# Paul Marmet.

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## About the Author

### Paul Marmet, Ph. D. (1932-2005)

From 1990 to 1999, Paul Marmet was assistant professor in the physics department of the University of Ottawa. He was a senior researcher at the Herzberg Institute of Astrophysics of the National Research Council of

Canada, in Ottawa, from 1983 to 1990. From 1967 to 1982, he was director of the laboratory for Atomic and Molecular Physics at Laval University in Québec City.

A past president of the Canadian Association of Physicists (1981-1982), he also served as a member of the executive committee of the Atomic Energy Control Board of Canada from 1979 to 1984. Marmet was elected Fellow of the Royal Society of Canada in 1973 and was made an Officer of the Order of Canada in 1981. The Order of Canada is the highest decoration bestowed by the Canadian government.

***The Author's Electron Beam Device.***

Paul Marmet (Who's Who) is shown here at the Herzberg Institute of Astrophysics in Ottawa with the electron spectrometer he pioneered. The spectrometer developed during his Ph. D. thesis (1960) produces a very low-energy monoenergetic electron beam (0 to 100eV) in vacuum which is used to study the internal structure of atoms and molecules. This spectroscopic technique uses a beam of monoenergetic electrons instead of photons used by most spectroscopists. As in other electron beam devices, the free electrons are produced by heating a filament in high vacuum. Just after emission, electrons in such a beam vary in their individual energies by 1eV or more. In Marmet's spectrometer, the spread of electron energies is reduced to 10mV so that the results of the interaction provide information with a resolution improved by a factor of 100. Also, an electrodynamic quadrupole mass spectrometer with hyperbolic electrodes is used instead of a magnetic analyser, since the sensitive electron source requires a magnetic-field free environment. The ion current is measured counting individual ions.

In the ion source, the electron beam is crossed with a collimated beam of atoms or molecules directed at right angle. The number of ions produced in the resulting interactions is measured as a function of the electron energy, and provides the information about the electron configuration in the atoms and molecules. The energy of the electron beam gives the absolute energy of the quantum state.

The advantages of using an electron beam instead of photons are multiples. Since photons do not carry electric charges, they cannot produce directly negative ions. The absence of an electric charge in photons is responsible for the fact that most of the negative ions have not been studied extensively. The energy of excited negative ion states is a very undeveloped field in physics. These negative ions are however very important in the experiments in plasma physics.

Using this electron beam, this instrument measures multiple electronic states of negative ions of hydrogen, helium, nitrogen, oxygen, all the halogens and also numerous diatomic molecules like carbon monoxide, methane, and many others. Even doubly or triply excited states of negative ions can be measured and identified. For example, using that electron beam, this instrument was used to discover and measure negative helium ions with all three electrons in an excited state [i.e. $He^-(2s^2 2p)$]. These short-lived quantum states cannot be measured using photon spectroscopy. It was also interesting to measure different quantum states (and their half-life) of negative diatomic argon molecules and all other inert gases, which remain stable long enough to be measured in the mass-spectrometer. Using that monoenergetic electron beam, several hundred states have been discovered in numerous atoms and molecules. Finally, using the filtering power of the mass spectrometer, several free radicals have been studied.

Marmet and his mentor, Larkin Kerwin, described their pioneer work on this electron source in Citation Classics (Nov. 23, 1987). More than 100 scientific papers of spectroscopic data and interpretations have been published on this subject. Furthermore, about 200 other papers have been presented in numerous international and national meetings.

Between 1978 and 1998, the author also published several other papers related to the fundamental principles in physics. Several of these papers are presented on this web site. In 1997-99, physicists of the establishment showed fierce disagreement with the fact that Marmet's research implied that the fundamental principles of physics were being questioned. Although the experimental work, which could determine the energy of numerous quantum stated was highly appreciated and even honored, the physics establishment required that the author should stop questioning the fundamental principles of physics. The author was first informed by NSERC (Natural Science and Engineering Research Council of Canada) to stop doing that fundamental research despite the fact that, being theoretical, it required no research funds – all research grants were used for the experimental work needed for the electron impact apparatus. Since the fundamental research was still going on the following year, the grant was cut to zero, putting an end to experimental work using the monoenergetic electron beams.

In May 1999, the head of the physics department came to Marmet's office and said: "*Ce n'est pas ton bureau que nous voulons, ton problème est que tu remets en question les principes fondamentaux de la physique*." ("We do not want your office, your problem is that you keep questioning the fundamental principles of physics.") Three months later, a letter was sent requiring Marmet's office to become unoccupied before the end of the month. Without research grant and being expelled from his office, Dr. Marmet continued his research alone at home.

This was the irrevocable death of a unique instrument in the world, which was able to measure the electronic structure of negative ions and their ionization efficiency curve using a high resolution monoenergetic electron beam. A few months later, the instrument was destroyed. Also, this shows that physics is not only a science, it is a doctrine. Therefore, there are heretics. It's not different from Galileo's time!

*Paul Marmet*

# Obituary

## Paul Marmet, Ph. D. (1932-2005)

*May 2005*

*On May 20$^{th}$ 2005, Paul Marmet passed away in Ottawa after complications due to bone marrow cancer. Dr. Marmet was a retired assistant professor at the Physics Department of the University of Ottawa. He was formerly a Senior Researcher at the Herzberg Institute of Astrophysics of the National Research Council of Canada in Ottawa. From 1967 to 1982, he co-founded and directed the laboratory for Atomic and Molecular Physics where he was full professor at l'Université Laval in Québec City. In 1967, he spent his sabbatical in the department of chemistry at l'Université de Liège in Belgium. In 1961, Dr. Marmet spent a year at the CSIRO Melbourne, Australia to work on negative ions. He developed an electron selector which played a major role in high resolution electron beam spectroscopy.*

A past president of the Canadian Association of Physicists (1981-2), he also served as a member of the executive committee of the Atomic Energy Control Board of Canada. Dr. Marmet has been elected Fellow of the Royal Society of Canada and was made an Officer of the Order of Canada. He was awarded the Herzberg prize, the Rutherford prize, the Parizeau medal and a Service Award from the Royal Astronomical Society of Canada. He is the author of over a hundred journal papers, four books and 200 presentations at scientific meetings.

At l'Université Laval, he worked with his mentor Larkin Kerwin on studies of the interaction of low-energy electrons at surfaces. This enabled him to develop a high resolution electron selector – 10 meV resolution with beam energy ranging from 0.5 eV to 100 eV. Multiple electronic states of negative ions were measured: hydrogen, helium, nitrogen, oxygen, all the halogens and numerous molecules. Even doubly or triply excited states of negative ions were measured and identified. Several hundred states which are not accessible via optical transitions have been discovered in numerous atoms and molecules. Finally, using the filtering power of a mass spectrometer he developped, several free radicals were studied. His electron selector was widely used in electron scattering studies which led to several discoveries such as enhanced vibrational excitation in nitrogen and the first Feshbach resonance in helium. The experimental system he developed was able to detect negative ions in the ionization efficiency curve. His design remains among the most popular in use today.

His interest in astronomy led him to study the numerous anomalies observed by astronomers, especially the inconsistent redshifts reported in the works of H. Arp. To explain these anomalies, Dr. Marmet suggested that an energy loss mechanism resulting from dipole emission could leave the same signature on spectral absorption lines as the Doppler redshift. The dipole is created by momentum transfer of a photon in its interaction with a single molecule in a low density gas. Observations of massive quantities of molecular hydrogen by the European Space Agency's Infrared Space Observatory confirms there is enough interstellar gas to support his hypothesis that the cosmological redshift is not entirely of Doppler origin. The mechanism still waits for a detailed quantum mechanical development and experimental verification in the laboratory. He also proposed other models to explain non-intuitive quantum mechanical phenomena and relativity. He is said to be a strong critic and a mighty rebel in physics. He leaves many incomplete ideas and many colleagues still wishing to discuss with him.

He will be missed as a good experimentalist and also as my father.

Louis Marmet
Institute for National Measurement Standards
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# Canadian Who's Who

2001 Edition

**MARMET, Paul,** O.C., D.Sc.; physicien, éducateur; né Lévis, Qué. 20 mai 1932; f. Albert et Corinne (Filteau) M. (décédés); e. Univ. Laval B.Sc. 1956, D.Sc. 1960; CSIRO Melbourne, Australia Postdoctoral 1960-61; ép. Jacqueline f. Albert Côté (dé.) 6 Juin 1959; enfants: Louis, Marie, Nicolas, Frédéric; Prof Adjoint, Dept. Physique Université d'Ottawa 1991-99; enseignement en Physique, Coll. Univ. Laval 1958-60; Asst. de recherche CSIRO, Melbourne, Australia 1960-61; prof. auxiliaire, Univ. Laval 1961, prof. agrégé 1966, prof. chercheur 1974-77, prof. titulaire 1970-84; Agent de recherche senior, Institut Herzberg d'astrophysique, Conseil National de recherches 1984-91; Dir. du Lab. de Physique Atomique et Moléculaire 1967-82; année sabbatique au service de Chimie, Université de Liège, Belgique 1967; mem. co-fondateur du Centre de recherche sur les atomes et les Molécules (CRAM), bureau de direction 1967-69; mem. du Comité de subventions du Gouvernement du Qué. 1975; Comité des Subventions-Physique du C.N.R.C. 1971-74, représentant Canadien, Union Internationale de Physique pure et appliquée 1976-79; Comité d'Organisation des IPEAC Paris 1977 et Tokyo 1979 (Organisateur du IV Congrès International de la Physique des Collisions Atomiques et Ioniques, Qué. 1965); Officier de l'Ordre du Canada, 1981; Médaille Herzberg de l'Assn. Canadienne des Physiciens 1971; Prix Rutherford de la Société Royale du Can. 1960; Médaille Pariseau (ACFAS) 1976; Service Award Soc. Royale d'Astronomiedu Can.; Prix Concours Scientifique de la Prov. de Qué. 1962; Bourse Post-doctorale du CNRC Melbourne 1960, 3 bourses graduées 1957-59; co-auteur *High Resolution Electron Beams and their Applications* 1969; Auteur *A New Non-Doppler Redshift* 1981; *Absurdities in Modern Physics: A Solution* 1993; *Einstein's Theory of Relativity versus Classical Mechanics* 1997; articles nombreux; mem, Conseil de Dir., Commn. de Contrôle de l'Énergie Atomique du Can. 1979-84; mem. Société

Royale du Canada; Assn. Canadienne des Physiciens Vice Prés. 1979-81, Prés. 1981-82; Am. Phys. Soc.; Soc. Royale d'Astronomie du Canada;

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