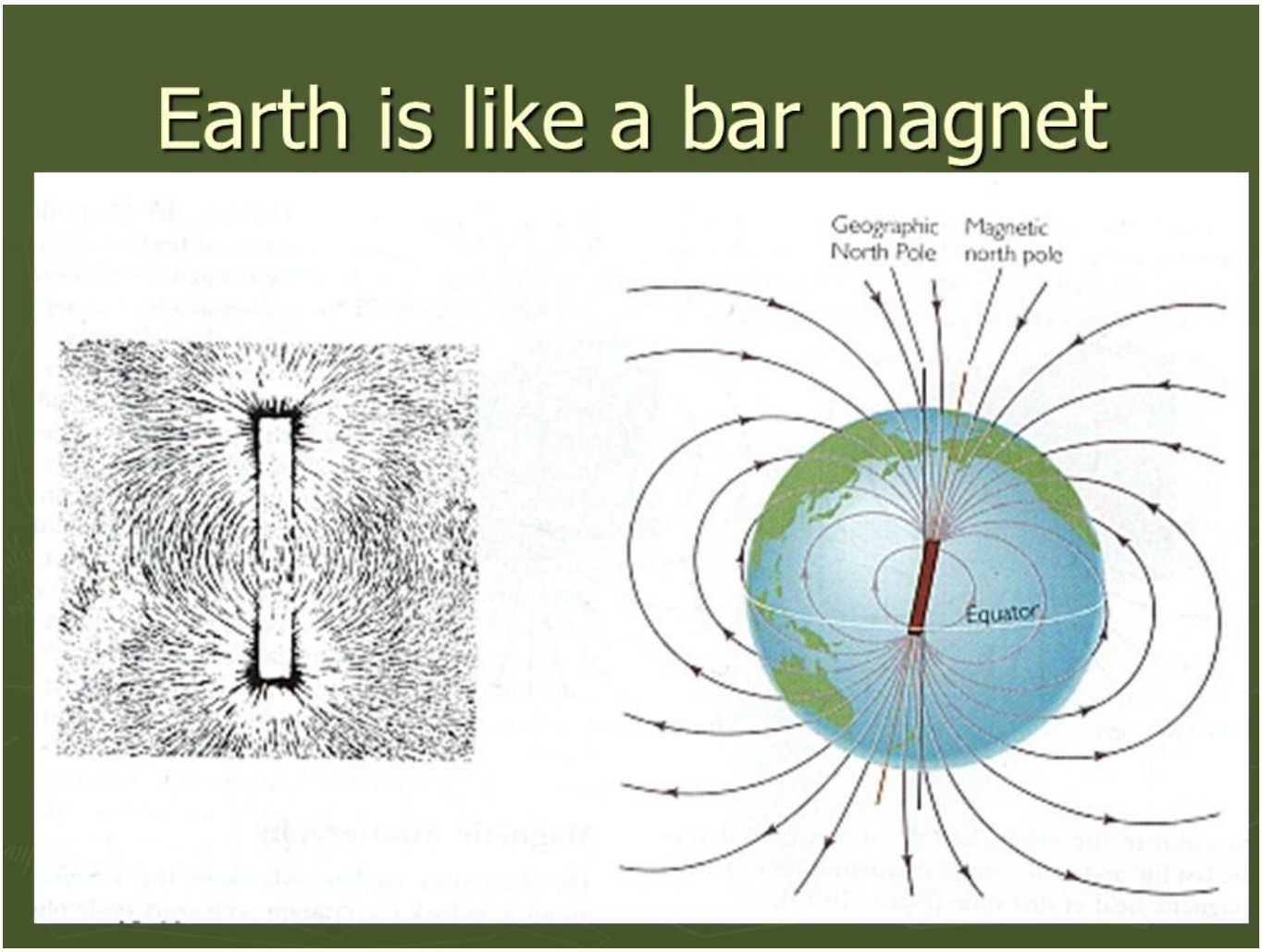
# Geomagnetism

# Geomagnetism



## Measuring Geomagnetism

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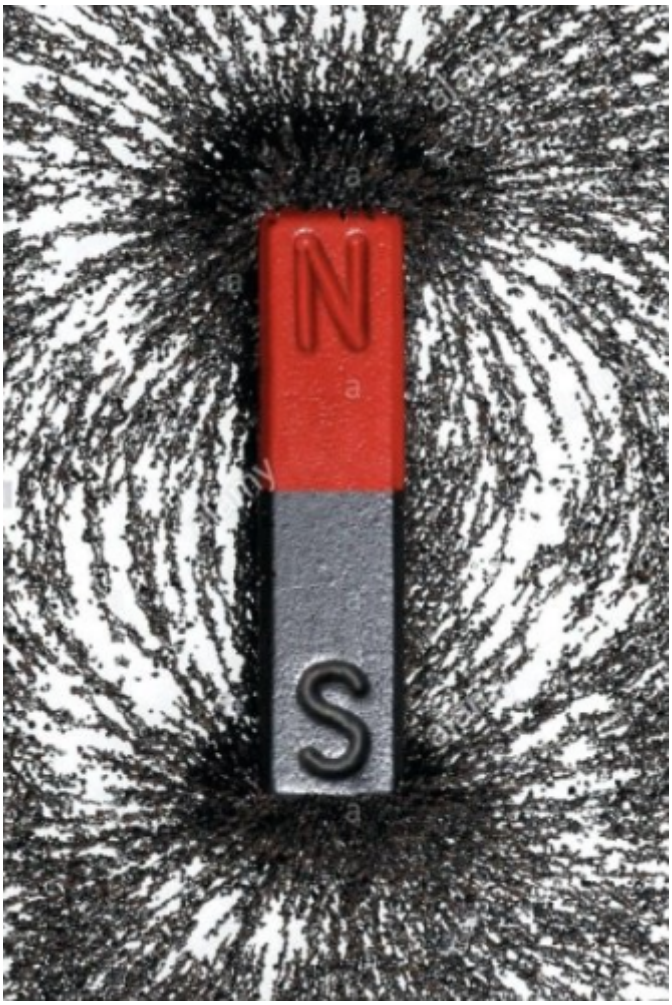
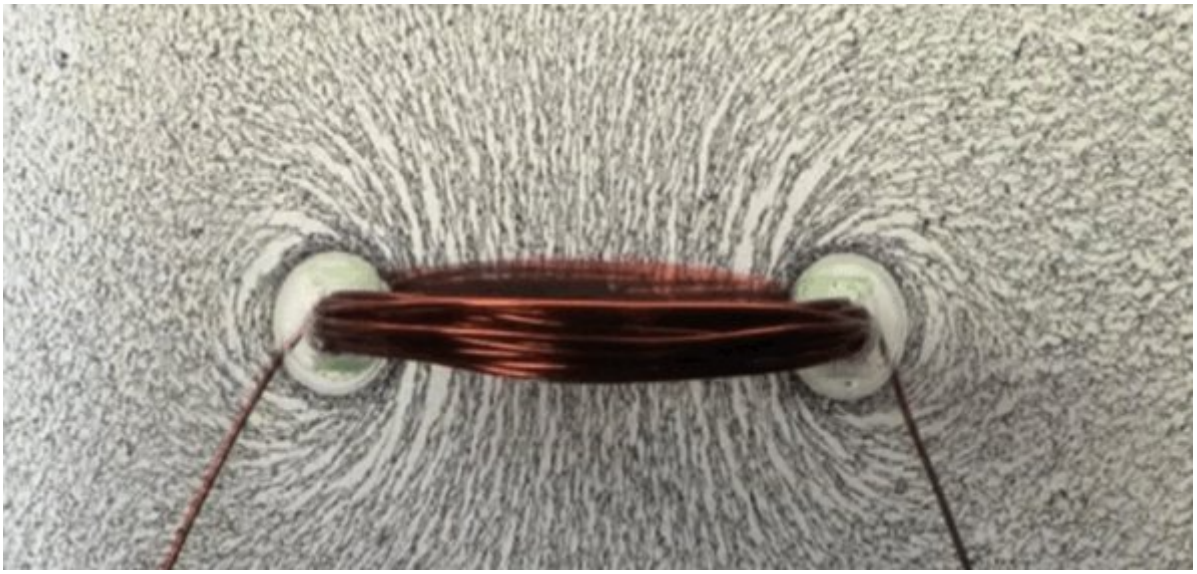
If the Earth functioned like a bar magnet, its poles would have attracted ferromagnetic particles from the atmosphere over 5 billion years, resulting in the formation of huge ferromagnetic mountains at the poles. A hypothetical magnet with the Earth's mass (approximately 6x10^24 kg) extending its magnetic field 40,000 miles into space would create a mountain.


N
S


NORTH POLE
90N

## Electromagnetic, not Ferromagnetic



A compass needle orients itself *perpendicular* to an *electromagnetic* field

## Magnetic North

A compass aligns parallel to the dielectric force, and perpendicular to the magnetic field.

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## Geomagnetic North Pole

The model-based area where the geomagnetic field is perpendicular to the surface, which the aurora borealis tends to surround

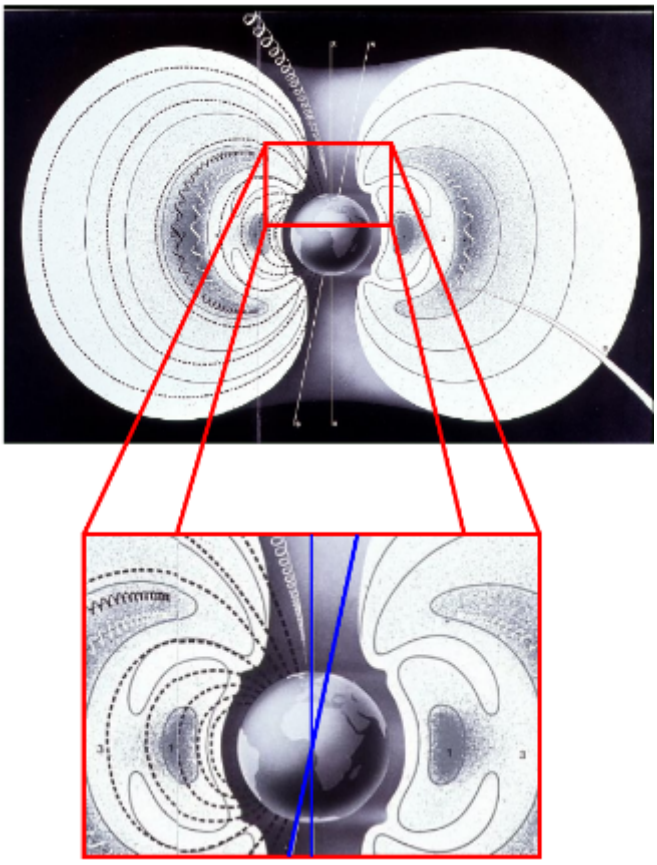
## Magnetic North Pole

The point towards which a compass orients, where the magnetic field should be oriented vertically downwards.

## Geographical (Celestial) North Pole

The location at which the north celestial sky's rotational axis is at the zenith.

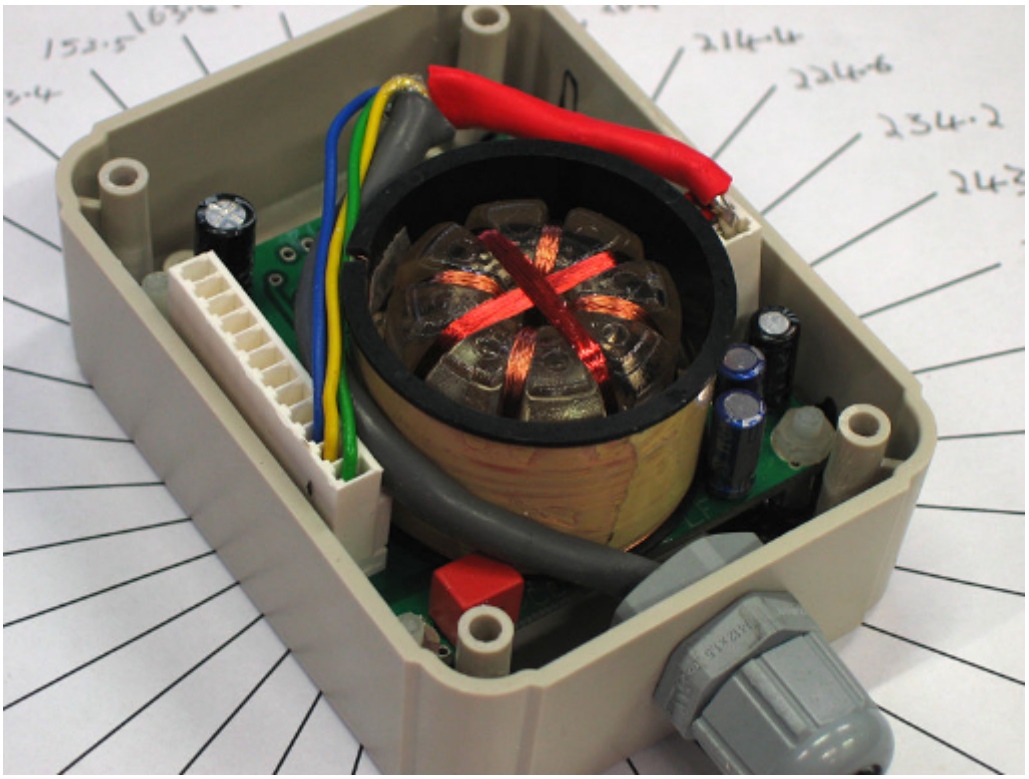

Convection currents of Fe/Ni in the *outer core* are not aligned with Earth's proposed axis, despite "Coriolis" being invoked as the central cause of the columnar and helical orientation of the currents.



# Measuring the Magnetic Field

## Magnetometers

- Fluxgate Magnetometers
  - Measure magnetic fields using a magnetic core and coils to detect changes in magnetic saturation caused by external fields.



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- Proton Precession Magnetometers
  - Detect magnetic fields by measuring the frequency at which hydrogen protons re-align and precess after the removal of a strong external magnetic pulse.

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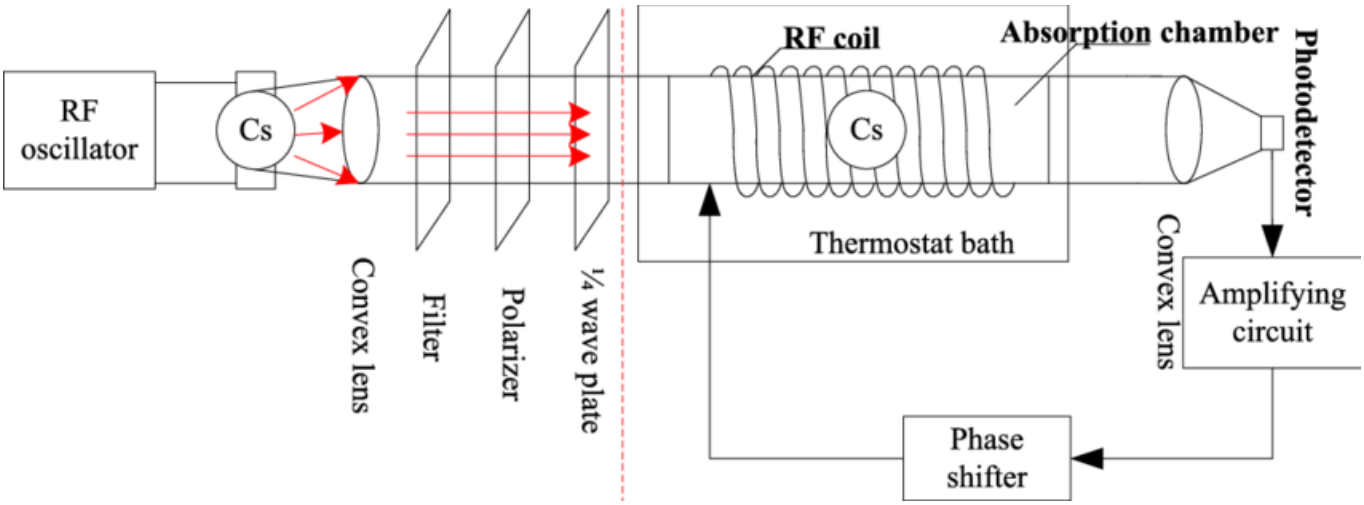
- Optically Pumped Magnetometers
  - Scalar magnetometers use excited atoms (like cesium or rubidium) affected by magnetic fields; changes in their atomic energy states are measured optically.

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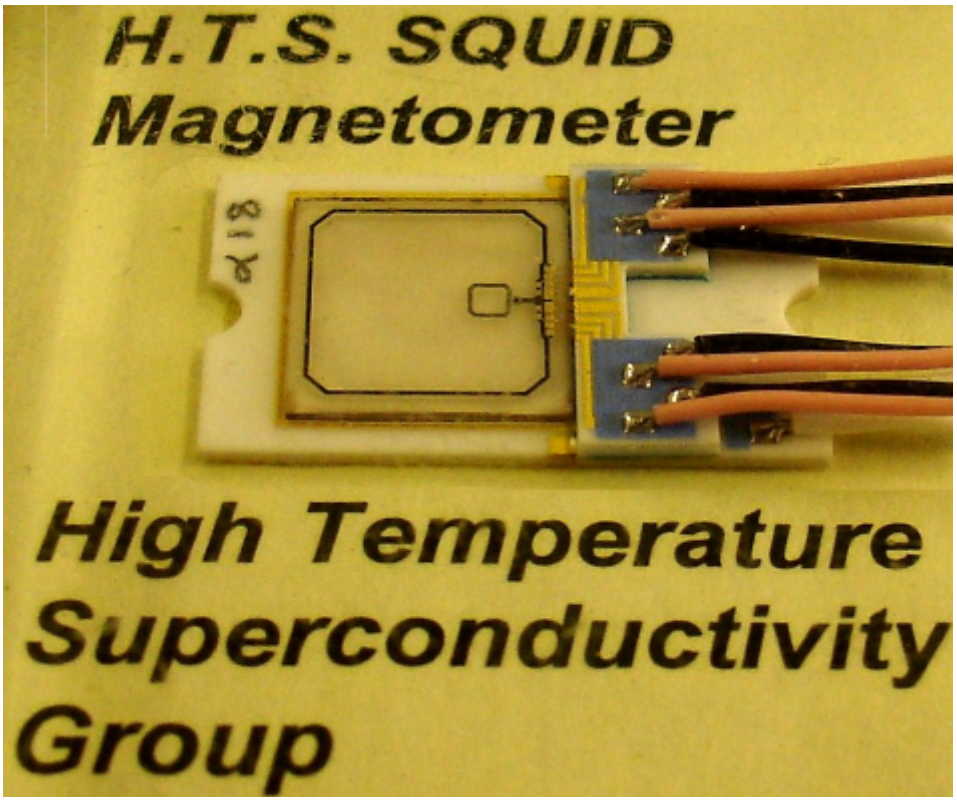
- SQUID Magnetometers
  - Extremely sensitive devices that measure minute magnetic fields using superconducting loops and quantum interference.

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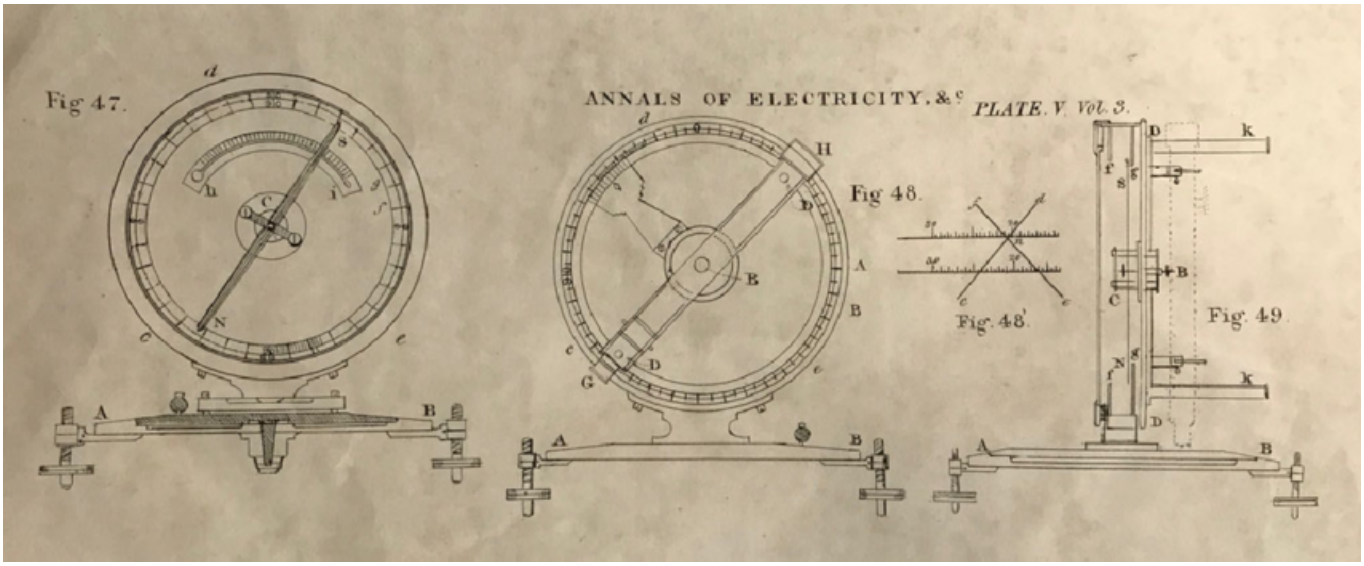
- Fox's Dipping Needle




## Royal Society Magnetic Expeditions

- Extensive magnetic surveys aimed to improve maritime navigation and geomagnetic science were conducted, led by figures from the Royal Society, such as Sir James Clark Ross and Sir Edward Sabine.
- The Earth's magnetic field was mapped, including anomalies "for better compass accuracy"

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> They had crossed the Magnetic Equator on 7 December, when Ross had noted with satisfaction  that the needle on his Fox dip circle ( a device used to measure the angle between the horizon and the earth's magnetic field) was perfectly horizontal. He had seen it point directly upwards at the North Magnetic Pole and, assuming the expedition was successful, would witness it point straight down when they reached the South Magnetic Pole.

Taken from "Erebus" by Michael Palin

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Sir James Ross Clark

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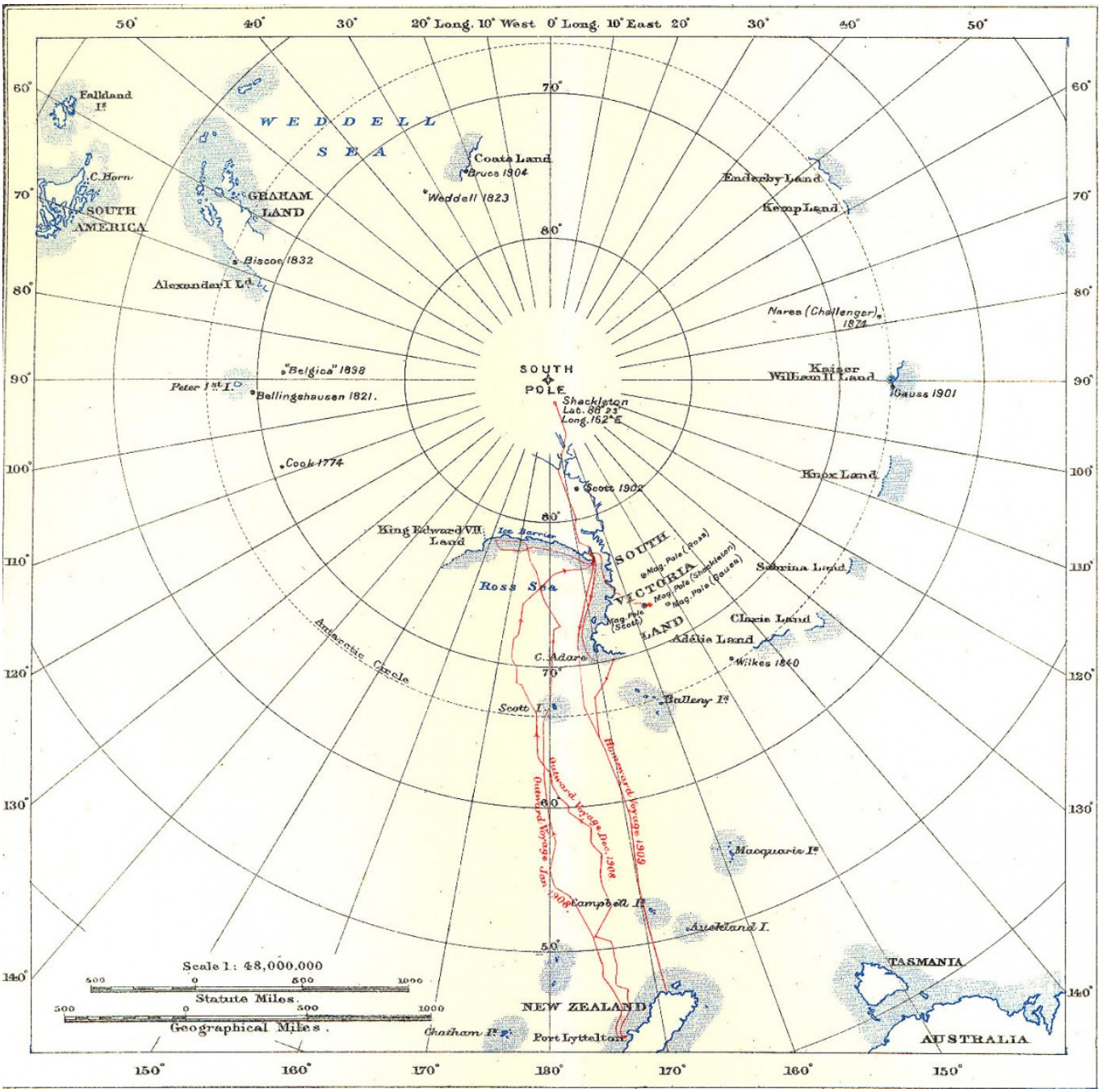
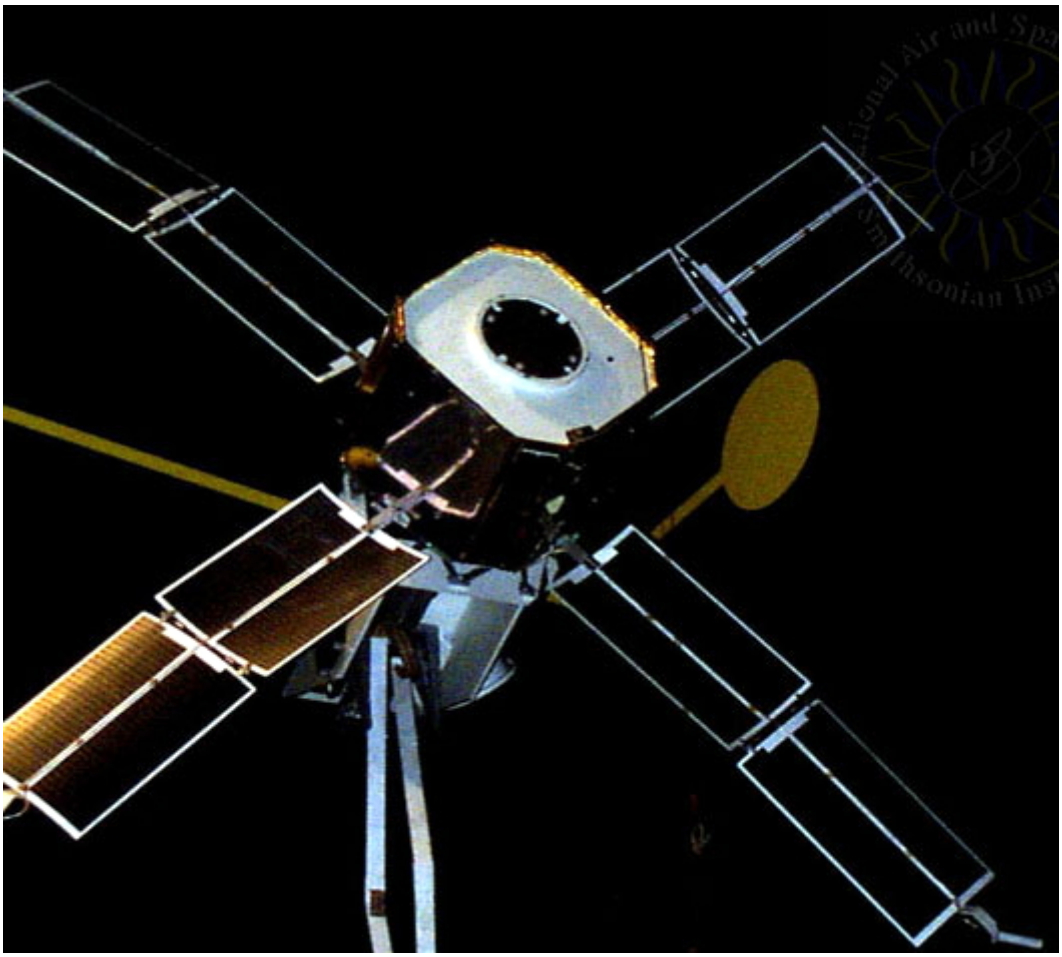



## MAGSAT

- Launched in 1979
- Equipped with vector magnetometers and scalar (optically pumped, helium) magnetometers
- Operated in a low Earth orbit from October 1979 to June 1980, collecting magnetic data



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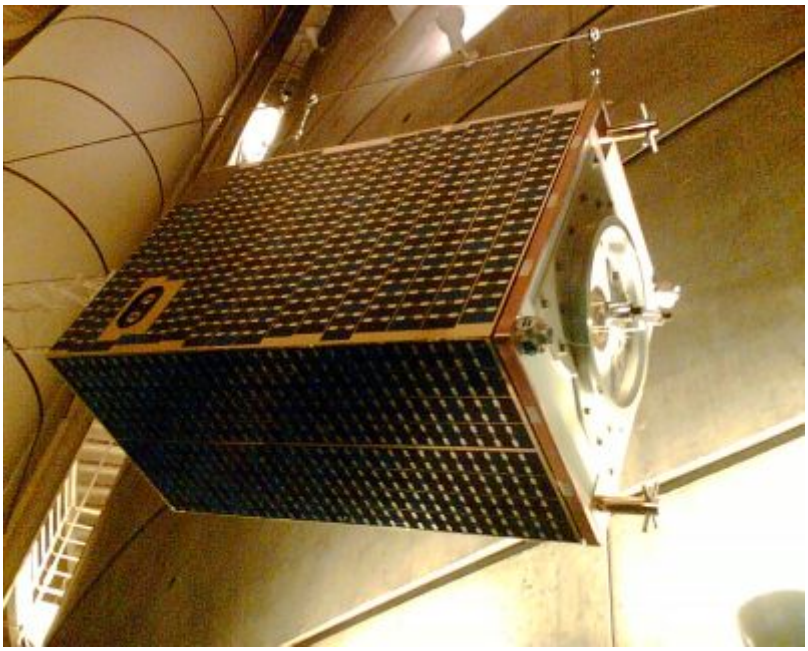
## Ørsted Satellite

- Launched in 1999
- Equipped with fluxgate magnetometers and a scalar (optically pumped) magnetometer, providing detailed measurements of Earth's magnetic field to further understand its dynamics and secular variation, until 1014



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## Swarm

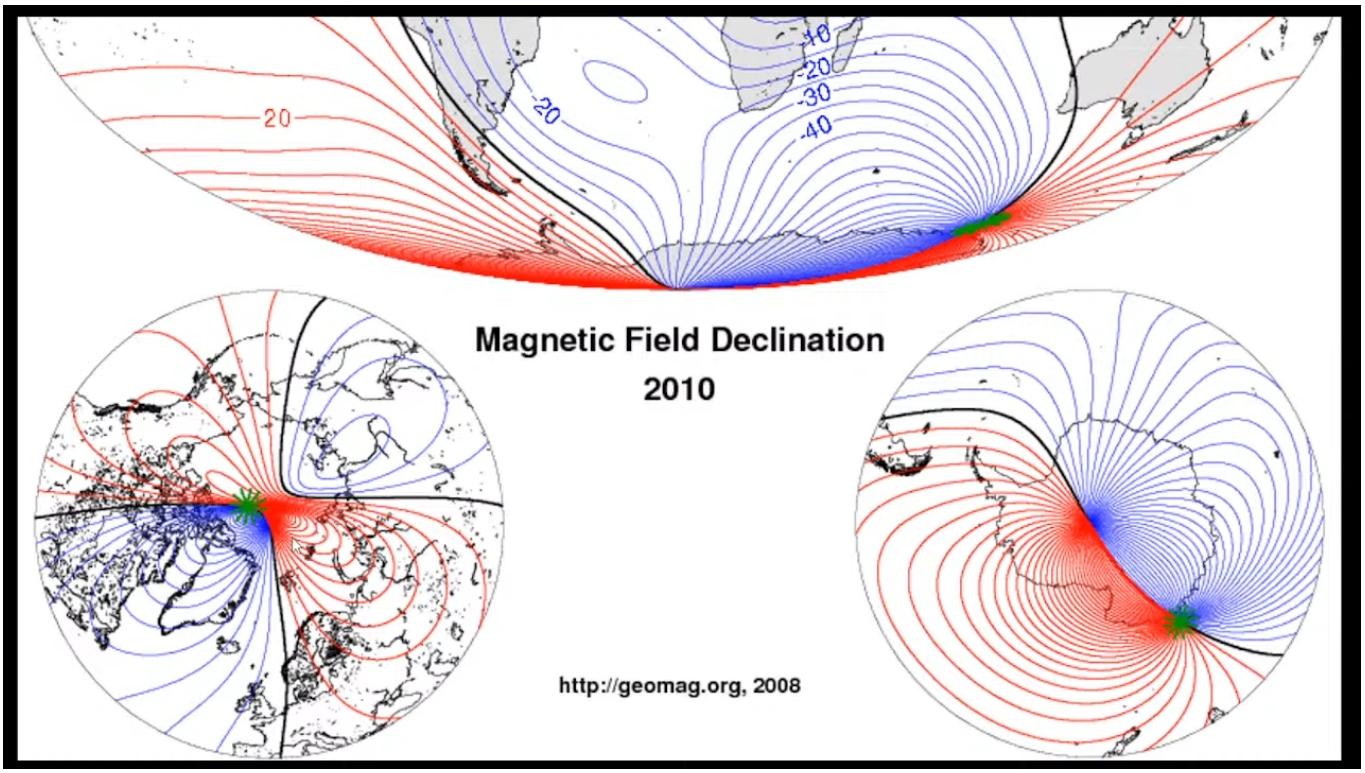
- Three satellites launched in 2013, still in operation
- Using vector field magnetometers (combinations of various fluxgate magnetometers on multiple axis) and scalar (optically pumped) magnetometers to map the magnetic field in high resolution
- Operate in "near-polar orbits," continuously collecting data to track changes in the magnetic field over time

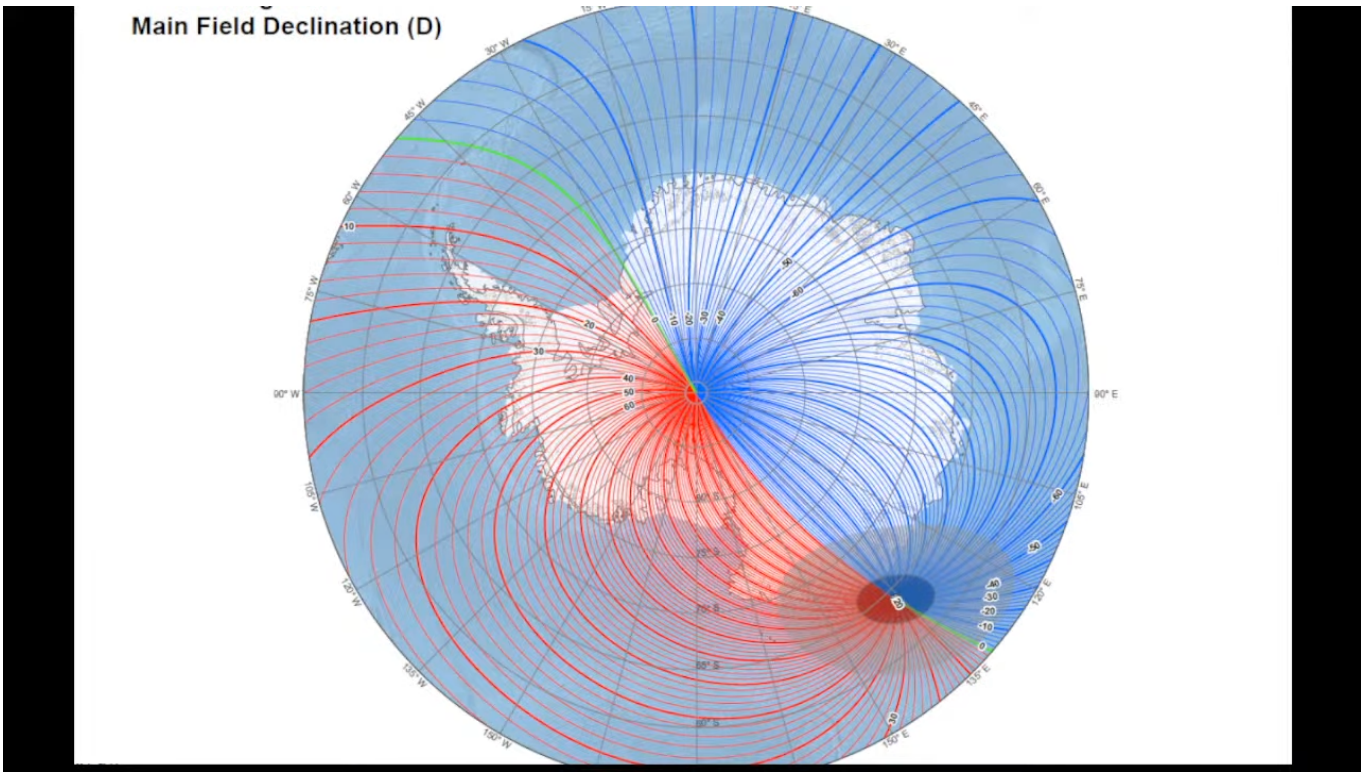
## The Earth's Magnetic Field is Asymmetric

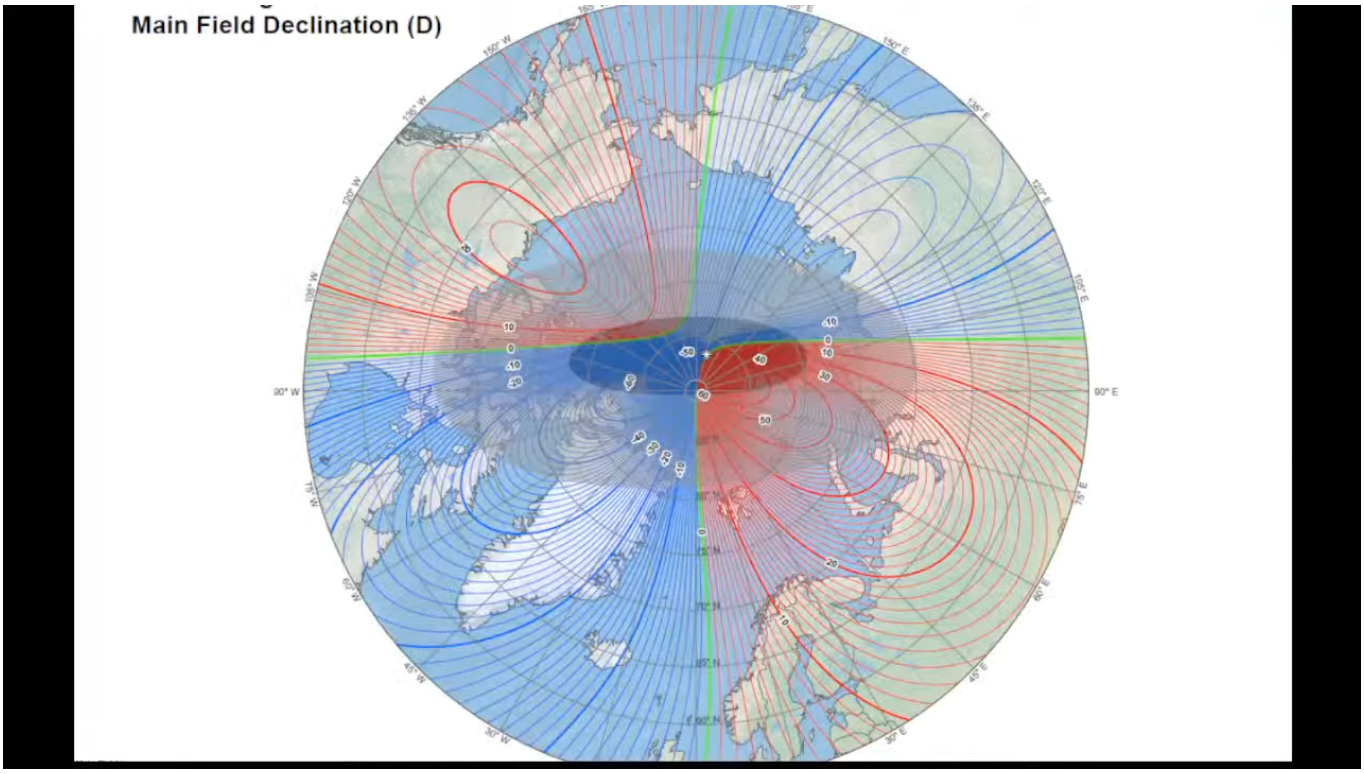
## Its Changes Over Time are Anomalous

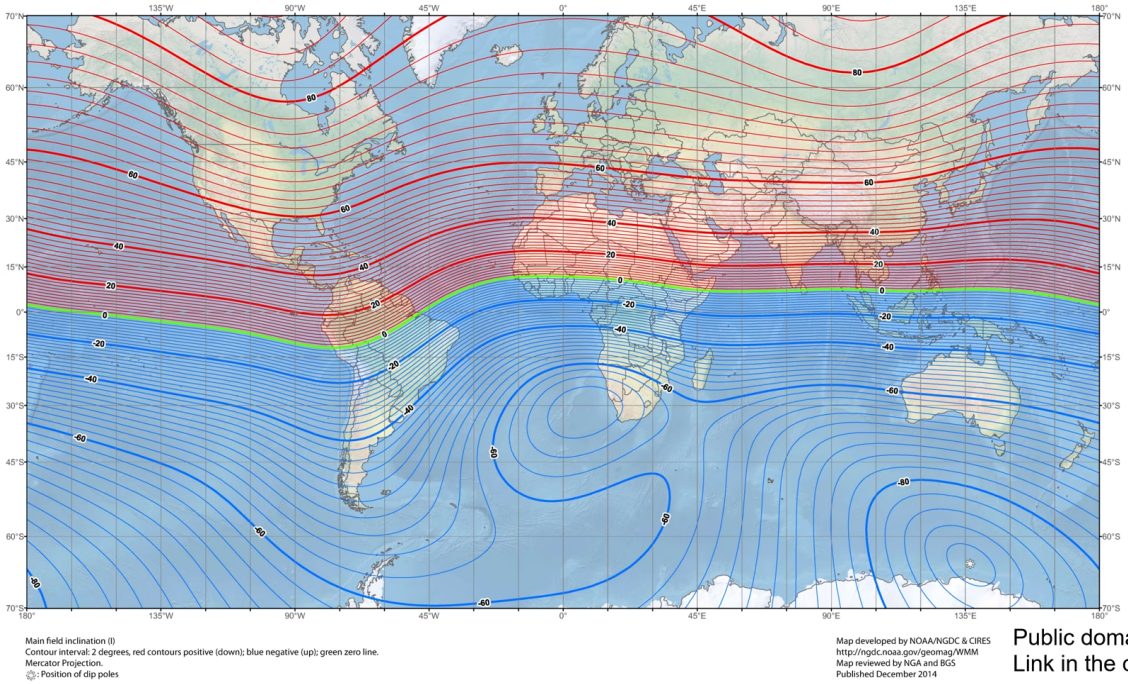
### Magnetic Declination

- It is claimed that a compass aligns with the Earth's magnetic field, pointing towards magnetic north, not directly to the North Magnetic Pole
- It is claimed that following a compass needle leads to the North Magnetic Pole, but not via the shortest path
- This is due to asymmetry and anomalies
- Navigation corrections for magnetic declination in the south can vary dramatically
- In some southern regions, magnetic declination can reach extreme values, requiring navigation corrections up to 92 degrees

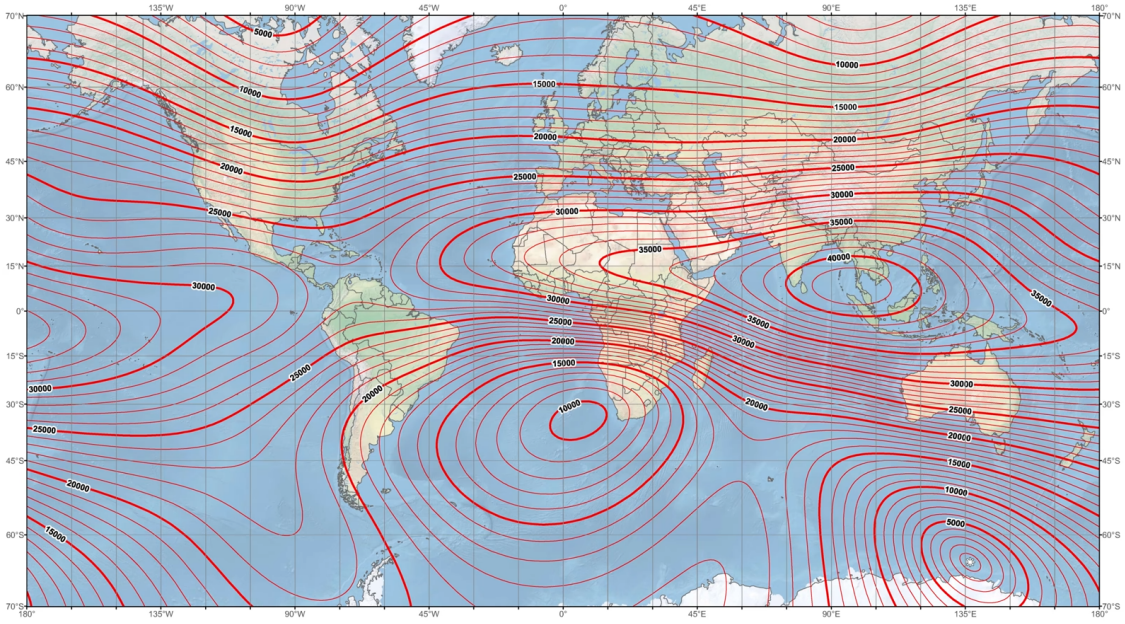

20
-20
-10
-20
-30
-40
Magnetic Field Declination
2010
http://geomag.org, 2008


Main Field Declination (D)



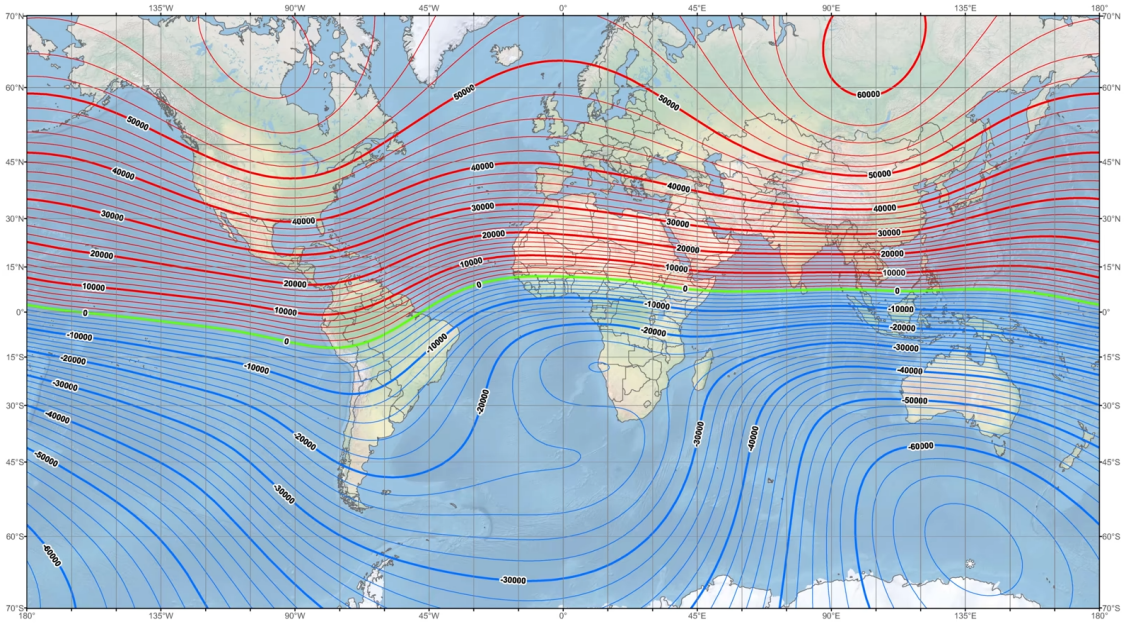
**US/UK World Magnetic Model - Epoch 2015.0**
**Main Field Horizontal Intensity (H)**




Main field horizontal intensity (H)
Contour interval: 1000 nT.
Mercator Projection.
: Position of dip poles

Map developed by NOAA/NGDC & CIRES
http://ngdc.noaa.gov/geomag/WMM
Map reviewed by NGA and BGS
Published December 2014

**US/UK World Magnetic Model - Epoch 2015.0**
**Main Field Down Component (Z)**




Main field down component (Z)
Contour interval: 2000 nT, red contours positive (down); blue negative (up); green zero line.
Mercator Projection.
: Position of dip poles

Map developed by NOAA/NGDC & CIRES
http://ngdc.noaa.gov/geomag/WMM
Map reviewed by NGA and BGS
Published December 2014

# Secular Variation

Secular variation refers to the slow and gradual changes in the Earth's magnetic field over time, caused by complex motions of molten metals within the Earth's outer core. These changes can alter the strength and direction of the magnetic field at various locations on the Earth's surface.

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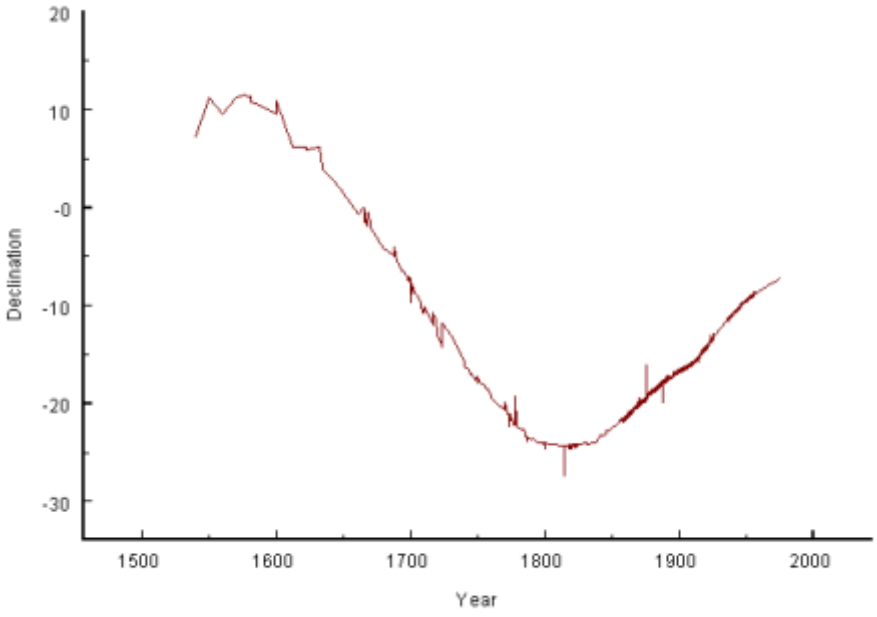
Secular variation was first recognized in 1634 when Gellibrand compared magnetic declination observations he had made at London with earlier observations. The observations of declination made at London over the years constitute one of the best records of secular variation.




Change in declination at London

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## More Evidences of the Magnetic Field

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### Aurora Borealis and Aurora Australis

- Said to be caused by solar winds interacting with Earth's magnetic field
- Aurora Borealis (north) is more frequently observed, and typically more colorful, with more greens
- Aurora Australis (south) is less frequently observed, and is more commonly pink

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## Aurora Borealis

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## Aurora Australis

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## Solar Wind Deflection

- It is claimed that Earth's magnetic field plays a critical role in deflecting the solar wind
- It is claimed that this is what prevents the atmosphere from being stripped away into space
- This assertion is reified via observations of celestial bodies and their interactions with "solar wind"

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## Rock Magnetism

- Some rocks preserve Earth's past magnetic fields, which geologists study to understand changes over time.

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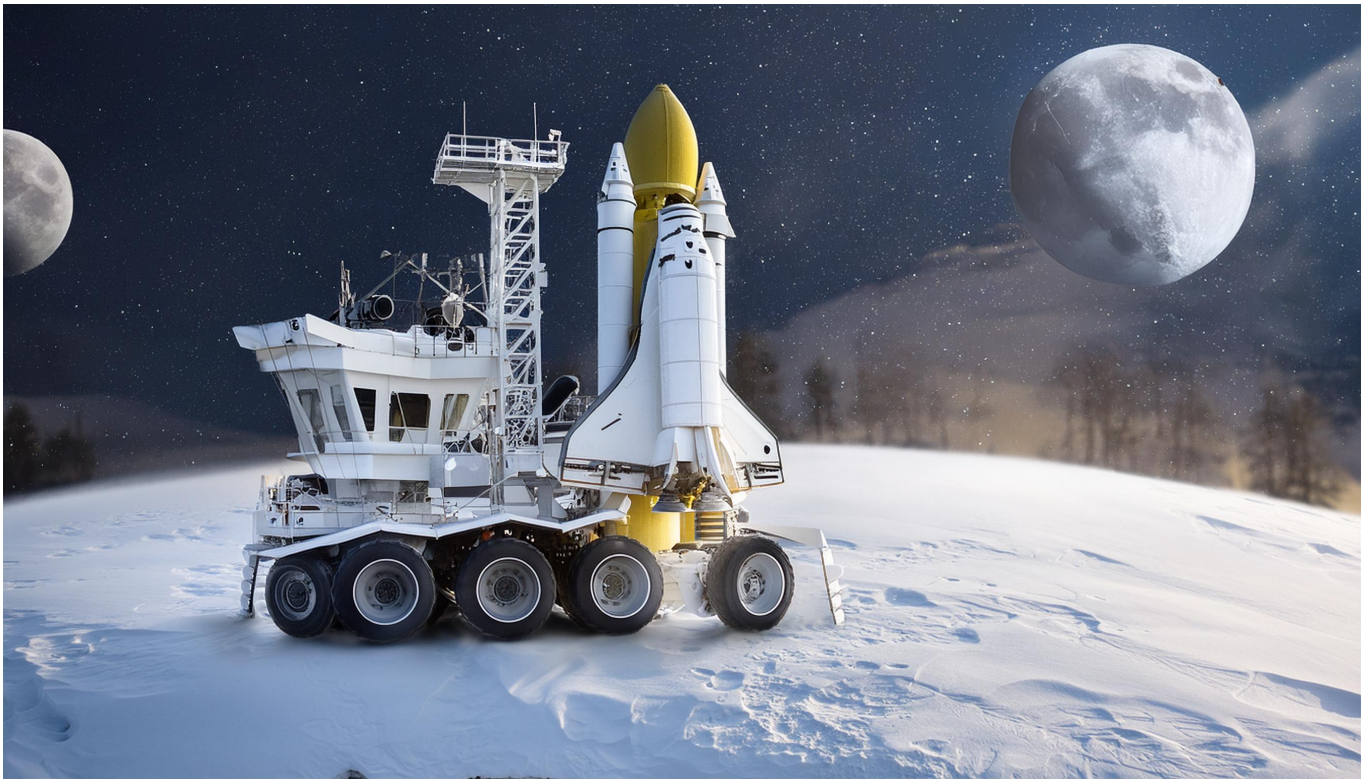
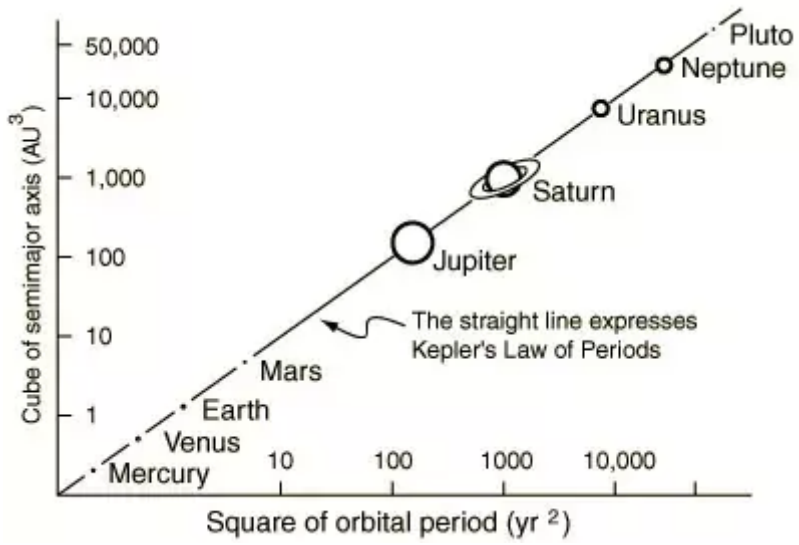
# Prerequisites for Geodynamo Theories

## Astronomy

### Pictures from Space

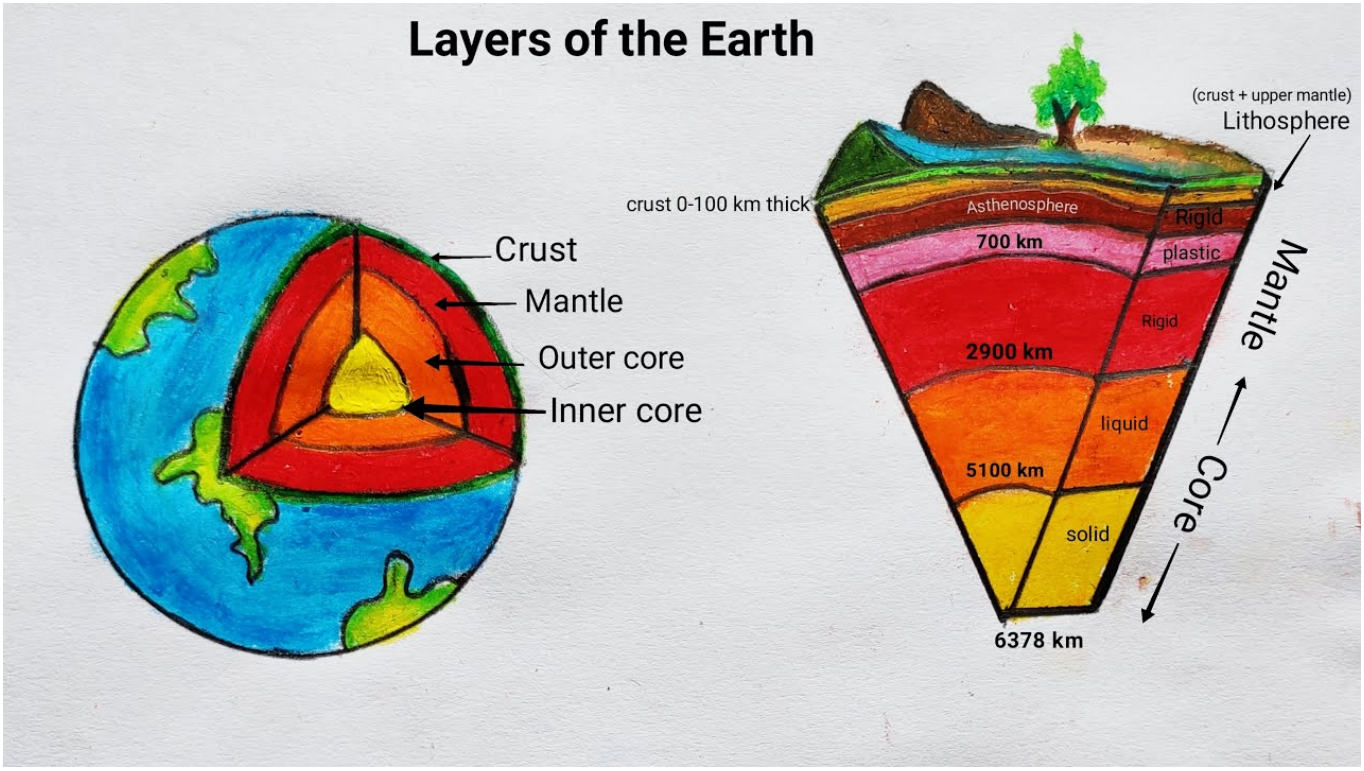


### The Kinematic Solar System

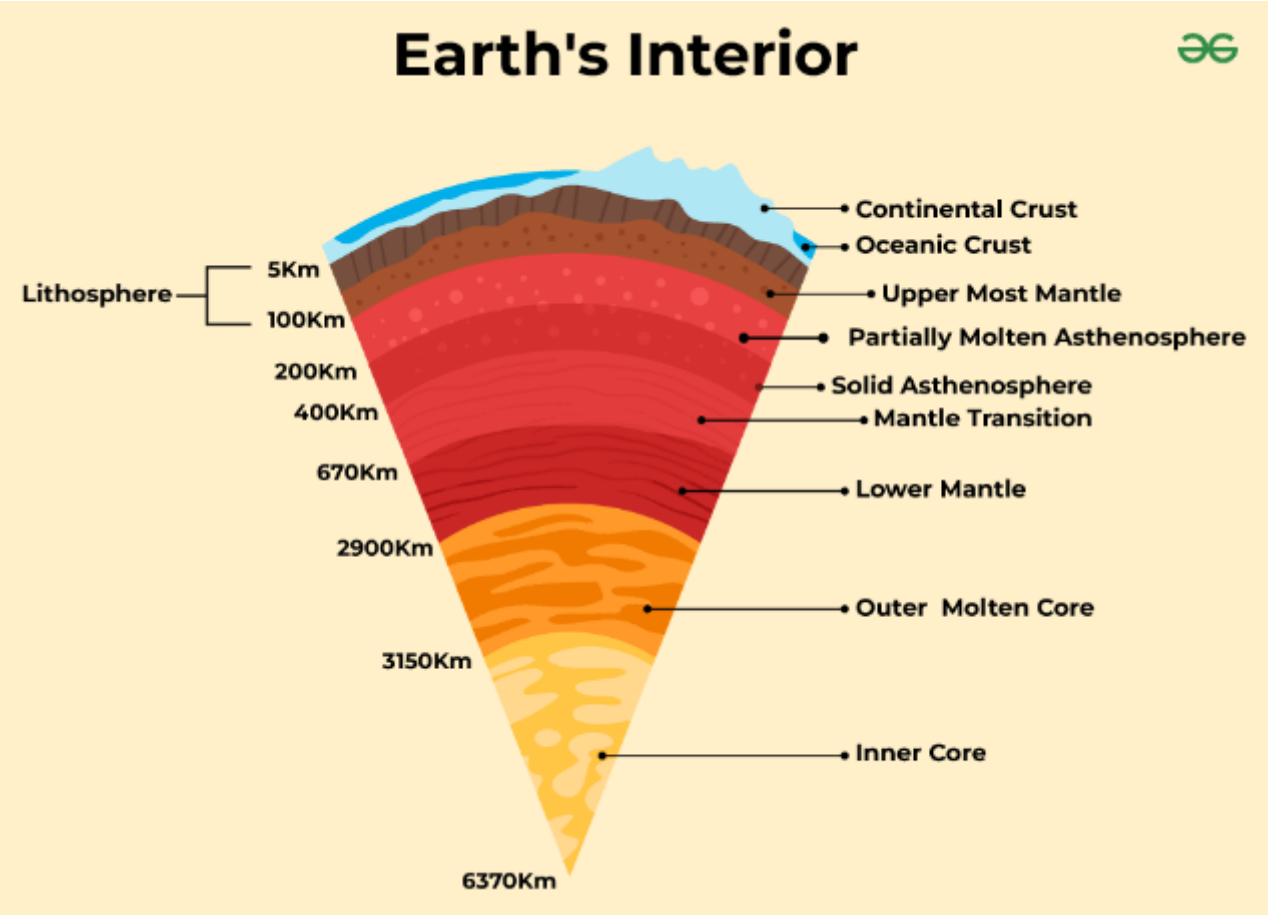



This could be you!

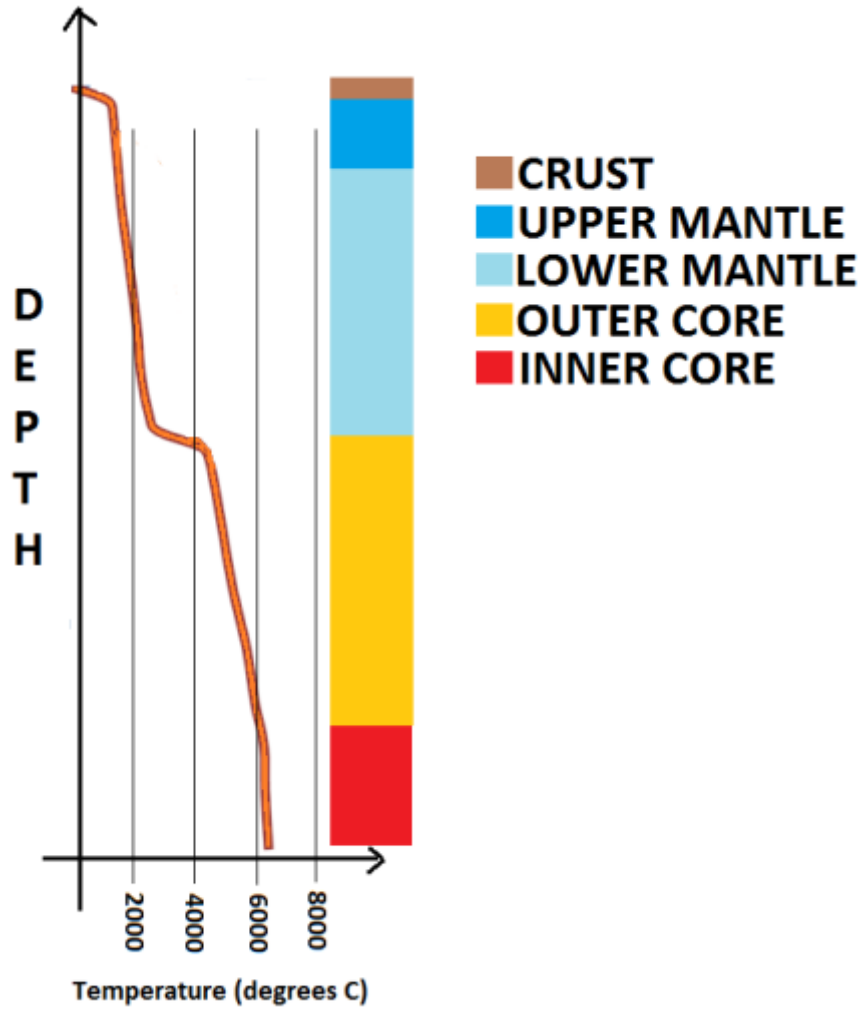
# Seismology




https://www.youtube.com/watch?app=desktop&v=rjAx51D1ehc




https://www.geeksforgeeks.org/earths-interior/




https://study.com/academy/lesson/the-layers-of-the-earth-facts-composition-temperature.html

Compare to surface of the Sun, theorized to be 5,500 degrees C

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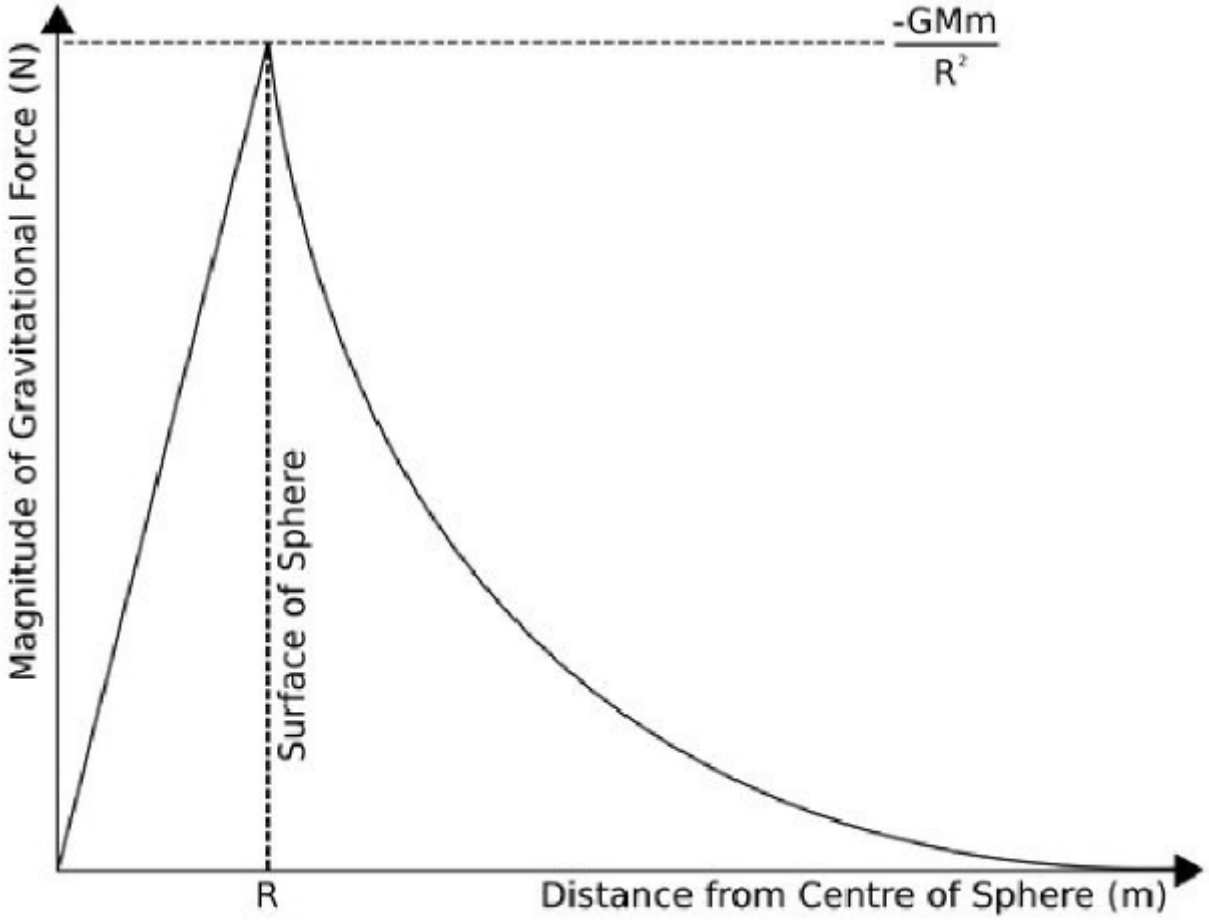
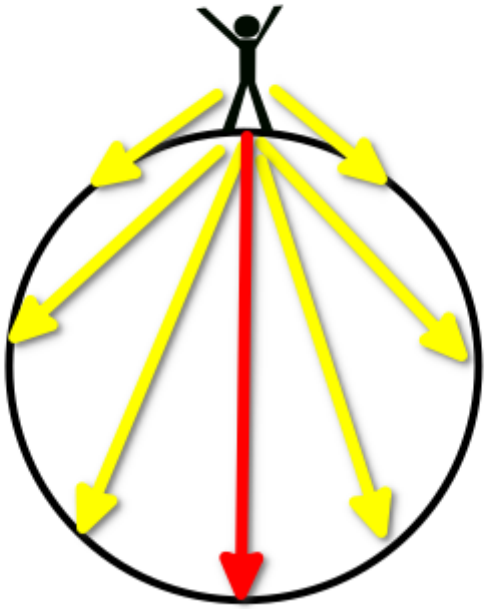
## Newton's Shell Theorem

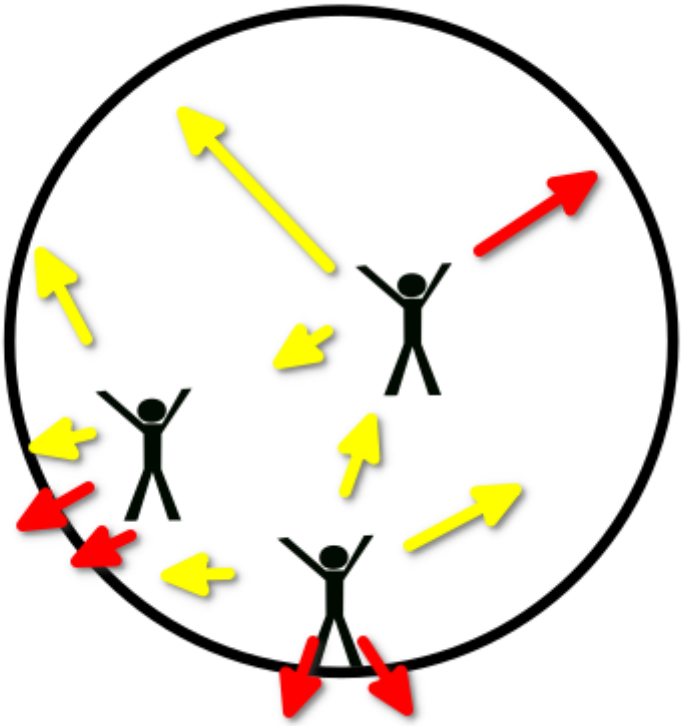
- The Earth's "dense iron core" is located at the point of 0 gravity
- Ad-hoc iron core is necessary for the globe to invoke point-specific gravity, which is required for a uniform downward bias, across the earth



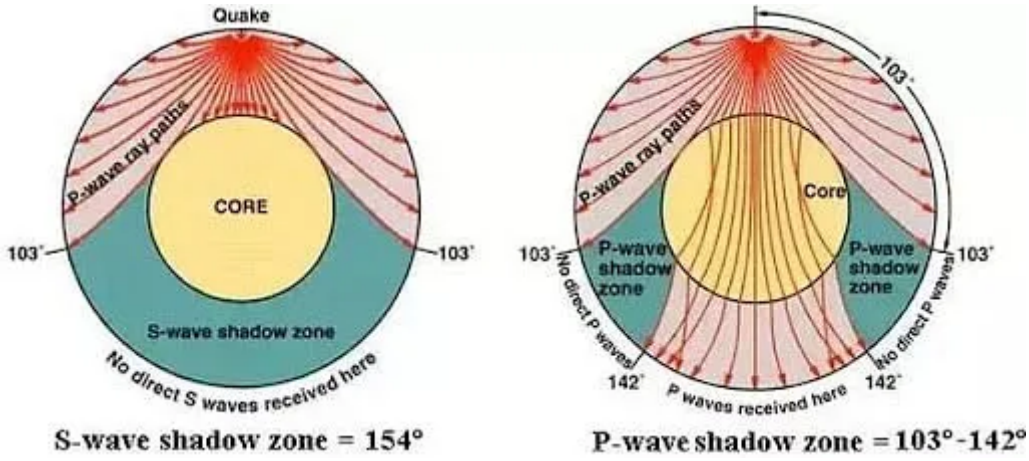

Symmetric force vectors on the surface of the shell



Asymmetric force vectors within the shell



## P and S Wave Shadow Zones



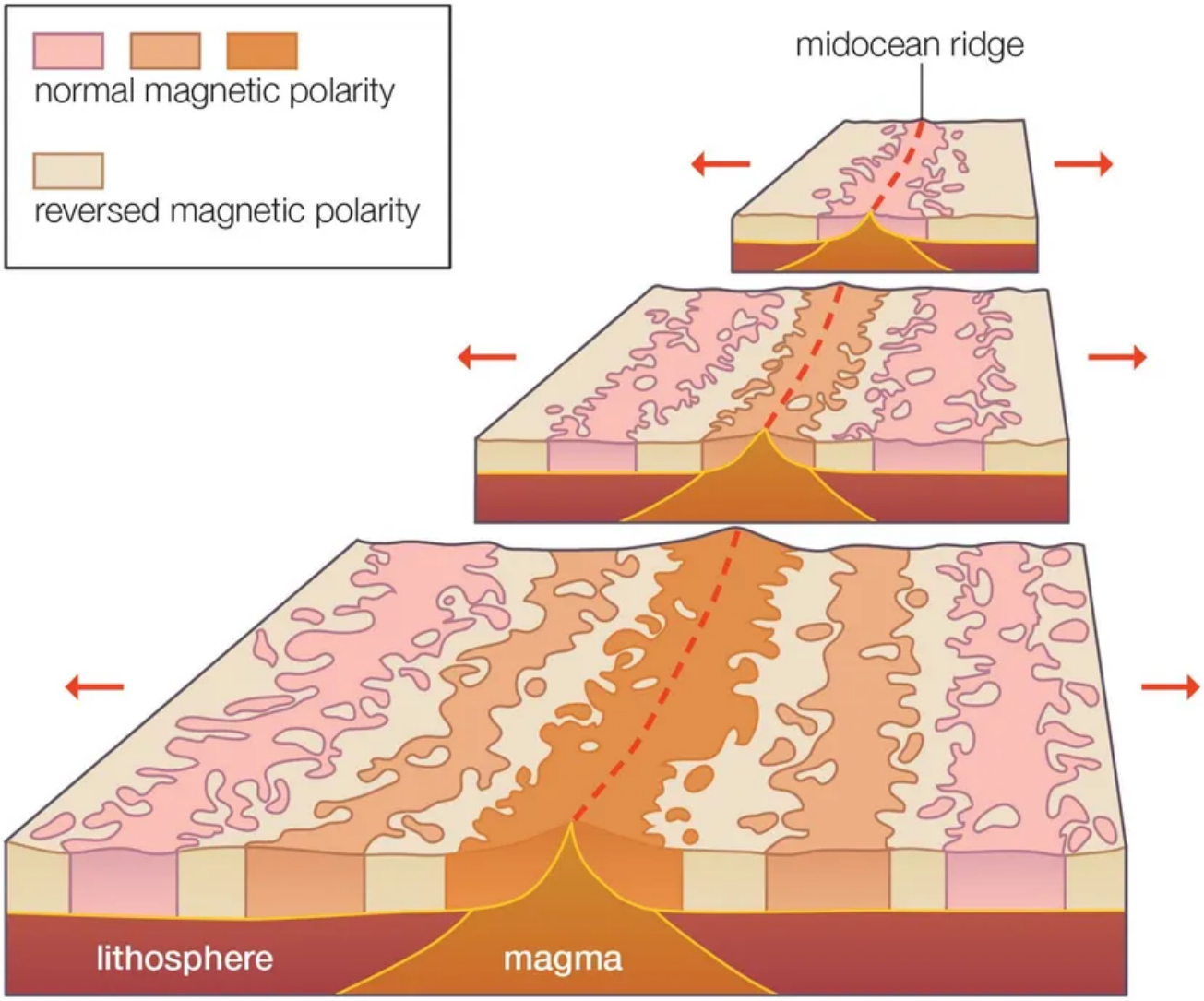

- Observations frequently do not match predictions
- Localized responses frequently occur hundreds of miles off from expected origin points, before the asserted origin
- Observations of the crust have not matched predictions

# Geology

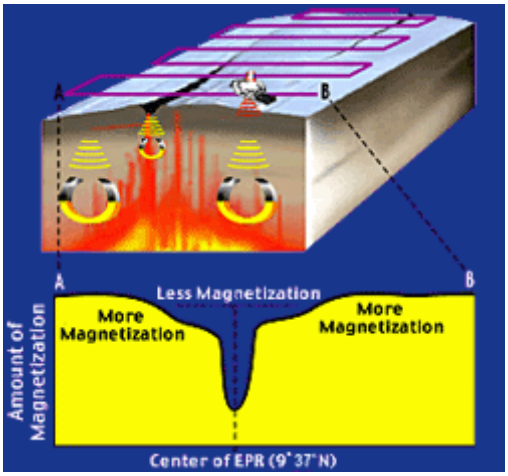
## Magnetogeology

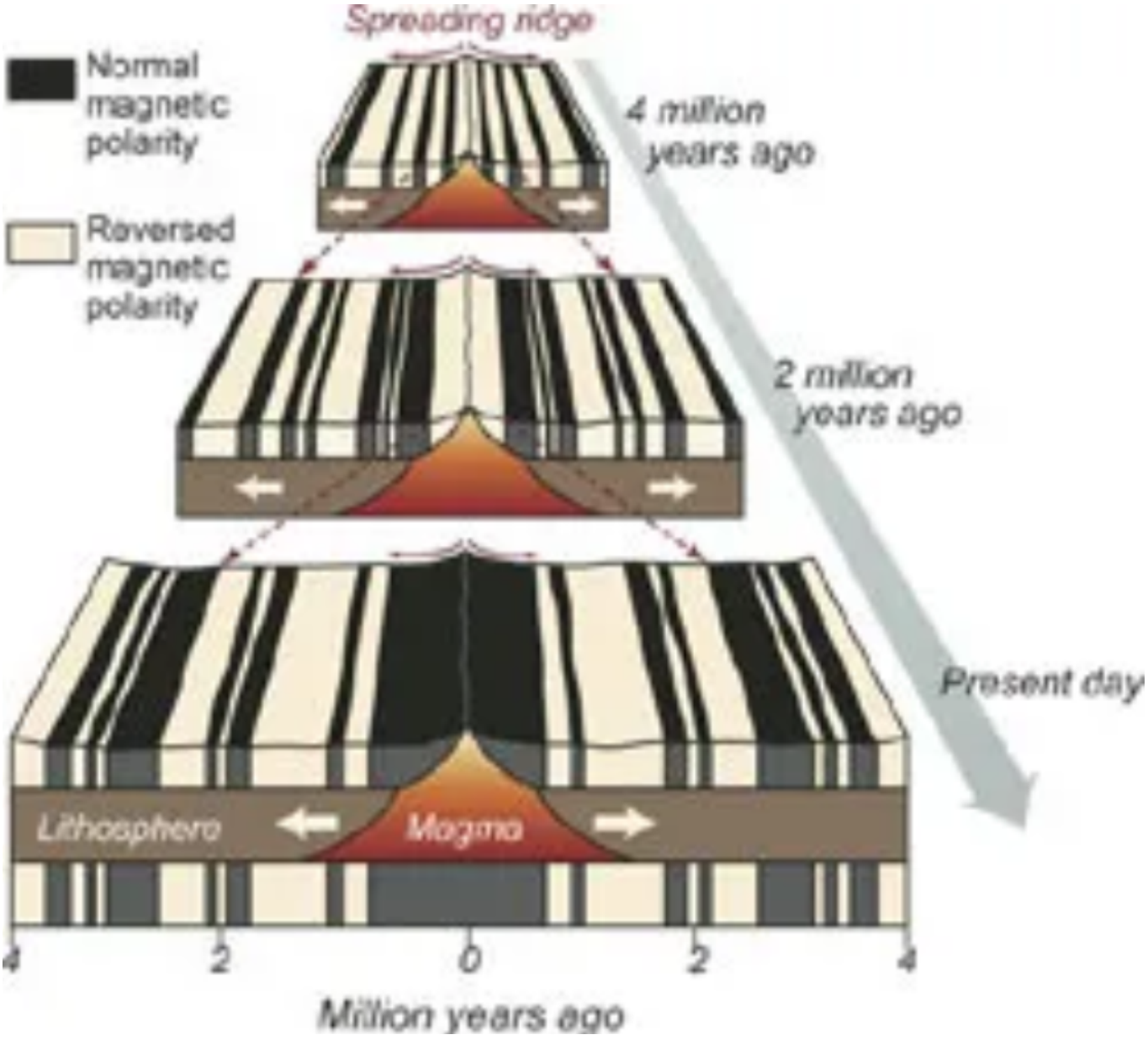
### Oceanic Magnetic Striping at the Sea Ridge

- The foundation of all geological theories comes from paleomagnetic signals which are found locked in rock at the "spreading sea floors" at the oceanic ridges
- It is claimed these can trace back hundreds of millions of years in the past







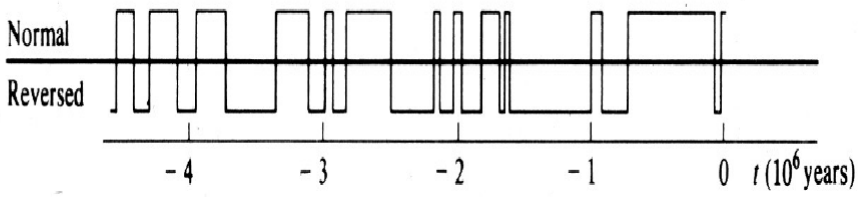



## Field Reversals

- Proposed by Harry Hess in 1962 "History of Ocean Basins"
- Anamolous and inconsistent
- Currently running behind by about 520,000 years (~2x the expected period)

# FIELD POLARITY REVERSAL

Field polarity reverses every 250,000 yrs. It has been 780,000 yrs. until the last reversal.




Is another reversal happening soon ? } Observations: 10% decrease in field intensity since 1830s

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## Previous Field Reversal Theories

1. Intrusions of magnetic material: Caused by large intrusions of magnetically distinct material into the oceanic crust, assuming that the intrusions had different magnetic properties than the surrounding rock, creating the striped magnetic patterns.
2. Localized Geological Activity: Localized sources for magnetic variations, such as volcanic activity or the irregular deposition of highly magnetic minerals, created striping patterns.
3. Polar wandering: The poles moved across the Earth's surface, and the magnetic minerals in the oceanic crust recorded the varying positions of the poles.
4. Vertical movements of the Earth's crust: The differences in magnetism were caused by changes in the elevation of the ocean floor, affecting the Earth's magnetic field locally.

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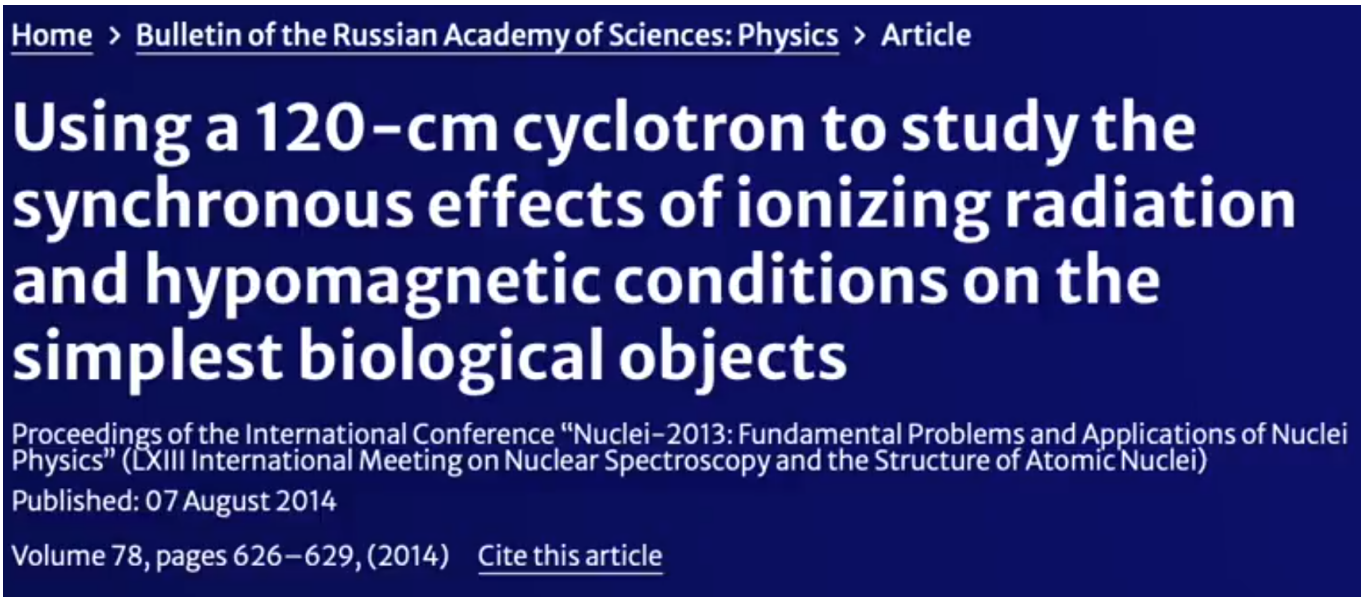
During reversal, if the field were "absent," this would cause a "hypomagnetic" effect, of which much research has been done.



Home > Bulletin of the Russian Academy of Sciences: Physics > Article

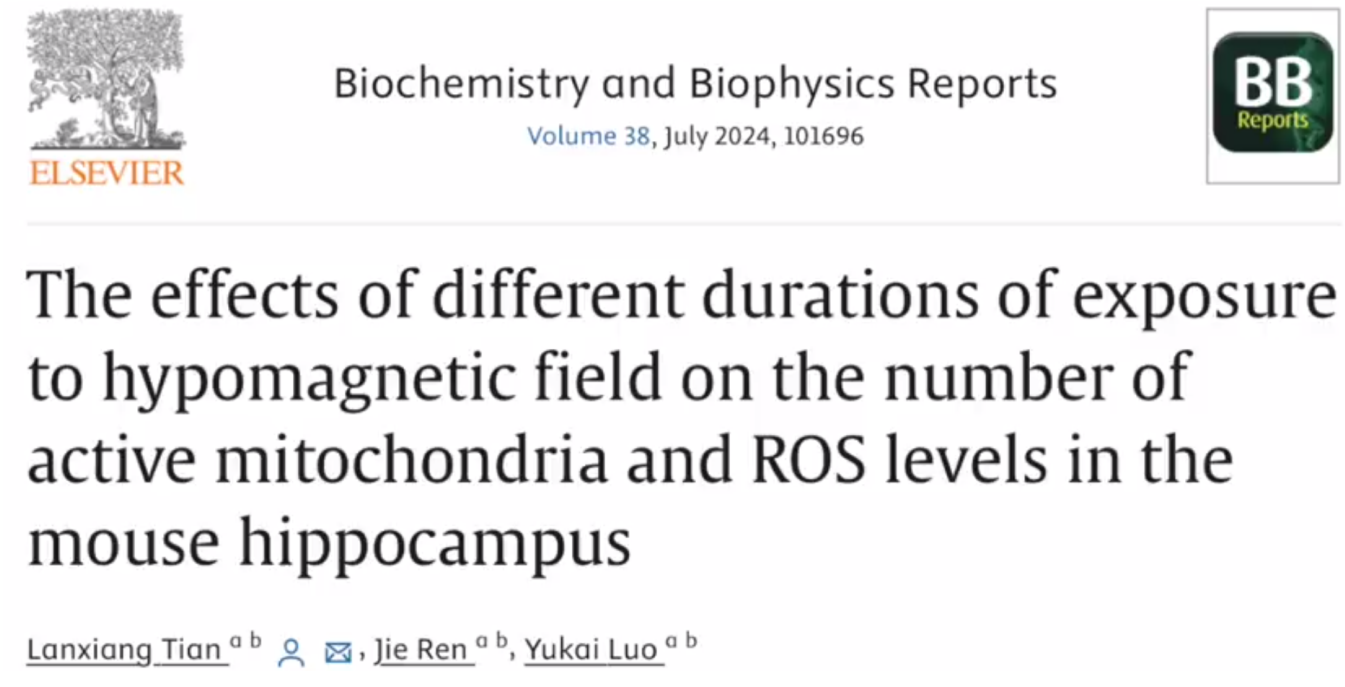
# Using a 120-cm cyclotron to study the synchronous effects of ionizing radiation and hypomagnetic conditions on the simplest biological objects

Proceedings of the International Conference "Nuclei–2013: Fundamental Problems and Applications of Nuclei Physics" (LXIII International Meeting on Nuclear Spectroscopy and the Structure of Atomic Nuclei)

Published: 07 August 2014

Volume 78, pages 626–629, (2014) Cite this article

Credit to @Suspicious0bservers on YouTube for pointing out these studies



ELSEVIER

Biochemistry and Biophysics Reports

Volume 38, July 2024, 101696

BB Reports

# The effects of different durations of exposure to hypomagnetic field on the number of active mitochondria and ROS levels in the mouse hippocampus

Lanxiang Tian [a b], Jie Ren [a b], Yukai Luo [a b]

# Delayed consequences of the influence of hypomagnetic field on roach (*Rutilus rutilus*) embryos

Viacheslav V. Krylov [A B], Yulia V. Chebotareva [A] and Yuri G. Izyumov [A]

+ Author Affiliations

*Marine and Freshwater Research* 72(8) 1125-1131 https://doi.org/10.1071/MF20240

Submitted: 5 August 2020 Accepted: 15 January 2021 Published: 27 February 2021

## Abstract

The absence of magnetic fields can affect fish embryogenesis. The influence of hypomagnetic field on the survival of roach (*Rutilus rutilus*) embryos was estimated. Delayed consequences of *R. rutilus* embryos and prelarvae exposure to these magnetic conditions were also studied. Hypomagnetic field during embryogenesis led to an increased mortality of embryos. The juveniles developed from the

BIO ELECTRO MAGNETICS BioEM

Review

# Reactive Oxygen Species: Potential Regulatory Molecules in Response to Hypomagnetic Field Exposure

Bingfang Zhang, Lanxiang Tian

First published: 30 September 2020 | https://doi.org/10.1002/bem.22299 | Citations: 23

BIO ELECTRO MAGNETICS BioEM

Review

# Biological Effects of Hypomagnetic Field: Ground-Based Data for Space Exploration

Zheyuan Zhang, Yanru Xue, Jiancheng Yang, Peng Shang ✉, Xichen Yuan ✉

First published: 10 July 2021 | https://doi.org/10.1002/bem.22360 | Citations: 16

BIO ELECTRO MAGNETICS BioEM

Research Article

# Decline of cell viability and mitochondrial activity in mouse skeletal muscle cell in a hypomagnetic field

Jing-Peng Fu, Wei-Chuan Mo, Ying Liu ✉, Rong-Qiao He

First published: 22 March 2016 | https://doi.org/10.1002/bem.21968 | Citations: 30

Open Access Review

# Hypomagnetic Fields and Their Multilevel Effects on Living Organisms

by Miroslava Sinčák and Jana Sedlakova-Kadukova *

Faculty of Natural Science, University of Cyril and Methodius in Trnava, Nam. J. Herdu 2, 91701 Trnava, Slovakia

* Author to whom correspondence should be addressed.

*Processes* **2023**, *11*(1), 282; https://doi.org/10.3390/pr11010282

**Submission received: 13 December 2022 / Revised: 9 January 2023 / Accepted: 12 January 2023 / Published: 16 January 2023**

PLOS ONE

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

# A Hypomagnetic Field Aggravates Bone Loss Induced by Hindlimb Unloading in Rat Femurs

Bin Jia, Li Xie, Qi Zheng, Peng-fei Yang, Wei-ju Zhang, Chong Ding, Ai-rong Qian, Peng Shang

Published: August 26, 2014 • https://doi.org/10.1371/journal.pone.0105604

Home > Biophysics > Article

# The Peculiar Features of Cognitive Processes in Rats Exposed to a Hypomagnetic Field Using Moderate Magnetic Shielding

COMPLEX SYSTEMS BIOPHYSICS | Published: 10 December 2020

Volume 65, pages 876–882, (2020) Cite this article

D. R. Khusainov, I. I. Korenyuk, V. I. Shakhmatova, K. N. Tumanyants, N. S. Tribrat, E. D. Khorolskaya, A. V. Chajka & I. A. Borzova

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RESEARCH ARTICLE

# Radical triads, not pairs, may explain effects of hypomagnetic fields on neurogenesis

Jess Ramsay, Daniel R. Kattnig

Version 2 Published: September 15, 2022 • https://doi.org/10.1371/journal.pcbi.1010519

BRIEF RESEARCH REPORT article

Front. Physiol., 20 October 2022

Sec. Biophysics

Volume 13 - 2022 | https://doi.org/10.3389/fphys.2022.1040083

This article is part of the Research Topic
Interactions of Magnetic Fields with Living Cells

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# Influence of hypomagnetic field on the heartbeat in zebrafish embryos


Viacheslav Krylov[1,2]*, Alexander Machikhin[1], Daniil Sizov[2], Anastasia Guryleva[1], Anastasia Sizova[1,2], Svetlana Zhdanova[2], Vladimir Tchougounov[2], Alexander Burlakov[1,3]

[1] Scientific and Technological Center of Unique Instrumentation, Russian Academy of Sciences, Moscow, Russia
[2] Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences, Borok, Russia
[3] Lomonosov Moscow State University, Moscow, Russia

2:37



# Effects of Hypomagnetic Conditions and Reversed Geomagnetic Field on Calcium-Dependent Proteases of Invertebrates and Fish

Published: 01 March 2018

Volume 53, pages 719–723, (2017) Cite this article

N. P. Kantserova ✉, V. V. Krylov, L. A. Lysenko, N. V. Ushakova & N. N. Nemova

nature > nature communications > articles > article

Article | Open access | Published: 19 February 2021

# Long-term exposure to a hypomagnetic field attenuates adult hippocampal neurogenesis and cognition

Bingfang Zhang, Lei Wang, Aisheng Zhan, Min Wang, Lanxiang Tian ✉, Weixiang Guo ✉ & Yongxin Pan

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BIO ELECTRO MAGNETICS BioEM

Research Article

# Hypomagnetic fields cause anxiety in adult male mice

Hai-min Ding, Xue Wang, Wei-chuan Mo, Ling-ling Qin, Steven Wong, Jing-peng Fu, Yan Tan, Ying Liu, Rong-qiao He, Qian Hua ✉

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## Other Archeomagnetic Artifacts

- Objects containing magnetic minerals that were heated to a high temperature in the past and then cooled down in the Earth's magnetic field

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## Lava Flows

The magnetic orientation of lava flows is used to make claims about the Earth's past magnetic field direction and intensity at historical times of the solidification of lava. By analyzing these orientations across multiple lava flows of different ages, scientists claim to reconstruct changes in the magnetic field.

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### Lake Sediments

As sediments settle and accumulate at the bottom of lakes, they are claimed to contain magnetic minerals that align with the Earth's magnetic field at the time of deposition. By analyzing the magnetic properties of layered sediment cores extracted from lake bottoms, scientists claim to trace variations in the magnetic field back throughout time.

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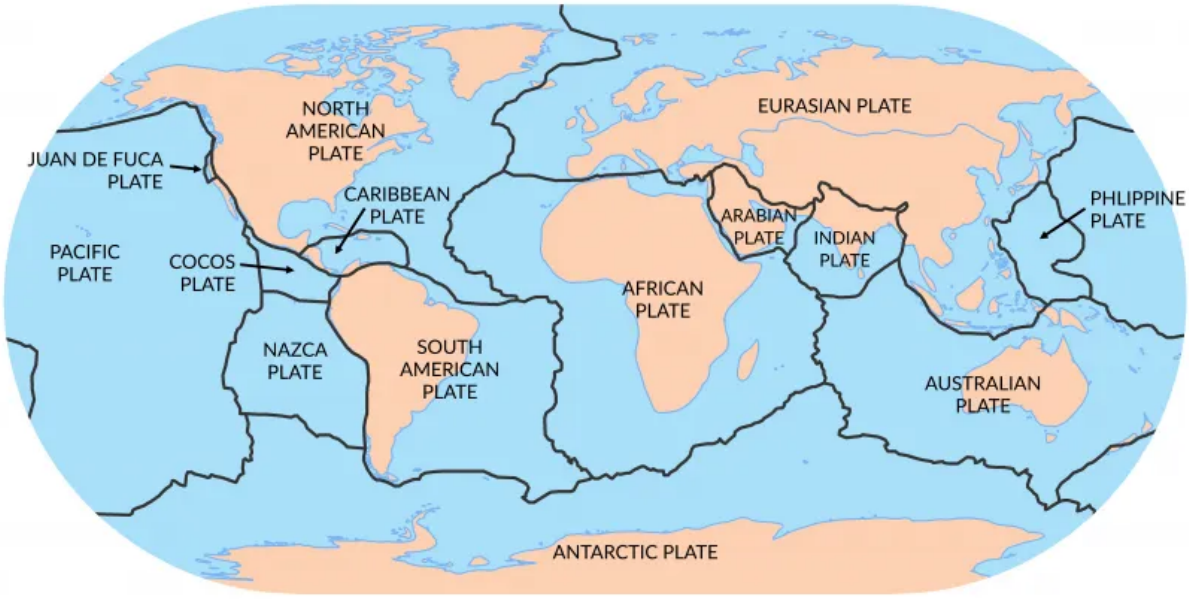
## Globular Plate Tectonics

- The foundation of geological theory and plate tectonics originates and conforms to magnetogeology

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## A Rotating Globe

What should a maximum-momentum, minimum-energy state look like?

- Semi-liquid interior should accentuate lack of uniformity in rotation
- The continents should "drift" outward to align the equator

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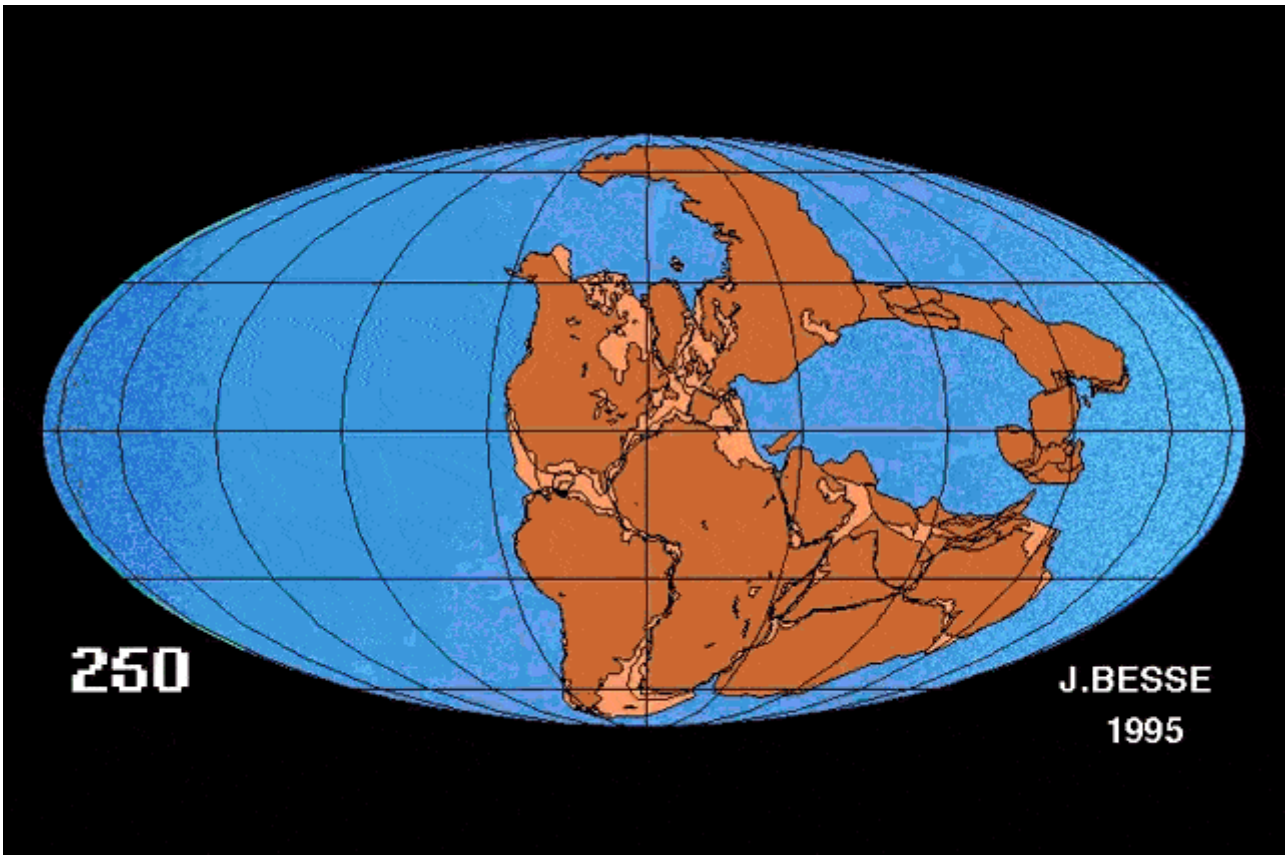
## Pangea




- Would cause great instability
- Paired with a semi-liquid interior, uniform rotation is impossible
- Foundational to geophysical assertions of the globe

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## Stratigraphy

Studying rock layers (strata) and their arrangement in order to understand Earth's history and the relative ages of geological formations

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- ### Lithostratigraphy
- Correlation of rock layers based on their lithology, composition, and physical characteristics.

- ### Magnetostratigraphy
- Utilizes magnetic polarities preserved in rock layers to establish chronological sequences

- ### Biostratigraphy
- Utilizes fossil content within rock layers to determine the relative ages of geological formations

- ### Chronostratigraphy
- Correlates rock layers based on their absolute ages, typically using radiometric dating methods, to establish a chronological framework

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## The Great Unconformity

A significant anomaly in modern geological theory, wherein older Precambrian rocks are directly overlain by much younger sedimentary rocks, often with a substantial gap in the geological record. This gap, which can represent hundreds of millions to over a billion years of missing rock layers, highlights a period of intense erosion and/or non-deposition that occurred before the deposition of the younger layers.

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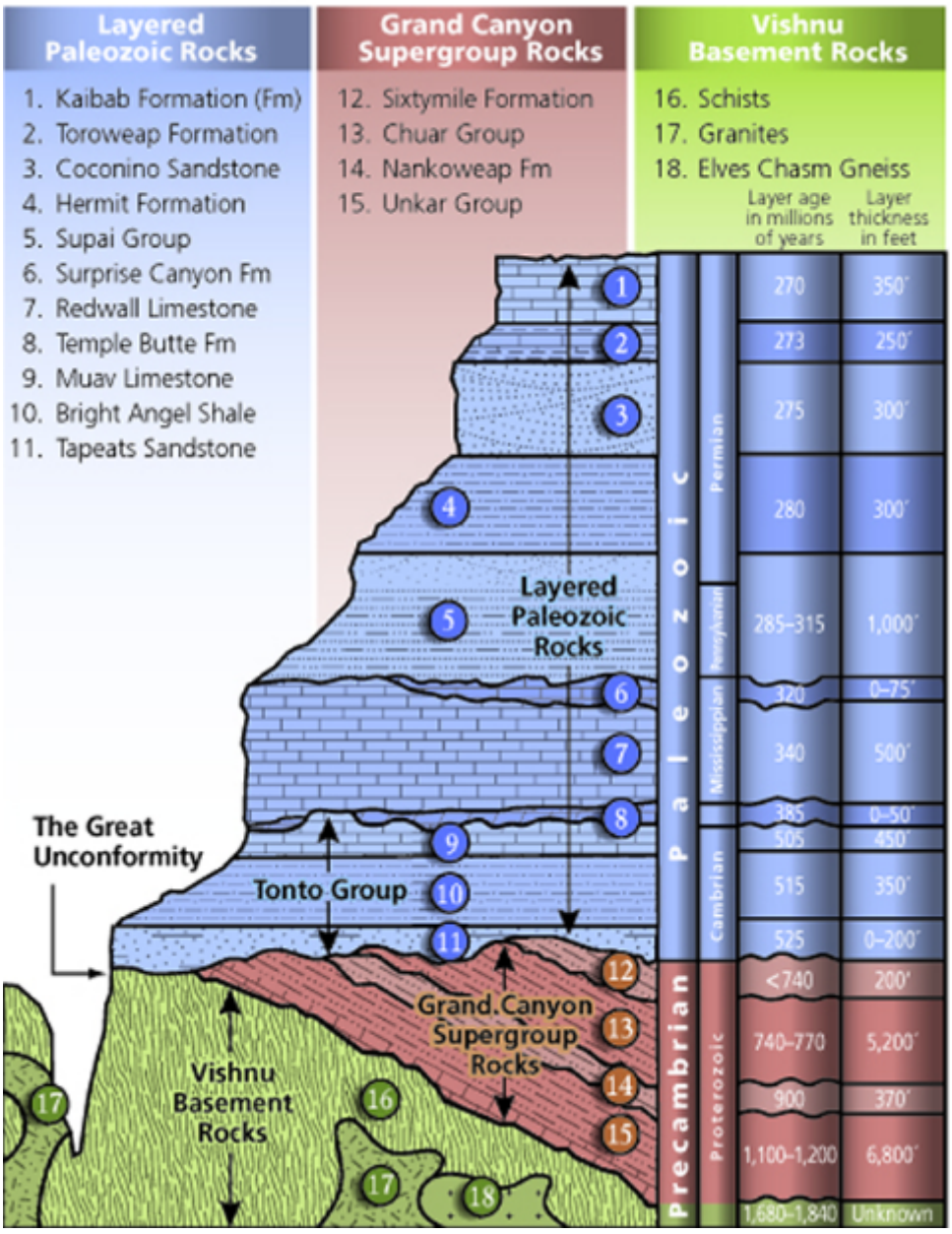
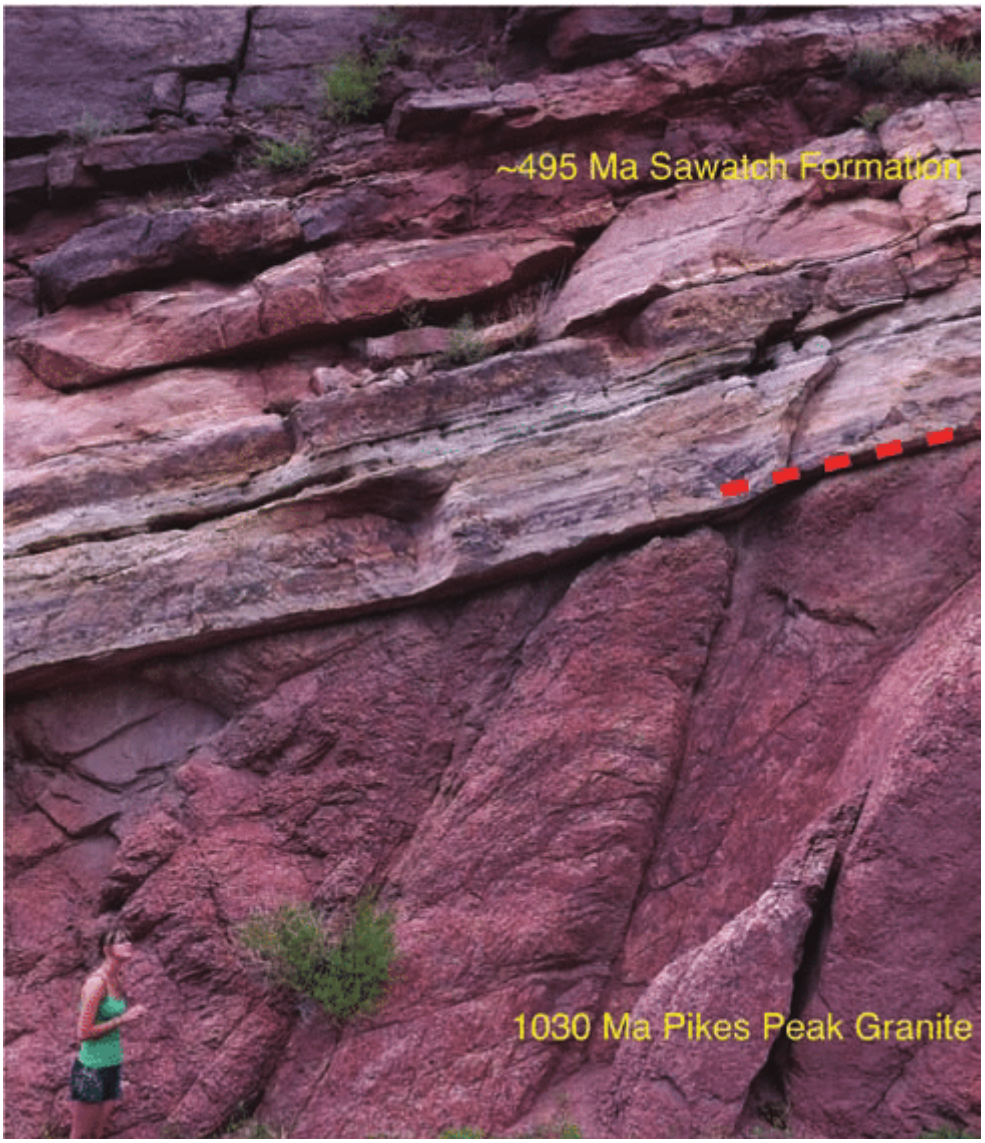
# Grand Canyon's Three Sets of Rocks




~495 Ma Sawatch Formation
1030 Ma Pikes Peak Granite

## The Crust-Mantle Boundary

- Never been observed or meaningfully measured
- Calculated and deduced from theory

## The Kola Superdeep Borehole

In the 1970's, Soviet scientists hoped to drill down 15,000 m in order to study the earth's "crust." It is now Bolted Down and Welded Shut.

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- Deepest Hole on Earth
- Deeper than the Mariana Trench
- Drilled for 24 years
- Depth
    - Expected 15,000 m
    - Reached 12,262 m
    - 0.002% of the way to the "center of the earth"
- Pressurized drilling mud and a custom drillbit
- Novel instrumentation invented to take measurements
- Water was found (at depths not expected)
    - "Squeezed out of rock crystals"
    - Never observed elsewhere
- Fossils found at depths up to 6.7 km
- Past the 12 km mark, heat and pressure became a technical issue
    - Expected Temperature: 100 degrees C
    - Discovered Temperature: 180 degrees C

    - Rocks "behaving like plastic"
- Earth's "mantle" begins at 35 km

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## The Bertha Rogers Well

1983, Oklahoma, USA
oil exploration well that inadvertently became one of the deepest holes ever drilled

- Much higher temperature and pressure than expected
- Reached a depth of about 9,583 m before it was abandoned, due to encountering molten sulfur

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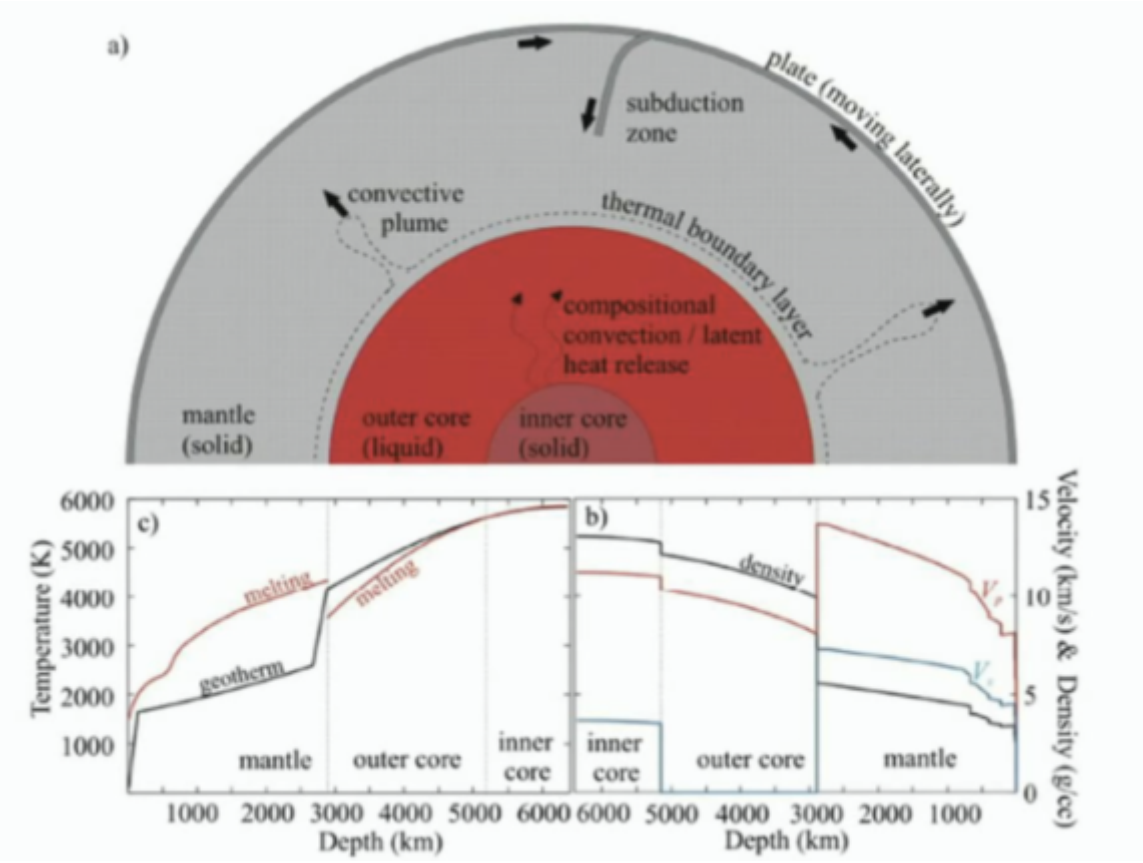
## The Core-Mantle Boundary

As pressure increases, the temperature necessary to melt minerals gets higher




*Carnegie Earth and Planets Laboratory: A Unique Window Into the Dynamics of Earth's Deep Interior*

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Modern theories maintain the idea that if the inner core of the earth were ~100 degrees C hotter, it would be liquid.

The crystal lattice orientation of the inner core is also a topic of debate.

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## Geodynamo Theories

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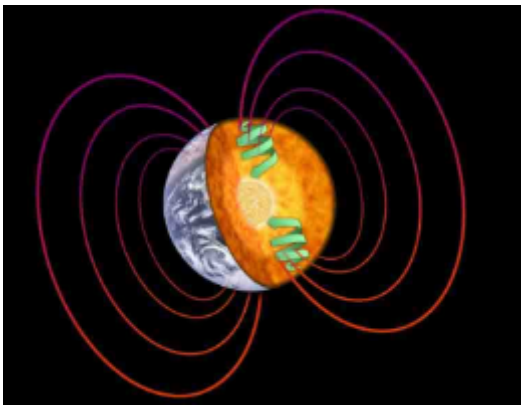

> In so far as a scientific statement speaks about reality, it must be falsifiable; and in so far as it is not falsifiable, it does not speak about reality.

- Sir Karl Popper (Philosopher)

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- Solid Inner Core
  - At least a few hundred million years old
  - Grows as the planet cools
- Liquid Outer Core
  - Convective and Coriolis motion of conductive fluids creates helical currents

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## Convection Currents

- Hot to cold, liquid iron and nickel in the outer core
- Hot Core (surface of sun temp)
- Cool Mantle
- Convective and Coriolis motion of conductive fluids creates helical currents
- The generated magnetic field, in turn helps to drive motion, and perpetuate the process of continuing to drive the

magnetic field

- As Earth rotates, the Coriolis effect influences these convection currents, organizing them into spiraling columns
- The turbulent movement of the molten metal generates electric currents, causing a dynamo effect
- Rotational movement of the helical currents is said to be the cause of secular variation

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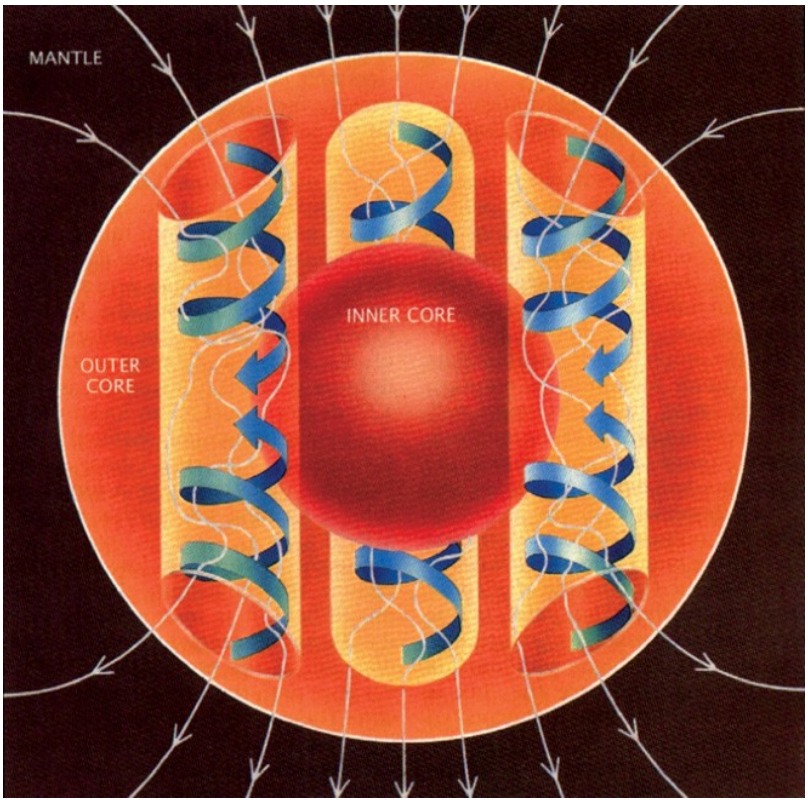


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- ## The Reynolds Value

  Ratio of advection of magnetic field to magnetic diffusion. The magnetic Reynolds number (Rm) in geodynamo models plays a crucial role in understanding magnetic field generation. It is defined as the ratio of magnetic advection to magnetic diffusion. In the context of geodynamo convection, the magnetic Reynolds number is a key

dimensionless parameter that influences the behavior of the magnetic field within the system. The Rm value determines the supercriticality of the magnetic Reynolds number, with values above 1 indicating a supercritical regime. This parameter is essential for assessing the efficiency of magnetic field generation processes within the Earth's core and is a fundamental aspect of geodynamo modeling. Understanding and analyzing the magnetic Reynolds number provide insights into the dynamics of the geodynamo system and its magnetic field generation mechanisms.

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## The Magnetic Reynolds Value

$$R_m \equiv \frac{\nabla \times (\mathbf{u} \times \mathbf{B})}{\eta \nabla^2 B} \sim \frac{u_o l}{\eta}$$

- $Rm$: Magnetic Reynolds number
- ∇×: Curl operator
- $u$: Velocity field
- $B$: Magnetic field
- $\eta$: Magnetic diffusivity
- ∇^2: Laplacian operator
- $u0$: Velocity scale
- $l$l: Characteristic length scale of the velocity field

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- The magnetic Reynolds number is crucial in determining the behavior of a self-sustained dynamo.

- For a dynamo to be sustained, the Reynolds number must be greater than 1, indicating that the rate of buildup of the magnetic field is higher than the rate of decay.
- If the Reynolds number is less than 1, the dynamo will not be able to sustain itself for an extended period.
- In the context of Earth's magnetic field, the Reynolds number helps in understanding how the Earth has maintained a relatively steady magnetic field over its history, with thermal convection balancing dissipative effects.

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## Magnetic Induction of the Geodynamo

$$\frac{\partial \mathbf{B}}{\partial t} = \nabla \times (\mathbf{u} \times \mathbf{B}) + \eta \nabla^2 \mathbf{B}$$

- ∂B: Rate of change of magnetic field with time
- ∇×($u$×$B$): Interaction of velocity field and magnetic field
- ($\eta$∇^2)×$B$: Rate of decay of magnetic field due to Ohmic dissipation

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- ### Ohmic Dissipation
  Ohmic dissipation represents the ratio of the rate of magnetic field buildup to the rate of decay due to dissipation. Ohmic dissipation plays a significant role in draining the mechanical energy stored in the magnetic field, converting it into heat. The interaction between the velocity field and the magnetic field leads to the buildup and breakdown of the magnetic field, with the dissipation balancing the energy loss. A critical condition arises when

the system becomes unstable due to the exponential increase in current and retarding torque, ultimately reaching equilibrium. This dynamic interplay between the magnetic Reynolds number and ohmic dissipation is fundamental in the context of dynamo theory and magnetic field generation.
magnetic diffusity

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## Lathrop Lab's Geodynamo

- Professor Dan Lathrop
- 3-meter steel sphere
- Filled with molten sodium to simulate Earth's core
- Spun to mimic Earth rotation, with an inner sphere spinning faster to represent the solid inner core.
- Adjustments to speeds and textures are used to generate electrical currents within sodium
- Aiming to replicate Earth's magnetic field without external power
- Decommissioned since it did not fully meet initial hopes
- Currently being "overhauled"

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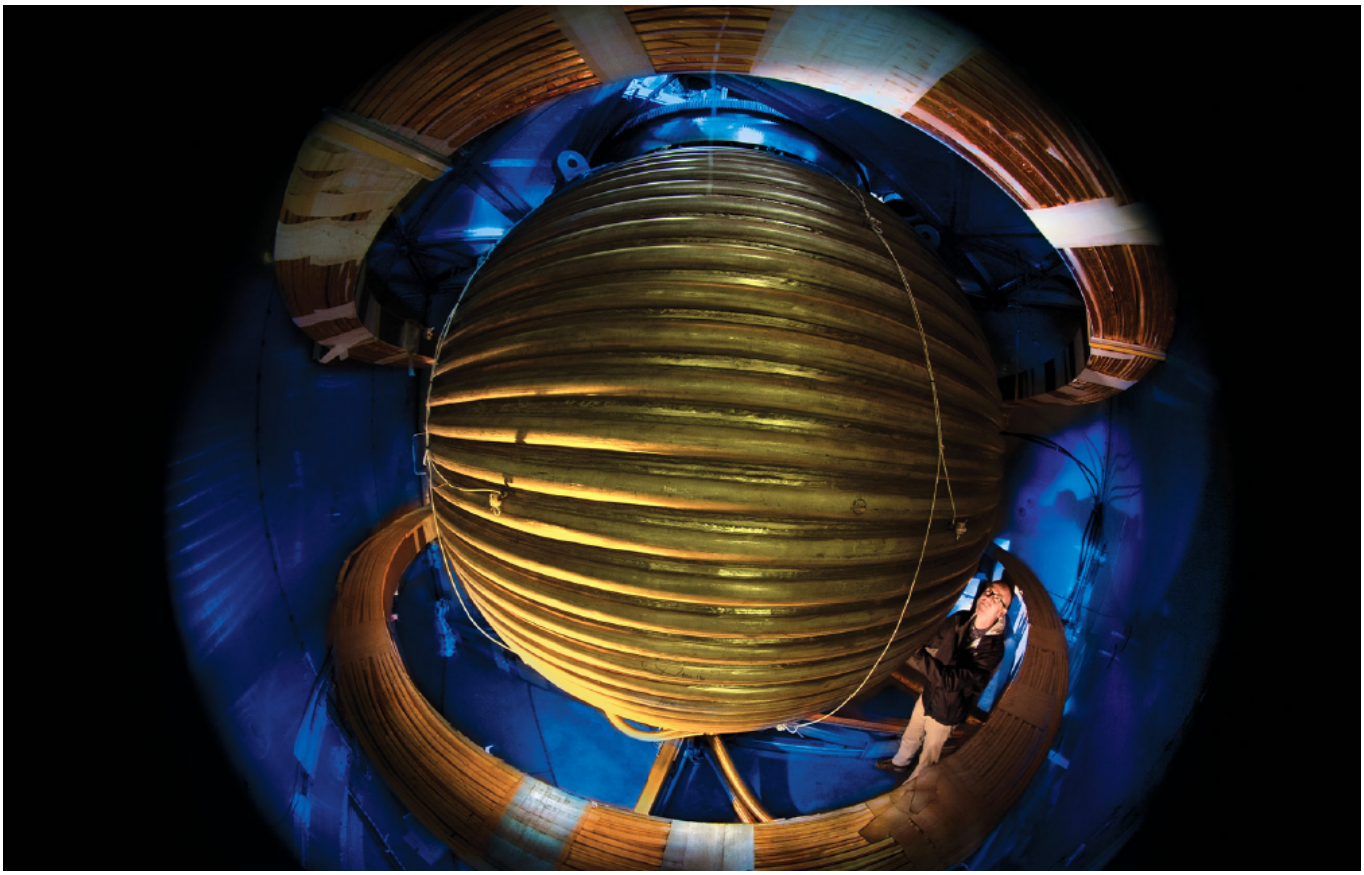

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- ## Dynamic Models
  - Dynamic models account for real forces and masses
  - If dynamic models are properly conceptualized, they should provide an equal or greater degree of accuracy to kinematic models, but with less computational efficiency

- ## Numerical Simulations
  - Advances in computational power have enabled detailed numerical simulations of the geodynamo.
  - Aim to reproduce observed features of Earth's magnetic field, such as field reversals and secular variation

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- ### Kinematic Models
  - Do not account for real forces and masses
  - Use the Boussinesq approximation, rather than the full Navier-Stokes equations (density variations in a fluid are negligible except where they appear in buoyancy terms)
  - Calculations are based on fluid motions
  - Frequently used for computational efficiency

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# Alternative Geomagnetism theories

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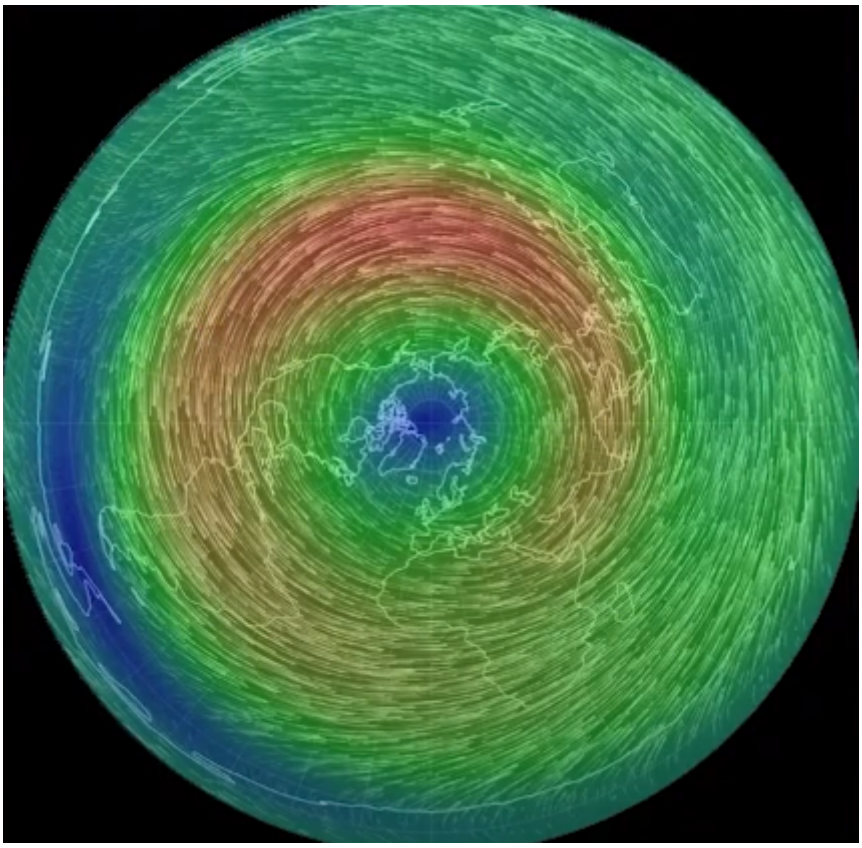
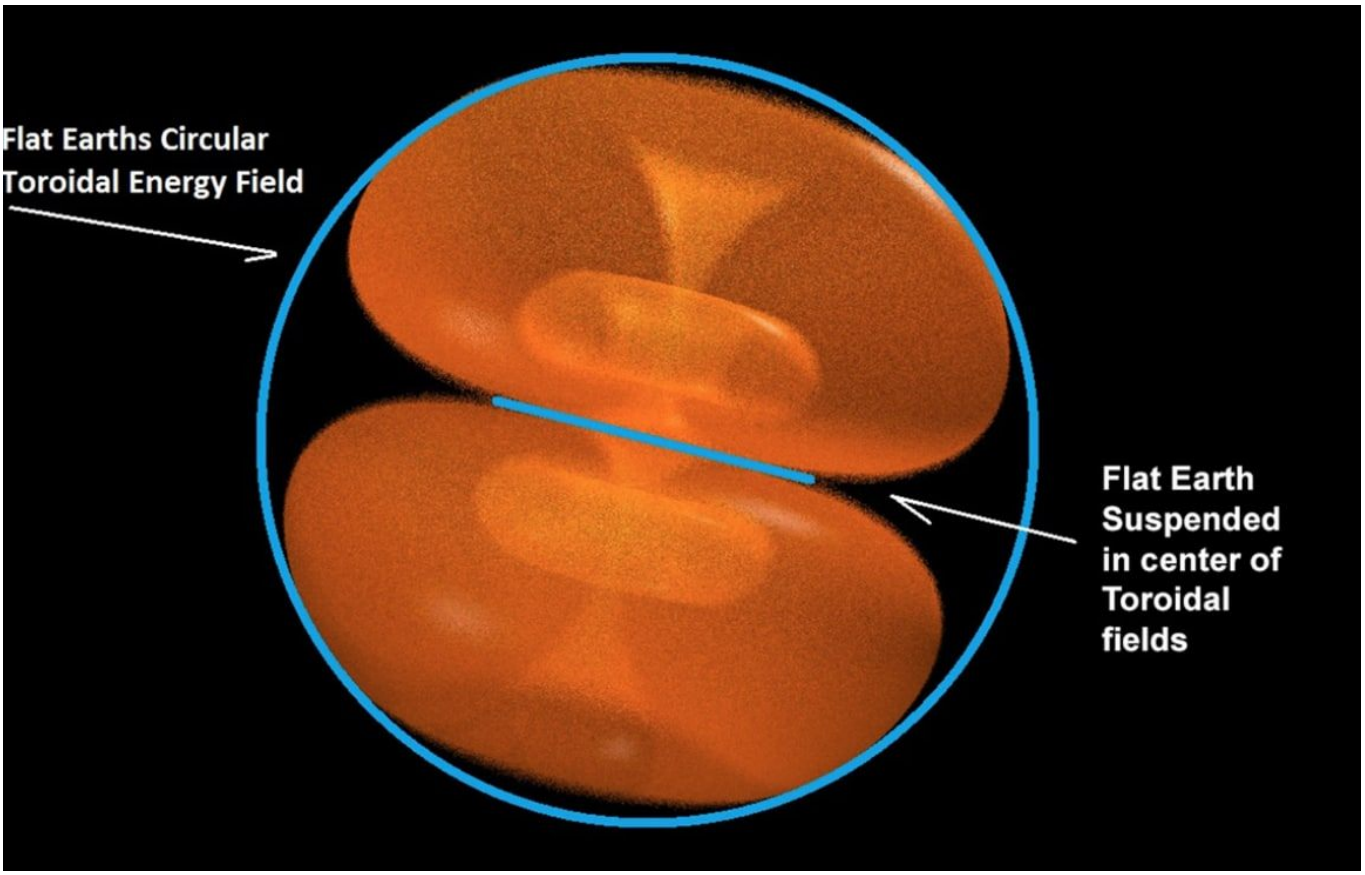
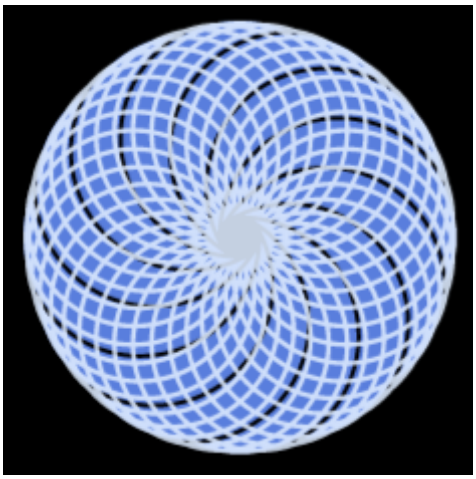
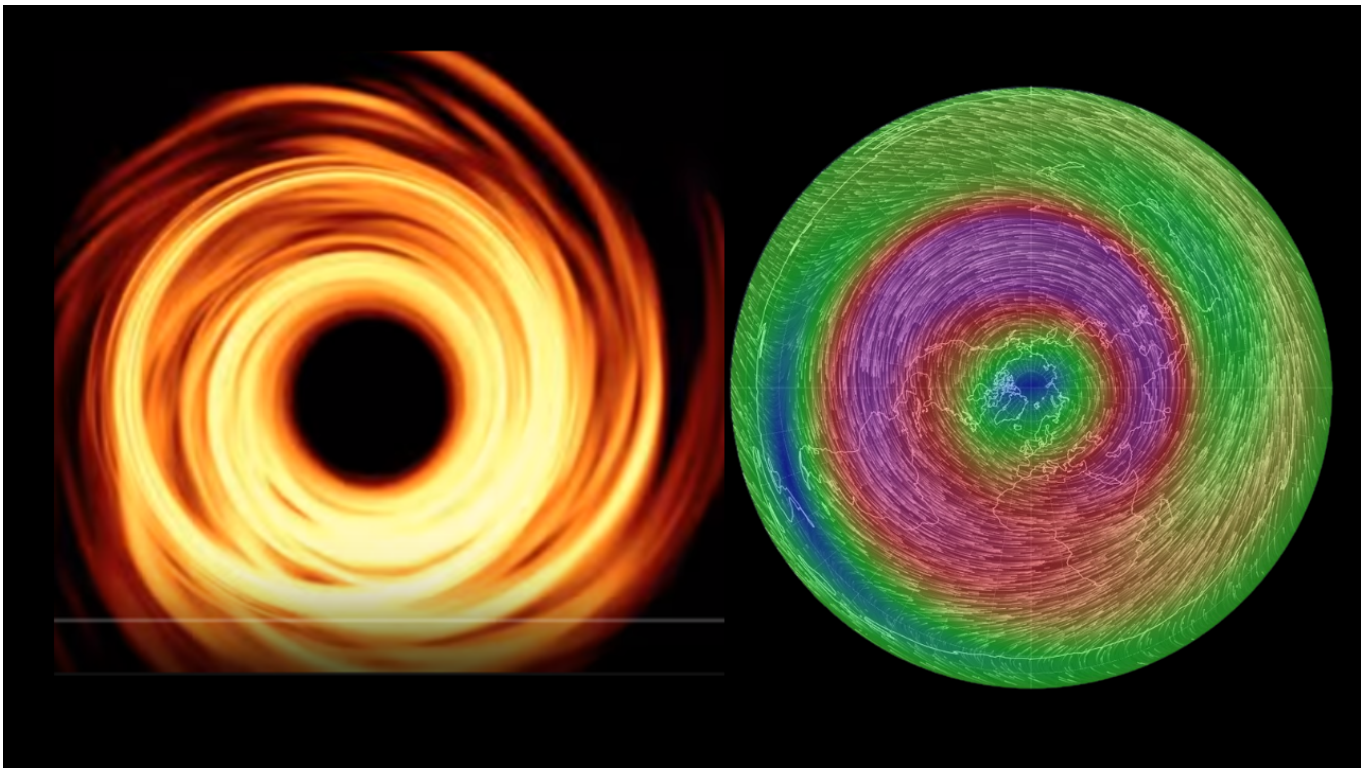
## Flat Earth Vortex Theory

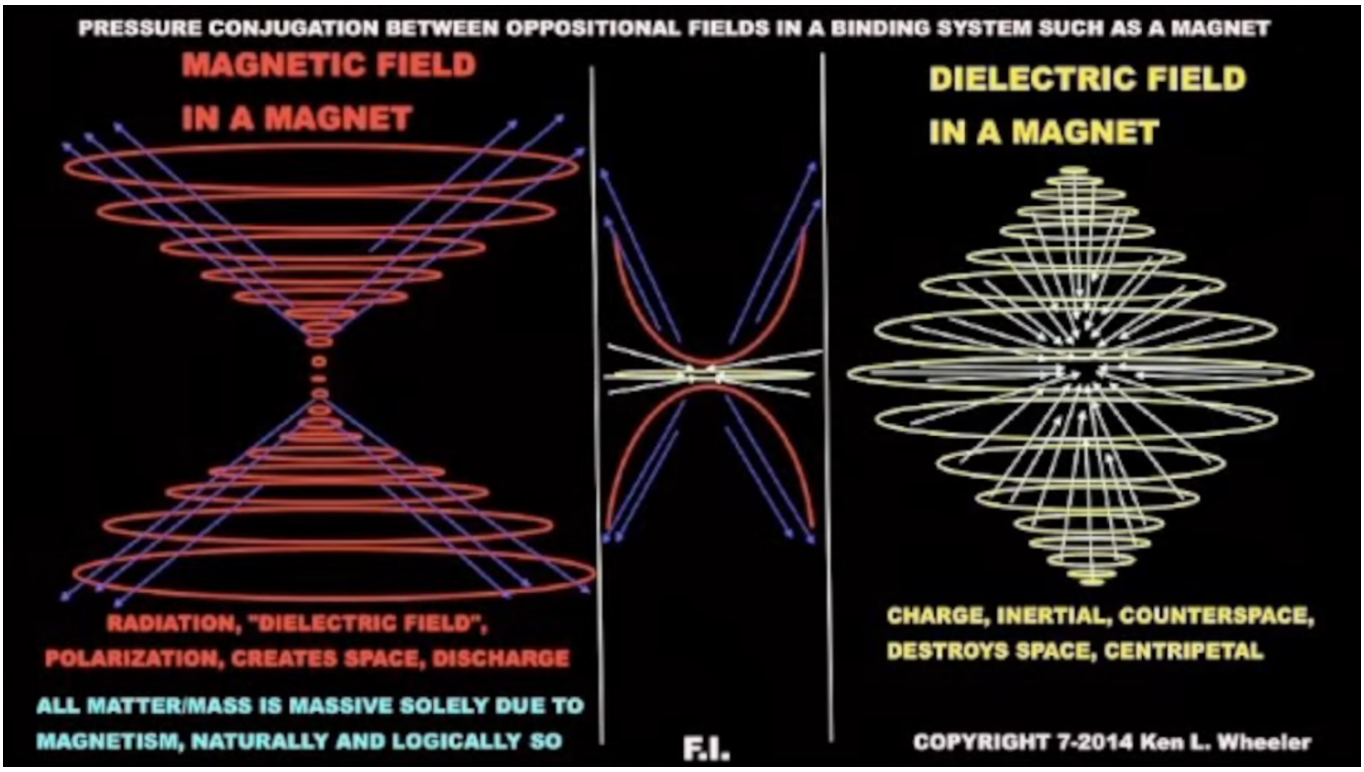
We live in a magnetic toroidal field
Compasses and the magnetic field align toward the center of the vortex




Flat Earths Circular
Toroidal Energy Field
Flat Earth
Suspended
in center of
Toroidal
fields






PRESSURE CONJUGATION BETWEEN OPPOSITIONAL FIELDS IN A BINDING SYSTEM SUCH AS A MAGNET
MAGNETIC FIELD
IN A MAGNET
DIELECTRIC FIELD
IN A MAGNET
RADIATION, "DIELECTRIC FIELD",
POLARIZATION, CREATES SPACE, DISCHARGE
CHARGE, INERTIAL, COUNTERSPACE,
DESTROYS SPACE, CENTRIPETAL
ALL MATTER/MASS IS MASSIVE SOLELY DUE TO
MAGNETISM, NATURALLY AND LOGICALLY SO
F.I.
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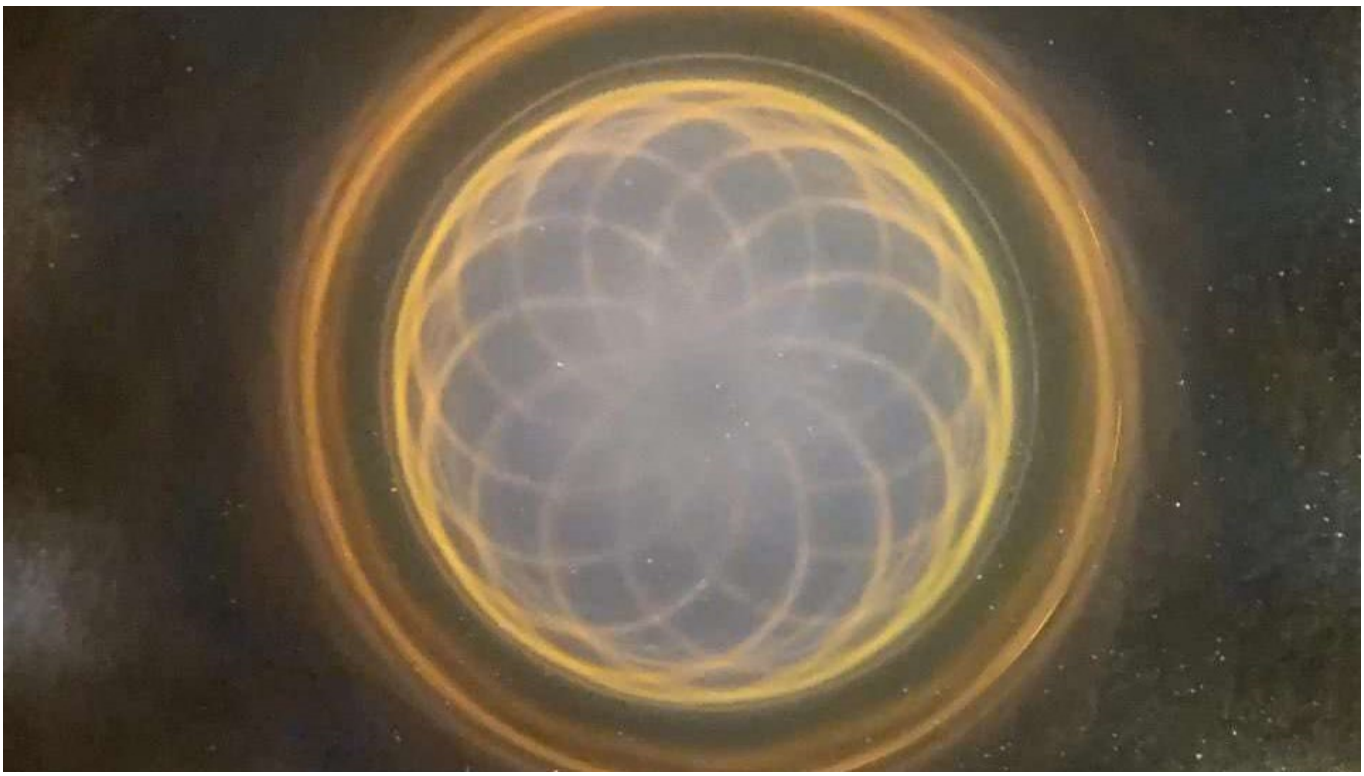
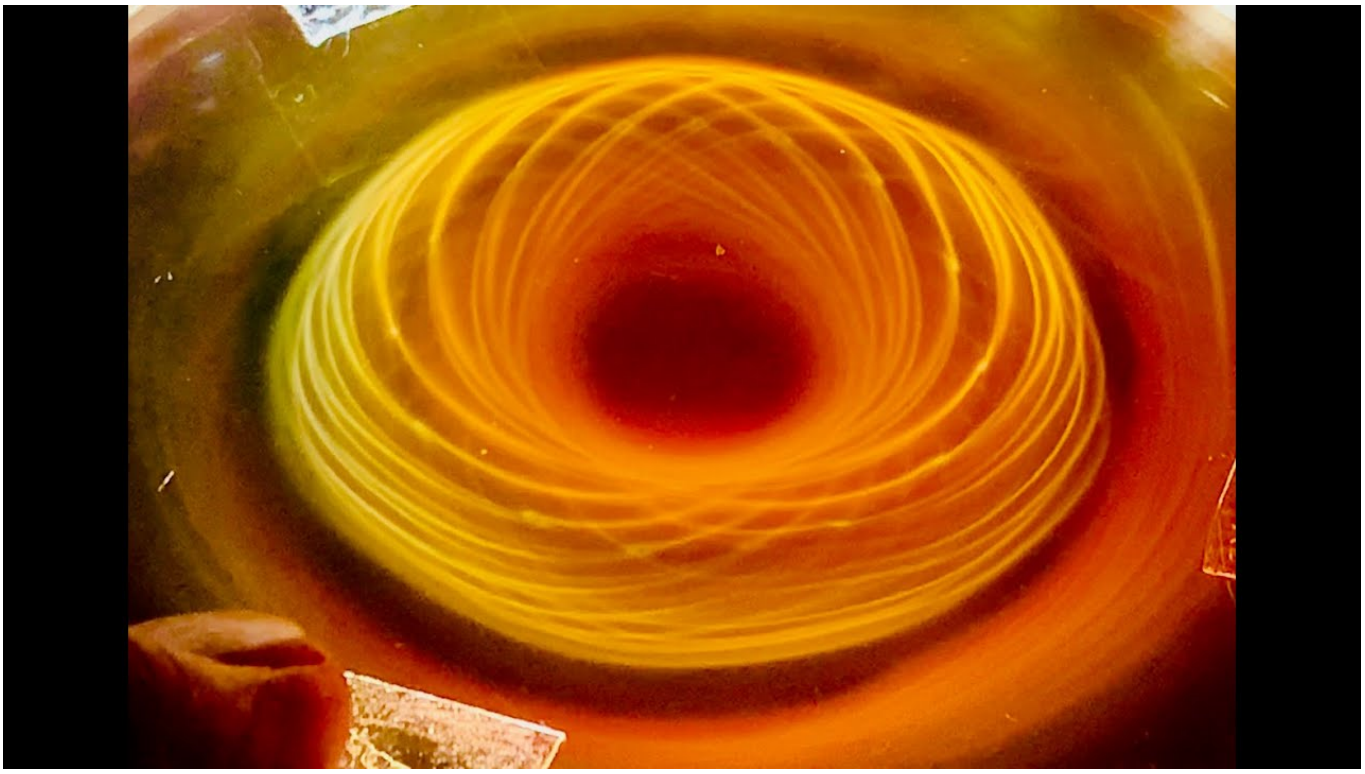




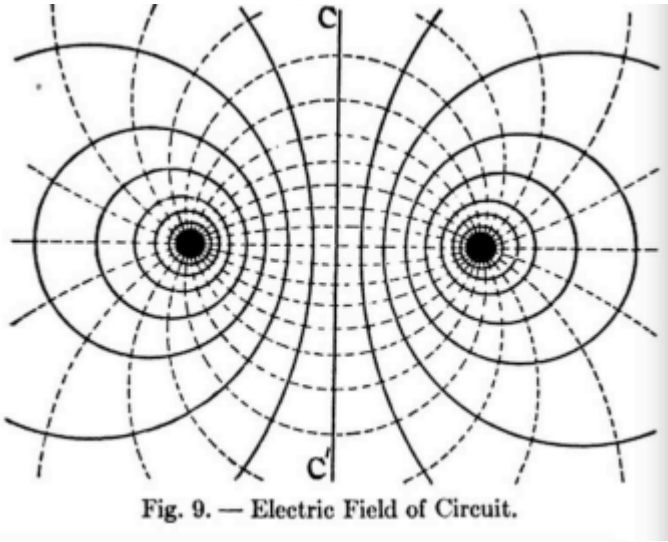
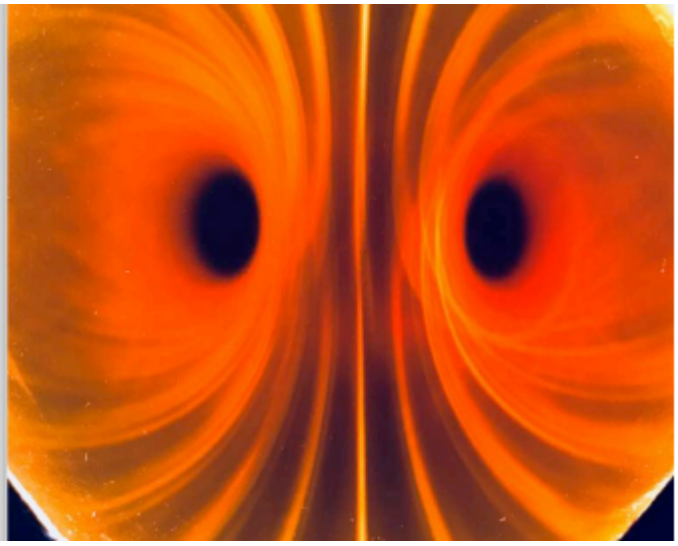
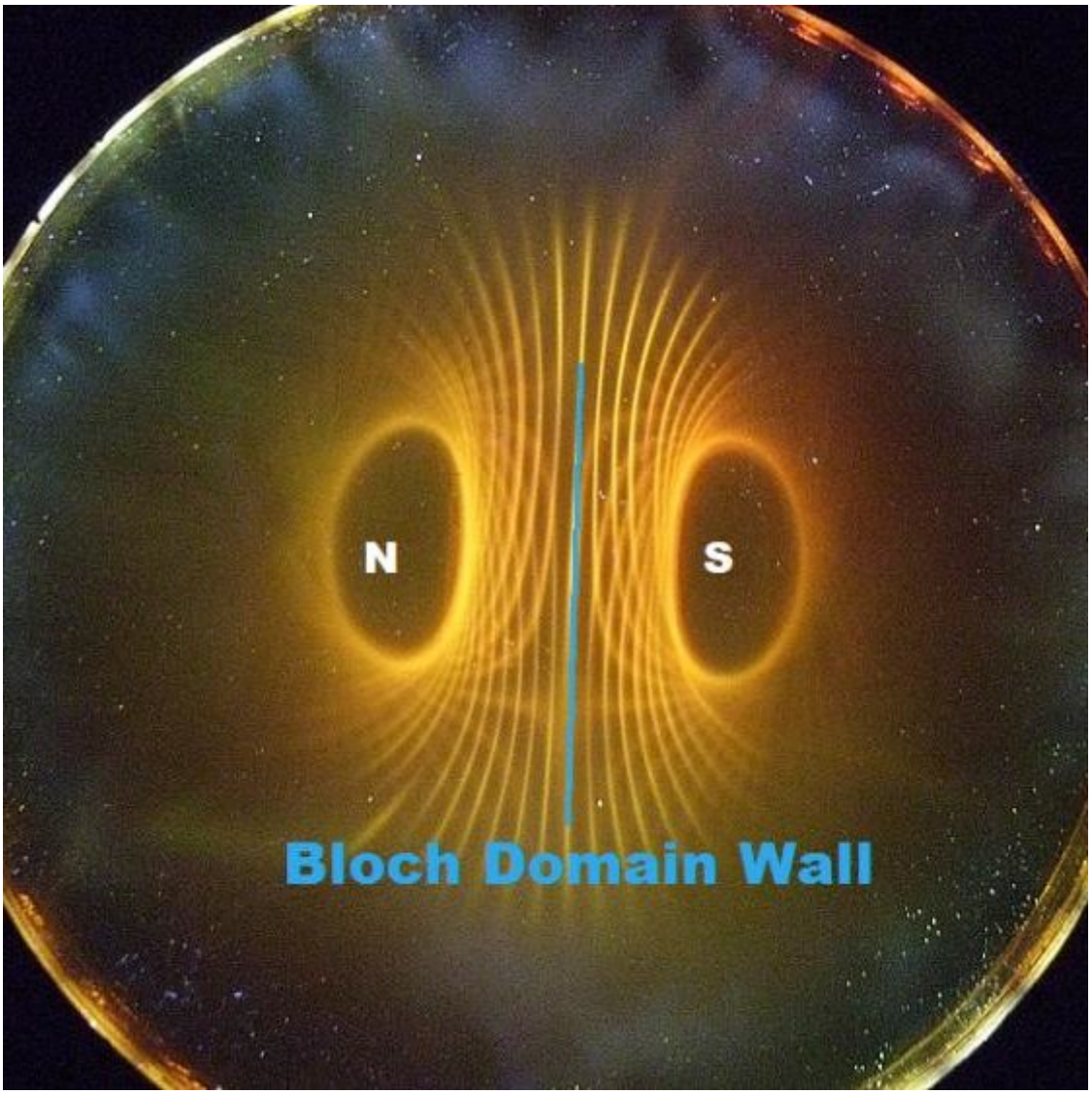
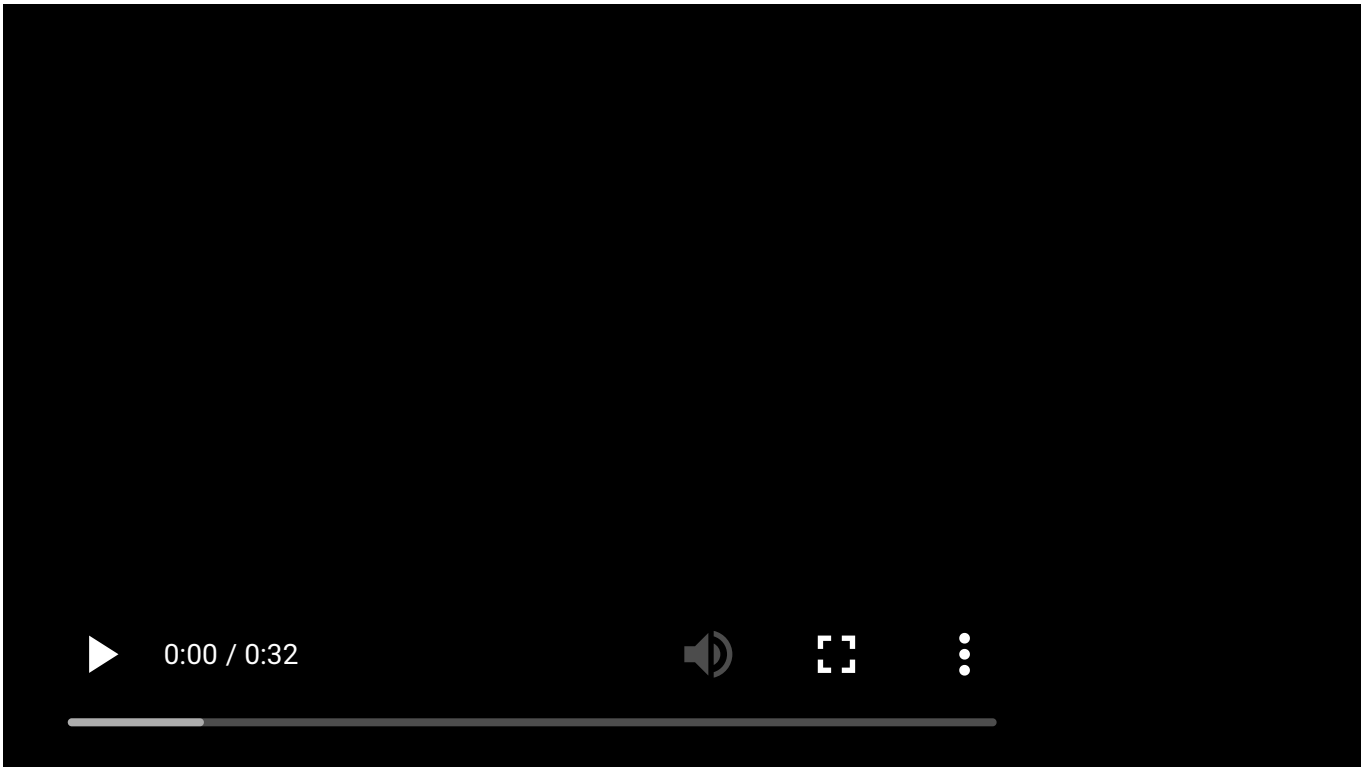



Fig. 9. — Electric Field of Circuit.






Video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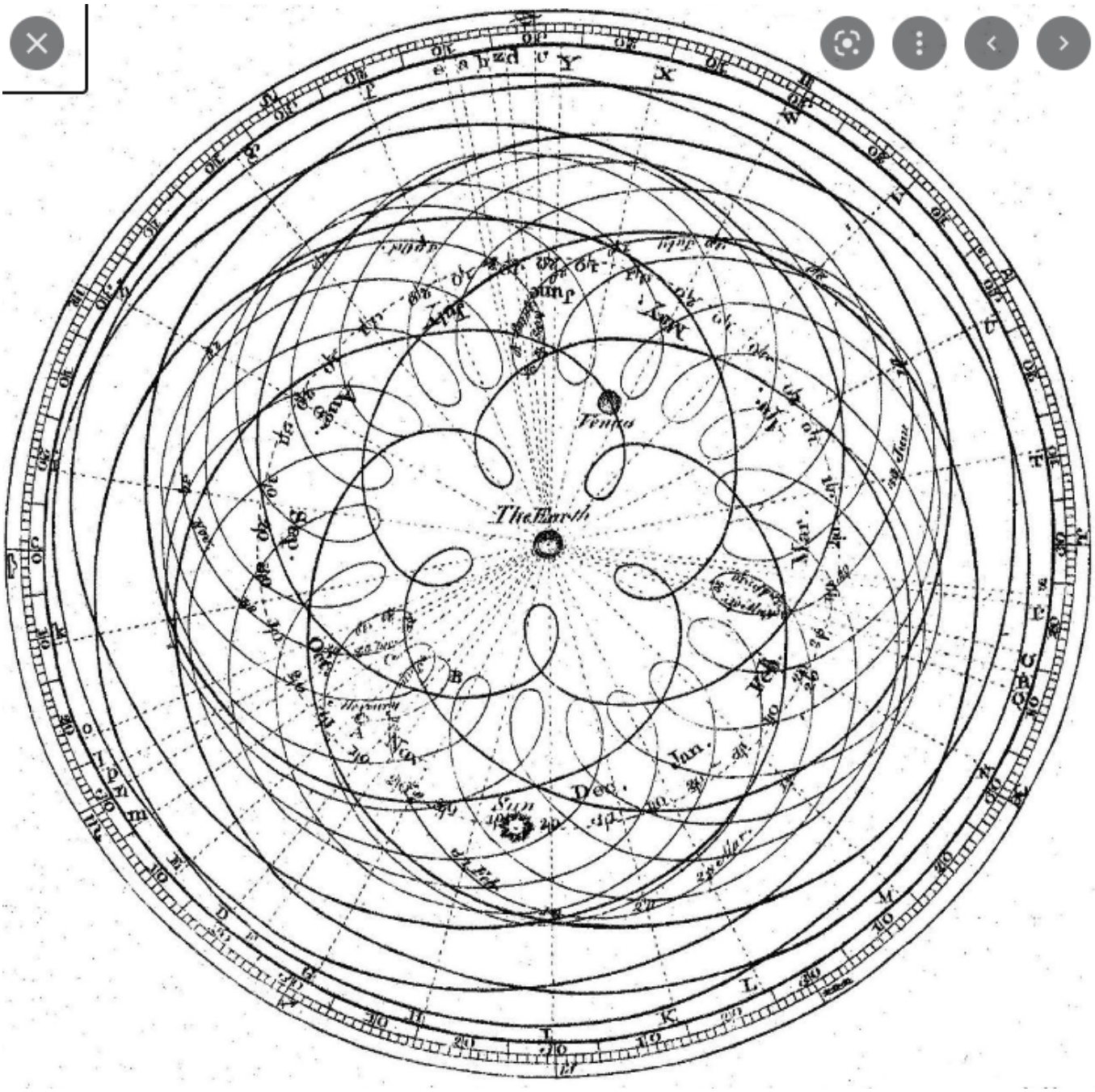
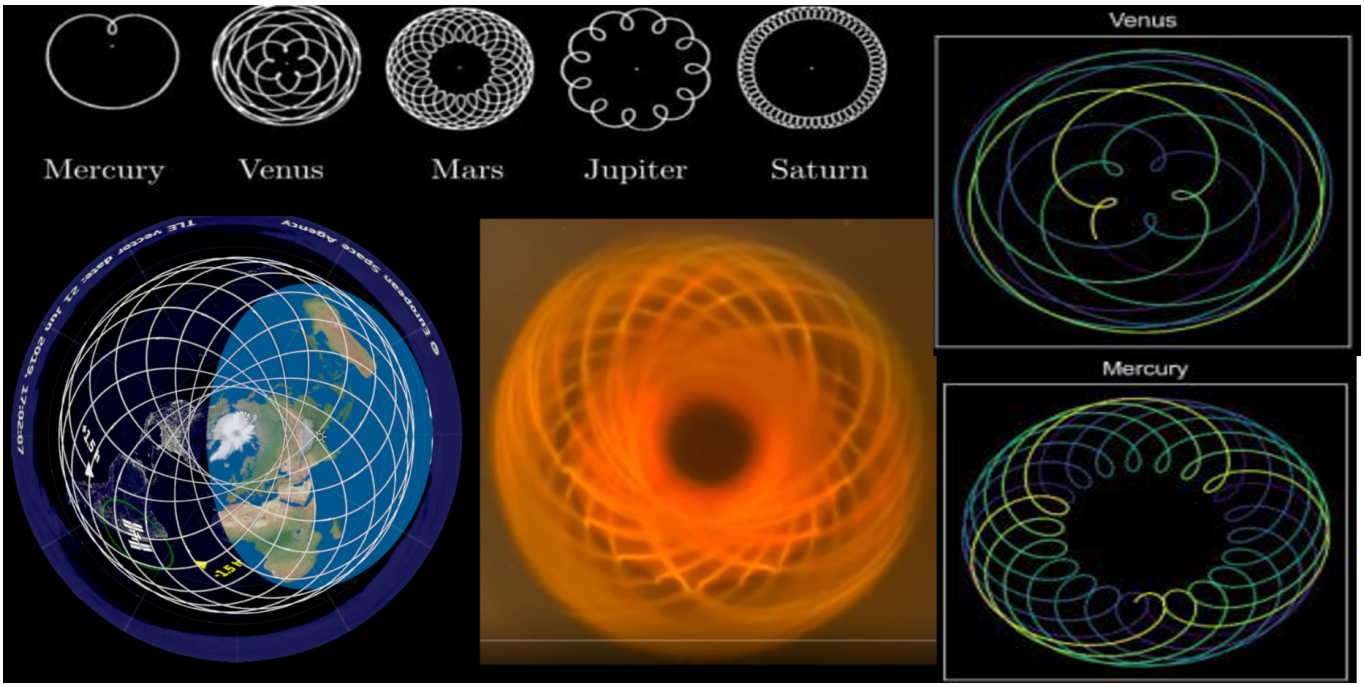
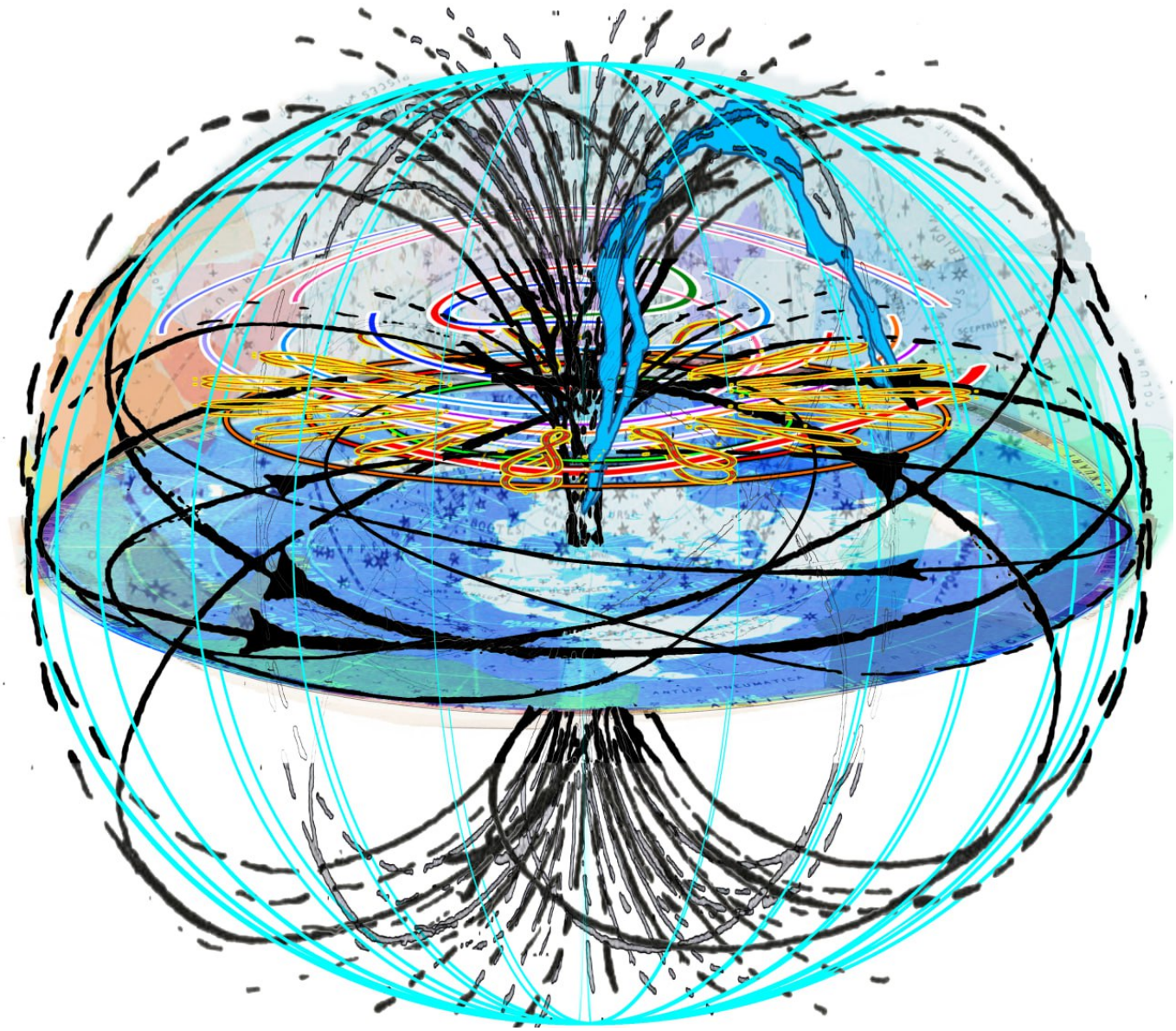
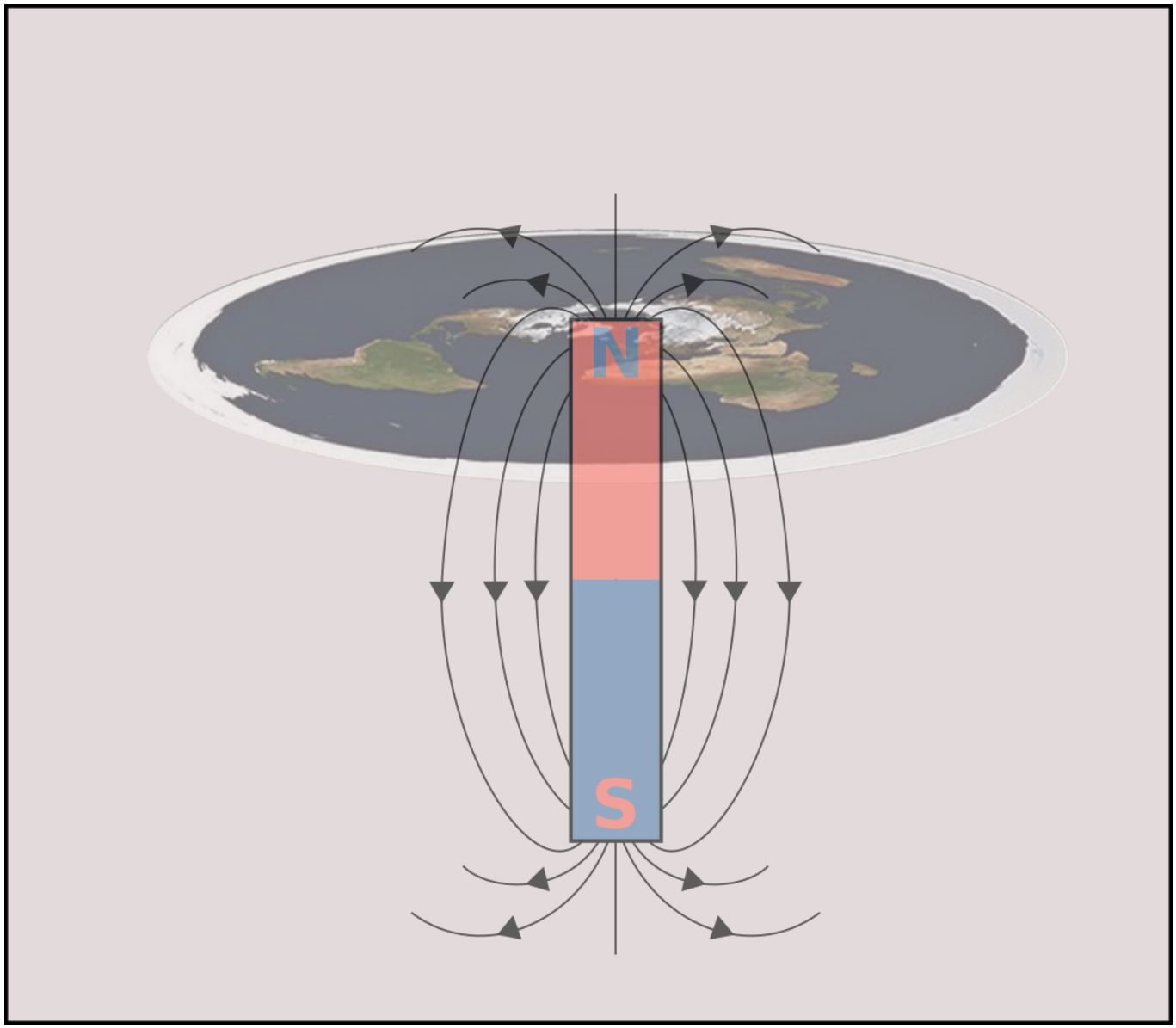

Venus
The Earth
June
May
April
March
Aug.
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.


Mercury
Venus
Mars
Jupiter
Saturn
Venus
Mercury



## Underground Ferromagnetism




Courtesy @ManofStone

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Thank You