

Biographical Encyclopedia of Astronomers

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Poincaré, Jules-Henri

Born Nancy, Meurthe-et-Moselle, France, 29 April 1854

Died Paris, France, 9 July 1912

The French mathematician and philosopher Henri Poincaré made contributions to a wide range of scientific problems, including many in celestial mechanics. Poincaré came from an eminent French intellectual family. His father was a professor of medicine at the University of Nancy, and an uncle was an inspector-general of roads and bridges in France. His cousin, Raymond Poincaré, was a lawyer, statesman, and president of the French Republic during World War I, and his sister married the philosopher Emile Boutroux. Henri Poincaré was happily married to the great-granddaughter of the zoologist Etienne Geoffroy Saint-Hilaire

From infancy, Poincaré experienced poor health, including diphtheria at age five. His motor coordination was poor, he had great difficulty learning to write, and he found drawing impossible. Poincaré was unable to read from a blackboard, but his memory was such that he could memorize mathematical formulas and theorems upon hearing them and remember the exact contents of books after a single reading.

Poincaré studied at the École Polytechnique and the École Supérieure des Mines (School of Mines), both in Paris. His inability to draw was a problem for a potential engineer, but he revealed himself as a brilliant student and a genius in mathematics. After graduating as a mining engineer, Poincaré earned a doctorate in mathematical sciences at the Paris Faculty of Sciences with a thesis on differential equations. Appointed professor of mathematics at the University of Caen in 1879, he moved to the University of Two years later he moved to Paris, where he held the chair of experimental physics until his death. Considered the last universalist in mathematics, Poincaré published more than 500 papers and 30 books on nearly all branches of pure and applied mathematics, including theoretical physics and mathematical astronomy.

In 1889, Poincaré received a prize offered by King Oscar II of Sweden and Norway for work on the stability of orbits in the n -body problem (in which more than two gravitating point masses interact mutually). This was on the advice of German mathematician Karl Weierstrass, who pointed out that, although Poincaré had not solved the problem in full generality, his results "inaugurated a new era in the history of celestial mechanics." Poincaré developed new mathematical techniques to approach the n -body problem and showed that there is no analytical solution even for the case of three bodies: The orbits can have very irregular and chaotic forms. Thus, Poincaré's work was a predecessor of modern chaos theory as applied, for instance, to the mutual perturbations of the orbits of the outer planets

Poincaré summarized his research on celestial mechanics in his fundamental work *Les méthodes nouvelles de la mécanique céleste* (three volumes, published 1892–1899) and his more practical *Leçons de mécanique céleste* (1905–1910). He applied the results of his study of the equilibrium of rotating fluid bodies (*Figures d'équilibre d'une masse fluide*) to the

problem of the origin of the Solar System (*Leçons sur les hypothèses cosmogoniques*). He concluded that the planets could not have formed from rotating bodies that contracted as they cooled (as implied in the hypothesis of Pierre de Laplace) because the rotating mass would separate into two distinct, unequal masses. The process may be relevant to the formation of binary stars. Poincaré also applied the method to the rings of Saturn. In 1906, his mathematical investigations of electromagnetism yielded results analogous to those put forward some months earlier by Albert Einstein in his special theory of relativity.

Besides his purely scientific work, Poincaré wrote some very accessible books on the philosophy of science and mathematics. These books became very popular and were translated into many languages. For his literary talent, he was elected a member of the Académie française in 1908, while he was already a member of the Académie des sciences, the Royal Society, and many other academies and scientific societies.

Tim Trachet

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