Biographical Encyclopedia of Astronomers

Gauss, Carl Friedrich

Born Braunschweig, (Lower Saxony, Germany), 30 April 1777

Died Göttingen, (Germany), 23 February 1855

Carl Gauss is best known for his formulation of the statistical method of least squares. In astronomy, his simplification of the process by which orbits are determined from observations made possible the postconjunction recovery of the first asteroid (1802). The cgs unit of magnetic field intensity, still generally used by astronomers, is named for him.

Gauss was the son of Gebhard Dietrich Gauss (1744–1808) and Dorothea Benze (1743–1839). After attending the gymnasium and subsequently the Collegium Carolinum in Braunschweig, he studied philology and mathematics in Göttingen (1795–1798) and received his Ph.D. in 1799 from the University of Helmstedt. The stipend from the Duke of Braunschweig (since 1792) allowed him to live and work in Braunschweig as a private mathematician The fame resulting from Gauss's successful computation of the orbit of (1) Ceres laid the foundation for his astronomical career. Having declined a call to Saint Petersburg in 1802, he became involved in plans to establish an observatory at Braunschweig. In parallel to his theoretical work, Gauss had begun practical observing quite early, which he continued until 1851. In 1803, he spent several months at the Seeberg Observatory at Gotha to improve his practical skills and to enlist János von Zach's help as an advisor for the Braunschweig project. Political developments and finally the death of his sponsor, Duke Carl Wilhelm Ferdinand (from fatal injuries received in the Battle of Jena in 1806), brought this endeavor to an end.

In 1805, Gauss married Johanna Osthoff (1780–1809); in 1810 he married Minna Waldeck (1788–1831). He was the father of six children.

Gauss was appointed University Professor and Director of the observatory at Göttingen in 1807. The layout of the new observatory there, completed in 1816, was essentially modeled after Gotha-Seeberg. His earlier experience with astronomical geodesy led to the additional responsibility of director of triangulation for the Kingdom of Hanover (1818–1847).

Already a Fellow of the Royal Society (London), Gauss was one of the first foreign associates elected by the Astronomical Society of London established in 1820. A member of the academies at Göttingen, Saint Petersburg, Berlin, and Paris, he received many other international honors, including knighthood in the Danish Order of the Dannebrog

The mathematical method developed during Gauss's work on the Ceres recovery problem led to his famous *Theoria Motus* (Theory of the motion of the heavenly bodies moving about the Sun in conic sections, 1809). It remained a basic tool for theoretical astronomy for one and a half centuries. His continuing work on orbit determination, especially on problems encountered with the second known minor planet, (2) Pallas, led to important results in the field of perturbation theory. The *General Disquisitions about an Infinite Series* (*Disquisitiones* *generales circa seriem infinitam*, 1813), containing the mathematical theory of the hypergeometric series and a general investigation of convergence criteria, was a result of these activities There followed a treatise on numerical quadrature (*Methodus nova integralium valores per approximationem inveniendi*, 1814) and, in 1818, the "Determination of the attraction which a planet exerts on a point of unspecific position..." (*Determinatio attractionis, quam in punctum quodvis positionis datae exerceret planeta...*).

Throughout the first two decades of the 19th century, Gauss's authoritative computations of the orbits of all newly discovered solar-system bodies were of particular importance. Later, other computers (such as Friedrich Bessel and Johann Encke) took over some of these chores

Gauss's papers as well as his personal library are held at the State and University Library at Göttingen.

Wolfgang Kokott

Selected References

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Dunnington, G.W. (1955). *Carl Friedrich Gauss, Titan of Science*. New York: Exposition Press

Gauss, C. (1809). *Theoria Motus corporum coelestium in sectionibus conicis solem ambientium*. Hamburg. (Gauss's most influential and enduring contribution to theoretical astronomy. Publication of this work, originally written in German, was delayed at the behest of the publisher who wanted a Latin text suitable for an international market. *The Theory of the Motion* was later retranslated into German and translated into several other languages. The first English translation [by Charles Henry Davis] was published in 1857 at Boston; it was reprinted in 1963 [Dover, New York]).

Gauss, H. W. (tr.) (1966). *Gauss: A Memorial*. Colorado Springs. (A translation of the 1856 summary of his life and work by Sartorius von Walthershausen.)

Trotter, Hale F. (1957). *Gauss's Work (1804–1826) on the Theory of Least Squares*. Princeton. (A good summary of Gauss's theory of least squares, originally published in the Theoria Motus as well as several other tracts, is found in this English translation from the French.)

Watson, James C. (1868). *Theoretical Astronomy relating to the motions of the heavenly bodies*. Philadelphia: J. B. Lippincott and Co. (Independent of the original text, the Gaussian Method [rendered more suitable for a wider audience by later authors, e.g., Encke] was the standard tool presented in the textbook literature of the 19th and 20th centuries—exemplified in this text.)