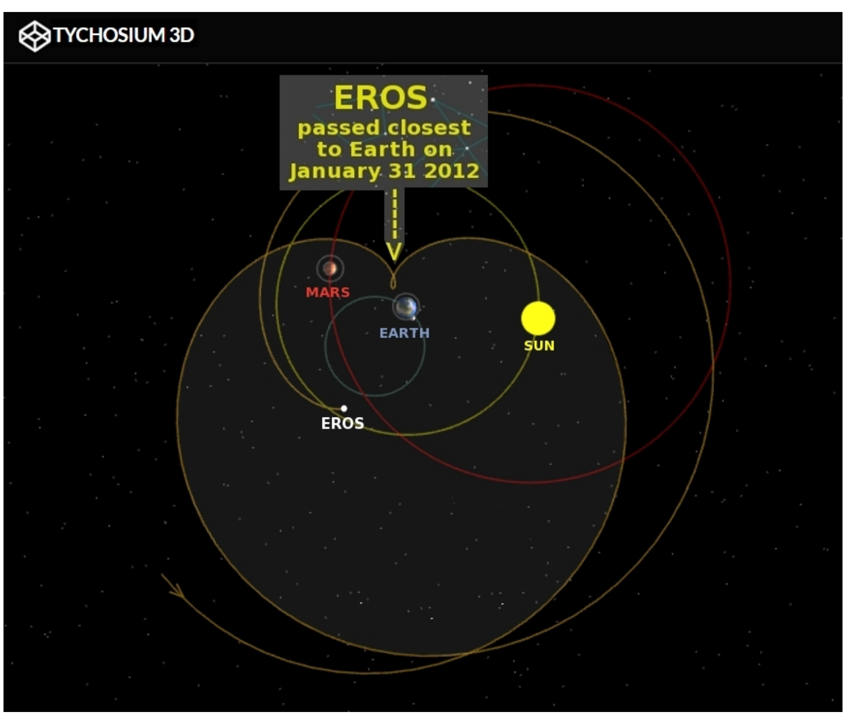
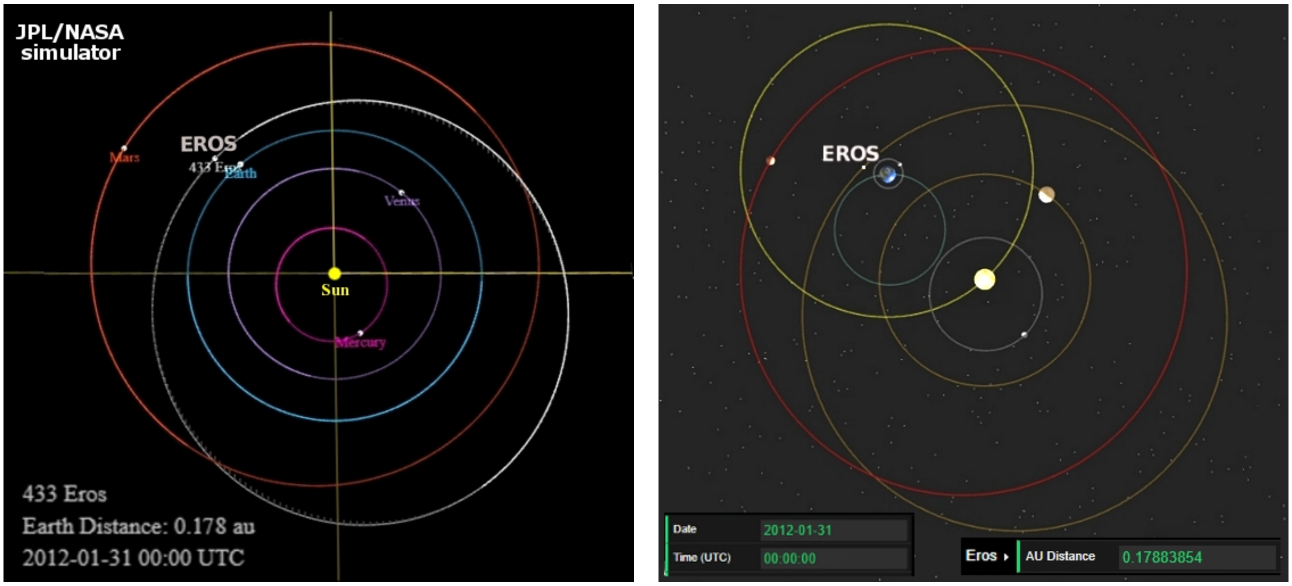


Fig. 29.1 Eros' closest approach to Earth on 31 January 2012, as traced in the Tychosium 3D simulator. Its peculiar heart-shaped orbit is not a product of any sort of manipulation on my part; it was naturally produced by the simulator as I entered the existing, official astrometric observational data for the famous asteroid (orbital speed, size, period, and computed perigees and apogees).



(a) *(b)*

Fig. 29.2 A comparison of Eros' positions (Jan 31, 2012), as of ***(a)*** JPL's simulator and ***(b)*** the Tychosium simulator.

29.2 Eros falsifies the heliocentric theory of retrograde motion

We shall now look at the most 'mysterious' aspect of Eros' observed behaviour: the fact that Eros is hardly ever observed to retrograde (reverse direction), unlike all the other planets of our system.

> *Unlike most objects in the solar system, Eros never appears to be retrograde (back-track across the sky).* [5]

The above statement from the Wikipedia is not quite correct. As Eros passes closest to Earth, it will indeed back-track by a mere ~20 min of RA on average, and sometimes by as little as 5 min of RA. As you will recall, Copernican astronomers claim the periodic retrograde motions of our planets occur because *"Earth overtakes Mars"* or *"Venus overtakes Earth"*, giving the impression that the planets back-track for several weeks. The shifting viewing angle of the planet in relation to the starry background is said to create the optical illusion of a reversal of direction.

However, the observed celestial motions of Eros highlight the glaring problem with this explanation. As we have seen, Eros transits much closer to Earth than Venus. Thus, if retrograde motions were caused by angular shifts, as claimed by the heliocentrists, the nearly imperceptible reversal of Eros would violate the basic laws of parallax and perspective: Eros should be observed to retrograde against the starry background by a much larger amount than Venus. This should become clear by examining Fig. 29.3.

Note that, within the Copernican model, Earth, Venus and Eros are said to have orbital speeds of 30 km/s, 35 km/s and 25 km/s, respectively. The absolute speed differential between Earth and Venus (5 km/s) is the same as the absolute speed differential between Earth and Eros. The fact that Eros hardly retrogrades at all is therefore inexplicable under the Copernican paradigm. So how exactly is Eros observed empirically as it transits closest to Earth? Fig. 29.4 shows how astronomers recorded the super-close transit of Eros in the early months of 2012.

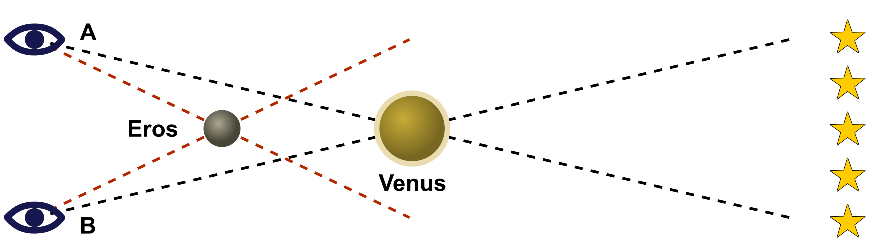


Fig. 29.3 Under current theory, Eros should be observed to 'backtrack' against the stars for a far larger angular amount than Venus. Instead, the exact opposite is observed. This roundly falsifies the heliocentric theory for retrograde motion.

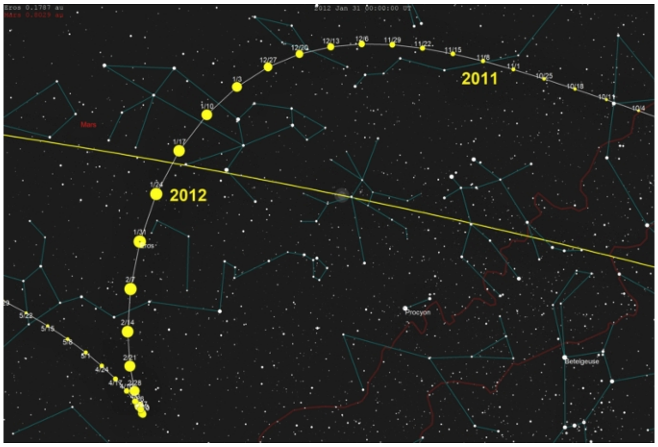


Fig. 29.4 Eros' observed 2012 trajectory (source: Wikipedia)

The abrupt, V-shaped retrograde pattern is quite bizarre if viewed within the Copernican framework. How can such a trajectory possibly be reconciled with what is claimed to be a simple, linear 'overtaking manoeuvre' on the part of Earth? Surely, something is amiss here. Once more, the Trace function of the Tychosium 3D simulator comes to our aid, showing precisely why Eros is empirically observed to retrograde in a V-shaped pattern.

In conclusion, it is the heart-shaped orbital trajectory of Eros, as predicted by the TYCHOS model, that causes the peculiar, minuscule, V-shaped reversal of Eros.

All the planets, comets and NEAs revolving around the Sun appear to obey some magnetic force, as if they were attached to the Sun with a magnetic yo-yo string. It is the length and speed of this 'string' that determines the variable shapes of our planets' orbital, spirographic paths and their variable retrogrades. There is nothing otherworldly about moving bodies being conditioned by a magnetic field: here on Earth, we can make small magnets levitate and, with a little finger push, revolve around a larger 'mother magnet', as if attached by invisible strings. Of course, what remains to be understood is just what sort of ethereal force originally set all our universe's celestial bodies in motion and how they are kept rotating like cogs in a perfect clockwork, century after century.

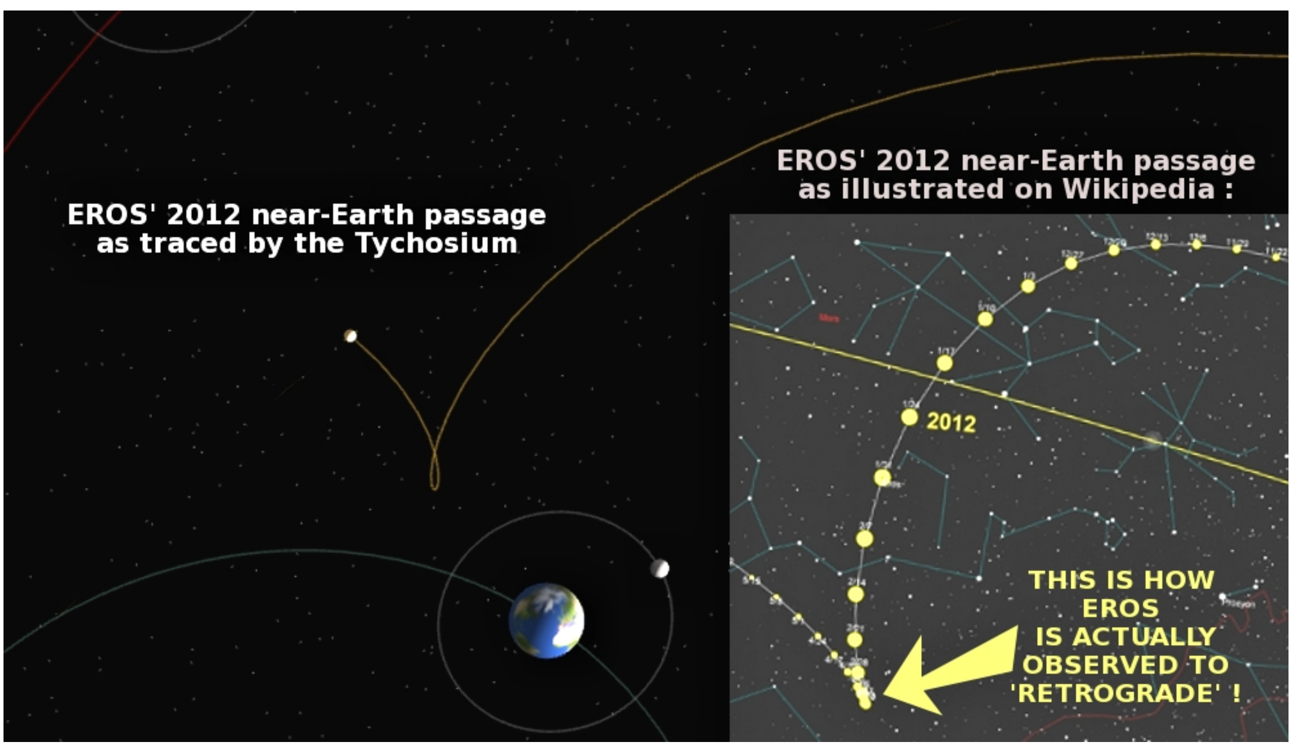


Fig. 29.5 The Tychosium 3D simulator traces Eros's peculiar V-shaped retrograde, in full accord with empirical observation.

29.3 The NASA spell

NASA claims to have landed a probe upon Eros back in February 2001, as it found itself at 2 AU (i.e., twice the distance to the Sun). As their story goes, their remote-controlled probe landed just around Valentine's Day (14 February). They also claim the probe captured some pretty sharp photographs of Eros from a distance of 2590 km (i.e., roughly the distance between Stockholm and Rome). These alleged photographs would have revealed a distinct heart-shaped depression on the suspiciously phallic tip of Eros.

NASA fan boys worldwide probably won't like the TYCHOS, much like children loathe the moment when Santa Claus is revealed to be a fiction instilled in them by their own, trusted parents. Evidently, one of the hardest things for most people to overcome is their emotional attachment to such dreamy and seductive childhood beliefs. The last two or three generations have grown up under the spell of the NASA storytellers' sagas of wondrous science and Promethean technology, although more and more people around the world are starting to realize that what they are being served is little more than wishful thinking and special effects.

The growing disbelief in NASA's space-travelling capabilities led the agency to effect a number of structural changes and launch damage control operations with the purpose of ridiculing those who expose the hollywoodesque nature of their exploits and discouraging the general public from any further scrutiny. One such clever operation—generously funded, it would seem—is the Flat Earth Movement, launched around 2015. Successful beyond all expectations, the operation is based on the discredit-by-association (DBA) principle. Scores of seemingly independent 'grassroot' videomakers diffuse the silly idea that planet Earth is flat as a pancake while at the same time posing as 'NASA deniers'. Since the Earth can easily be proved to be spherical, the general public is made to spurn the criticisms and exposés of NASA's deceptions championed by what they see as 'kooky, tinfoil-hatted flat earthers'.

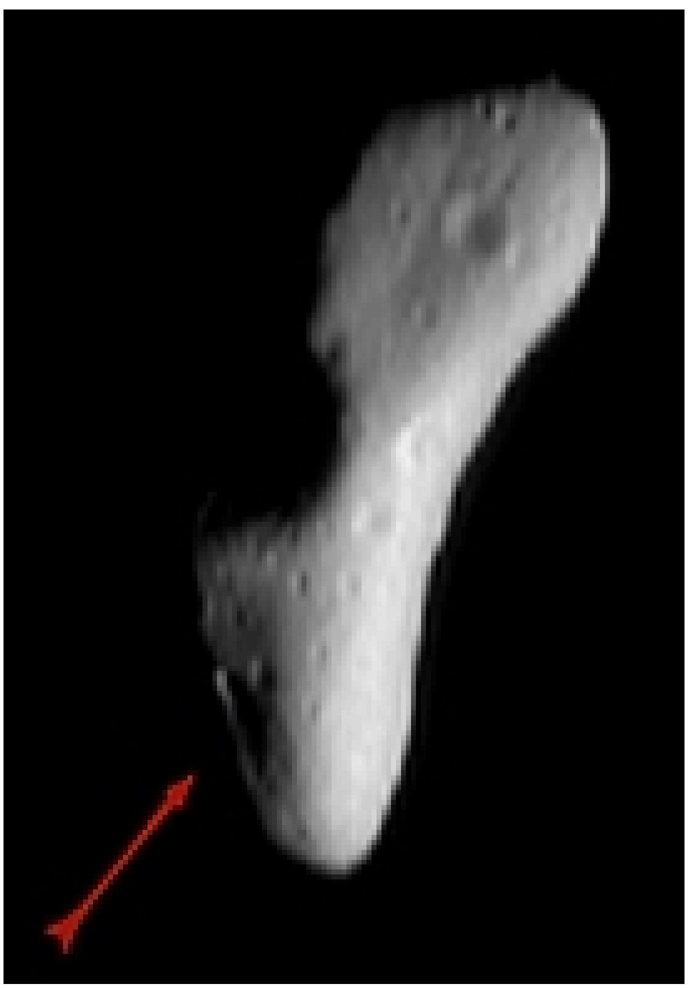


Fig. 29.6 The caption for this NASA image reads:

"Just in time for its Valentine's Day date with 433 Eros, the Near Earth Asteroid Rendezvous (NEAR) spacecraft snapped this photo during its approach to the 21-mile-long space rock. Taken on Feb. 11, 2000, from 1609 miles (2590 km) away, the picture reveals a heart-shaped depression about 3 miles (5 km) long. Scientists at the Johns Hopkins University Applied Physics Laboratory—which manages the NASA mission—processed the image on Feb. 12. Photos taken from closer in during the next few days will help the NEAR team unravel the mystery of this shadowy feature."

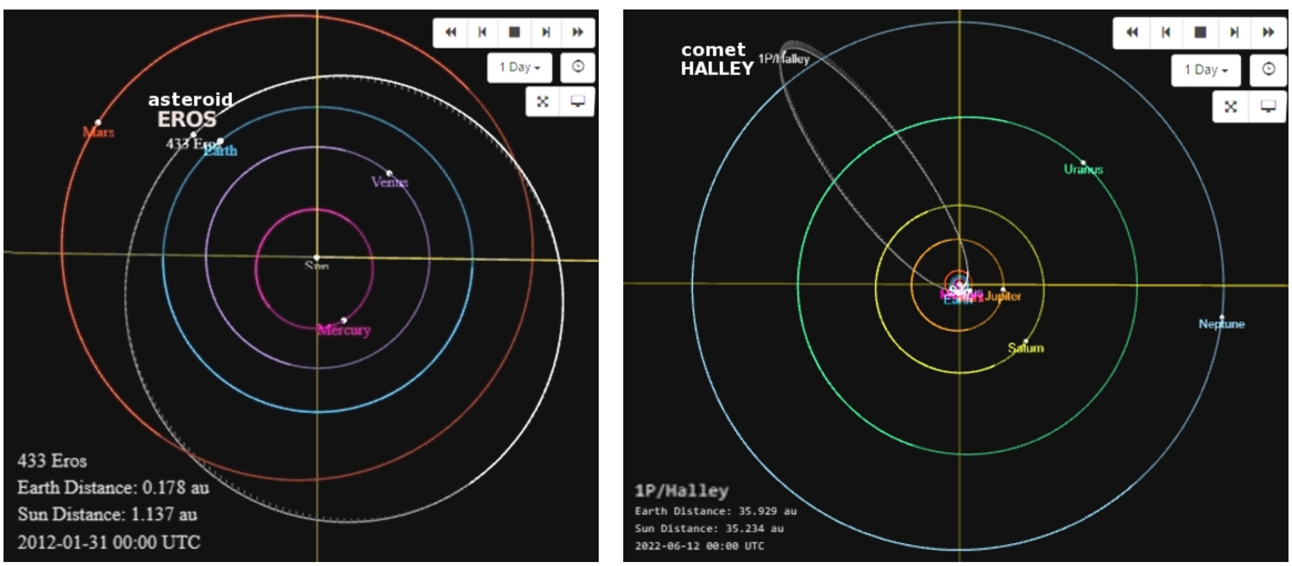
Source: NASA (Image 0125693155)

29.4 An abiding error

Even Mother Nature herself can sometimes trick our senses, including those of our sharpest minds and observational astronomers. For example, comets are currently believed to move in unphysical 'cigar-shaped' orbits due to what was originally a case of mistaken identity: the 'Great Comet of 1680' (also called 'Newton's comet') was simply the sighting of the asteroid Eros, not the appearance of a new comet. This fateful gaffe prompted Sir Isaac Newton to formulate the most bizarre theory of his entire career, namely that comets orbit in extremely elongated ellipses, in stark contrast to all other orbital motions.

Keep in mind that asteroids and comets can be very similar in size and approach Earth at very similar distances. For instance, Eros measures ∼16 km and Halley's comet measures ∼15 km, and both may transit as close to Earth as ∼0.1 AU. It is therefore reasonable to ask why asteroids and comets would have wildly different orbital shapes. Aren't Newton's 'laws of universal gravitation' precisely meant to apply everywhere in the universe? The term 'universal' is clearly a misnomer if two types of Earth-grazing celestial objects of similar dimensions obey wholly different physical principles.

Rational thinkers should pause and ask themselves why a universal law of gravity would govern the orbital paths of asteroids and comets in totally different manners. While we wait for the best of our astrophysicists to answer that question, in Chapter 30 we shall meticulously demonstrate that comets do not revolve in 'cigar-shaped' orbits, as erroneously concluded by Newton, but have circular (yet trochoidal) trajectories, like all other celestial bodies. The 'reverse engineering' of the secular motions of Halley's comet as recorded (and messed up) by astronomers throughout the ages is a prime example of the explanatory power of the TYCHOS.



(a) *(b)*

Fig. 29.7 The orbital shapes of asteroid Eros and Halley's comet, according to the JPL/NASA simulator.

29.5 References

[1] *Venus' 1874 transit*, Wikipedia
https://en.wikipedia.org/wiki/1874_transit_of_Venus

[2] *Essays in Astronomy* by Edmund Ledger (1900)
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[3] *Amor asteroids*, Wikipedia
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[4] *JPL orbit viewer for Eros*
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[5] *Eros*, Simple Wikipedia
https://simple.wikipedia.org/wiki/433_Eros

30

Halley's comet: the great deceiver

30.1 A Copernican comedy of errors

Astronomers have been obsessed with comets for centuries, but have strangely enough never reached any rational or definitive conclusion regarding their orbital motions. For example, Halley's comet, the most well-known comet among the general public, has given rise to endless controversy due to its allegedly unpredictable behaviour. Each time around, this little joker has played peekaboo with earthly observers, showing its face only during relatively brief, intermittent time windows, when it is not hidden from view behind or in front of the Sun. The introduction of the Copernican heliocentric model has only made things worse, leaving scientists utterly befuddled. Still, the discovery of a new comet is perhaps the most prestigious feather in any amateur or professional astronomer's hat.

Fig. 30.1

> *The return of Halley's comet suddenly made comets the headliners of astronomy, and for several decades it seemed that the greatest feat any astronomer could achieve was to discover comets.* [1]

Few people will be aware that Halley's comet, with its supposedly wildly irregular or 'chaotic' orbital period, is one of the greatest oddities in astronomy. Paradoxically, in spite of our astronomers' unsuccessful attempts to explain its behaviour, we are told it provided the ultimate proof of Sir Isaac Newton's theories. Indeed, when Halley's comet passed in 1758, as predicted by Newton's mentor, Edmond Halley, it was celebrated as the greatest triumph of Newton's gravitational 'laws':

> *Its discovery was hailed as a triumph of scientific reasoning and Newtonian physics. By its appearance at this time, the truth of the Newtonian Theory of the Solar System is demonstrated to the conviction of the whole world, and the credit of the astronomers is fully established and raised far above all the wit and sneers of ignorant men.* [2]

In hindsight, as will be thoroughly demonstrated in this chapter, those *"sneers of ignorant men"* were quite rightful and well-founded: the many hypotheses set forth to account for the observed behaviour of Halley's comet soon turned into a bewildering hodge-podge of assumptions and complex numerical integrations. Indeed, current cometary theory is riddled with aberrations, the most glaring of which is the claim that Halley's periodicity can fluctuate by as many as 6 years, unlike any other celestial body in our system: according to modern astronomy tables, the interval between the passages of the comet can be anywhere between 73 years and 79 years. Oddly enough, these minimum and maximum values are rarely mentioned in today's textbooks, most of which tell us that Halley's comet returns *"every 75 or 76 years or so"* (as was more correctly reckoned in the 17th century). As we shall see further on, the TYCHOS model allows us to affirm that Halley's comet has a quite regular and definitely 'non-chaotic' mean orbital period of 75.7 years.

As shown in Fig. 30.2, Halley's comet is currently believed to travel around the Solar System in a highly elongated, almost cigar-shaped orbit. Moreover, as it recedes from Earth, its speed is thought to gradually decrease until it reaches the orbit of Neptune where, for some reason, it reverses course and initiates its return trip to the Sun. Upon returning, it is said to accelerate markedly and make a sharp U-turn around our system, curiously enough always passing much closer to Earth than to the Sun. Indeed, one has to wonder how Newton's gravitational theories would account for this fact: does the Earth exert a stronger 'gravitational pull' upon the comet than the Sun?

The European Space Agency (ESA) makes no bones about the vital role comets played in the development and confirmation of Newton's theorems:

> *Testing gravity: how comets helped to prove Newton right. In the seventeenth century, science was thriving across Europe. The concept of a heliocentric Solar System was slowly spreading, bringing with it a reignited curiosity for astronomy and a lessened fear of previously mysterious celestial objects, such as comets. Cometary science was to take many great steps forward in the coming centuries—but first, comets had a vital part to play in developing one of the most fundamental theories in all of physics: Newton's law of universal gravitation.* [3]

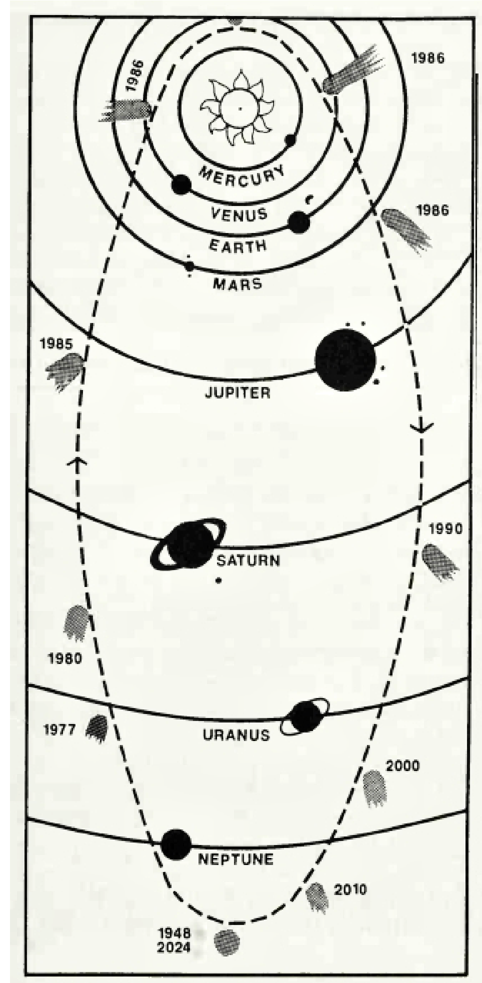


Fig. 30.2 Illustration from Isaac Asimov's *"Guide to Halley's Comet"* (1985).

The astronomy literature is awash with such boastful and celebratory statements, yet the titanic efforts deployed over the years to justify comet Halley's apparently irregular periods have been based on a veritable comedy of errors. A host of exotic *ad hoc* theories have been dreamed up by the scientific community in what reads like a cheap, yet exhilarating, science fiction novel. As we have seen, according to one extravagant hypothesis, Halley's comet would somehow be drastically slowed down or sped up by 'perturbating gravitational forces' as it transits in the vicinity of Uranus, Saturn, Jupiter or Venus. We are asked to accept this as the explanation for why the official orbital period of Halley's comet fluctuates by as much as ±3 years, corresponding to a whopping 8% of its mean period of 75.7 years. Over time, an array of assorted and purely speculative 'non-gravitational effects' were added to those ghostly 'perturbations' to make the equations work, since Newtonian physics *per se* was insufficient to predict the comet's observed returns with any degree of precision.

> *Our results show that the behaviour of the non-gravitational effects in the motion of Comet Halley with time is a very important problem which requires a careful investigation.* [4]

The TYCHOS shows that, as Halley's comet enters our Solar System, it passes quite close to Earth and may be seen telescopically on occasions stretching over two or three years, or even four successive years, provided conditions are favourable. As we shall see, this extensive transit period is at the root of the dire confusion surrounding its periodicity. It is indeed ironic that Halley's comet, which is falsely claimed to have provided *"vital and definitive proof of Newton's law of universal gravitation"*, is now providing conclusive evidence in support of the TYCHOS model.

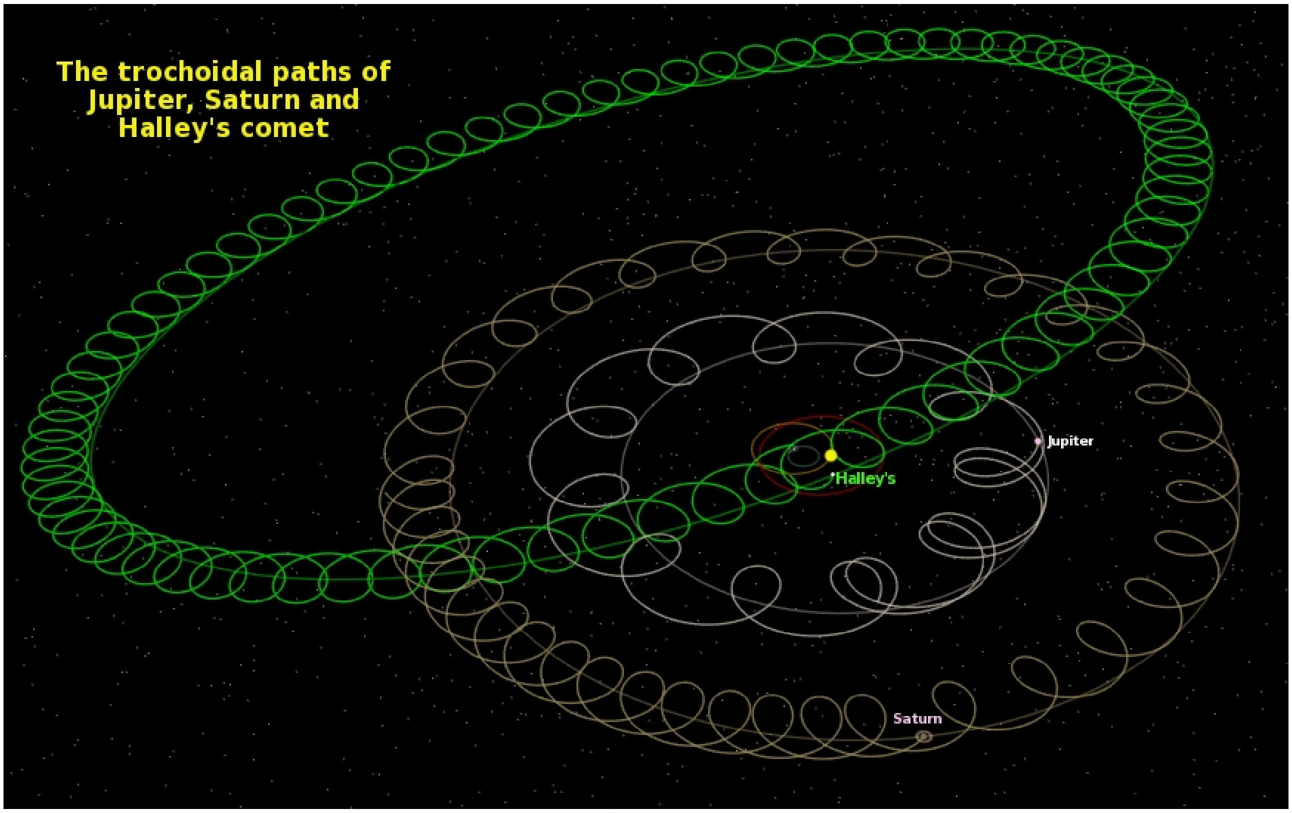


Fig. 30.3 A full 75.7-year orbital period of Halley's comet in the Tychosium 3D simulator.

While reading this chapter, try running the Tychosium 3D simulator on your laptop or desktop. Activate Halley's comet by checking the "Halley" box in the "Planets" menu to get familiar with its celestial motions in the TYCHOS model. Select any date and verify the comet's position. Then activate the "Trace" function for Halley's comet and push the "Run" button to see how the comet moves in a circular (albeit trochoidal) orbit, like all the planets in the Solar System (as demonstrated in Fig. 30.3).

Before proceeding, it is important to understand why Halley's comet can be sighted more than once, during two or three successive years, as it transits across the Solar System. The screenshot from the Tychosium 3D simulator in Fig. 30.4 shows Halley's comet passing in 1985 and in 1986. During its first close passage around June 1985, it was mostly swamped by the Sun's glare, making it very difficult to observe. As we shall see later, though, it was briefly, yet unwittingly, spotted in May 1985 by Don Machholz, a skilled amateur 'comet hunter'. However, during its second close passage around April 1986, it was observed by many people in the southern hemisphere.

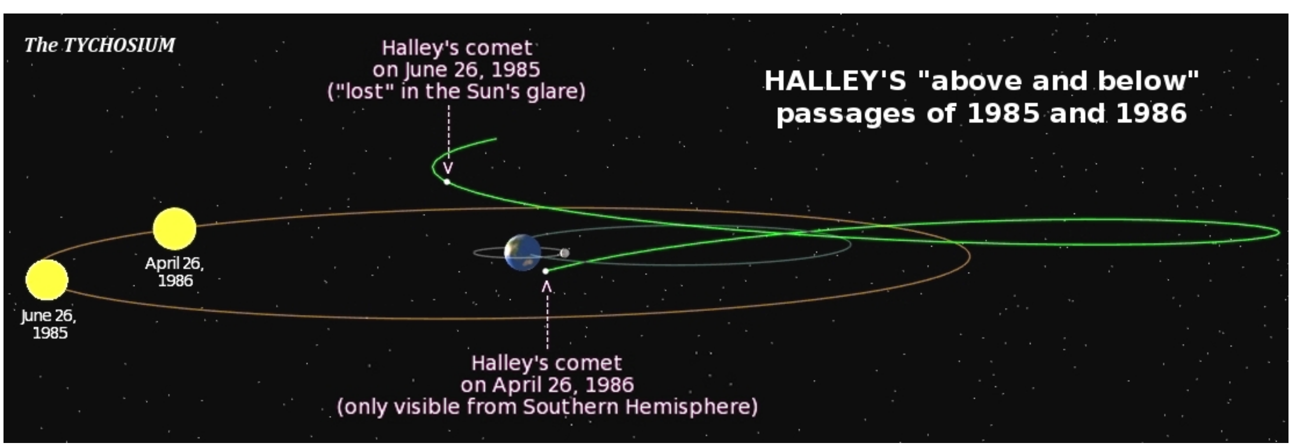


Fig. 30.4

Due to the comet's inclined trochoidal orbit, it is seen 'above' the Earth the first time it passes and 'below' the Earth upon the second passage. Curiously, the Wikipedia entry for Halley's comet features a diagram, reproduced in Fig. 30.5, showing the comet passing close to Earth on 10 April 1986 (which it did) and then proceeding into the distance in trochoidal loops similar to those traced in the Tychosium 3D simulator (Fig. 30.6). Since the heliocentric model does not envision orbits as trochoidal loops, one wonders how the authors of that diagram arrived at such a 'conceptual' representation of Halley's motions.

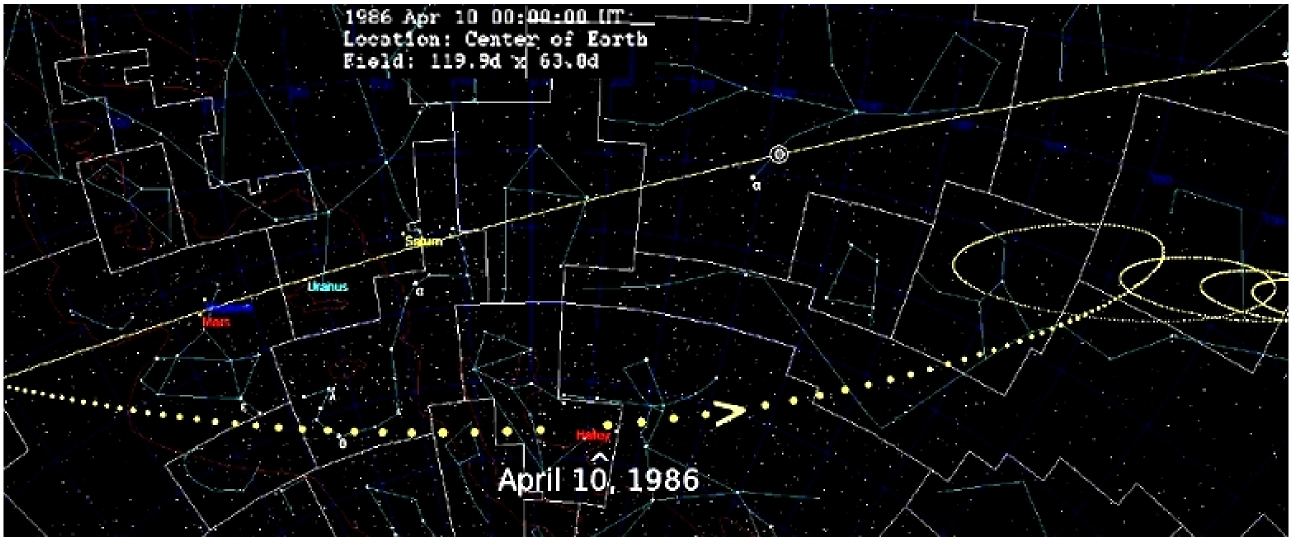


Fig. 30.5 *"1986 passage of Halley's comet"*, Wikipedia [5].

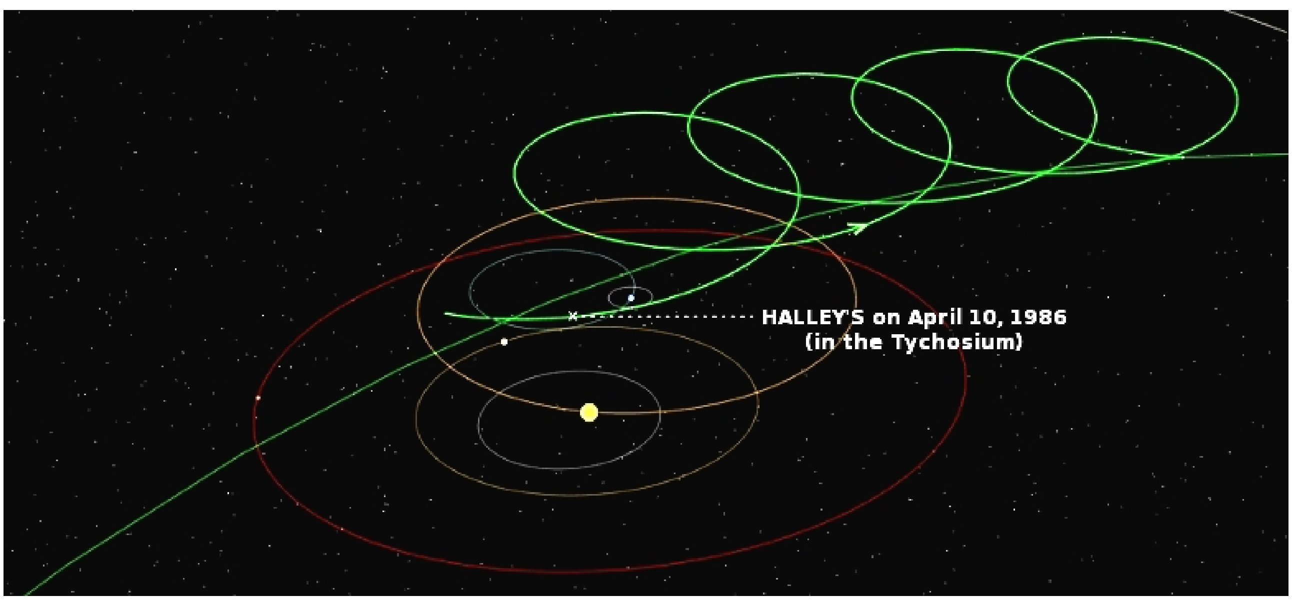


Fig. 30.6 1986 passage of Halley's comet viewed in the Tychosium 3D simulator

Another most interesting aspect of Halley's circular-trochoidal orbit is that the width of its loops are commensurate with the diameter of the Sun's orbit (2 AU), as illustrated in Fig. 30.7. This would support the hypothesis that Halley's comet is simply an ejectum of the Sun which has preserved its original, solar orbital momentum and dynamics. According to this view, all comets may be small 'fireballs' ejected from the Sun which then gradually cool off and fizzle out, much like Halley's comet appears to be doing. This, of course, would require far more study to be confirmed.

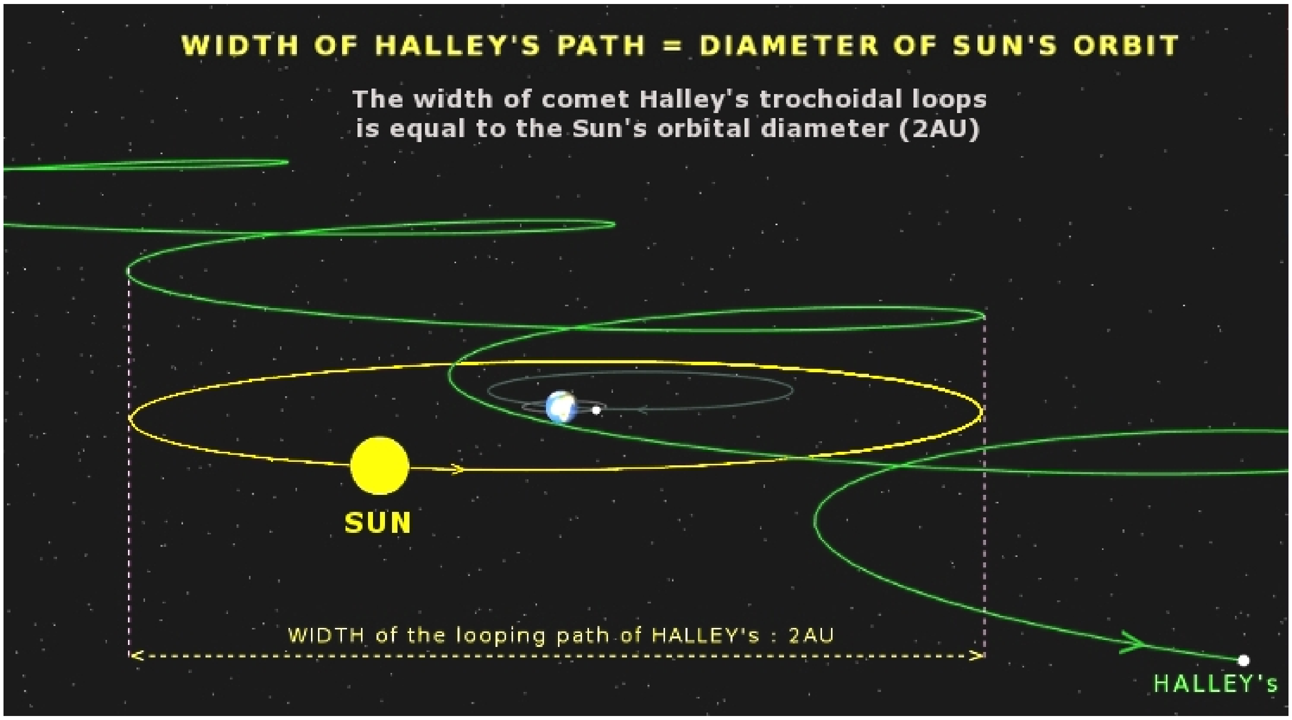


Fig. 30.7 The width of comet Halley's trochoidal loops is equal to the Sun's orbital diameter (2AU)

The trochoidal path of Halley's comet, as traced in the Tychosium 3D simulator, provides clear and demonstrable answers to the dreadful, longstanding confusion around the comet's periodicity. Needless to say, astronomers' failure to realize the true motions of Halley's comet can be ascribed to their obtuse adherence to heliocentrism: since they refuse to give up the unproven theory that the Earth races around the Sun, their complex computations attempting to plot and predict the comet's trajectory across our system have been utterly fruitless. Moreover, opportunities to empirically observe Halley's comet are few and far between. Keep in mind that each time the comet passes through our system it will only be visible intermittently—i.e., for relatively short periods of time—and, more often than not, its ever-diminishing gleam will be shrouded by the glare of the Sun.

Another remarkable aspect revealed by the Tychosium 3D simulator is that Halley's orbital speed is not only constant but also identical to that of the Sun (107226 km/h). This can be readily verified by counting the days the comet employs to traverse the PVP orbit's diameter. Fig. 30.8 shows that Halley's comet and the Sun cover the exact same distance in 44 days (see Chapter 11).

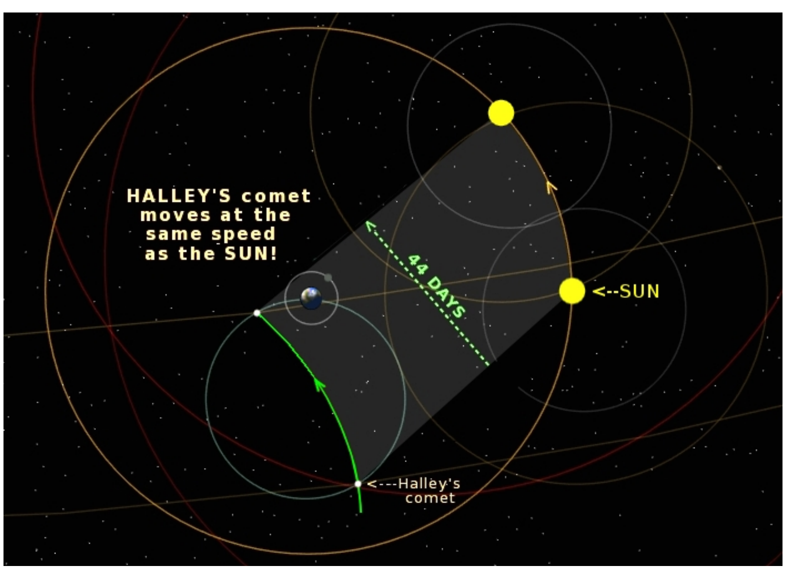


Fig. 30.8 In this screenshot, from the Tychosium 3D simulator, Halley's comet and the Sun travel at the exact same speed (107226 km/h).

Note: this verification was performed in the Tychosium 3D simulator prior to applying the comet's orbital inclination of 18° in relation to the Sun's orbital plane.

30.2 The OFFICIAL roster versus the TYCHOS roster of Halley's secular passages

The official roster of comet Halley's periodic transits across the Solar System features single sightings only, but the roster generated with the TYCHOS model has double or triple sightings for each transit since the comet passes close to Earth (within 0.55 AU) in at least two successive years.

As an example of the inadequacy of the heliocentric model, note that the official roster's interval between Halley's transits in 2061 and 2134 is only ~73 years, while the interval given between the transits in 1222 and 1301 is ~79 years! Have astrophysicists ever provided any rational explanation for this massive 6-year variation in Halley's orbital period? No.

In the TYCHOS roster, Halley's transits occur at quite regular intervals of ~75.7 years. Moreover, as may be verified in the Tychosium 3D simulator, Halley's comet will return to very nearly the same place in our skies every 227 years (3 × ~75.7). This is very similar to the behaviour of our Moon which returns to virtually the 'same place' after 3 saros cycles, or 1 exeligmos cycle. We may therefore say that Halley's 75.7-year and 227-year cycles are the equivalent of the Moon's saros and exeligmos cycles (see Chapter 13). More remarkably still, Halley's comet has a long cycle of 984 years (i.e. 13 × ~75.7y) at both ends of which we may find it transiting closest to the Earth on the exact same calendar dates. Now, our Moon also has a long cycle of 85609 days (i.e. 13 saros cycles) at both ends of which we may find it eclipsing the Sun! Needless to say, no astronomers have ever noticed these wondrous orbital resonances between our Moon and Halley's comet.

One may well say that the TYCHOS model supports Newton's fundamental claim that *"physics work the same everywhere"*. Newton himself, however, concluded that comets moved around highly elliptical, almost cigar-shaped orbits, completely unlike any other known type of celestial body. In the following section we shall try to understand why Sir Isaac reached such a bizarre and illogical conclusion, contradicting his own claim to universality. The fact that his cigar-shaped cometary orbits have been universally accepted ever since goes to show how the almost god-like status posthumously assigned to scientists like Newton and Einstein has blinded the scientific community for centuries, making otherwise capable researchers accept all sorts of self-contradictory edicts.

Table 30.1 – OFFICIAL roster of Halley's historical transits [6]

240 BC	66	374	684	989	1301	1607	1910
164 BC	141	451	760	1066	1378	1682	1986
87 BC	218	530	837	1145	1456	1759	2061
12 BC	295	607	912	1222	1531	1835	2134

Table 30.2 – TYCHOS roster of Halley's historical transits

210, 209 BC	395, 396	1001, 1002	1606, 1607, 1608
135, 134, 133 BC	471, 472	1076, 1077, 1078	1682, 1683
59, 58 BC	546, 547, 548	1152, 1153	1757, 1758, 1759
17, 18	622, 623, 624	1228, 1229	1833, 1834, 1835
92, 93, 94	698, 699	1303, 1304, 1305	1909, 1910
168, 169	774, 775	1379, 1380	1985, 1986
244, 245	849, 850, 851	1455, 1456	2060, 2061, 2062
319, 320, 321	925, 926	1530, 1531, 1532	2136, 2137

All comet passages are within a distance of 0.55 AU from the Earth.

30.3 The 'Great Comet of 1680' (Newton's comet)

Let it be clear, as we tackle this dreadfully ruinous episode of astronomical history, that no one has ever suggested to this day that the 'Great Comet of 1680' (also known as 'Kirch's comet' [7] or 'Newton's comet') might have been a misidentified sighting of Halley's comet. The general consensus is that this 'one-off' comet—observed until early 1681, never to return again—just happened to transit close to the Earth only a year or so prior to comet Halley's 1682 passage, by pure chance.

The case of the ‘Great Comet of 1680’ has to be one of the most egregious examples of how a single spurious observation can lead astray the progress of astronomical knowledge and, indeed, the entire course of science. To be sure, the ‘Great Comet of 1680’[8] was the ‘founding stone’ upon which Isaac Newton and Edmond Halley erected their cometary theories which, in turn, were universally acclaimed as definitive confirmation of Newton’s ‘laws’ of gravitation.

> <u>*Newton’s Comet 1680-1681:*</u> *The comet that was observed by skilled observers, astronomers for the first time in history. Newton’s cometary theory is based on it. Also, it was the first comet that was discovered telescopically (by Gottfried Kirch and others). None of the more ancient Comets of which we have any record was so closely observed as this. It was observed by a large number of scientific people, and it was mainly from observations of this Comet, that Sir Isaac Newton, as set forth in great length in his “Principia” evolved his cometary theory. In Proposition XLI, Problem 21, “from three observations given to determine the orbit of a Comet moving in a parabola” after giving his calculations and drawings, Newton says, “Let the Comet of the year 1680 be proposed.” Newton’s theories evolved from the observations of this Comet, made by Flamsteed, Halley and others, and lie at the foundation of all modern learning on the subject of Cometary orbits.* [9]

A lengthy controversy between Newton and Flamsteed centred upon the nature of the successive sightings in 1680 and 1681, which were eventually—yet, as we shall see, erroneously—deemed to have been the same comet. It is a well-documented fact that Sir Isaac was, initially, profoundly perplexed (and rightly so) over the *“extraordinary hairpin turn around the Sun”* the comet must have made if Flamsteed’s single-comet theory was correct.

> *Through an intermediary he [Newton] also corresponded about it with John Flamsteed, the astronomer royal, who was convinced that the two appearances were not two comets but a single one which reversed its direction in the vicinity of the sun. He expounded the theory in terms of a fantastic magnetic dynamics, rejected by Newton, who also resisted the notion of a single comet.* [10]

But let us start from the beginning of this pivotal case of misidentification. On 14 November 1680, the German astronomer Gottfried Kirch saw an object in his telescope close to Mars at about 10h of RA, which was later interpreted as a comet. The object was a rather dull speck of light and Kirch first thought it might be some previously unobserved nebula because he never detected any tail behind it.

> *Kirch noticed the comet first at Coburg, early on the morning of the 14th of November, 1680, and seems to have felt a natural pride at being the first to detect a comet with the assistance of a telescope before it had been seen with the naked eye. It was, at the time, not far from the planet Mars, and was just visible to the naked eye. At first, he doubted whether it was a new comet, or a nebula similar to that in the girdle of Andromeda; but its motion soon decided that it was the former.* [11]

> The comet’s extraordinary hairpin turn around the sun was the subject of debate in England between Newton and John Flamsteed, the Astronomer Royal. Many, including Newton, initially believed that there were two comets. Flamsteed disagreed. Brattle independently recognized that the comets approaching and receding from the sun were the same comet before and after perihelion. His observations from November 1680 to February 1681 were appended to a 1681 almanac.[20] In June 1681, Brattle shared the same observations with Flamsteed, who likely communicated them to Newton.[21] When the 1680 comet became an important test case for Newton’s theory of gravitation, Newton favorably reported observations taken with respect to the fixed stars by an “observer in New England.”[22] Brattle was rightly proud of the citation, and he later wrote Flamsteed that this “was no small comfort to me, that I was none of the last of all the Lags.”[23]

Fig. 30.9

In short, Kirch saw a faint, tailless body in proximity to Mars, moving prograde. Other observers such as Brattle and Foster reported seeing the same dull object in November 1680 and, only a month or so later, reported a far brighter object with a distinct tail in the opposite part of the firmament.

> *1680: Morning comet, observed by Thomas Brattle and John Foster, disappears sometime in November, too close to the Sun to observe.*
>
> *1681: Evening comet appears, observed by Thomas Brattle and John Foster. Whether by genius or ignorance, they conclude this is the same comet they saw the year before.* [12]

In summary, the original tailless object reported by Kirch disappeared soon after being observed on 14 November 1680, and only one month later (on 15 December) a large comet with a clearly visible tail made its spectacular appearance in the diametrically opposite quadrant of our skies, leading to the curious conclusion—after much controversy—that the two objects were one and the same comet. An unbiased researcher would look for alternative explanations for the November 1680 sighting, so let us consult the Tychosium 3D simulator for enlightenment. As shown in Fig. 30.10, precisely on 14 November 1680 the asteroid Eros was transiting close to Mars, as seen from Earth, and—believe it or not—the JPL/NASA simulator has both Eros and the ghostly 'Great Comet of 1680' transiting at the near-exact same place on this date!

Furthermore, the Tychosium 3D simulator has Eros passing at 0.43 AU from Earth on 14 November 1680, whereas the Wikipedia has the 'Great Comet of 1680' (a.k.a 'Newton's Comet') passing at 0.42 AU from Earth on 30 November 1680. As illustrated in Fig. 30.10, the JPL simulator places Eros and 'Newton's comet' in virtually the same celestial spot on 14 November 1680. Heliocentrists may wish to chalk this up to sheer coincidence, but evidently what Kirch and his colleagues saw in their telescopes in November 1680 was simply Eros, the existence of which was unknown to them, as it would only be formally discovered more than two centuries later (see Chapter 29).

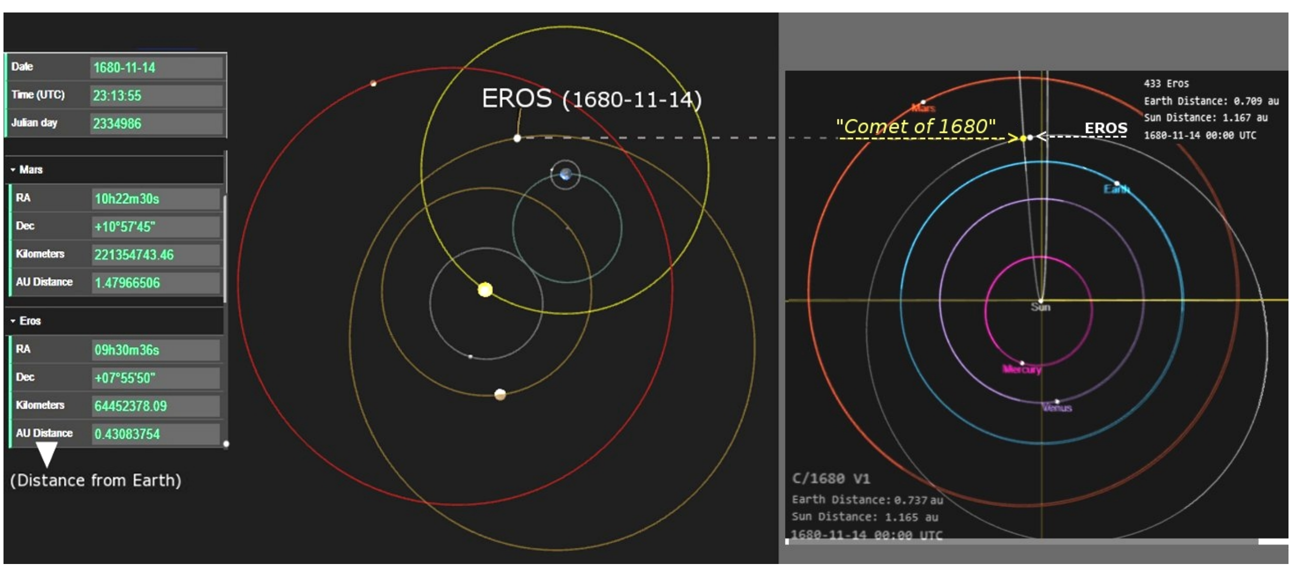


Fig. 30.10 **Left:** The location of asteroid Eros on 1680-11-14, according to the Tychosium 3D simulator.
Right: The location of Eros and the *"Great Comet of 1680"*, according to the JPL simulator.

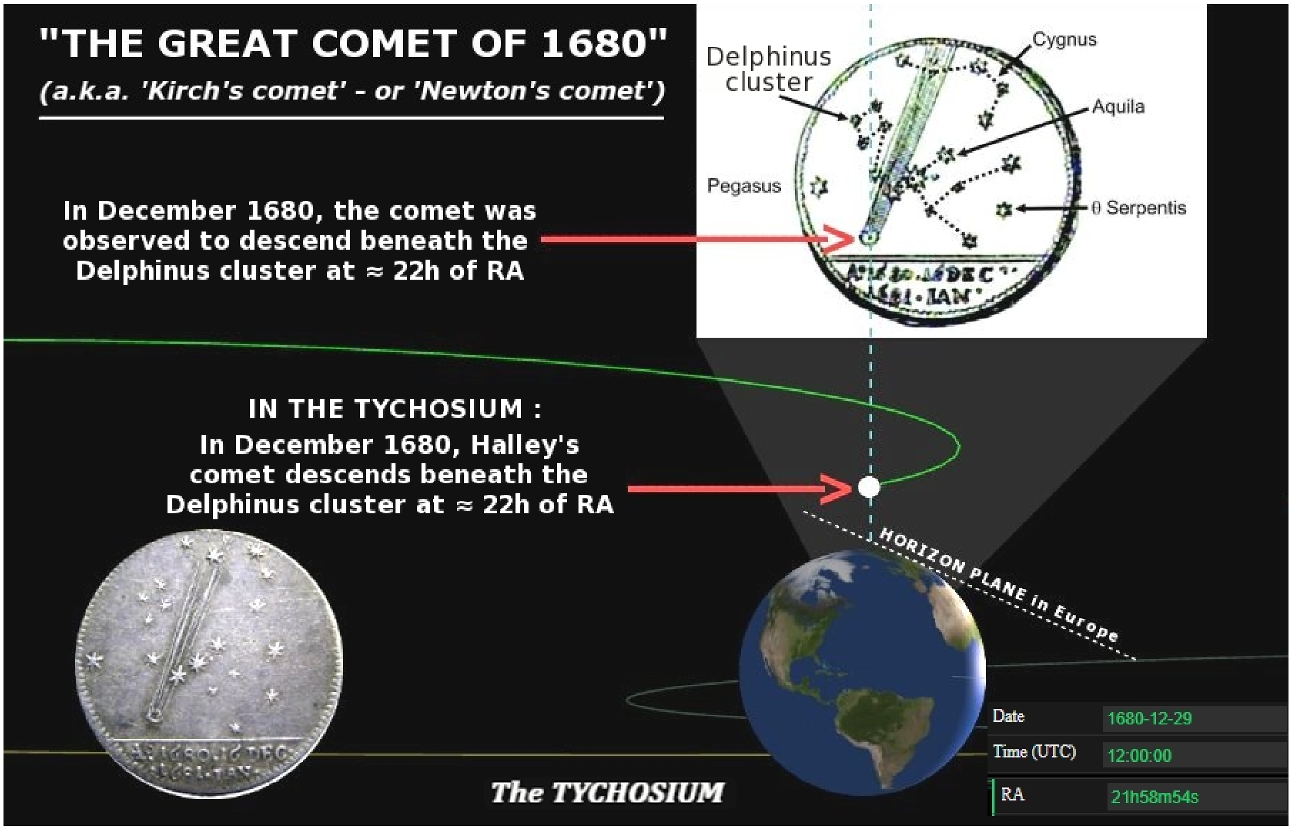


Fig. 30.11 The Tychosium shows that the so-called 'Great Comet of 1680' was none other than Halley's comet.

Suddenly, in mid-December of 1680, a large comet with an impressive tail, reportedly *"one of the brightest comets of the 17th century"*, appeared on the opposite side of our planet. Considering the radically different aspects of the two objects observed, respectively in November and December, one can only wonder why no astronomer objected to the glaringly absurd claim that they were one and the same comet. In astronomy circles, it seems, consensus is not always the product of common sense. Anyhow, as of historical record, this blazing comet was observed to descend in our skies on 29 December 1680, just beneath the small Delphinus star cluster at about 22h of RA. In the Tychosium 3D simulator, this is precisely the path and location of Halley's comet on 29 December 1680, as illustrated in Fig. 30.11.

Interestingly, a commemorative medal of the 'Great Comet of 1680' was minted back then, as shown in Fig. 30.11. The medal depicts the actual location of the comet, just below the Delphinus cluster. A 2012 study by Robert McIvor argues convincingly that the anonymous designer of this medal had to be an accomplished and rigorous astronomer to have correctly placed the comet in the portion of the sky where it was actually observed [13].

The following may be affirmed about what came to be known as 'Newton's comet':

- On 14 November 1680, a dull and tailless object was sighted by Kirch as close as 0.42 AU from Earth. Despite its uncometlike appearance, it was eventually labelled the 'Great Comet of 1680'. In reality, the object Kirch saw near Mars was in all likelihood the then uncatalogued near-Earth asteroid, Eros.
- A month or so later, in late December of 1680, a bright, long-tailed comet appeared on the opposite side of the firmament on a descending path beneath the Delphinus cluster at about 22h of RA. This is exactly where the Tychosium 3D simulator shows Halley's comet at the end of December 1680. Astoundingly, this splendid comet was deemed to be a second sighting of the same dull and tailless object observed by Kirch on 14 November 1680.
- There never was a 'Great Comet of 1680', described in the Wikipedia as *"one of the brightest comets of the seventeenth century"*. These late 1680 and early 1681 cometary sightings were simply the first

appearances of Halley's comet as it approached Earth prior to its famous 1682 passage. As will be illustrated later on, it was observed once more in 1683.

Thusly, and ironically enough, it was a misidentified passage of Halley's comet (mislabelled as the 'Great Comet of 1680') that led Sir Isaac Newton to mathematically formulate the notion of cigar-shaped, parabolic cometary orbits. Until then, most astronomers (including Kepler) thought comets moved in straight lines, passing through the Solar System only once, never to return again. Other astronomers thought comets came in pairs, moving in opposite directions. Knowing what we do about trochoidal trajectories, it is easy to understand why they had this impression. In fact, in a famous controversy with Flamsteed, Newton himself initially argued that the 'comet of 1680' and the 'comet of 1681' were two separate comets. Here is a brief summary of Flamsteed's position on the matter:

> *In 1680, The Royal Astronomer, John Flamsteed, gathered observational data about a massive comet that passed Earth. At this time, astronomers thought that comets came in pairs: to the general observer, it appeared as though one comet would go past the earth and get lost in the sun, and then another would arrive from the opposite direction. John Flamsteed made extremely accurate observations of this new comet in 1680, and he became convinced that there was only one comet, not a pair of comets. Moreover, he thought that the comet did not move in a circular pattern, but rather, in an ellipse. However, Flamsteed incorrectly believed that the comet only approached the sun and was forcibly repelled by its cosmic rays, which sent it careening back the way it came. He did not think that it traveled around the sun.* [14]

In conclusion, Newton's mind was misled by a single spurious astronomical observation: the report of the sighting of Eros in November 1680. It is hard to overstate the import and dire consequences of this discombobulated episode of science history, from which arose the idea of cigar-shaped cometary paths and their tight 'U-turns' around the Sun. Yet, the blunder of mixing up an asteroid with a comet effectively elevated Isaac Newton to the condition of immortal 'science hero'. Today, questioning his sacrosanct treatise, *"Principia Mathematica"*, which contains a huge fold-out diagram of his imagined trajectory of the 'Great Comet of 1680', is tantamount to heresy. In his irreverent book *"Quirky Sides of Scientists"* (2007), David Topper recounts this episode of 'Newtonian hesitance' in a chapter titled *"A Change of Mind: Newton and the Comet(s?) of 1680 and 1681"* [15].

30.4 The bizarre reports of comet Halley's 1759 return

Two very odd circumstances, one in Germany and one in France, surround the all-important return of Halley's Comet in 1759, a famous event that came to be hailed as the glorious triumph of Edmond Halley's and Isaac Newton's theories and predictions.

30.4.1 Odd circumstance 1

In Germany, a wealthy potato farmer and amateur astronomer named Georg Palitzsch is said to have been the first to observe the returning comet, on 25 December 1758. Strangely enough, the official Dresden document announcing the sighting made no mention that it was, in fact, the comet predicted by Edmond Halley. Today, the TYCHOS model sheds light on the reasons for this unpardonable omittance: Palitzsch had observed the long-awaited comet approaching from the 'wrong' side in relation to what astronomers were expecting! Here is a brief overview of the events, as penned by Gary A. Becker:

> *What was indeed remarkable about his find was that Palitzsch had succeeded in winning the competition against some of the best professional astronomers in Europe, who were also searching for the comet, and who were much better equipped to recover it first. To their embarrassment, Palitzsch's discovery came four weeks prior to the next independent sighting, which was made by the great French astronomer and comet seeker, Charles Messier (1730-1817). Messier sighted the comet on January 21, 1759. He had been jealously anticipating that he would win the competition to see it first, and rightfully so, for his search had been in progress for about 18 months. The first published announcement of Palitzsch's find occurred*

the day before Messier independently saw the comet. Hofmann wrote an article which appeared in the second part of the Dresden Scholarly Announcement of 1759 under the title, "Report of the Comet which has been seen since the 25th of December". Curiously enough, the document made no claim that this was the comet predicted by Halley over one-half century earlier. [...] Already European astronomers had been fooled twice in announcing that Dr. Halley's comet had returned. One of these visitors was observed in the fall of 1757, while the other was seen just a few months earlier during the summer of 1758. [16]

30.4.2 Odd circumstance 2

In France, an even stranger episode took place: the young Charles Messier 'rediscovered' Halley's comet in his telescope on 21 January 1759 (almost four weeks after Palitzsch) and promptly shared his finding with his allegedly ill-tempered old boss, Joseph-Nicolas Delisle. Inexplicably, Delisle ordered Messier to keep it a secret! In fact, Delisle announced the arrival of Halley's comet only on April 1st, for reasons that shall soon become clear.

Charles Messier (1730-1817) rediscovered the comet on 21 January 1759 and followed it until 5 February, where it came too close to the Sun to remain observable. But Messier was only the assistant of Joseph-Nicolas Delisle (1688-1768). Delisle, who wanted to be the first to report the discovery to the Academy of Sciences, imposed the secret to Messier. The other Parisian astronomers, for their part, feared the wrath of Delisle, who had a bad temper, and did not attempt to find the comet. However, on April 1, Delisle and La Caille received a letter from Germany announcing the rediscovery of the comet by Palitzsch. Disaster! Unless completely losing face, it was no longer possible to keep the secret: Messier announced to several members of the Academy that he had seen the comet on 21 January and had also just seen it again that very night. He traced the route of the comet on a large map that he and Delisle presented to the king. The official announcement of the rediscovery by the Academy of Sciences took place only on April 25. This was very late; the comet was now very bright and easily seen. [17]

Charles Messier was nicknamed *"the comet ferret"* due to his legendary obsession with discovering new comets and asteroids. Fig. 30.12 reproduces a relevant extract from *"David Levy's Guide to Observing and Discovering Comets"* [18].

The puzzling yet well-documented events above raise at least three pertinent questions:

1. Today Palitzsch is recognized as the man who first witnessed the return of Halley's comet in 1758. Why wasn't his sighting of 25 December 1758 initially announced as Halley's comet?
2. Why did Delisle order his assistant, Messier, to keep quiet about his sighting on 21 January 1759?
3. Why did the Academy of Sciences wait until 25 April 1759 to announce Halley's approach?

The comet ferret

I have a hunch that Messier's comet search got its start because he failed to be the first person to see Halley's comet in 1758. Although Messier thought he was the first, that honor actually went to Johann Georg Palitzsch, who found the comet through his telescope on Christmas Night, 1758. More than 3 weeks later, Messier found the comet from Hôtel de Cluny on January 21, 1759. He was thrilled – "It was one of the most important astronomical discoveries," he wrote, "for it showed that comets could return."[3] He summoned Delisle, who observed the comet and then, for some unexplained reason, promptly ordered Messier not to announce it in any way. Delisle was not persuaded to announce Messier's recovery of Halley's Comet until April 1, a full 3 weeks after the comet had already rounded the Sun. (Locating a comet in this manner is called a "recovery" rather than a discovery.) By this time, Messier had already heard of Palitzsch's Christmas Night sighting and knew that he would have lost the race anyway, despite anything Delisle did.

Fig. 30.12 Extract from David Levy's *"Guide to Observing and Discovering Comets"*.

With the help of the Tychosium 3D simulator, we shall now attempt to answer these questions, with a descriptive graphic (Fig. 30.13) featuring a chronological reconstruction of the events of 1758/1759.

1. Palitzsch's sightings of December 1758 were initially questioned either because he failed to report the positional data (ephemerides) or because his data were deemed to be in error by the scholars in Dresden. In December 1758, Halley's comet was not only transiting on the 'wrong' side of the firmament, but was also—Heaven forbid!—moving prograde. Officially, Halley's comet is thought to only ever move retrograde, that is, in the opposite direction of our surrounding planets.
2. Delisle reportedly witnessed his assistant's discovery in the telescope around 21 January 1759. He must have been shocked to see the comet moving prograde and so ordered Messier to keep quiet about the sighting for the moment. However, we know that Deslisle announced the comet's arrival on 1 April 1759. Consulting the Tychosium 3D simulator, it turns out that Halley's comet reversed direction, as viewed from Earth, only two days earlier, on 30 March 1759. I leave it up to the reader to draw the conclusion.
3. The Academy of Sciences happily announced to the world the passage of Halley's comet on 25 April 1759, long after it had reversed direction and was now moving retrograde. The Copernican model and Newton's theorems were thus salvaged, along with the status and credibility of the world's scientific community. Phew!

Why, you may ask, was Messier, the man hailed as the greatest comet finder of all times, beaten to the punch by the German potato farmer and amateur astronomer, even though he spent 18 months feverishly scouring the skies for comet Halley's all-important 1758 return? Well, according to the Italian Wikipedia, he was using the wrong chart:

> *Messier showed great will on that occasion, spending the nights of nearly 18 months at the top of the observatory tower looking for the comet in an area of the sky where it could not be.* [19]

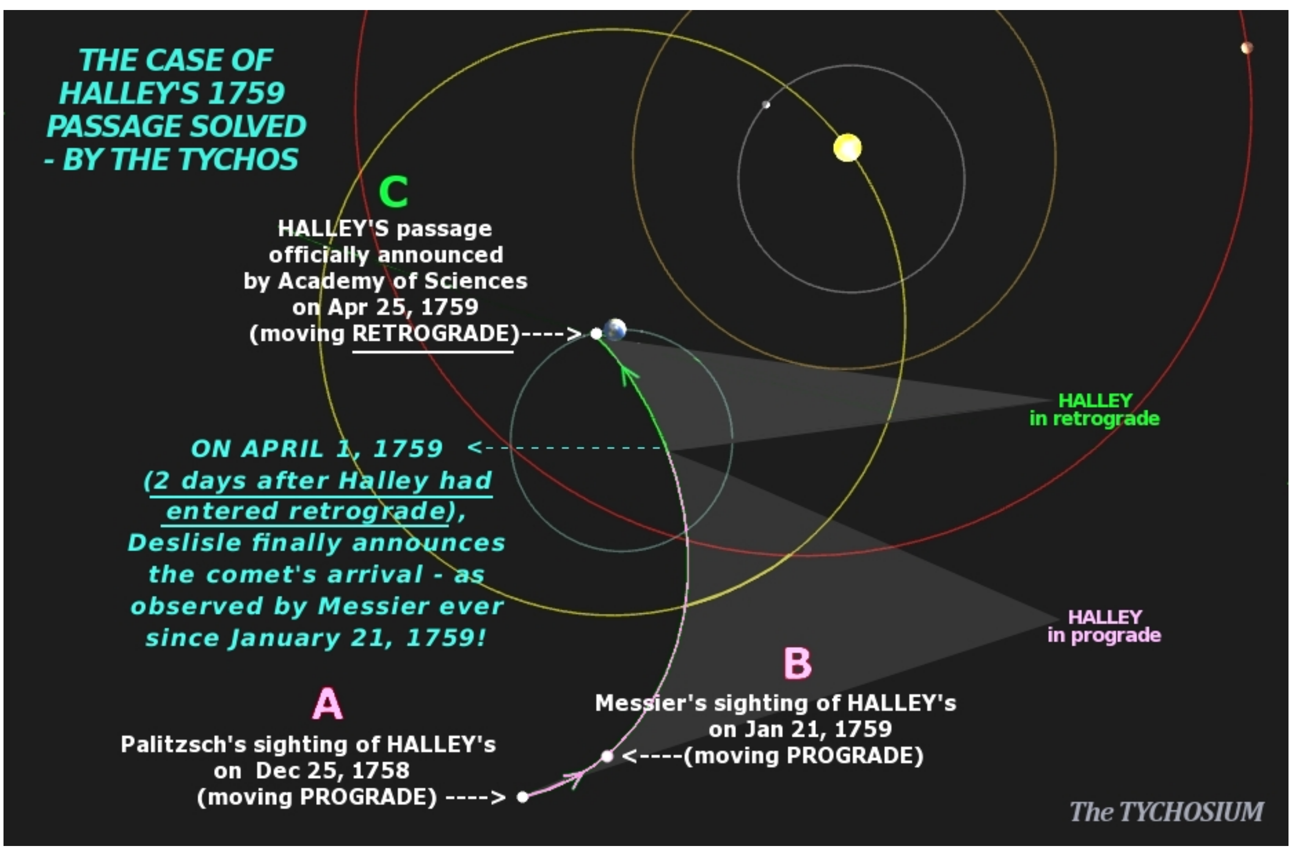


Fig. 30.13 The strange case of comet Halley's 1759 passage, illustrated with the Tychosium 3D simulator.

In other words, the great astronomer and celebrated 'comet ferret', Charles Messier, spent 18 months looking for Halley's return in the wrong part of the night sky! This major blunder by a legendary comet hunter is a good example of how Copernican astronomers have been helplessly confounded with regard to the kinematics of cometary motions due to their dogmatic attachment to heliocentrism.

You may now justly ask yourselves: *"What about Georg Palitzsch's observational data? Is it anywhere to be found? Surely he must have kept records of his 'damning' December 25 sighting, when Halley's comet transited in a celestial position wholly incompatible with its expected approach?"*

Well, after endless vain searches for this crucial data I ended up at the Palitzsch Gesellschaft website where I learned that... *"In the turmoil of war, Palitzsch lost the records of 'his' comet and later also his books. During the 'bombardment' of the city center by Prussian cannons in July 1760 (in the meantime the Austrian troops had moved in) his library, which was stored at an acquaintance's house in the city centre for supposed protection, fell victim to the flames."*

Have there been other instances of comet sightings a year or two ahead of or after Halley's 'official' transits? And if so, can it be demonstrated that these 'untimely' appearances were, in fact, Halley's comet? The answer to these two questions is yes, absolutely. I like to call them 'coincidental comets' and, as we shall see, all of the last ten passages of Halley's comet have been preceded or succeeded by sightings of supposedly unrelated comets. Of course, the odds of unrelated comets unfailingly appearing around each and every visit of Halley's comet are, if you will pardon the pun, simply astronomical.

30.5 The 'coincidental comets' surrounding each of comet Halley's returns

Astronomy almanacs contain scores of observational reports of comets that happened to pass close to the Earth one or two years prior to or after the predicted return of Halley's comet. The sightings of these 'coincidental comets' have been systematically dissociated with Halley's comet for one or more of the following reasons:

- They were sighted in parts of the sky incompatible with the prevailing theory of its motions.
- They implied an 'unacceptable' prograde direction of its orbital path.
- They did not occur close enough to its computed/expected dates.
- Multiple appearances of the comet in consecutive years were deemed impossible.

Consequently, all these historical 'coincidental comets' were classified as 'non-periodic' (allegedly passing only once, never to return) and baptised with a variety of names:

- The Great Comet of 1680 (also called 'Newton's comet')
- Dunlop's comet
- Gambart's comet
- Boguslawski's comet
- The Great January Comet of 1910
- Machholz's comet
- ... and several others.

As we go along, it should gradually become evident that each and every one of these 'coincidental comets' was, in actuality and in all logic, none other than Halley's comet.

30.5.1 Halley's 1682 passage

Let us begin with the 'coincidental comets' surrounding the officially sanctioned passage of Halley's comet in 1682. The astronomy literature reports a number of other cometary sightings between 1680 and 1683, supposedly unrelated to comet Halley.

As we saw above, the first sighting occurred on 14 November 1680 (the 'Great Comet of 1680', also called 'Newton's Comet'), but the tailless object observed was in actuality asteroid Eros. On 29 December 1680 it was seen descending beneath the Delphinus cluster at about 22h of RA. According to the history books, it was last observed by Sir Isaac Newton on 19 March 1681 [21]. Another sighting of the comet was subsequently reported by Robert Hooke on 20 August 1682 [22] as it passed at about 0.42 AU from Earth; this one was officially—and correctly so—later deemed to have been Halley's comet (the Tychosium has it transiting at ~0.4 AU on that date). Finally, around 13 July 1683 (or in any case, *"in the summer of 1683"*, as stated on the Royal Society's website) Hooke reported seeing 'yet another' unidentified comet.

In Fig. 30.15, the Tychosium 3D simulator shows how all the 'coincidental comets' of 1680, 1681 and 1683 were nothing but misidentified sightings of Halley's comet itself (or, in November 1680, asteroid Eros, which was then uncatalogued).

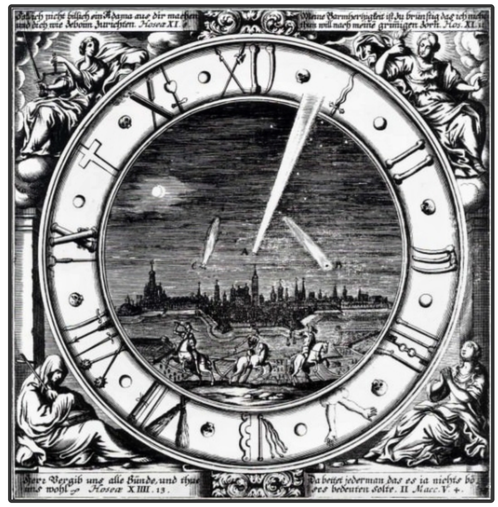


Fig. 30.14 The caption of this drawing published at the Universe Today website reads: *"The illustration shows a view of Augsburg, Germany with the comets of 1680, 1682 (Halley's Comet), and 1683 in the sky. Credit: NASA/JPL."* Source: *"What is Halley's comet?"*, Universe Today [20]

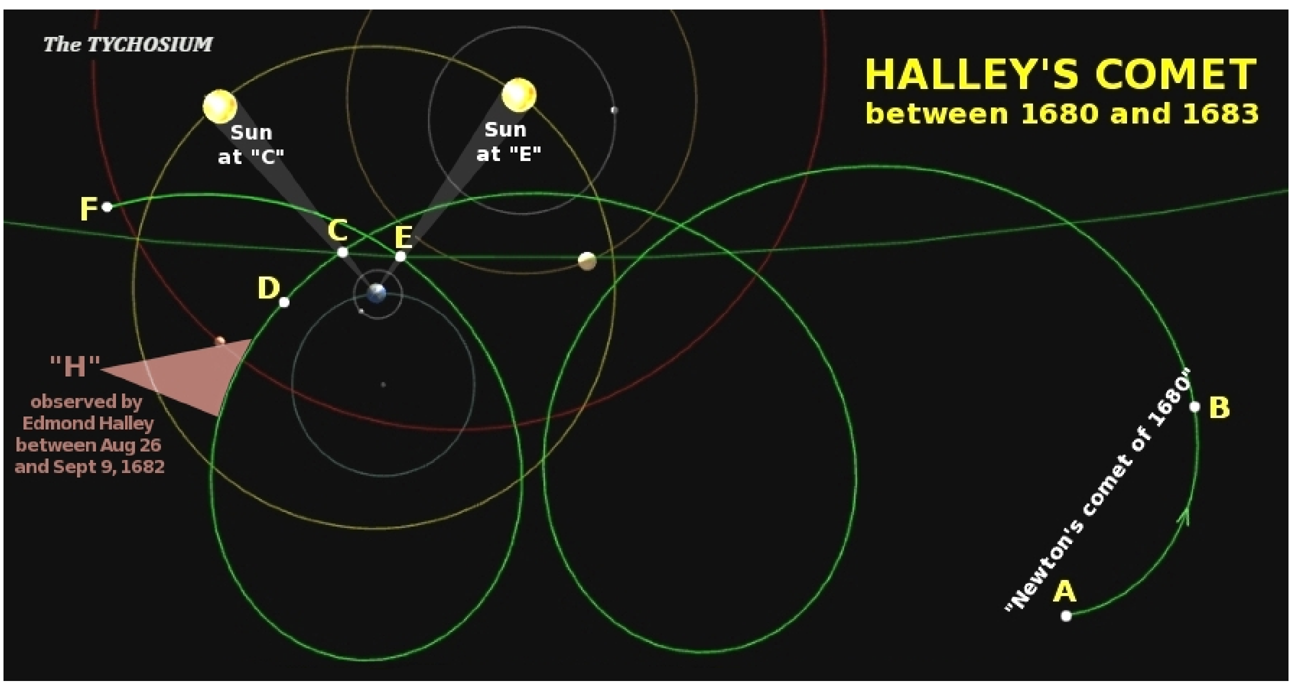


Fig. 30.15 Halley's path between 1680 and 1683. Note that, at positions C and E, Halley's comet would have been swamped in the glare of the Sun. Hence, no sightings occurred at or near those dates.

A ⇒ **1680-12-29**: Observed at about 22h of RA beneath the Delphinus cluster.
B ⇒ **1681-03-19**: Observed by I. Newton *"as it transited at 2.2 AU from the Sun"*.
C ⇒ **1682-08-03**: Halley's comet closest passage in 1682 (swamped in Sun's glare).
D ⇒ **1682-08-20**: Halley's comet observed by Robert Hooke (at about 0.4 AU)*.
E ⇒ **1683-05-10**: Halley's comet closest passage in 1683 (swamped in Sun's glare).
F ⇒ **1683-07-13**: Unnamed comet observed by Hooke *"in the summer of 1683"**.
*Source: royalsociety.org

Edmond Halley’s own celestial map and crucial observations of ‘his comet’, covering the period from 26 August to 9 September 1682, can be found in the Harvard.edu archives [23]. As can be easily verified by perusing the Tychosium 3D simulator, the TYCHOS model’s proposed 1682 trajectory of Halley’s comet is in excellent agreement with the historical data.

30.5.2 Halley’s 1759 passage

Another notoriously controversial passage of Halley’s comet occurred in 1759. Unsurprisingly, two ‘coincidental comets’ were reported in the astronomy literature, this time in the two preceding years (mid-September 1757 and mid-August 1758). Both sightings were, however, promptly dismissed by establishment astronomers as unrelated to Halley’s comet (Fig. 30.16).

However, as shown by the Tychosium 3D simulator (Fig. 30.17), Halley’s comet would have been within the Sun’s orbit and visible from the Earth in mid-1757 and mid-1758. Messier and his fellow comet hunters were therefore entirely justified in believing that they had detected the approaching Halley’s comet in the two years preceding its closest passage in April 1759.

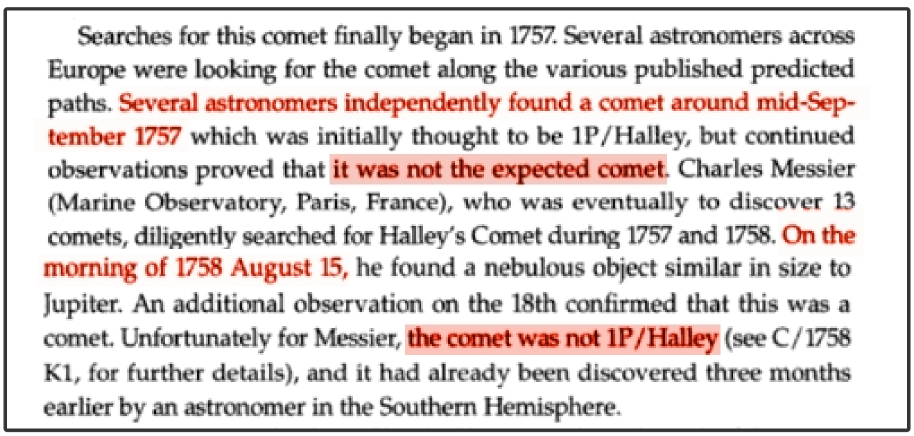

Searches for this comet finally began in 1757. Several astronomers across Europe were looking for the comet along the various published predicted paths. Several astronomers independently found a comet around mid-September 1757 which was initially thought to be 1P/Halley, but continued observations proved that it was not the expected comet. Charles Messier (Marine Observatory, Paris, France), who was eventually to discover 13 comets, diligently searched for Halley's Comet during 1757 and 1758. On the morning of 1758 August 15, he found a nebulous object similar in size to Jupiter. An additional observation on the 18th confirmed that this was a comet. Unfortunately for Messier, the comet was not 1P/Halley (see C/1758 K1, for further details), and it had already been discovered three months earlier by an astronomer in the Southern Hemisphere.

Fig. 30.16 In the two years preceding the officially sanctioned 1759 passage of Halley’s comet, two *“non-identified”* comets were observed in mid-September 1757 and mid-August 1758. Source: *“Cometography – A Catalog of Comets”*, by Kronk, Marsden, Meyer, Allan and Seargent (1999).

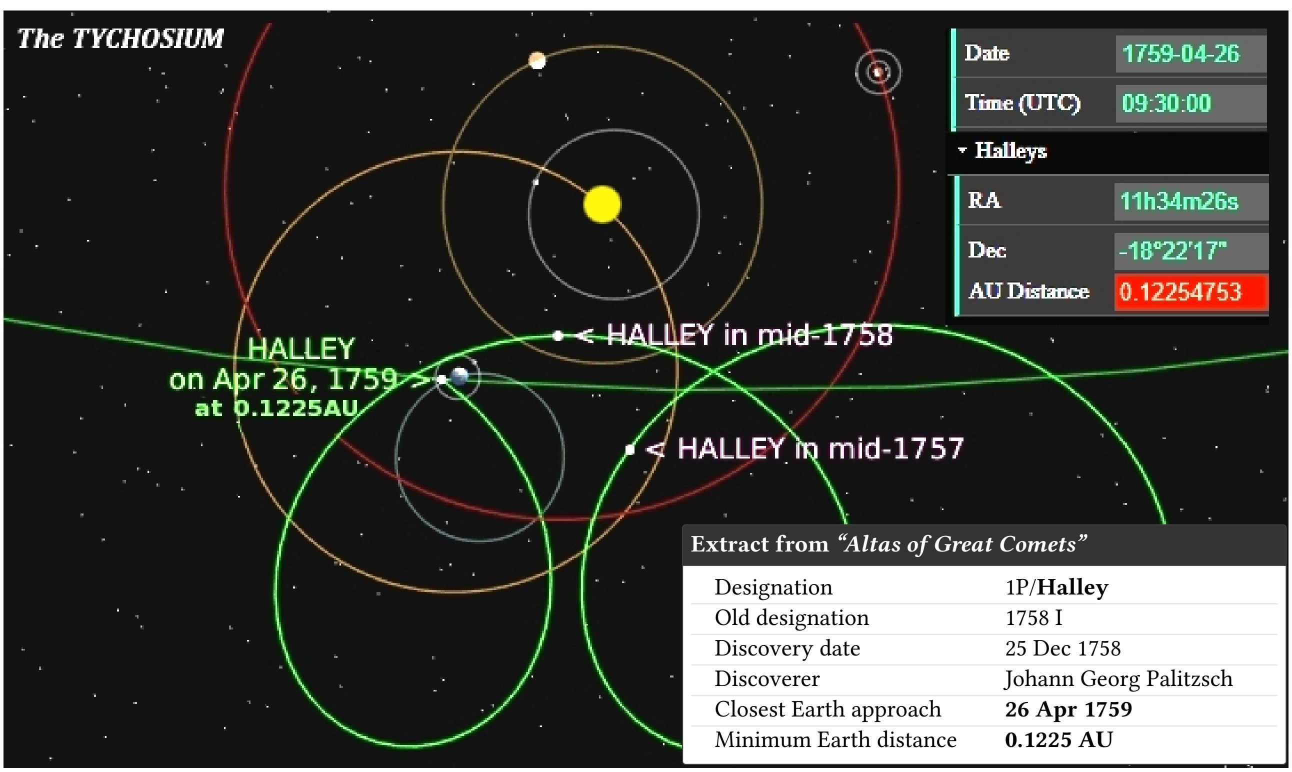


Fig. 30.17 Successive positions of Halley’s comet in 1757, 1758 and 1759.

Note that the Tychosium 3D simulator has Halley's comet passing closest to Earth on 26 April 1759, at 0.1225 AU, and that the *"Atlas of Great Comets"* also has it passing closest to Earth on 26 April 1759, at 0.1225 AU.

The attentive reader will sense where this is going. The coincidences are already piling up, with much more to come, but let us proceed one step at a time. Thus, 'two untimely comets' were observed in 1833 and 1834, only one and two years before Halley's officially sanctioned 1835 passage. For those who wish further details, the sightings of 1833 and 1834 are described in a French paper titled *"Sur les orbites des deux comètes de 1833 et 1834"* [24].

According to the Tychosium 3D simulator, Halley's comet made three successive perigee passages quite close to the Earth: 25 August 1833 (0.27 AU), 11 June 1834 (0.39 AU) and 11 April 1835 (0.44 AU). Each one was observed slightly later than the actual perigee dates, yet not one of them was recognized as Halley's comet. In fact, they are now known as 'Dunlop's comet' (1833), 'Gambart's comet' (1834) and 'Boguslawski's comet' (1835). The following analysis will show that, once more, we are dealing with misidentified sightings of Halley's comet, needlessly rebaptised.

30.5.3 Dunlop's comet of 1833

On 15 October 1833, 'Dunlop's comet' (C/1833 S1 Dunlop) was observed to transit in our skies at approximately 17h of RA [25]. On this same date, the Tychosium 3D simulator also has Halley's comet transiting at approximately 17h of RA. Interestingly, the most spectacular meteor shower in recent memory took place on 12 November 1833, making some people wonder if it was a sign of the end of the world [26]. Well, the Tychosium 3D simulator shows Halley's comet (or, if you will, 'Dunlop's comet') making its closest passage to the Earth in late August 1833, moving roughly towards Leo as it swept across our skies. Conceivably, its trajectory put its long tail on collision course with the annual Leonid meteor shower, causing that exceptional and memorable meteoric spectacle.

30.5.4 Gambart's comet of 1834

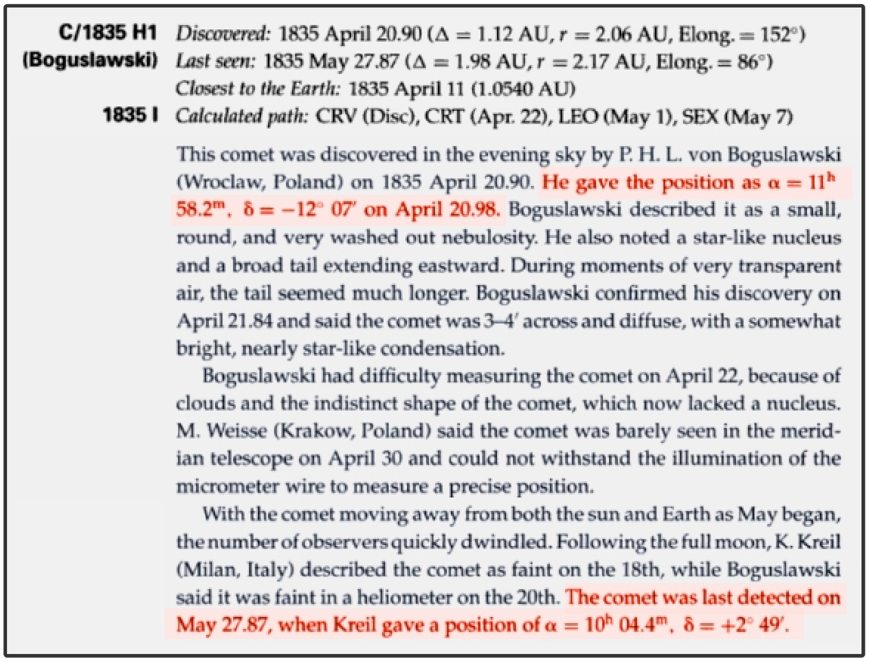
On 10 March 1834, 'Gambart's comet' (C/1834 E1 Gambart) was seen to transit at approximately 20h of RA [27]. On that same date, the Tychosium 3D simulator has Halley's comet transiting at approximately 21h of RA. Now, since both 'Dunlop's' and 'Gambart's' comets were observed to move in prograde direction (i.e., in the same direction as our planets), an 'early' sighting of comet Halley was ruled out. However, the Tychosium 3D simulator tells a different story: the three cometary sightings of 1833, 1834 and 1835 are perfectly consistent with Halley's trochoidal trajectory. Unsurprisingly, 'Dunlop's' and 'Gambart's' comets are today classified in astronomy textbooks as 'non-periodic', meaning they have supposedly only been observed once and no one knows if they will ever return. There could be no easier way of disposing of 'copernicidal' observations.

30.5.5 Boguslawski's comet of April 1835

According to official tables, Halley's comet transited at perihelion (closest to the Sun) in November 1835. Yet, the astronomer Ludwik von Boguslawski had observed a comet in April 1835. He was actually awarded a 'gold comet medal' for it:

> *Palm Heinrich Ludwik von Boguslawski, (1789-1851) was a Polish/German professor of astronomy and head of the observatory in Breslau. Boguslawski discovered a comet in April 1835 and calculated its course. For this he was awarded the first gold comet medal and the comet was named after him.* [28]

The Catalog of Comets (1800-1899) provides this precious description of the exact celestial positions of 'Boguslawski's comet'.



C/1835 H1 (Boguslawski) *Discovered:* 1835 April 20.90 ($\Delta = 1.12$ AU, $r = 2.06$ AU, Elong. = 152°)
Last seen: 1835 May 27.87 ($\Delta = 1.98$ AU, $r = 2.17$ AU, Elong. = 86°)
Closest to the Earth: 1835 April 11 (1.0540 AU)
1835 I *Calculated path:* CRV (Disc), CRT (Apr. 22), LEO (May 1), SEX (May 7)

This comet was discovered in the evening sky by P. H. L. von Boguslawski (Wroclaw, Poland) on 1835 April 20.90. He gave the position as $\alpha = 11^h\ 58.2^m$, $\delta = -12°\ 07'$ on April 20.98. Boguslawski described it as a small, round, and very washed out nebulosity. He also noted a star-like nucleus and a broad tail extending eastward. During moments of very transparent air, the tail seemed much longer. Boguslawski confirmed his discovery on April 21.84 and said the comet was 3–4′ across and diffuse, with a somewhat bright, nearly star-like condensation.

Boguslawski had difficulty measuring the comet on April 22, because of clouds and the indistinct shape of the comet, which now lacked a nucleus. M. Weisse (Krakow, Poland) said the comet was barely seen in the meridian telescope on April 30 and could not withstand the illumination of the micrometer wire to measure a precise position.

With the comet moving away from both the sun and Earth as May began, the number of observers quickly dwindled. Following the full moon, K. Kreil (Milan, Italy) described the comet as faint on the 18th, while Boguslawski said it was faint in a heliometer on the 20th. The comet was last detected on May 27.87, when Kreil gave a position of $\alpha = 10^h\ 04.4^m$, $\delta = +2°\ 49'$.

Fig. 30.18 Source: *“Cometography”*, Volume 2 (1800-1899), by Gary W. Kronk [29]

- On 21 April 1835 Boguslawski observed a comet transiting at 11h58min RA and −12°07′ DECL.
- On 21 April 1835 the Tychosium has Halley’s comet at 11h50min RA and −12°56′ DECL.
- ‘Boguslawski’s comet’ was calculated at the time to have passed closest to Earth on 11 April 1835.
- In the Tychosium 3D simulator, Halley’s comet transited closest to Earth precisely on 11 April 1835.

‘Boguslawski’s comet’ was never seen again. The reason should now be perfectly clear: it was, beyond all reasonable doubt, simply Halley’s comet appearing at the ‘wrong’ time and in the ‘wrong’ place. The screenshot in Fig. 30.19 shows how the Copernican astronomers Dunlop, Gambart and Boguslawski were all deceived by Halley’s comet.

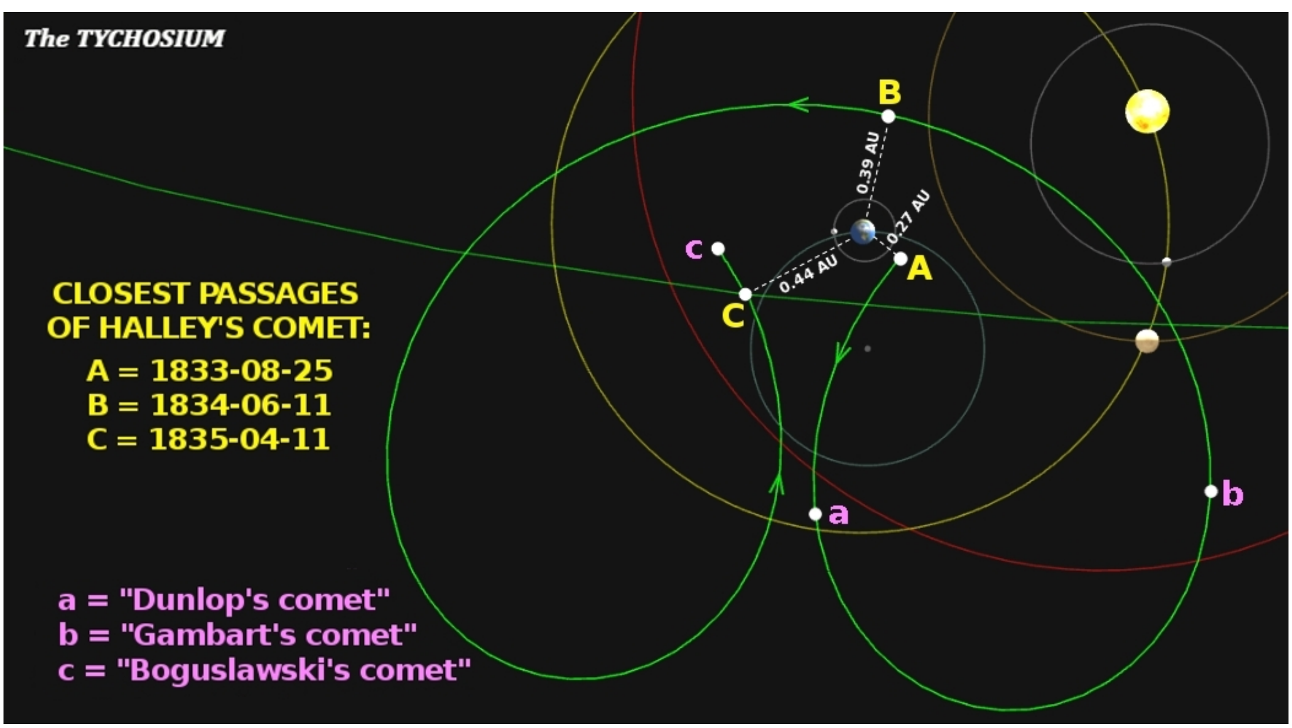


Fig. 30.19 The comets of Dunlop, Gambart and Boguslawski were none other than Halley’s comet.

The French and British astronomers of the time were all expecting Halley's comet to return in the month of November 1835—about 7 months after the sighting of 'Boguslawski's comet' in April 1835. This prognostication had attained a reasonable level of consensus, but not without lengthy academic debates and intricate calculi involving 'gravitational and non-gravitational perturbations' believed to significantly alter the comet's orbital speed. When Boguslawski reported the sighting of a large comet several months ahead of the official prediction, the scientific community was more than happy to name the 'new' comet after him. The same can be said of Dunlop's and Gambart's comets. Surely their calculations for Halley's return could not possibly be in error by more than two years! Be that as it may, if the laws of probability count for anything, the Tychosium 3D simulator provides highly compelling evidence that the three 'coincidental comets' were in fact Halley's comet.

30.5.6 Halley's 1910 passage

Halley's 1910 passage also caused quite a stir. The newspapers of the time ran terror stories about how the Earth would be enveloped by the comet's tail, which was thought to contain deadly hydrogen cyanide, leading to the extermination of mankind. A veritable worldwide panic ensued, similar in many ways to the modern pandemic scares instilled by the mainstream media corporations:

> *In 1910, Halley's Comet was due to pass close by Earth—and everyone from religious fanatics to news reporters stoked the fires of a global panic, believing it was the end of the world. [...] The scientific debate didn't stop less scrupulous people from taking advantage of the situation. Suddenly, anti-comet pills flooded the market. One promised to serve as an elixir for escaping the wrath of the heavens. Gas masks became best-sellers and some even bought up 'comet-protecting umbrellas'.* [30]

The 1910 transit of Halley's comet was preceded by telescopic observations of its approach in 1908 and 1909. This time around, some astronomers actually made drawings of the comet's observed path as it approached the Solar System. The graphic in Fig. 30.20 compares their illustration of Halley's approach in 1908 and 1909 to the trajectory traced by the Tychosium 3D simulator.

The Tychosium has Halley's comet passing between the Sun and the Earth at close distance (0.24 AU) on 19 May 1910, at about 4h of RA (in Taurus), in close agreement with its recorded position as documented in the astronomy annals. But, as usual, a 'coincidental comet' appeared a few months ahead of the expected passage of Halley's comet.

We shall now see that what astronomers refer to as the 'Great Daylight Comet' (or the 'Great January Comet of 1910') was, once again, none other than Halley's comet.

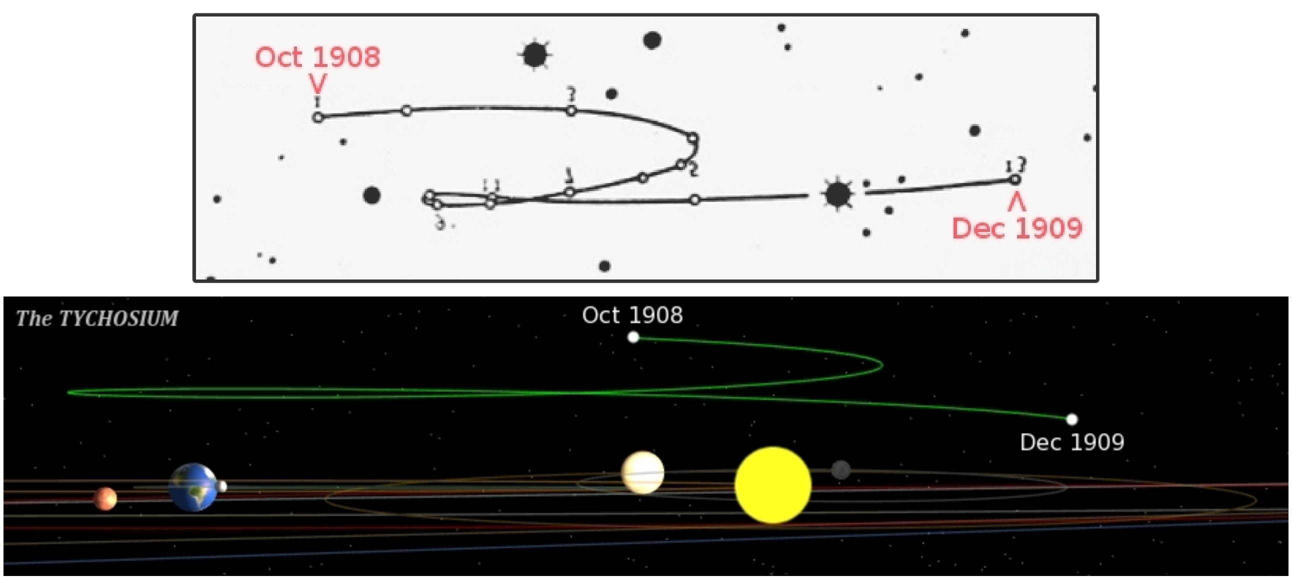


Fig. 30.20 Above: Image from *"The Popular Science Monthly"* [31] (January 1910).
Below: A screenshot from the Tychosium 3D simulator for comparison.

30.5.7 The Great Daylight Comet of 1910

The so-called 'Great Daylight Comet' or 'Great January Comet of 1910' (C/1910 A1) was observed only for a brief period of time during the second half of January 1910. It appeared at around 19h of RA and −21° of DECL, a position wholly incompatible with the officially expected path of Halley's comet. Despite the obvious similarity with Halley's comet, having spotted it in the 'wrong' place and at the 'wrong' time, astronomers concluded it must be an entirely different object passing through our solar neighbourhood by sheer coincidence:

> *The Great January Comet of 1910, formally designated C/1910 A1 and often referred to as the Daylight Comet, was a comet which appeared in January 1910. It was already visible to the naked eye when it was first noticed, and many people independently* discovered *the comet. At its brightest, it outshone the planet Venus, and was possibly the brightest comet of the 20th century. The comet brightened rather suddenly, and was initially visible from the southern hemisphere only. A number of individuals claimed* discovery, *but the comet is thought to have been first spotted by diamond miners in the Transvaal before dawn on January 12, 1910, by which time it was already a prominent naked-eye object of apparent magnitude −1.* [32]
>
> *In 1910, the world awaited the return of the famous Comet Halley in May. However, the unexpected arrival of a bright comet in mid-January created much fear and awe. Deemed the Great Daylight Comet of 1910, it was bright enough to be seen during the day and at its peak, was brighter than Venus. It began to fade away in early February, followed a few months later by the arrival of the fainter, but still significant, Comet Halley. When Comet Halley returned in 1986, many of the older people around the world who recalled seeing it in 1910 had clearly described the Great Daylight Comet of 1910 and not Halley. In 1985 Jack Butler, a Jiwarli man from the Henry River in Western Australia, told of a "star with a tail in the east" he saw early in the year 1910 as a child. The comet caused fear among the elder men who "questioned what it was". When the comet faded away, then men were confused and wondered where it had gone. According to Butler, the object he saw in 1910 was Comet Halley. However, the Great Daylight Comet of 1910 was prominent in the morning twilight, consistent with the "star with a tail in the east" visible early in the year. Therefore, it is probable that Butler was describing the Great Daylight Comet of 1910 rather than Comet Halley.* [33]
>
> *Great January Comet of 1910. The first people to see this comet—then already at first magnitude—were workmen at the Transvaal Premier Diamond Mine in South Africa on Jan. 13, 1910. Two days later, three men at a railway station in nearby Kopjes casually watched the object for 20 minutes before sunrise, assuming that it was Halley's Comet. Later that morning, the editor of the local Johannesburg newspaper telephoned the Transvaal Observatory for a comment. The observatory's director, Robert Innes, must have initially thought this sighting was a mistake, since Halley's Comet was not in that part of the sky and nowhere near as conspicuous. Innes looked for the comet the following morning, but clouds thwarted his view. However, on the morning of Jan. 17, he and an assistant saw the comet, shining sedately on the horizon just above where the sun was about to rise. Later, at midday, Innes viewed it as a snowy-white object, brighter than Venus, several degrees from the sun. He sent out a telegram alerting the world to expect "Drake's Comet"—for so "Great Comet" sounded to the telegraph operator. It was visible during the daytime for a couple more days, then moved northward and away from the sun, becoming a stupendous object in the evening sky for the rest of January in the Northern Hemisphere. Ironically, many people in 1910 who thought they had seen Halley's Comet instead likely saw the Great January Comet that appeared about three months before Halley.* [34]

Summarizing the information we have for this particular comet sighting:

- It was observed only for a couple of weeks, during the second part of January 1910, then faded out of sight, never to return again.
- It was quite low in our skies and was therefore only visible from locations in the southern hemisphere such as South Africa and Australia.
- It was seen to be gradually ascending in our skies and to move prograde. This, and the unexpected location in the sky, explains why astronomers promptly dismissed it as being Halley's comet.

As shown in Fig. 30.21, the Tychosium 3D simulator has Halley's comet passing in mid-January 1910 at ∼19h of RA and −20° of DECL, very close to the celestial location described by the eyewitnesses of the 'Great Daylight Comet'. For instance, Jack Butler in Australia would have seen Halley's comet *"in the east, in the morning twilight"*. It then gradually rose up in the sky and, as reported, became a stupendous object in the evening sky for the rest of January in the northern hemisphere. And, in fact, the Tychosium 3D simulator shows it ascending between January and May 1910, from about −20° to +20° of DECL. Clearly, due to their faulty understanding of cometary motions, heliocentric astronomers failed to realize that the 'Great Daylight Comet' and Halley's comet were the same object becoming visible at different moments during its transit through our system. Note that, as Halley's comet passed closest to Earth in May, it was transiting between the Earth and the Sun, on our 'daylight side'. Drowned by the Sun's glare, it was much less conspicuous in May than in January, if visible at all. So much so that the highly advertised and even dreaded passage in May turned out to be a great disappointment.

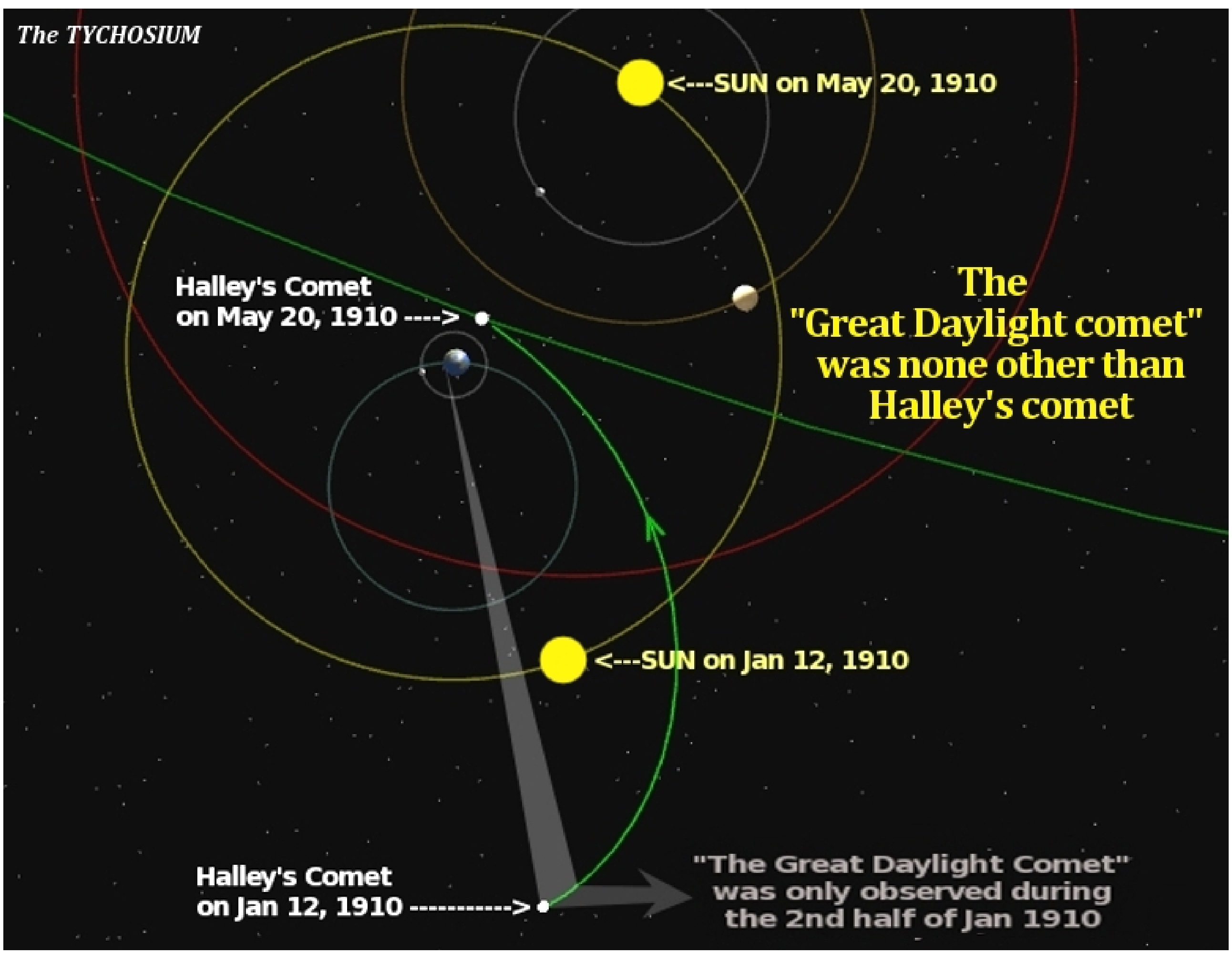


Fig. 30.21 Halley's path between 12 January and 20 May 1910, according to the Tychosium 3D simulator.

30.5.8 Machholz’s comet of 1985

The latest officially recognized passage of Halley’s comet around April 1986 was by all accounts a disappointment. The comet was barely visible to the naked eye and those who got a glimpse of it described it as a faint speck of light with a minuscule tail. Now, since the Tychosium 3D simulator has Halley’s comet also passing close to Earth about ten months earlier, one would think some observational astronomer had seen it around this time. And sure enough, Donald Machholz, an accomplished ‘comet hunter’, reported seeing a comet approaching Earth in May 1985. In fact, the object he observed now bears his name: C/1985 K1 Machholz.

> *Donald Edward Machholz, born October 7, 1952 in Portsmouth, Virginia, is an American amateur astronomer who is the leading visual comet discoverer, credited with the visual discovery of 12 comets that bear his name.* [35]

For some odd reason, this particular comet (C/1985 K1 Machholz) discovered by Machholz is nowhere to be found on the English-language version of the Wikipedia. Luckily though, it can be found on the Italian version and is reproduced below, in translation:

> *C/1985 K1 (Machholz) is a non-periodic comet discovered on 27 May 1985, the second comet discovered by US astrophile Donald Edward Machholz. According to the ephemeris, the comet was supposed to reach magnitude 4a to 5a between the end of June and the beginning of July 1985. In fact, the comet, which was very poorly positioned for observations as it was extremely close to the Sun, after being observed at 7.6a in the first half of June was no longer observed until four days before perihelion when it was observed in the infrared.* [36]

So let’s see: ‘Machholz’s comet of 1985’ eventually came extremely close to the Sun. It was expected to reach magnitude 4a to 5a (i.e., within naked-eye view, the threshold of which is around 6a), but this never happened. After being viewed telescopically at 7.6a in the first half of June, it disappeared from view and was only observed in the infrared spectrum a short while later. Note that ‘Machholz’s comet of 1985’ is classified as a ‘non-periodic’ comet, meaning it is not expected to return. So, was this just another ‘coincidental

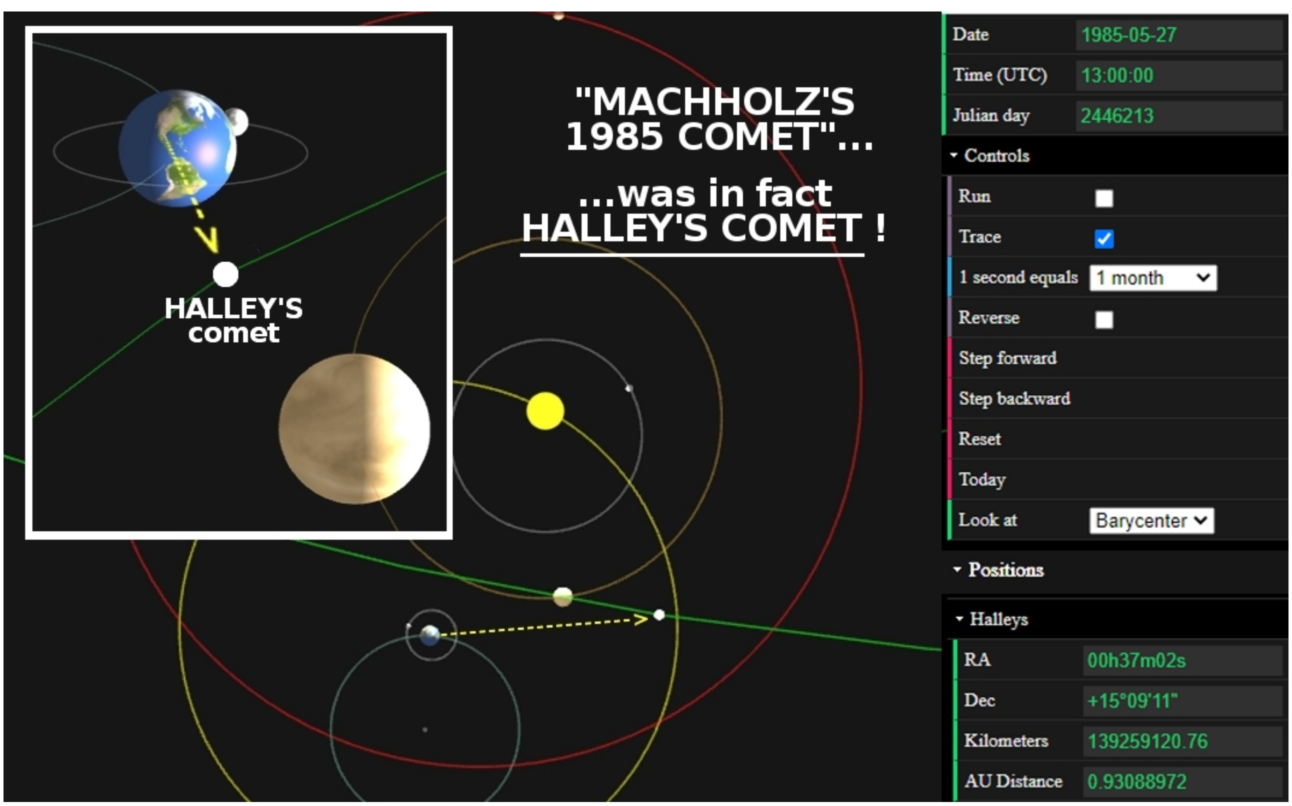


Fig. 30.22

comet' preceding Halley's comet, against all reasonable odds, or was it another act in the comedy of errors of Copernican astronomy?

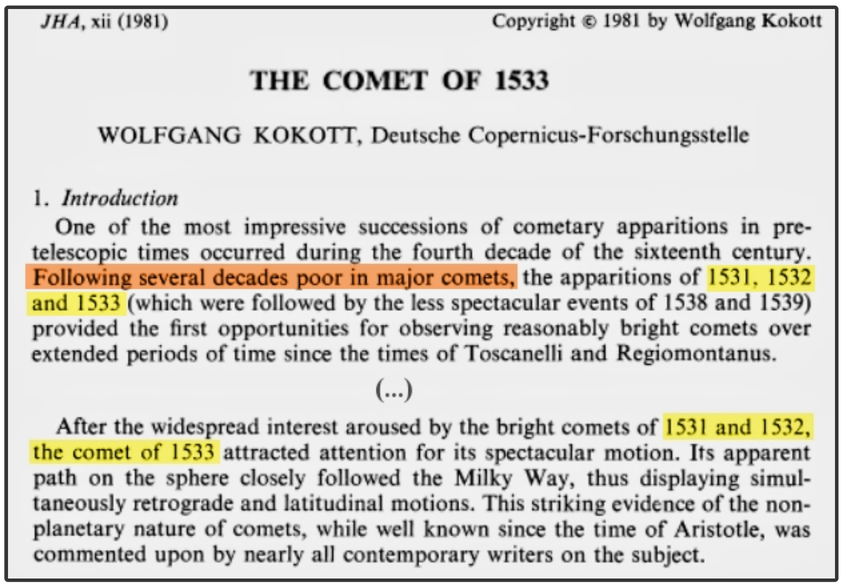
On 27 May 1985, Machholz saw the comet from a mountain called Loma Prieta, in California, using a home-made cardboard telescope. On that night, at about 4 am local time (13:00 UTC), he recorded the location as 0h49m of RA and +15°08′ of DECL. As shown in Fig. 30.22, on that very same date and time, the Tychosium 3D simulator has Halley's comet transiting at 0h37m RA and 15°09′ of DECL. Evidently, the comet 'Machholz' observed in 1985 was none other than Halley's comet.

So far, we have looked at comet Halley's transits between 1682 and 1986 and shown that the officially sanctioned transits were all preceded or followed by 'coincidental comets'. We will now go backwards in time, all the way to Antiquity, and investigate a number of documented passages of Halley's comet.

30.5.9 Halley's 1531 passage

Contemporary documents report the appearance of Halley's comet around the year 1531, and a paper by Wolfgang Kokott, an extract of which is reproduced in Fig. 30.23, mentions spectacular sightings in 1531, 1532 and 1533.

In Fig. 30.24, the Tychosium 3D simulator shows, once again, that Halley's comet did indeed make close approaches to Earth between 1531 and 1533.



JHA, xii (1981) Copyright © 1981 by Wolfgang Kokott

THE COMET OF 1533

WOLFGANG KOKOTT, Deutsche Copernicus-Forschungsstelle

1. *Introduction*

One of the most impressive successions of cometary apparitions in pre-telescopic times occurred during the fourth decade of the sixteenth century. Following several decades poor in major comets, the apparitions of 1531, 1532 and 1533 (which were followed by the less spectacular events of 1538 and 1539) provided the first opportunities for observing reasonably bright comets over extended periods of time since the times of Toscanelli and Regiomontanus.

(...)

After the widespread interest aroused by the bright comets of 1531 and 1532, the comet of 1533 attracted attention for its spectacular motion. Its apparent path on the sphere closely followed the Milky Way, thus displaying simultaneously retrograde and latitudinal motions. This striking evidence of the non-planetary nature of comets, while well known since the time of Aristotle, was commented upon by nearly all contemporary writers on the subject.

Fig. 30.23

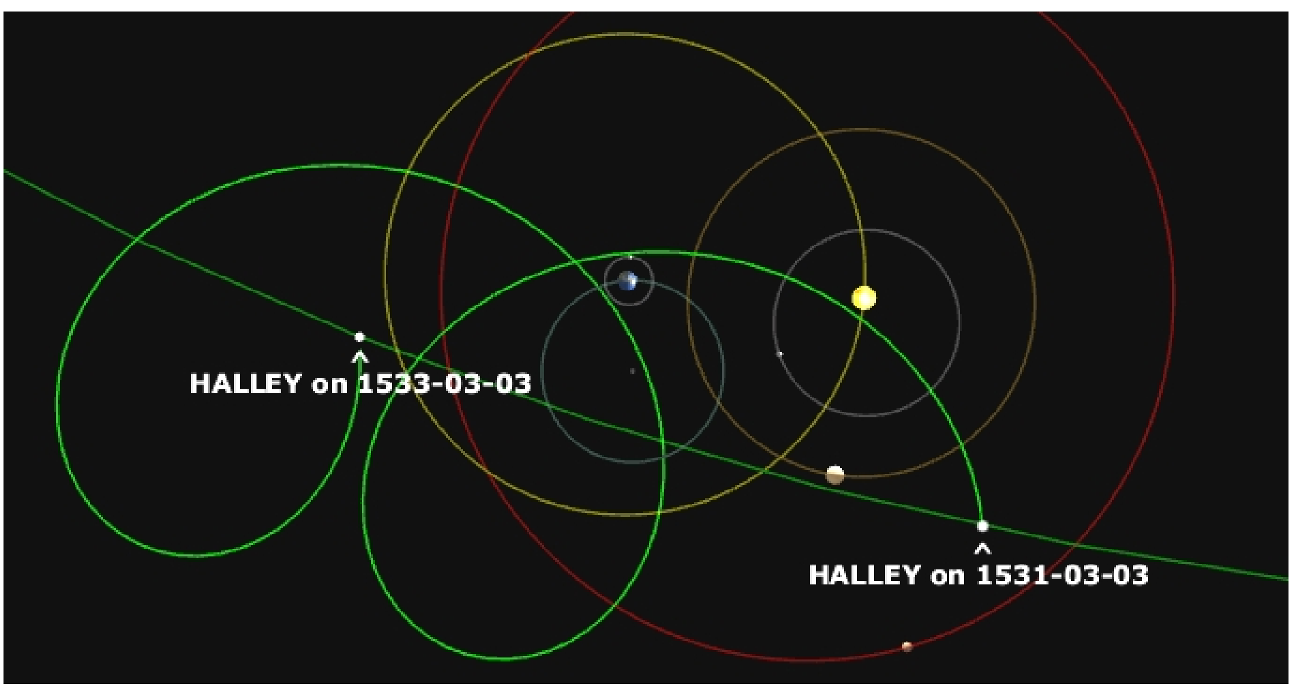


Fig. 30.24 Halley's comet would have been visible from the Earth between 1531 and 1533.

30.5.10 Halley's 1456 passage

Here's what we can read in a book titled *"Astronomical Enigmas"* (2005) by Mark Kidger, a former member of the IAU Commission for Physical Study of Comets & Minor Planets:

> *There was no bright comet in 1455, but Halley did notice that one was observed in 1456, which he suspected was his comet, although he did not calculate its orbit. Actually, besides the one in 1456, there were two bright comets in 1457 and another in 1458, which somewhat confused the issue [37].*

In Fig. 30.25, the Tychosium 3D simulator shows, once again, that Halley's comet may well have been observed multiple times between 1456 and 1458.

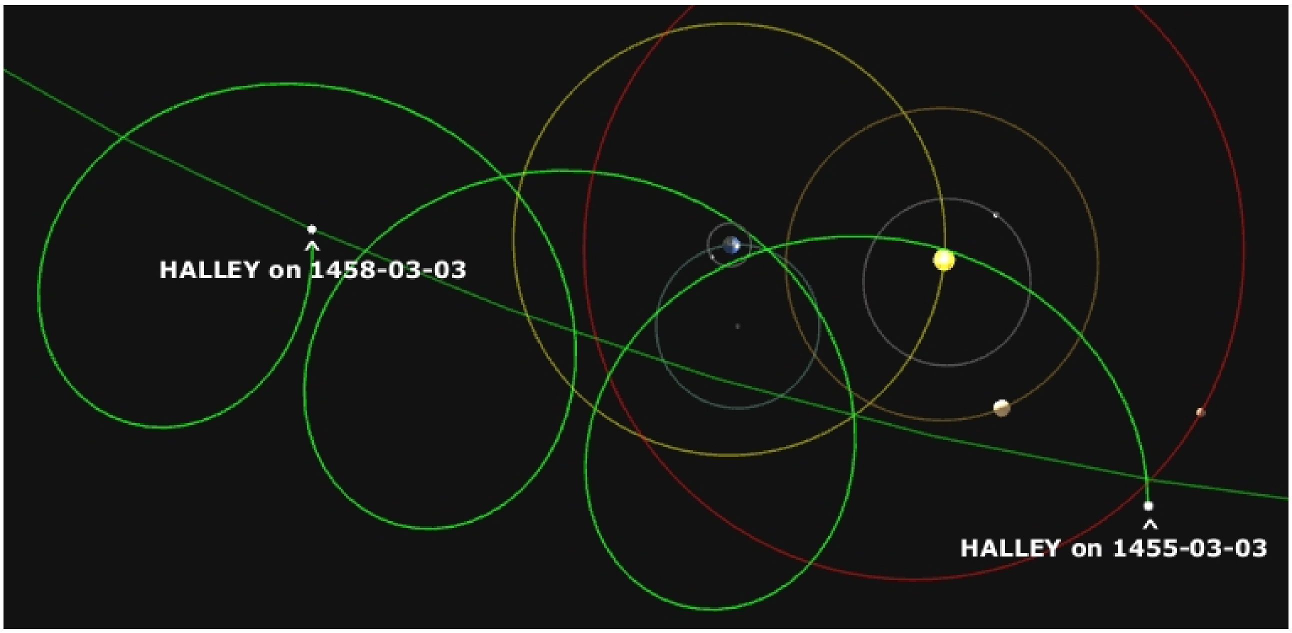


Fig. 30.25

30.5.11 Halley's 1380 passage

According to the official tables, Halley's comet passed close to the Earth in 1378. However, the catalogues of Alstédius and Lubienietski reported that *"two comets had also been observed in 1379 and 1380"* [38].

In Fig. 30.26, the Tychosium 3D simulator shows, once again, that Halley's comet would have been visible on several occasions between 1378 and 1380.

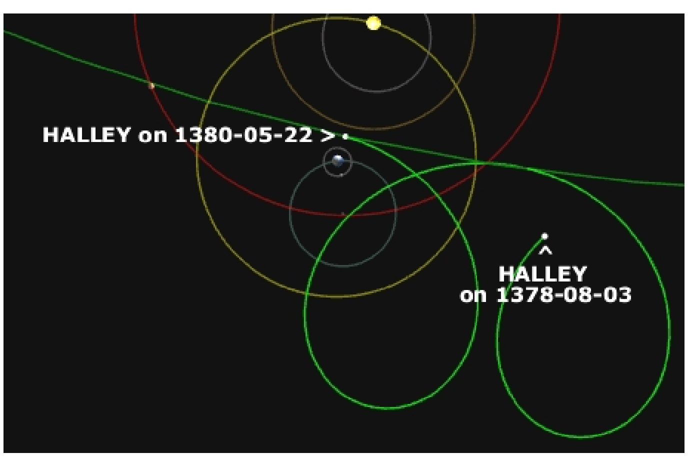
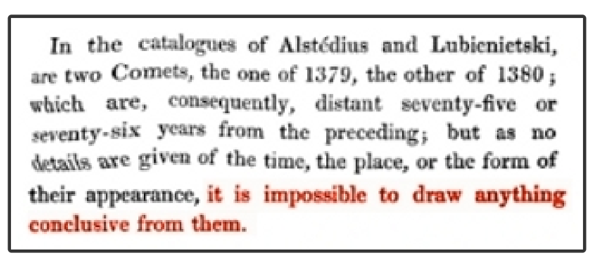


Fig. 30.26



In the catalogues of Alstédius and Lubienietski, are two Comets, the one of 1379, the other of 1380; which are, consequently, distant seventy-five or seventy-six years from the preceding; but as no details are given of the time, the place, or the form of their appearance, it is impossible to draw anything conclusive from them.

Fig. 30.27

30.5.12 Halley's 1305 passage

This one is a true oddball, since modern tables inexplicably now has Halley's comet passing in 1301. It is a veritable mystery why this most spectacular 1305 passage reported in scores of contemporary writings has now been erased from the official Halley roster in favour of the year 1301, in spite of the fact that Edmond Halley himself used the well-documented 1305 passage for his famed calculations of the comet's return. Moreover, dependable reports of a comet passing in 1301 are arguably absent from the astronomy literature. Instead, we have vague, popular conjectures that Italy's famous painter Giotto *"may have personally witnessed the comet in 1301"* and that this would have inspired him to depict the comet as the star of Bethlehem in his *"Adoration of the Magi"*, a painting completed in 1305!

As it is, two 'coincidental comets' were actually observed in February 1304 and in January 1305, yet neither was deemed to be Halley's comet.

> *The dating of Giotto's "Adoration" is unfortunately not exact so while the bright comet of February 1304 seems to be the most probable we cannot rule out the comet that reached perihelion in January 1305.* [39]

In Fig. 30.30, the Tychosium 3D simulator shows, once again, that Halley's comet did indeed make close approaches to Earth between 1304 and 1305. Much like in 1985/86, it was the second passage, in 1305, which was most visible from Earth, whereas the view of the comet was largely impeded by the Sun's glare in 1304. Also note that 1305 AD and 1986 AD are separated by 681 years (3 × 227, or 9 × 75.7).

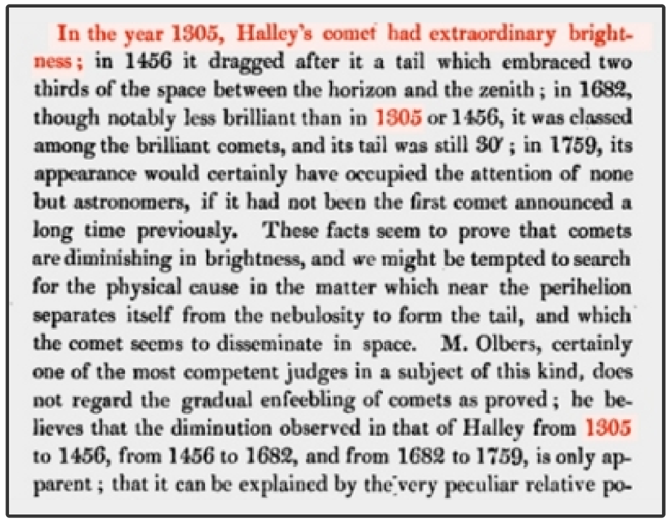
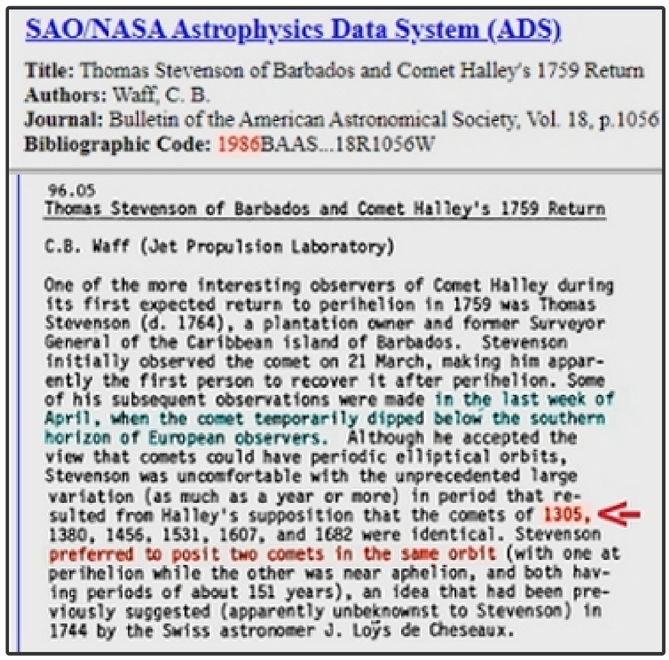

In the year 1305, Halley's comet had extraordinary brightness; in 1456 it dragged after it a tail which embraced two thirds of the space between the horizon and the zenith; in 1682, though notably less brilliant than in 1305 or 1456, it was classed among the brilliant comets, and its tail was still 30°; in 1759, its appearance would certainly have occupied the attention of none but astronomers, if it had not been the first comet announced a long time previously. These facts seem to prove that comets are diminishing in brightness, and we might be tempted to search for the physical cause in the matter which near the perihelion separates itself from the nebulosity to form the tail, and which the comet seems to disseminate in space. M. Olbers, certainly one of the most competent judges in a subject of this kind, does not regard the gradual enfeebling of comets as proved; he believes that the diminution observed in that of Halley from 1305 to 1456, from 1456 to 1682, and from 1682 to 1759, is only apparent; that it can be explained by the very peculiar relative po-

Fig. 30.28 Extract from the *Edinburgh Philosophical Journal* (1835).


SAO/NASA Astrophysics Data System (ADS)

Title: Thomas Stevenson of Barbados and Comet Halley's 1759 Return
Authors: Waff, C. B.
Journal: Bulletin of the American Astronomical Society, Vol. 18, p.1056
Bibliographic Code: 1986BAAS...18R1056W

96.05
Thomas Stevenson of Barbados and Comet Halley's 1759 Return

C.B. Waff (Jet Propulsion Laboratory)

One of the more interesting observers of Comet Halley during its first expected return to perihelion in 1759 was Thomas Stevenson (d. 1764), a plantation owner and former Surveyor General of the Caribbean island of Barbados. Stevenson initially observed the comet on 21 March, making him apparently the first person to recover it after perihelion. Some of his subsequent observations were made in the last week of April, when the comet temporarily dipped below the southern horizon of European observers. Although he accepted the view that comets could have periodic elliptical orbits, Stevenson was uncomfortable with the unprecedented large variation (as much as a year or more) in period that resulted from Halley's supposition that the comets of 1305, 1380, 1456, 1531, 1607, and 1682 were identical. Stevenson preferred to posit two comets in the same orbit (with one at perihelion while the other was near aphelion, and both having periods of about 151 years), an idea that had been previously suggested (apparently unbeknownst to Stevenson) in 1744 by the Swiss astronomer J. Loys de Cheseaux.

Fig. 30.29 Extract from a 1986 paper by C. B. Waff (NASA/JPL).

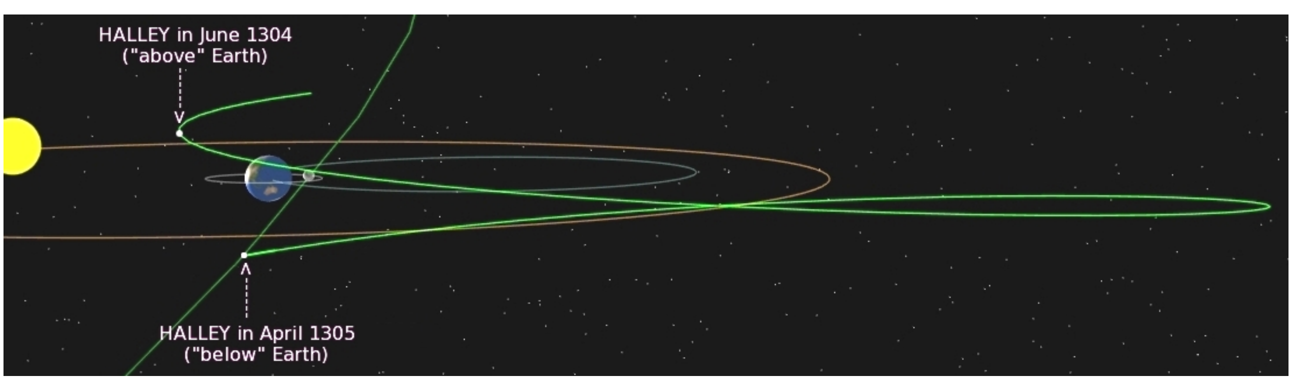


Fig. 30.30 Halley's "above and below" passages of 1304 and 1305.

We have now reviewed all 10 passages of comet Halley between 1305 and 1986 and shown that the Tychosium 3D simulator is not only in excellent agreement with all, but can also determine that the 'coincidental comets' observed a year or two before and after each officially sanctioned passage were none other than Halley's comet itself. We have also shown that there is nothing random or irregular about Halley's periodicity, which spans ~75.7 years. Using this stable and accurate periodicity provided by the Tychosium, we shall now boldly travel even further back in time and probe a number of fairly well-documented ancient records of cometary sightings against screenshots for the same dates.

30.5.13 Hipparchus' new star of 134 BC

In 134 B.C., Hipparchus noticed a star that he had never seen before in the constellation Scorpius. Unsure whether this was a new star or one that he simply hadn't noticed, he began to compile the first star catalog, showing the positions of the stars in the sky. [40]

Perhaps the best-known observational account by Hipparchus, considered the greatest astronomer of Antiquity, is this brief sighting of a 'new star'. Incidentally, this is reminiscent of the sighting of a supernova by the young Tycho Brahe, an event which triggered his interest in astronomy. Now, while most popular astronomy texts, such as the Wikipedia, will tell you that what Hipparchus observed in Scorpius in 134 BC was a supernova, a number of researchers believe it was most likely a comet:

The third-century historian Justin, however, makes it clear that the new "star" Hipparchus saw was actually a comet, a fact that is confirmed by Chinese annals for that year. [41]

The Chinese also observed a comet in 134 BC which they named *"the Standard of Tch'e-yeou"*:

There can, I think, be little doubt that the Standard of Tch'e-yeou, appearing in 134 B.C., was identical with the new star observed by Hipparchus and begotten in his age, as recorded by Pliny. The record of the observation follows a series of cometary observations, and this alone renders it probable that the new star at least resembled a comet. [42]

According to the Chinese annals, the 134 BC comet passed in June or July. Unfortunately, there seems to be no information in the astronomy literature regarding the month in which Hipparchus witnessed the appearance of the 'new star' in the Scorpius constellation.

30.5.14 Mithridates' comet of 135 BC

History books report that a giant comet appeared in the sky around 135 BC at the birth of Mithridates (or Mithradates), the 'king of kings' who opposed the Roman Empire. 'Mithridates comet' of 135 BC is said to have appeared in the constellation of Pegasus, having *"lit up the sky for 70 days"* [43].

Justin, in his c. 2nd-3rd century CE epitome, which was itself a summation of an earlier historical work by Pompeius Trogus dated sometime to the 1st century BC, claims that Mithridates' birth coincided with the passage of a comet through the sky which "lit up the sky for seventy days". [...] Justin makes the only mention of such a phenomenon in the literary sources on Mithridates, and for years it was assumed that the story of the comet was just a legend. As Ramsey, however, has shown, astronomical records from the Han Empire in China have confirmed the passage of a comet through the sky for the period of c. 135 BC and thus there may in fact be some factual basis behind Justin's account. [44]

Comet 135 B.C. (X/-134 N1), "Mithridates Comet"

In the opinion of modern-day cometologist Gary Kronk, this comet may have been one of the most spectacular of ancient times. From the records available to us, this opinion seems well founded.

Between August 31 and September 29 in the year 135 B.C., the Chinese record the appearance of a "long-tailed star" appearing in the east. They note that it remained visible for 30 days and that its tail stretched "across the heavens." Although this does not necessarily mean that it reached from horizon to horizon, it certainly implies a very great length that, as we shall shortly see, was also strongly hinted in the records of other ancient civilizations.

A later Chinese text records a long-tailed star in the year 134 B.C. (almost certainly the same comet misdated), and there also exists a report of a "sparkling star" from July 3 to August 1, 135 B.C., which may refer to earlier observations of the comet before its tail had become readily visible. As an indication of the reaction to the appearance of this comet, we may note an entry in a Chinese chronicle for the following year to the effect that the reign-period changed because of a comet!

Rome was the other ancient civilization to record a great comet about that time. Despite the tendency of some to differentiate between the Roman and Chinese comets, the chance of two such brilliant objects with unusually long tails appearing so close together in time seems too remote to be accepted without very good supporting evidence. Unfortunately, the existing Roman records all date from a time much later than the comet itself, and clearly depend upon earlier accounts that have since been lost.

Fig. 30.31 Source: *"The Greatest Comets in History"*, by David Seargent (1999). [45]

Take note of Seargent's acute remark: *"The chance of two such brilliant objects with unusually long tails appearing so close together in time seems too remote to be accepted without very good supporting evidence"*. Further details about the birth and conception of Mithridates are provided by historian John T. Ramsey:

> *The star appeared in the East, so brilliant that it seemed to rival the sun and set the night sky aflame. The luminous tail curved across a quarter of the heavens, as long as the Milky Way. The year was 135 BC. John T. Ramsey, a historian who studies ancient observations of celestial events, recently reexamined these independent Chinese observations of the comets to determine the years of Mithradates' birth and the beginning of his reign. Ancient Greek and Latin sources are inconsistent about the chronology of this period; the only secure date is the year of Mithradates' death in 63 BC. Ramsey's comparison of the Roman and Chinese astronomical details indicates that Mithradates was probably born in the spring of 134 BC (conceived in summer or autumn of 135) and was crowned king in about 119, when he was fourteen or fifteen. At least two Roman sources agree with the birthdate of 135/134.* [46]

So, we know from several sources that Mithridates was conceived in the summer or autumn of 135 BC and born in the spring of 134 BC, and that a blazing comet adorned the sky in 135 BC.

> *Chinese sources record the occurrence of a comet in 135 BC, the year of Mithridates' birth. This comet appeared in the constellation of Pegasus.* [47]

The Chinese records actually have two entries for comets observed in the year 135 BC. The first record states that it was observed *"in the west, in July 135 BC"*. The second record says it was observed *"in the east, in September 135 BC"* [48].

Summarizing the information we have for this particular comet sighting:

- A most spectacular comet was observed in the Pegasus constellation around mid-135 BC which *"lit up the sky for 70 days"*. Chinese annals report a comet *"in the west"* in July 135 BC.
- Chinese records also report a comet *"in the east"* around September 135 BC.
- Mithridates was, according to historian John T. Ramsey, probably born in the spring of 134 BC.
- Other Chinese records report a comet in July 134 BC.
- Hipparchus saw a comet (mistaking it for a new star) in the Scorpius constellation in 134 BC.

Let us now go to the Tychosium 3D simulator and see just where it places Halley's comet around the years 135 BC and 134 BC.

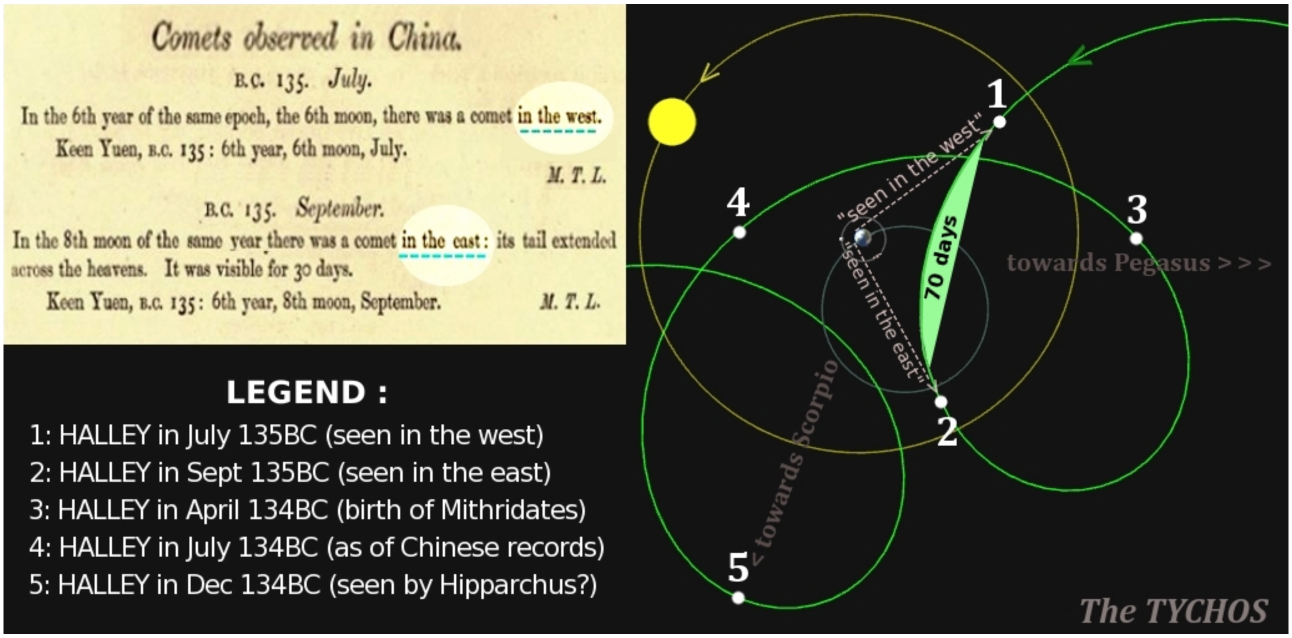


Fig. 30.32 Comets observed 135 BC and 134 BC in China.

Astounding, isn't it? The Tychosium 3D simulator can show Halley's comet transiting in the years 135 and 134 BC in as many as 5 celestial locations consistent with a wide variety of historical cometary observations and related literature! The agreement between all these relatively independent sources and the screenshot in Fig. 30.32 strongly corroborates the validity of the TYCHOS model and the accuracy of the simulator.

Note that the official roster of Halley's comet makes no mention of a passage anywhere near the year 135 BC, but only has it passing in 164 BC and 87 BC. Hence, this is the first demonstration of the identity between Mithridates' comet of 135 BC, Hipparchus' 'new star' of 134 BC, and Halley's comet. In fact, there are numerous problems with the current official 'European' roster of Halley's ancient passages. Most sightings have actually been cherry-picked from various Chinese annals covering sightings of different comets over the ages. The Russian revisionist historians A. T. Fomenko and G. V. Nosovskiy have performed a thorough analysis and critique of how these ancient Chinese records were made to fit the complex European computations of Halley's visits. Their paper, which has its own flaws and inaccuracies, is nevertheless a useful resource highlighting the problematic nature of the official roster, particularly with regard to Halley's passages prior to 1456.

> *This leads us to a very important conclusion. Taking into account all the above considerations, we must admit that the "Chinese saw-tooth curve" as the presumed recurrence cycle function of Comet Halley is manifestly false. It cannot possibly reflect the real sightings or the real trajectory of the comet. Therefore, it is either of a random nature, or a forgery, all in all, either premeditated or unwilled and resulting from "the very best intentions".* [49]

30.6 Other ancient, unidentified transits of Halley's comet

The following is a list of ancient cometary sightings reported in the literature which would seem to be in excellent agreement with the TYCHOS roster of Halley's transits, although not a single one of them is listed in the official 'European' roster.

⇒ 362 BC: *China, A broom star comet appeared in the west in 362 BC.* [50]

In the Tychosium 3D simulator, select the date −362-07-27 and activate Halley's comet in the "Planets" scroll-down menu. You will see that Halley's comet would indeed have appeared in the west that year, as seen from the Earth.

⇒ 209 BC: *Babylonian cuneiform tablet BM 45608 gives an account of a comet seen sometime within the 4th month of −209. A translation by Herman Hunger (1996) says it "appeared in the path of Ea in the region of Scorpius; it was surrounded by stars; its tail was toward the east."* [51]

In the Tychosium 3D simulator, select the date −209-04-27 and activate Halley's comet in the "Planets" scroll-down menu. Also, activate the Zodiac ring in the "Stars & helper objects" scroll-down menu. You will see that Halley's comet indeed passed very close to Earth on 27 April 209 BC, and that it was indeed in Scorpius on that date.

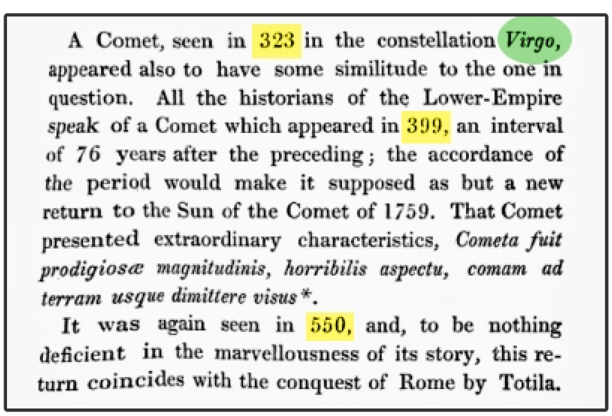
⇒ AD 245: *Halley-type comet 12P/Pons-Brooks (hereafter 12P) has been linked to observations dating back to 1385 A.D. and possibly, to observations in 245 A.D. (Green 2020a; Nakano 2020), making it the comet with the second longest observational arc of all known comets, after only 1P/Halley.* [52]

In the Tychosium 3D simulator, select the date 245-05-01 and activate Halley's comet in the "Planets" scroll-down menu. You will see that comet Halley passed very close to Earth on 1 May 245 AD. In other words, the documented comet of 245 AD referred to as '12/Pons-Brooks' was in reality Halley's comet, just as listed in the TYCHOS roster of Halley's transits.

⇒ AD 396: *A record from year 396 AD reports a comet and 'prior to this, a large yellow star'. This apparition was in summer and 'in winter… the large yellow star appeared again.' That the star is reported yellow might be due to atmospheric condition and positive omens but the initial position and date of re-appearance matches planet Venus. Of course, they were able to identify Venus but this mantic text uses 'a star' in an astrological way where the nature of the object is not at all important.* [53]

In the Tychosium 3D simulator, select the date 396-06-01 and activate Halley's comet in the "Planets" scroll-down menu. You will see that Halley's comet indeed transited between the Sun and Earth in the summer of 396 AD, as stated in the TYCHOS roster. Next, select the date 396-12-30. You will see that Halley's comet would indeed have been visible from the Earth in the winter of 396 AD.

323, 399 & 550 AD: Gustave de Pontécoulant was the top French expert of Halley's comet in his day. In his book *"A History of Halley's Comet"*, he mentions three comets *"seen in the constellation Virgo"* in 323, 399 and 550 AD [54]. (Fig. 30.33)



A Comet, seen in 323 in the constellation *Virgo*, appeared also to have some similitude to the one in question. All the historians of the Lower-Empire speak of a Comet which appeared in 399, an interval of 76 years after the preceding; the accordance of the period would make it supposed as but a new return to the Sun of the Comet of 1759. That Comet presented extraordinary characteristics, *Cometa fuit prodigiosæ magnitudinis, horribilis aspectu, comam ad terram usque dimittere visus**.

It was again seen in 550, and, to be nothing deficient in the marvellousness of its story, this return coincides with the conquest of Rome by Totila.

Fig. 30.33 Excerpt from *"A History of Halley's Comet"*, by Gustave de Pontécoulant. [54]

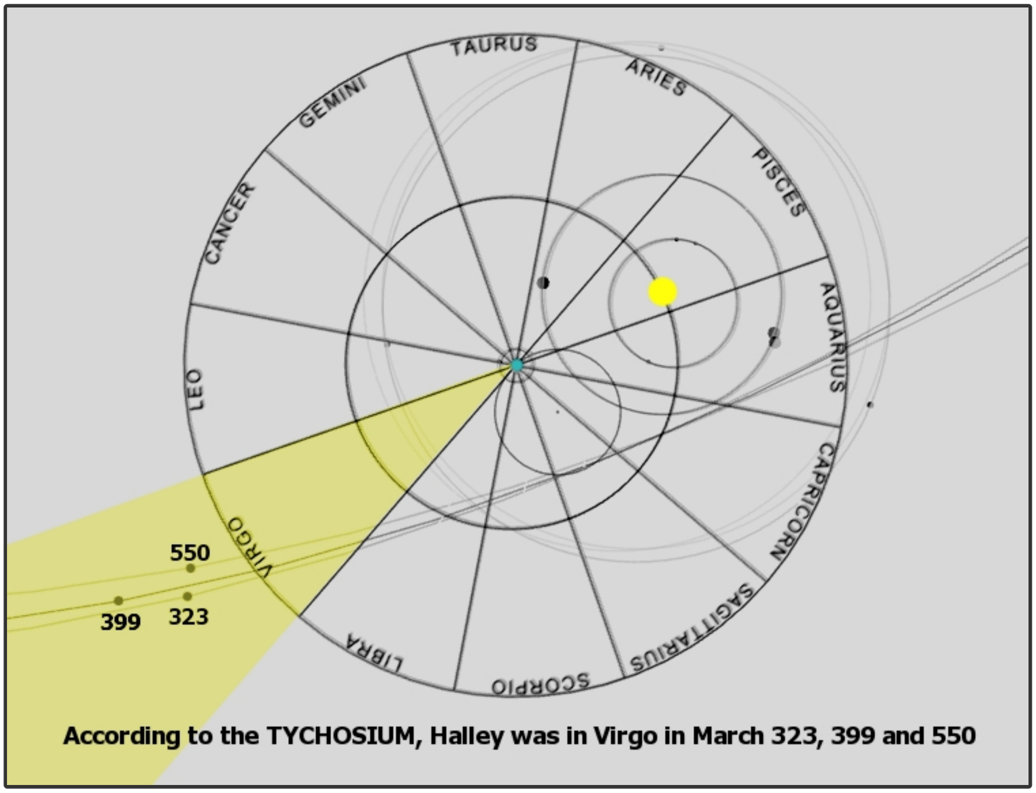


Fig. 30.34

In the Tychosium 3D simulator (Fig. 30.34), Halley's comet may be seen transiting in Virgo on 323-03-05, then on 399-03-05 and then again on 550-03-05. Note that, on all three occasions, the comet found itself in opposition to the Sun and would thus plausibly have been visible to the naked eye at night, despite its considerable distance from the Earth (>2 AU). Consider also that Halley's comet and its tail were considerably brighter and larger back in those days.

Again, note that none of these three passages are to be found in the current official roster, which has Halley's passing instead in 374, 451 and 530 AD. So which table of Halley's transits should we trust? Needless to say, I submit that the TYCHOS roster of comet Halley is hands down the winner. Why? Well, for one thing it manages to harmonize a regular 75.7-year periodicity with all the historical records of sightings examined in this chapter. But we are not done with the 'coincidences' yet. Let us now take a look at yet another double-transit of Halley's comet, this time in connection with a hotly debated carbon-14 spike event.

30.7 The mysterious carbon-14 event of 774-775 AD

Numerous separate studies can be found concerning an exceptional spike of carbon-14 levels around the years 774 and 775 AD. Over the last decade, researchers from diverse scientific disciplines have been vividly debating the possible causes of this peculiar and still unexplained phenomenon. The following excerpt from an article by Ethan Siegel is a good place to start, as it succinctly summarizes the controversial topic:

> *Every once in a while, science gives us a mystery that comes as a complete surprise. Typically, when we slice open a tree and examine its rings, we discover three different forms of carbon in each ring: carbon-12, carbon-13, and carbon-14. While the ratios of carbon-12 and carbon-13 don't appear to change with time, carbon-14 is a different story. Its abundance slowly decays with a half-life of a little over 5,000 years, with a typical variation of about 0.06% from year-to-year in the rings. But in 2012, a team of Japanese researchers were analyzing tree rings dating to the years 774/775, when they noticed an enormous surprise. Instead of the typical variations they were used to, they saw a spike that was 20 times larger than normal. After years of analysis, the unlikely culprit has finally been revealed: the Sun.* [55]

So the Sun would be responsible for the spike? Well, in actuality, there is no consensus about that. While some authors have concluded that *"large solar superflares remain very unlikely as the cause for the 14C increase in AD 774/5"*, others have suggested that the exceptional 14C-spike in the years 774/775 was the result of a cometary event. To get some perspective, here are some extracts from three academic studies:

> *Comet Encounters and Carbon 14.*
> *It is noted that the superflare from a large comet (comparable to C/Hale-Bopp) colliding with the sun could produce shock-accelerated GeV cosmic rays in the solar corona and/or solar wind, and possibly account for the C.E. 775 event. Several additional predictions of cometary encounters with the sun and other stars may be observable in the future. [...] Here we consider whether (1) a giant solar flare or (2) the close approach of a large comet to the sun could have occurred in the year 775, when the levels of 14C rose by 1.2% within a year or so (Miyake et al. 2012).* [56]

> *Excursions in the 14C Record at A.D. 774-775 in Tree Rings from Russia and America*
> *Abstract: Improved instrumentation has contributed to high-resolution (interannual) radiocarbon activity measurements, which have revealed sudden and anomalous activity shifts previously not observed at the common resolution of 5–10 years of most of the calibration scale. One such spike has been recently reported from tree rings from Japan and then again in Europe at A.D. 774–775, for which we report here our efforts to both replicate its existence and determine its spatial extent using tree rings from larch at high latitude (northern Siberia) and bristlecone pine from lower latitude (the White Mountains of California). Our results confirm an abrupt ~15‰ 14C activity increase from A.D. 774 to 776, the size and now the hemispheric extent of which suggest that an extraterrestrial influence on radiocarbon production is most likely responsible.*
>
> *A Cometary Event? In a recent paper, Liu et al. [2014] proposed that the 14C increase at A.D. 774-775 was caused by a cometary impact into the Earth's atmosphere. In their work, they observed a similar 15‰ excursion in corals about the same time.*
>
> *Conclusions: We have confirmed the A.D. 774–775 event in the 14C record at two additional locations, in the western United States and Russia. The amplitude of the event is very similar to previously reported results from Japan, Germany, and New Zealand. This emphasizes the global nature of this phenomenon and according to existing models, only a production-rate change could cause this type of event. The fact that the 14C signal is observed in five very different locations with exactly the same amplitude is remarkable in itself. The exact cause of the event is unclear, although a number of mechanisms have been proposed, all of which require an extraterrestrial origin. It appears then that the A.D. 774-775 event is the first unambiguous case of extraterrestrial enhancement of atmospheric 14C in the tree-ring record.* [57]

> *A Solar Super-Flare as Cause for The 14C Variation in AD 774/775?*
> *We present further considerations regarding the strong 14C variation in AD 774/5. For its cause, either a solar super-flare or a short gamma-ray burst were suggested. We show that all kinds of stellar or neutron star flares would be too weak for the observed energy input at Earth in AD 774/5. [...] We conclude that large solar super-flares remain very unlikely as the cause for the 14C increase in AD 774/5.* [58]

In other words, there appears to be no scientific consensus as to what exactly caused this exceptional radiocarbon spike of 774/775. Was it a cometary event? Was it a solar superflare? Or was it a 'short gamma ray burst', as has also been theorized? In any case, the cited studies appear to agree that the cause was extraterrestrial and all concur in dating the event to the years 774/775 AD.

The screenshot from the Tychosium 3D simulator shown in Fig. 30.35 illustrates the path of Halley's comet in the years 774 and 775. On 6 July 774, the comet made a close approach to Earth (0.38 AU) and on 19 April 775 it was exceptionally near our planet (0.097AU).

Note that, according to the official astronomy tables, Halley's comet would have passed by Earth about 15 years earlier, in the year 760 AD. Hence, no geophysical study has ever considered the possibility that the 'mysterious' spike of 14C levels in 774/775 could be related to the unusual proximity of Halley's comet.

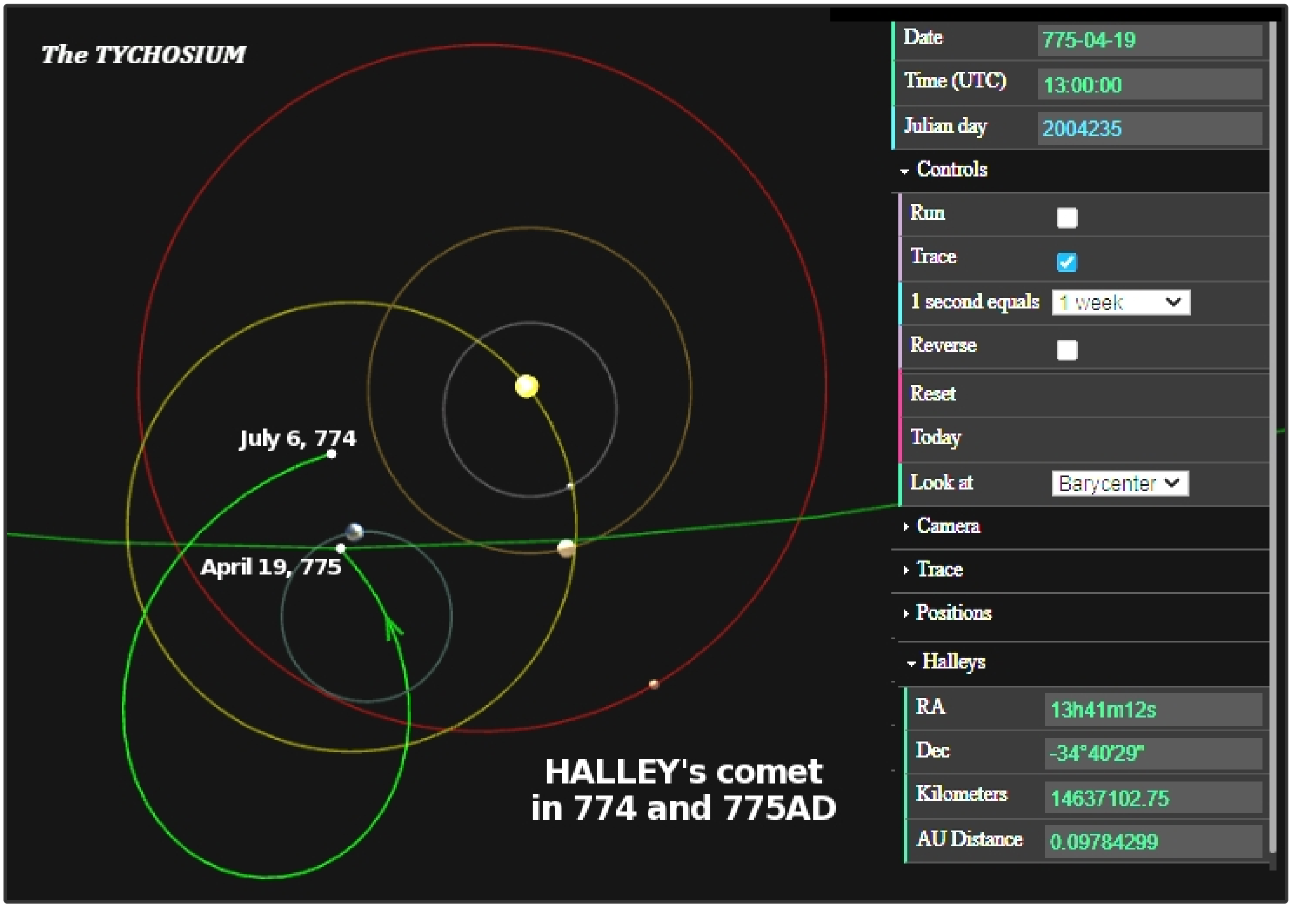


Fig. 30.35

30.8 Morozov's dating of the 'Apocalypse' (395 AD)

To wrap up this chapter, let us take a look at a fascinating study by the 'eccentric' astronomer and historical revisionist, Nikolai Morozov. Morozov's most compelling historical revision is to be found in a book from 1907 titled *"Revelation In Thunderstorm And Tempest. History of the Apocalypses Origin"*. The title of the German version translates as *"The Revelation to John: An Astronomic Historical Investigation"*.

Morozov makes the case that the Bible's Book of Revelation actually describes an apocalypse-like celestial event which must have occurred on 30 September 395 AD, on occasion of a solar eclipse. For a concise overview of how Morozov reached his conclusions, the Wikipedia is a good place to start [59]. In fact, it may be all you need to understand the 'revelation' I will make a little further on.

Morozov's thesis was initially harshly criticized by theologians and assorted academics, but over time astronomers have been probing his claims and have had to concede that, 'chrono-cosmologically' speaking, they are virtually incontrovertible:

> *The description within the Book of Revelation matches exactly the Constellation for the Julian date 30-9-395. [...]Sun, Moon and the 3 outer and 2 inner planets will produce 3.732.480 combinations within the 12 signs of the zodiac (125 $\times$ 5 $\times$ 3). Therefore, an accidental match is quite unlikely.* [59]

In other words, the peculiar positional configuration of our Sun, Moon and planets on that date, as described in the Book of Revelation, has only 1 chance in 3 700 000 of occurring! There can therefore be little doubt that Morozov's thesis and calculations rest on solid ground. However, as lamented by one of his fiercest critics, Morozov's interpretation of the Book of Revelation is leaving out significant details of the celestial metaphor. In a paper titled *"Pseudoscience and Revelation"* [60], reproduced in Fig. 30.36, Professor Bobrovnikoff points out that the famous Biblical text also mentions 200,000,000 horsemen and countless locusts that looked like horses. Bobrovnikoff thus mockingly asks whether there was, in addition to the solar eclipse and the quite remarkable planetary alignments of that day, also a meteoric shower to boot (*"and the stars of Heaven fell onto Earth"*). In short, Bobrovnikoff attacks Morozov for failing to account for the *"200 million horsemen"* mentioned in the Book of Revelation.

So, in the context of Morozov's literal interpretation of the Book of Revelation, what could the other striking celestial phenomena have been? Well, if we consult the Tychosium 3D simulator, we find that none other than comet Halley was hurtling across our skies on that day, having just made a most exceptional passage right above the Earth at only 0.2 AU in mid-August 395. A formidable spectacle must have played out in our skies on 30 September 395, what with a solar eclipse occurring just as Mars was transiting in opposition (i.e. very close to Earth) and Mercury, Venus, Jupiter and Saturn were all roughly located in the same portion of our skies where Halley's comet was 'releasing its 200 000 000 horsemen'! But, as wryly suggested by Bobrovnikoff, perhaps there was also a *"meteoric shower to boot"*. As you may recall from the section about 'Dunlop's comet', the most spectacular meteor shower in recent memory took place in November 1833 AD, making people wonder if it was a sign of the end of the world. Well, it so happens that the path of Halley's comet as it passed closest to Earth in the autumn of 1833 was near-identical to its path in the autumn of 395 AD, the two events being separated by 1438 years. Add to this the fact that, as it approached our planet in August 395, Halley's comet would have emerged with its blazing long tail resembling a great sword right in front of Mars which is traditionally associated with the god of war. The earthly observers who witnessed this fiery cosmic spectacle during a total solar eclipse must have thought the end had come, in the grandest possible style.

Note that, in the Tychosium 3D simulator, the celestial locations of all the planets and our Moon for that date are in excellent agreement with Morozov's calculated ephemerides. In fact, even Bobrovnikoff acknowledges the correctness of Morozov's computed positions for Jupiter, Mars, Mercury, Saturn and the Moon on 30 September 395 AD:

> *Morozov's reasoning is briefly the following: The procession of the four horsemen of the apocalyptic vision (Rev, 6:2) is taken to mean four planets which are identified mainly by the color of the horses; namely, the white horse of Jupiter, the red one of Mars, the black one with Mercury, and the pale one with Saturn. The constellations in which the planets were supposed to have been at the time of the vision were identified from the description of the riders. Thus Mercury was in Libra because the rider of the black horse had scales in his hand. Finally, the vision of "a woman clothed with the sun and the moon under her feet" (Rev. 12:1) is taken to mean an eclipse of the sun occurring when the sun was at the feet of the constellation Virgo. Approximate calculations showed that an eclipse of the sun on September 30, A.D. 395, would satisfy the assigned positions of the planets. Morozov's assignment of the planets to the corresponding constellations for that date was later confirmed by rigorous calculations carried out by two Poulkovo astronomers, Liapin and Kamensky.* [60]

Keep in mind that Halley's comet has been gradually shrinking over the centuries and was therefore a far brighter and impressive object in the past. To be sure, Morozov himself never suggested that those *"200 million horsemen"* might have been a celestial metaphor describing comet Halley's blazing tail (and very likely a fiery meteoric shower) since no conventional historical records exist of the famous comet visiting our Solar System anywhere near the year 395 AD (the official tables have Halley's comet passing in 374 AD and 451 AD). The TYCHOS model thus provides compelling 'cosmological support' to Morozov's thesis by effectively countering Bobrovnikoff's argument of the absent 'horsemen'.

SAO/NASA Astrophysics Data System (ADS)

Title: Pseudo-Science and Revelation
Authors: Bobrovnikoff, N. T.
Journal: Popular Astronomy, Vol. 49, p.251
Bibliographic Code: 1941PA.....49..251B

There are other horses in the vision which were overlooked by Morozov. There were 200,000,000 horsemen (Rev. 9:16) ; there were countless locusts that looked like horses (Rev. 9:7) ; there were the armies of the heaven on white horses (Rev. 19:14), and, above all, the Faithful and True sitting upon a white horse (Rev. 19:11) described very much in the same fashion as the horseman identified with the planet Jupiter. Are these also planets?[15]

The eclipse of the sun, which supplies the most exact date of the event, is not very convincing. "The sun became black as sackcloth of hair, and the moon became as blood," (Rev. 6:12). If the first part of this quotation is an adequate description of the solar eclipse, the second part describes just as well the eclipse of the moon. Do we have, then, a simultaneous eclipse of the sun and the moon with an earthquake and a meteoric shower to boot ("and the stars of heaven fell unto the earth") ? A little later when the fourth angel sounded, the third part of the sun and of the moon was darkened, and a third part of the stars (Rev. 8:12). Again, then, a partial eclipse of the sun and of the moon with something unheard of happening to the stars? Such passages should deter anybody from the attempt to take the apocalypse literally.[16]

Fig. 30.36 Source: *"Pseudoscience and Revelation"* by N.T. Bobrovnikoff (1941).

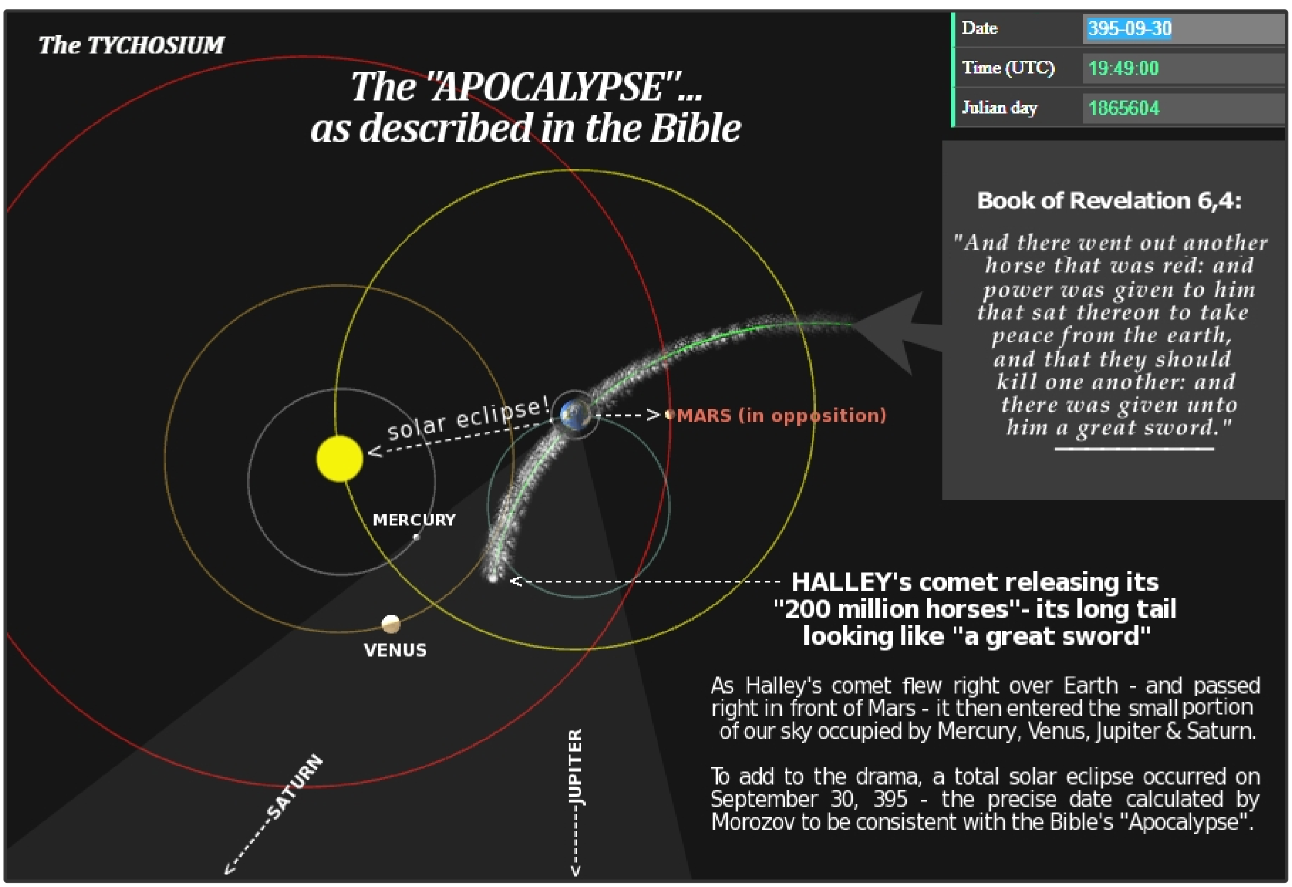


Fig. 30.37

30.9 Conclusive remarks

To my knowledge, no existing model of our Solar System other than the TYCHOS can rationally account for the behaviour of Halley's comet, as recorded throughout the centuries by scores of observational astronomers and historians. To be sure, Newtonian equations have proven to be wholly inadequate for computing Halley's appearances even in the modern era, as stated in a paper published in 2015 by the Cambridge University Press:

> *Numerical experiments have been made in an attempt to remove the residuals of P/Halley and link the seven apparitions from 1456 to 1910. All efforts to link more than two apparitions using Newtonian equations have invariably failed.* [61]

The paper goes on to say that anomalies found in the official ('European') roster of Halley's ancient passages *"can be made reasonable if the Chinese records are adopted in preference to the European records"*. In other words, our Copernican astronomers are openly admitting that they have been cherry-picking the cometary sightings in the extensive Chinese records that best suited their theories and computations. This sounds to me rather like the opposite of the scientific method!

I believe to have definitively demonstrated that Halley's comet has a constant and regular period of $\sim$75.7 years, much like all the other celestial bodies in our system. The notion of a cigar-shaped orbit with a period fluctuating by as many as 6 years has no place in astronomy. How the Newtonian 'universal law of gravitation' could possibly justify the starkly different orbital shapes of comets and asteroids is truly unfathomable. The TYCHOS model provides unassailable evidence that a large number of comets 'coincidentally' passing a couple of years before or after Halley's officially recognized transits were simply early or late appearances of comet Halley itself. Critics and opponents of the present research are welcome to try and argue that all these comets closely preceding or following Halley's transits were nothing but clusters of merry coincidences. However, from the outset it would give the distinct impression that the conclusion is more important than sound logic and facts.

This concludes the 2nd Edition of my book on the TYCHOS model. Five years of extensive research lie between this and the 1st Edition, released in 2018. I trust the new contents and discoveries will stimulate a sound and earnest debate among scientists and laymen willing to reexamine their lifelong beliefs. I am fully aware that my findings will ruffle a great many feathers; however, having grown a thick skin over the years, I will be enjoying every minute of what I expect to be a long and arduous journey, riddled with the inevitable scorn and ridicule that precede all inconvenient discoveries. Meanwhile, I will be confidently looking forward to the inevitable collective 'cosmo-logical' realization that we live in a binary system, similar to all the star systems that surround us. In any event, the heliocentric Copernican model is broken beyond repair and needs to be abandoned once and for all.

As I like to say: *"The TYCHOS is here to stay."*

30.10 References

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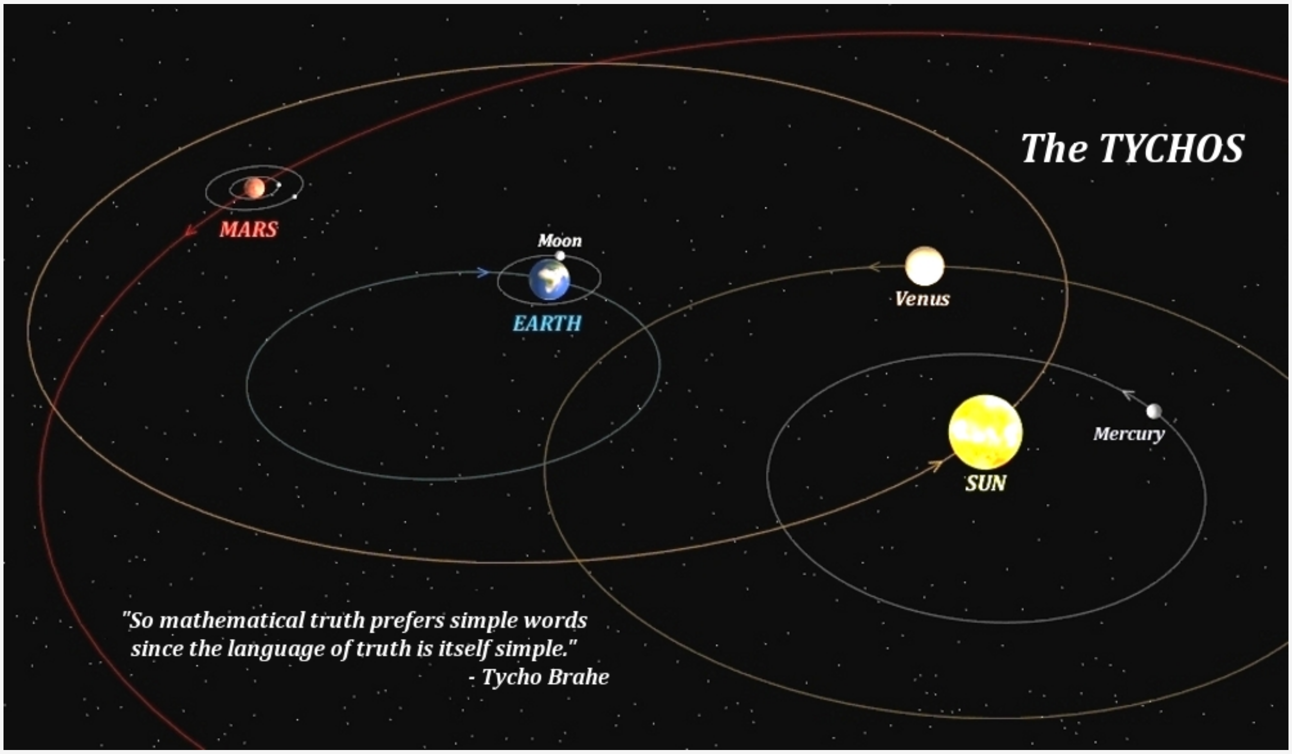
41 ENIGMAS SOLVED BY THE TYCHOS

It is a common misconception that the heliocentric model, as envisioned by Copernicus, Kepler and Galileo back in the 16th and 17th centuries and still staunchly defended by establishment astronomers, has by now been fully confirmed as the correct configuration of the Solar System. However, heliocentric physics and geometry are afflicted by recalcitrant inconsistencies and 'enigmas' which remain unsolved to this day, though rarely mentioned outside specialized circles. In fact, when questioned about it, most earnest astronomers and cosmologists will openly admit that many important empirical observations lack a minimally satisfactory explanation.

The TYCHOS model differs from the Copernican model in numerous important aspects, which confer on it a vastly greater explanatory power. The most important of these aspects is the local, barycentric orbit of the Earth, in this book referred to as the 'PVP orbit' in reference to the periodic shift in pole stars which occurs along the Great Year.

In this final chapter, we will review and summarize the main secular astronomical issues and puzzles resolved by the TYCHOS model as of the time of writing. If you have enjoyed exploring this book and think it deserves to be considered seriously and shared with laymen and experts alike, the checklist below may come in handy. Having come this far in the book, you will know that each item on the list has been exhaustively cross-verified with observational data produced over the centuries by renowned and committed astronomers.



1. **Our Sun has a binary companion**

   Some find the notion of a binary companion of the Sun highly exotic, but it would actually be far more sensible to ask why our Sun would lack a binary companion. We know today that the vast majority (quite possibly all) of the visible stars in our skies have local orbits intersecting with the orbits of one or more smaller companions around a common barycentre. The notion that the Sun is a rare exception to the rule—perhaps even the only exception—should set off alarm bells in the mind of any rational person. The TYCHOS model does away with this glaring aberration and exhaustively substantiates that Mars is the obvious binary companion of the Sun and that it regularly transits in the middle of Earth's PVP orbit. The latter accounts for the Earth's 'clockwise' equinoctial precession in the simplest manner imaginable (Chapter 2).

2. **Only Mercury and Venus have no moons**

   As stated in the Wikipedia entry on natural satellites, no moon is known to have subsatellites. In the TYCHOS model, Mercury and Venus are moonless simply because they are the moons of the Sun, not planets. This should come as no surprise: Mercury and Venus rotate around their axes at 'jogging pace' (10.93 km/h and 13.56 km/h, respectively), similarly to our Moon (16.65 km/h) and completely unlike planets (for example, Jupiter and Saturn rotate at 43000 km/h and 35000 km/h, respectively). Moreover, Mercury and Venus are tidally locked to the Sun, just like our Moon is tidally locked to Earth. That such a striking contrast between the Mercury/Venus pair and our planets could have gone unnoticed or remained undebated to this day is a mystery in itself (Chapter 3).

3. **Mars and the Sun exhibit 79-year cycles locked at a 2:1 ratio**

   Under the Copernican model, this little-known fact would have to be classified as a coincidence of the most implausible kind. Under the TYCHOS paradigm however, Mars and the Sun are binary companions and move in intersecting orbits. Therefore, a long-term resonance between their cycles is expected and perfectly coherent (Chapters 5 and 9).

4. **Planetary retrograde motions contradict the laws of perspective**

   Heliocentrists' explanation for our planets' periodic and irregular retrograde motions, a phenomenon that has puzzled astronomers for millennia, is directly contradicted by the most basic laws of perspective: if retrograde motions were caused by speed differentials between Earth and the other planets, producing a parallax effect, then the amount of a planet's retrograde motion in relation to the firmament should be greater the closer to Earth it is. Instead, the exact opposite is observed. The TYCHOS solves the enigma of retrograde motions through geometrically rigorous and empirically supported demonstrations of the dynamics of trochoidal loops (Chapters 5 and 29).

5. **Sirius A and Sirius B are proportionally identical to the Sun and Mars**

   This issue is more important than it might seem at first glance, and to offhandedly dismiss it as happenstance is not an acceptable argument in reasoned scientific discourse. In terms of size, the proportion between the Sun and Mars is practically identical to the proportion between Sirius A and Sirius B. Moreover, Sirius A-B is arguably a 'companion system' to our own Solar System. The idea is not new: over the last decades, it has been put forth by several independent research groups, supported by a host of compelling facts. The TYCHOS model makes it possible to reasonably envision the two binary systems (Sun-Mars and Sirius A-B) as a 'double-double' system, of which there are other well-documented examples in the universe. In such systems, the two pairs slowly revolve around each other over very extended periods (Chapter 6).

6. **Mars can line up with the same star in only 546 days**

   If you choose a star to align with Mars, on 7 successive occasions the alignment will occur after 707 days on average, but the 8th time around it takes only about 546 days. In the Copernican model, Earth is believed to be displaced laterally by about 300 million km in this same period and still align perfectly with

Mars and the chosen star, a patently absurd contention which is explained away by invoking the notion of 'unimaginable remoteness'. In the TYCHOS model, this 707/546-day variation in periodicity is the natural result of the peculiar trochoidal motion of Mars, as viewed from Earth (Chapter 7).

7. **Venus appears to rotate clockwise around its axis**

   In reality, Venus rotates counterclockwise, just like all the other components of our Solar System. The illusion of its apparent clockwise (or 'retrograde') rotation is upheld by the erroneous notion that Earth rotates around it in the course of its 1.6-year (584.4-day) synodic period. This is another case of confusion induced by the heliocentric frame of reference (Chapter 8).

8. **The orbits of Venus and Mercury are co-planar with the Sun's equatorial ecliptic**

   The Sun's polar axis is inclined at about 6° or 7° with respect to our ecliptic plane. This is a still unresolved enigma of astrophysics. The orbits of Venus and Mercury display the same inclination, a fact which can be verified in the Tychosium 3D simulator. This constitutes a very strong case for the notion that Venus and Mercury are the moons of the Sun, not planets (Chapter 9).

9. **The 7° axial tilt of the Sun, Mars, the Moon, and the Sirius system**

   The TYCHOS model provides a basis for the notion that this peculiar 7° obliquity, as seen from the Earth, is shared by components of our system and the Sirius binary system due to the 'double-double' binary configuration of the two systems (Chapters 6, 9 and 20).

10. **The Precession of the Equinoxes and the alternating north stars**

    The Precession of the Equinoxes (or 'General Precession') is the observed annual eastward drift of the entire firmament, as observed and documented since Antiquity. To explain the phenomenon, heliocentrists have resorted to the nonsensical lunisolar hypothesis which has the Earth 'wobbling' in the opposite direction of its axial rotation. No credible mechanism has been proposed for such an unphysical motion and recent research has roundly disproved it, leaving Copernican astronomy without a shred of explanation for this massively important phenomenon. In the TYCHOS model, the Precession of the Equinoxes is simply the optical effect of the Earth's snail-paced clockwise motion around the PVP orbit. During a complete 25344-year orbit, this motion causes the pole star to change from Polaris to Vega, and back to Polaris, hence the name 'PVP' (Chapter 11).

11. **The solar day is longer than the sidereal day but the solar year is shorter than the sidereal year**

    This well-known and empirically verifiable fact has still not been explained convincingly by Copernican astronomers. However, the conundrum is easily resolved by the TYCHOS, using simple math and geometry (Chapter 12).

12. **The Moon appears to be the 'central driveshaft' of the Solar System**

    Our Moon's 29.22-day true mean synodic period (TMSP) is reflected in almost exact integer multiples by all the components of our system. This would seem utterly mysterious under the heliocentric configuration. If the Moon were just one of many satellites revolving around the various planets in our system, why would its orbital period be harmonized with the orbital periods of all the planets? In the TYCHOS, all this becomes a far less mysterious affair: the Moon revolves around the Earth, near the barycentre of our Sun-Mars binary system. This places the Moon in a privileged central position, although the 'driveshaft mechanics' involved remains unexplored (Chapters 13 and 16).

13. **Our Moon lines up with the same star every 27.3 days**

    The heliocentric model has the Earth-Moon system hurtling around the Sun at the insane speed of 107226 km/h, allegedly covering a 70 million-km orbital section every 27.3 days. Yet, the Moon is inexplicably observed to reconjunct with any given star every 27.3 days. In the TYCHOS, there is no such riddle: the Earth-Moon system moves at 'snail pace' along the PVP orbit, covering a mere 1049 km every 27.3 days.

Remarkably, 27.3 days (the so-called 'Carrington number') is also the time employed by the Sun to rotate around its own axis (Chapter 13).

14. The Moon's oscillating perigees and apogees

The Moon oscillates from perigee to perigee (as it transits closest to Earth) by about 14036 km, and from perigee to apogee (as it transits farthest from Earth) by 42108 km (3 × 14036 km). These distances reflect Earth's annual motion (EAM) of 14036 km along the PVP orbit, thus providing spectacular support to the TYCHOS model's proposed orbital speed of the Earth. Moreover, while Copernican astronomers remain clueless, the TYCHOS fully explains the existence of the Moon's puzzling exeligmos cycle of 54.1 years (or 3 saros cycles of 18.03 years), corresponding to the time needed for the Earth-Moon system to cover a distance equal to the Moon's orbital diameter (Chapter 13).

15. The Moon appears to accelerate in relation to the Earth

This acceleration is an optic illusion which has long deceived mainstream astronomers due to their erroneous heliocentric perspective. In the TYCHOS model, the phenomenon is a fully expected corollary of the Earth-Moon system's 'snail-paced' motion around the PVP orbit (Chapter 14).

16. The largest meteor showers recur at regular annual intervals

The currently favoured explanation for recurring meteor showers is that they are caused by our planet crossing through dust trails left behind by various comets, every year at specific dates and locations, despite the fact that no comet is known to return on a yearly basis. The TYCHOS submits a much more rational and demonstrable explanation: the annual recurrences of large meteor showers coincide with the regularly intersecting orbital paths of the Sun and Mars (Chapter 15).

17. The 405-kyr cycle

As shown in the Tychosium 3D simulator, all the 'inner' bodies of the Solar System (Mars, Venus, Mercury and the Sun), with the exception of our Moon, are governed by a distinct and very stable 405500-year cycle, also identified by geologists, which makes them return to virtually the same place (ephemeris) in the sky by the end of this period. After two such cycles (405500 × 2 = 811000 years), the 'inner' bodies will obviously return to the same position, but this time around they will be joined by the Moon. The 811000-year mega cycle may also be the time required by our Solar System and the Sirius system to revolve around each other (Chapters 16 and 20).

18. The conjunctions of Jupiter and Saturn appear to be unequal or 'chaotic'

Hotly debated at the end of the 19th century, the 'Great Inequality' is the observed fluctuation of Jupiter's and Saturn's conjunctions. According to Newton's laws, this fluctuation would have Jupiter eventually crashing into the Sun, while Saturn would be driven away into the depths of space. The puzzle was never truly solved, despite the abstruse and convoluted claims to the contrary and all the fear it engendered. The TYCHOS, however, reveals that these apparently irregular Jupiter-Saturn conjunctions are a perfectly natural consequence of Earth's motion around its PVP orbit, and that our planets are not falling out of their regular orbits anytime soon (Chapter 17).

19. The orbital periods of Uranus, Neptune and Pluto support the TYCHOS model's tenets

The TYCHOS can demonstrate that the orbital periods of all the components of the Solar System are multiples of the Moon's synodic period, and therefore also exact multiples of the Sun's 1-year orbital period. The orbital periods of Uranus, Neptune and Pluto may appear to be exceptions because their respective periods are slighter shorter than integer years, but the difference disappears when the periods are adjusted for the optical effect of Earth's progression along its PVP orbit (Chapter 18).

20. The equinoctial precession appears to increase exponentially

The TYCHOS model provides a plain geometric explanation for this age-old, unresolved mystery. The rate of precessional increase is exponential because it is caused by two separate, cumulative components: the east-to-west lateral displacement of the Earth in relation to the stars, and the east-to-west secular rotation of Earth's equinox in relation to the stars (Chapter 19).

21. Mars' officially reckoned 'great cycle'

Since the orbits of the Sun and Mars are 'locked' in a 2:1 ratio, it is to be fully expected that the 'Great Year of Mars' (50688 solar years) would have twice the duration of the 'TYCHOS Great Year' of 25344 solar years (Chapter 19). It is in fact officially reckoned that Mars has a great cycle of approximately 51000 years.

22. Earth's rotation is believed to decelerate

Unaware of Earth's motion around its PVP orbit, heliocentrists are under the impression that Earth's rotation is decelerating. The TYCHOS can readily demonstrate, both geometrically and mathematically, that this is not the case. Using the wrong model of the Solar System inevitably leads to confusion and faulty conclusions (Chapter 19).

23. The 811000-year 'mega cycle'

It is officially estimated that the last reversal of the Earth's magnetic poles occurred roughly 800 thousand years ago. The TYCHOS model submits that this event may be related to the 'mega cycle', i.e., the time employed by the Solar System and the Sirius system to revolve around each other (811000 years) (Chapter 20).

24. The enormous disparity between the pole reversals of the Sun and the Earth

The Sun's magnetic pole reversals occur every 11.5 years on average, whereas the last reversal of the Earth's poles is estimated to have occurred about 781000 years ago. As viewed under the TYCHOS paradigm, this would seem to suggest that the polar reversals of the Sun and the Earth are commensurate with their respective orbital speeds: 107226 km/h and 1.6 km/h (Chapter 20).

25. The analemma and the need for the 'Equation of Time'

The asymmetric 8-shaped analemma traced by the Sun is caused by the trochoidal path travelled by the earthly observer during a full year. In the TYCHOS, this is referred to as 'a man's yearly path'. This motion required the adoption of the 'Equation of Time' to make earthly time-keeping feasible. The analemma may be viewed as a 'speedometer' since it can be shown to reflect our planet's orbital velocity of 1.6 km/h. Moreover, it directly falsifies the heliocentric explanation of the apparent solar (or earthly) accelerations and decelerations around the solstices. It makes no sense that the Earth would 'speed up' between June and July, when it is farthest from the Sun. Kepler's 'laws' of planetary motion, which stipulate that Earth should decelerate as it transits farthest from the Sun, are thus disproven by observation (Chapter 21).

26. The mysterious 137 number

In the TYCHOS model, for every diurnal rotation of the Earth, the Sun moves by a distance corresponding to 1/137 of the circumference of the Earth's PVP orbit. Physicists call this peculiar 1:137 ratio the 'fine-structure constant alpha' and many think it pervades the entire structure of our universe, at both micro and macro level. As a mere speculation, one could envision the Sun as playing the role of the 'electron' as it orbits around the 'nucleus' represented by the central magnetic field delineated by Earth's PVP orbit. Moreover, the observed minuscule variation of alpha is compatible with the daily motion of the Earth (Chapter 21).

27. ‘Stellar aberration’ as ‘ultimate proof’ of Earth’s revolution around the Sun

Though long falsified by ‘Airy’s failure’, Bradley’s theory of ‘stellar aberration’ is still regarded as ‘proof’ of Earth’s revolution around the Sun. The TYCHOS demonstrates that Bradley’s abstruse theory was accepted simply because the observed ‘looping’ motions of the stars were incompatible with the heliocentric paradigm. The appearance of looping motions is the result of the trochoidal path around which earthly observers revolve annually (Chapter 22).

28. The purportedly anomalous precession of Mercury’s perihelion

This non-existent anomaly in Mercury’s perihelion was ‘resolved’ by Einstein with his Theory of General Relativity, making him a world celebrity overnight. However, the TYCHOS model shows that the seeming 43″ annual discrepancy in Mercury’s perihelion is the corollary of falsely assuming that the Earth revolves around Mercury’s orbit. Once the heliocentric model is replaced with the TYCHOS model, which has the Sun-Mercury-Venus trio revolving around Earth, the purported anomaly simply disappears. There could be no simpler falsification of Einstein’s theory (Chapter 22).

29. Remote stars are clearly visible to the naked eye

Copernican astronomers estimate the distance to the stars based on what they believe to be Earth’s lateral displacement over a period of six months orbiting the Sun (∼300 million km). In the TYCHOS, however, the Earth does not orbit the Sun and only moves laterally by 7018 km in this same period. The ratio between these two parameters is 42633:1, meaning that the stars are many thousand times closer to us than the absurdly inflated official estimates. This is a quite plausible scenario, considering the ease with which stars ‘thousands of light years’ away can be seen. For example, Sirius and Jupiter subtend roughly the same angular diameter in the sky, but the former is believed to be 88000 times more remote than the latter. If this were true, Sirius would have to be 8834 times larger than our Sun. Likewise, we are expected to believe that the actual angular diameter of Vega, a first-magnitude star, is 622000 times smaller than the Sun’s—instead of 16 times smaller, as reckoned by Tycho Brahe—due to atmospheric distortions which would affect the stars only (Chapter 23).

30. The perceived speed of our Solar System in relation to the stars

Our entire Solar System is estimated to move at approximately 19.4 km/s in relation to the stars (or vice versa). Once more, the TYCHOS has a plain and simple explanation for this generally accepted parameter: 19.4 km/s is tantamount to 69840 km/h; if we divide 69840 by 42633 (the TYCHOS ‘reduction factor’), we obtain 1.638 km/h—almost exactly the orbital speed of Earth proposed by the TYCHOS. In fact, the evidence available from observational data is overwhelmingly supportive of Earth’s 1.6 km/h orbital motion (Chapter 23).

31. The Michelson-Morley experiments

The numerous interferometer experiments attempting to detect the supposed hypersonic motion of Earth are said to have produced ‘null results’ or to have failed entirely, thus confirming Einstein’s theories. However, on closer scrutiny, the velocities recorded by most of these experiments (especially those of Dayton Miller), though small, are certainly not ‘null’ and actually support Earth’s 1.6 km/h orbital speed, as proposed by the TYCHOS. Moreover, Michelson is even quoted as saying that he thought of the possibility that the Solar System as a whole might have moved in the opposite direction of the Earth. This is, of course, precisely what happens in the TYCHOS model, as Earth slowly revolves in the opposite direction of all of the other components of the system (Chapter 24).

32. The existence of negative and zero stellar parallax

If our planet were orbiting the Sun, as Copernicans claim, the parallax between nearby stars and remote stars would invariably be positive. Negative parallax would occur only if the Earth reversed direction, something no sane person has ever proposed. The problem is that only 25% of observed stellar parallaxes are positive, while 25% are negative and 50% are zero. This incontrovertible and highly ‘copernicidal’ fact is perfectly compatible with the TYCHOS model's geometry. Note that the TYCHOS model does not negate the vast amount of stellar parallax data gathered to this day; on the contrary, it provides—for the first time in the history of astronomy—a perfectly logical explanation for its observed distribution into positive, negative and zero values (Chapter 25).

33. The stars appear to be moving in two opposite streams

Based on painstaking observation, star statistician Jacobus Kapteyn put forth the remarkable thesis (now largely forgotten) that the stars can be segregated into two 'streams', moving in opposite directions. Likewise, French astronomer Ernest Esclangon detected a minute 'dissymmetry of space', but only during a semi-diurnal period (12 hours). Kapteyn's and Esclangon's puzzling findings actually support the TYCHOS model's tenets: as our planet moves along the PVP orbit at an almost imperceptible speed and curvature, the closest stars to our 'right' and the closest stars to our 'left' will exhibit opposite (positive vs negative) parallaxes in relation to the more distant 'fixed stars'. On the other hand, stars 'behind' and 'in front of' the Earth are not visually affected by our planet's motion, corresponding to the other, semi-diurnal period for which no dissymmetry is observed (Chapter 26).

34. The fallacy of elliptical planetary orbits and variable orbital speeds

Kepler himself admitted his theories of elliptical orbits and variable speeds could not be derived from observational data. They were simply mathematical devices necessary to make the heliocentric model 'work' and compensate for the optical illusion of dissymmetry. In the TYCHOS, all celestial bodies move in circular orbits and at constant speeds. Since they all revolve directly or indirectly around a barycentre occupied by Earth's PVP orbit, they will alternately find themselves on either side of our planet, giving rise to the hypothesis of elliptical orbits and variable speeds. Moreover, Kepler's and Newton's theories are mutually contradictory, a fact that has been largely ignored (Chapter 26).

35. The angular momentum problem

On the false assumption that the Sun needs 240 million years to complete a single orbit, heliocentrists estimate its angular momentum to be 0.3% of the total angular momentum of the Solar System. This is an embarrassing situation for them since it completely violates Newtonian physics. However, in the TYCHOS, the Sun has a local orbit of 365.25 days and a full cycle of 25344 years. When these parameters are used in the equation, the observed angular momentum of the Sun is within the limits of plausibility (Chapter 27).

36. The peculiar motions of Barnard's star

Barnard's star, the fastest-moving star in the firmament, displays a peculiar 4-month/8-month lateral oscillation in its apparent trajectory. The TYCHOS shows that, depending on a star's location, the annual trochoidal path travelled by any earthly observer ('a man's yearly path') will produce an illusory zig-zag pattern. No fanciful astrophysical theory is needed to explain what is merely the result of the peculiar trochoidal gyration of our terrestrial frame of reference (Chapter 28).

37. The minuscule retrograde periods of Eros

Under the heliocentric model, retrograde motions are said to be the result of Earth "overtaking" its fellow planets. Within this rationale, the closer the overtaken body is, the more it should be seen to retrograde. However, the retrograde period of the asteroid Eros, which passes much closer to Earth than Mars or Venus, is so short it is barely perceptible. In the TYCHOS model, no such contradiction exists: Eros has a minuscule retrograde period due to its peculiar heart-shaped trochoidal orbital pattern (Chapter 29).

38. Cigar-shaped cometary orbits

It was Isaac Newton who fathered the theory of extremely elongated elliptical cometary orbits, based on a case of mistaken identity: in 1680, Eros made a close approach to Earth shortly before the appearance of Halley's comet in another area of the sky. Newton thought they were the same object making a sharp U-turn, leading him to envision the orbit as cigar-shaped. Unfortunately, astronomers have been holding on to this unphysical notion ever since. Comets and asteroids are roughly of the same size and obey the same laws of motion, meaning that both have uniformly circular orbits and move at constant speeds. The TYCHOS provides unassailable evidence of this (Chapter 30).

39. **The 'chaotic' periodicity of Halley's comet**

Mainstream astronomers believe Halley's comet behaves 'chaotically', returning at intervals between 73 and 79 years, and dream up fantastical gravitational and non-gravitational forces to justify it. The Tychosium 3D simulator shows instead that Halley's comet has a regular period of 75.7 years, but becomes visible on multiple occasions during each transit, deluding comet hunters and leading them to rebaptise it many times over. The simulator sheds light on the passages of comet Halley over the past two millennia—and on the numerous misidentified 'coincidental comets' which have unfailingly appeared in adjacent years of our most famous comet's nearmost transits. Even hard-core sceptics will want to reconsider their 'cosmological' beliefs after examining the extensive evidence provided by the TYCHOS, based on the vast body of literature and observational records related to Halley's comet (Chapter 30).

40. **We can't feel the Earth rotating or orbiting**

The orthodox explanation as to why we cannot sense the Earth's axial rotation is quite correct: the Earth rotates at a constant speed and its rate of rotation is a mere 0.0007 rpm, which is far too little to produce a perceptible centrifugal force. On the other hand, the heliocentric claim that the Earth is hurtling around the Sun at the breakneck speed of 107226 km/h (90 times the speed of sound) has no scientific or experimental foundation whatsoever. As proposed by the TYCHOS model, our actual barycentric orbital speed is only 1.6 km/h, which is comfortably below the threshold of human sensory perception (Chapter 24).

41. **"Dark matter" and "dark energy" are entirely spurious concepts**

It is an undeniable fact that current astrophysical theories are stuck in an intractable crisis, spawned by the idea that the stars are formidably distant. Modern observations of our surrounding 'galaxies' (more likely particularly large and densely-populated binary systems) have shown that the orbital velocities of their various components would be formidably—and quite abnormally—fast; that is, as viewed under the 'sacred Newtonian and Einsteinian laws'. Since the latter would require much more mass to justify these humongous velocities, astrophysicists have come up with the idea that some sort of invisible 'dark matter' (that somehow only affects those distant galaxies yet not our own) is responsible for these 'inexplicable' orbital velocities. In the TYCHOS model, of course, the stars are 42633 times closer than currently believed. Hence, the orbital velocities observed in distant 'galaxies' (as interpreted by heliocentric astronomers) are grossly inflated.

Conclusion

All the astronomical puzzles and quandaries listed above find sensible and forthright answers when assessed within the TYCHOS paradigm and its proposed 1.6 km/h motion of Earth around its PVP orbit. In light of this, the TYCHOS model stands on solid ground, whereas Copernicus, Kepler and Galileo's heliocentric paradigm emerges as utterly untenable. It is often and correctly affirmed that a modern scientific theory must by definition be falsifiable, meaning that it must specify the type of empirical test or evidence required to refute it.

I believe to have met the criteria to roundly disprove the heliocentric model—and I am certainly not the first person to do so—so I now pass on the buck to the world's scientific community in the hope they will apply the same objective principles and honesty to the task of trying to falsify the TYCHOS model's tenets and impugn my interpretation of the vast volume of astronomical observations incorporated into the argumentation of this book.

I also believe to have duly observed an objective and respectful approach to the rigorous and indefatigable efforts of others; it would therefore seem fair that the contents of this book be granted a similarly careful appraisal and scientific inquiry.

Epilogue: may reason prevail

In light of the evidence presented in this book, I will venture to say that the TYCHOS model is more than just another 'alternative' cosmological theory. I am satisfied that it represents the most solid interpretation of the vast body of ancient and current astronomical observations available to mankind. These observations, gathered tirelessly over the centuries by lovers of science and wisdom, constitute the very foundation from which the TYCHOS model draws its logical conclusions. All I have done is to rearrange the pieces of a seemingly disjointed puzzle, using what was already there for everyone to see. My infinite respect and gratitude go to all the patient souls who dedicated their lives to the noble cause of understanding our surrounding cosmos. To name them all would fill several pages, so let me just symbolically tip my hat to Tycho Brahe whose widely snubbed yet formidably accurate observational opus is now well and truly resurrected.

It is a most unfortunate fact that Tycho Brahe's and Pathani Samanta's magnificent contributions to astronomy have been virtually obliterated from history in spite of their substantial accuracy and verifiable validity. The TYCHOS model emphatically revives and revalidates their lifetime efforts along with those of other industrious scientists whose work was misunderstood, belittled or merely ignored. The time has come to do them justice and to reassess the configuration of our Solar System with a fresh and earnest outlook.

For the last three centuries or more, modern Western civilization has identified with the world view of heliocentrism, despite its glaring contradictions and complete lack of empirical support. Man's place in the universe was made to change from central to peripheral, from meaningful to insignificant. The immediate physical perception of our centrality in relation to the Sun and the planets, the perfect order and stability of the celestial motions and the non-gargantuan size of the stars were negated by the Copernican paradigm, despite forceful objections from a number of judicious minds. Throughout the 17th century, at a time when the Tychonic world view was widely disseminated, the configuration of the Solar System was still open to vivid debate. However, along with the systematic promotion of Kepler, Galileo, Newton, Einstein and others to the rank of 'science heroes', and more recently the advent of 'space agencies' of make-believe hyper-technological prowess, the debate on fundamental issues capable of rocking the Copernican boat has become a no-no within mainstream academic institutions.

The fact of the matter is that the heliocentric edifice has begun to crackle and will inevitably collapse, as it should have long ago. Not even the most creative ad hoc hypotheses can keep the Copernican corpse fresh forever. The insufferable dogmatic attitude and instinct of institutional self-preservation preventing scholars and thoughtful laymen from openly discussing the stunning evidence amassed in this book is not doing a service to science or the common good. It is time to shake off the Copernican dust and the existential catastrophe anxiety and realize how privileged we are to be on this beautiful and unique planet cruising blissfully through space at the comfortable speed of 1 mph, embraced by the Sun-Mars binary system.

May reason prevail.

Appendix I

Table of Acronyms, Terms and Constants

TYCHOS: I gave the name 'TYCHOS' to my model of the Solar System in honour of Tycho Brahe's geo-heliocentric model, on which it is heavily based. The final 'S' stands for 'Simon' (my first name) since I humbly consider to have completed Brahe's unjustly sidelined work.

Tychosium: The interactive 3D simulator of our Solar System developed by IT-programmer Patrik Holmqvist and Simon Shack.

The PVP orbit: The local orbit of the Earth around the barycentre of our Solar System (Ø = 113 230 656 km; circumference = 355 724 597 km), so named because it causes our two polar stars to alternate, from Polaris to Vega and back to Polaris.

The PVP constant: The percentage ratio (0.00149326%) of Earth's orbital speed in relation to the Sun's orbital speed. The Sun travels at 107226 km/h in one direction, the Earth at 1.601169 km/h in the opposite direction.

TGY (TYCHOS Great Year): 25344 solar years. The time the Earth takes to complete one PVP orbit.

ACP: Annual Constant of Precession (51.1363 arcseconds). This is the TYCHOS-computed, true angular amount by which the stars are drifting eastwards in relation to the Sun each year, as a consequence of Earth's 1.6 km/h motion around its PVP orbit.

TMSP: Our Moon's True Mean Synodic Period (29.22 days). This is the TYCHOS-computed, true average synodic period of our Moon. The synodic periods of all our Solar System's planets are 'round' multiples of 29.22 days.

MVC: The Mean Variation Coefficient (0.8 km/h), representing the expected oscillation of the observed positions of all our surrounding celestial bodies caused by the slow and almost rectilinear displacement of the Earth in relation to the same.

Moon/moon: When capitalized, 'Moon' refers to the satellite of Earth. In lower case, 'moon' is any satellite of any celestial body. It should be kept in mind that, in the TYCHOS model, Venus and Mercury are moons.

AU: Astronomical Unit, corresponding to the average Earth-Sun distance (149 597 870.7 km, or roughly 149.6 Mkm)

RA: Right Ascension. Used in astronomy, RA is the celestial equivalent of terrestrial longitude.

DECL: Declination. Used in astronomy, DECL is the celestial equivalent of terrestrial latitude. The celestial sphere is divided into degrees, arcseconds, minutes or hours of RA (360° = 1 296 000 arcseconds = 1440 minutes = 24 hours = 1 full circle or revolution).

Sidereal period: A celestial body completes a sidereal period each time it aligns again with a given star.

Synodic period: A celestial body completes a synodic period each time it aligns again with the Sun.

Perigee: Closest transit point of a body with respect to Earth.

Apogee: Farthest transit point of a body with respect to Earth.

Perihelion: Closest transit point of a body with respect to the Sun.

Aphelion: Farthest transit point of a body with respect to the Sun.

Inferior conjunction: When a body (e.g. Venus) is aligned with the Sun while transiting closest to Earth.

Superior conjunction: When a body (e.g. Venus) is aligned with the Sun while transiting farthest from Earth.

Prograde: A celestial body is said to be in prograde mode when it moves in the same direction as the Sun.

Retrograde: A celestial body is said to be in retrograde mode when it moves in the opposite direction of the Sun.

Precession: Precession is another word for 'drift'. In astronomy, a celestial body is said to be precessing whenever it is observed to drift over time in relation to other celestial bodies. In the TYCHOS, the stars slowly precess over time in relation to the Sun (our 'timekeeper') as a consequence of Earth's motion. This stellar drift (traditionally called 'the Precession of the Equinoxes') is known today as the General Precession, since the entire firmament is observed to constantly drift eastwards in relation to the Earth's equinoxes.

Binary system: A system wherein two celestial bodies orbit around each other around a common barycentre. The TYCHOS posits that 100% of all star systems are binary. Supported by modern and ongoing discoveries, this hypothesis is gaining ground by the day. So far, more than 90% (and counting) of all visible star systems have been shown to have a binary or multiple configuration. More often than not, binary systems host additional bodies (moons, planets, asteroids) known as 'circumbinary bodies'.

Circumbinary: The term 'circumbinary' refers to the bodies (moons, planets, asteroids) orbiting around binary star systems.

Equinox: In astronomy, an equinox is either of two places on the celestial sphere at which the ecliptic intersects the celestial equator. It is the moment when Earth's rotation axis is directly perpendicular to the Sun-Earth line (currently around March 20 and September 23) when the longitude of the Sun is respectively 0° or 180°. In the TYCHOS, these two dates correspond to when the Earth's motion is pointing directly towards or away from the Sun.

Apsidal precession: The apsides are the orbital points farthest from (apoapsis) and closest to (periapsis) any celestial body, all orbits of which are eccentric (i.e., 'off-centre') to some degree in relation to the Earth. Over time, these apsides will precess against the background stars, as our entire Solar System revolves around the Sirius binary system.

Saros: The Moon's cycle of 18 years, 11 days and 8 hours. It can be used to predict eclipses of the Sun and the Moon

Exeligmos: The Moon's cycle of 54.1 years (19756 days), equivalent to three Saros cycles.

Metonic cycle: The Moon's cycle of approximately 19 years, named after Meton of Athens.

Callippic cycle: The Moon's 76-year cycle (equivalent to 4 metonic cycles), named after the Greek astronomer Callippus.

Evection: The variation of the Moon's ecliptic longitude (± 1.274°, with a period of about 31.8 days).

Appendix II

Physical parameters of the bodies in the Solar System according to the TYCHOS model

EARTH
Orbital Ø: 113 230 656 Mkm (the 'PVP' orbit)
Orbital circumference: 355 724 597 km
Diameter at equator: 12756.3 km
Equatorial circumference: 40075 km
Orbital speed: 1.601169 km/h or 0.000444 km/s (0.00149326% of the Sun's orbital speed)
Rotational period: 23 hours 56 minutes and 4 seconds (or 23.9345 hours)
Rotational speed: 0.0006963 rpm or 1674.36 km/h (40075 km / 23.9345 hours) at the equator
Earth moves daily by 38.428 km and by 14036 km each year (EAM)
Earth's annual motion (EAM) against the stars amounts to ~51.136 arcseconds
Earth completes 1 revolution (1 TGY) around its PVP orbit in 25344 years
(25344 × 51.1363636 [periodic] = 1 296 000 arcseconds, or 360°)

MOON
Orbital Ø: 763 095 km
Orbital circumference: 2 397 333.6 km
Diameter at equator: 3474.8 km (about 27.24% of Earth's Ø, 51% of Mars' Ø and 0.25% of the Sun's Ø)
Equatorial circumference: ~10920 km
Orbital speed: 3656 km/h (i.e., ~29.3 × slower than Sun's orbital speed of 107226 km/h)
Mean perigee: 363396 km
Mean apogee: 405504 km
Difference between mean perigee
and mean apogee: 42108 km (or 3 × 14036 km)
Closest perigee on record: 356375 km (4 Jan 1912)
Most distant apogee: 406720 km (predicted for 3 Feb 2125)
Average Earth-Moon distance: 381547.5 km
Rotational speed: 16.65 km/h (~10 × Earth's orbital speed and ~100 × slower than Earth's rotational speed)
The Earth-Moon distance is also approximately 10 × Earth's circumference of 40075 km
Rotational period: 27.322 days (same as sidereal period of 27.322 days, due to tidal lock)
Moon's True Mean Synodic Period (TMSP): ~29.22 days
Earth's orbital Ø versus Moon's orbital Ø: 113 230 656 km / 763095 km = 148.38343 : 1

SUN
Orbital Ø: 299 193 439 km
Orbital circumference: 939 943 910 km (2.6423 × Earth's PVP orbit)
Diameter at equator: 1 392 000 km
Equatorial circumference: 4 373 093 km
Orbital speed: 107226 km/h (or 29.785 km/s)
Perigee: 147.1 Mkm
Apogee: 152.1 Mkm
Average Earth-Sun distance : 149.6 Mkm (1 AU)
Rotational speed: 6675 km/h (~1/16 of its own orbital speed and ~4 × Earth's rotational speed)
Rotational period (around own axis): ~27.3 days (similar to the Moon's 27.322-day sidereal period)
1 arcsecond of the Sun's displacement as viewed from Earth = 725.265 km

MARS

Orbital Ø: 456 800 000 km
Orbital circumference: 1 435 079 524 km (1.52677 × Sun's orbit or 4.034 × Earth's PVP orbit)
Diameter at equator: 6792.4 km
Equatorial circumference: 21339 km
Perigee: 56.6 Mkm (or near-exactly the PVP orbit's radius of 56.615 Mkm)
Apogee: 400.2 Mkm (average Mars-Earth distance: 228.4 Mkm)
Perihelion: 206.6 Mkm
Aphelion: 250.2 Mkm
Average Mars-Sun distance: 228.4 Mkm
Rotational speed: 891.55 km/h (1.88 × slower than Earth's rotational speed).
Mars revolves once around the Sun in 686.9 days, or almost exactly 365.25 days × 1.88)
Rotational period (around its axis): 23.9345 hours, the same as Earth
Perihelion cycle: current official estimate: 51000 years (or approx. 2 × 25344)

VENUS

Orbital Ø: 216 400 000 km
Orbital circumference: 679 840 650 km
Diameter at equator: 12103.6 km
Equatorial circumference: 38024.5 km
Perigee: 38.2 Mkm
Apogee: 261 Mkm
Average Venus-Earth distance: 149.6 Mkm (or 1 AU)
Perihelion: 107.48
Aphelion: 108.94
Average Venus-Sun distance: 108.2 Mkm
Note: 108.2 Mkm + 5 Mkm (Sun's perigee/apogee difference) = 113.2 Mkm (i.e. Ø of Earth's PVP orbit)
Rotational speed: 13.56 km/h (about 18.6% slower than our Moon)
Rotational period (around its axis): 116.88 days, or 2805.12 hours

MERCURY

Orbital Ø: 115 818 454 km
Orbital circumference: 363 854 404 km
Diameter at equator: 4879.4 km
Equatorial circumference: 15329 km
Perigee: 77.3 Mkm
Apogee: 221.9 Mkm
Average Mercury-Earth distance: 149.6 Mkm (or 1 AU)
Perihelion: 46.0 Mkm
Aphelion: 69.8 Mkm
Average Mercury-Sun distance: 57.9 Mkm
Rotational speed: 10.93 km/h (about 19.4% slower than Venus)
Rotational period (around its axis): 58.44 days or 1402.56 hours

PHOBOS

Orbital Ø: 18756 km
Time of orbit around Mars: 459 minutes (7.65 hours)
Diameter: ∼22.2 km (27×21.6×18.8)
Orbital circumference: 58923.66 km
Orbital speed: 58923.66 / 7.65 hours = 7702.44 km/h

DEIMOS

Orbital Ø: 46918 km
Time of orbit around Mars: 1818 minutes (30.3 hours)
Diameter: ∼12.6 km (10×12×16)
Orbital circumference: 147397.11 km
Orbital speed: 147397.11 km / 30.3 hours = 4864.6 km/h

JUPITER
Orbital Ø: 1 557 140 000 km (13.752 × Earth's PVP orbit diameter)
Orbital circumference: 4 891 899 584.6 km
Diameter at equator: 142984 km
Orbital period: 12 years (or 4383 days, or 105192 hours)
Jupiter's orbit is 5.204 × larger than the Sun's orbit

SATURN
Orbital Ø: 2 853 332 844 km (25.2 × Earth's PVP orbit diameter)
Orbital circumference: 8 964 009 501 km
Diameter at equator: 120536 km
Orbital period: 30 years (or 10957.5 days, or 262980 hours)
Saturn's orbit is 9.536 × larger than the Sun's orbit

URANUS
Orbital Ø: 5 744 920 000 km (50.73 × Earth's PVP orbit diameter)
Orbital circumference: 18 048 198 467.5 km
Diameter at equator: 51118 km
Orbital period: 84 years (or 30681 days, or 736344 hours)
Uranus' orbit is ∼19.2 × larger than the Sun's orbit

NEPTUNE
Orbital Ø: 8 990 120 000 km (79.39 × Earth's PVP orbit diameter)
Orbital circumference: 28 243 294 946.9 km
Diameter at equator: 49528 km
Orbital period: 165 years (or 60266.25 days, or 1 446 390 hours)
Neptune's orbit is ∼30 × larger than the Sun's orbit

PLUTO
Orbital Ø: 11 812 760 000 km (104.32 × Earth's PVP orbit diameter)
Orbital circumference: 37 110 880 034.6 km
Diameter at equator: 2374 km
Orbital period: 248 years (or 90582 days, or 2 173 968 hours)
Pluto's orbit is ∼39.5 × larger than the Sun's orbit

EROS
Orbital Ø: 436 194 115 km (3.85 × Earth's PVP orbit diameter)
Orbital circumference: 1 370 344 227 km
Size: ∼16.84 km (34.4 × 11.2 × 11.2 km)
Orbital periods: 1.76 years.
Perigee to perigee cycle: 81.1 years
Eros' orbit is 1.4579 × larger than the Sun's orbit

HALLEY'S COMET
Orbital Ø: 5 009 994 136 km
Orbital circumference: 15 739 360 772 km
Size: 15 × 8 km
Orbital period: 75.692 years
Halley's orbit is 16.745 × larger than the Sun's orbit