

Siméon Denis Poisson's Contributions to Mathematics



Siméon Denis Poisson (1781-1842)

On June 21, 1781, French mathematician, geometer, and physicist **Siméon Denis Poisson** was born. He is known for his work on definite integrals, advances in Fourier series, electromagnetic theory, and probability, esp. the eponymous Poisson series, the Poisson integral and the Poisson equation from potential theory. His works also included applications to electricity and magnetism, and astronomy.

Simeon Denis Poisson – The Youth of a Mathematician

Poisson was born in Pithiviers, Loiret, the son of soldier Siméon Poisson, who after retiring from active service was appointed to a lowly administrative post. Poisson's health was also very fragile as a child, and his father had a large influence on his young son, devoting time to teach him to read and write. Siméon-Denis Poisson was eight years old when the Parisian insurrection of 14 July 1789 heralded the start of the French Revolution. However, his father enthusiastically supported the political turn of events and he became president of the district of Pithiviers, about 80 km south of Paris. From this position he was able to influence the future career of his son.[1] In 1798, Poisson entered the *École Polytechnique* in Paris to study mathematics despite his father's wish to become a medical doctor, who thought that the medical profession would provide a secure future for his son. Poisson's teachers Pierre-Simon de Laplace and Joseph-Louis Lagrange quickly saw his mathematical talents. They were to become friends for life with their extremely able young student and they gave him strong support in a variety of ways.[1,5,6]

Academic Career

In his final year of study Poisson wrote a paper on the theory of equations and Étienne Bézout's theorem of elimination, which was of such quality that he was allowed to graduate in 1800 without taking the final examination. He proceeded immediately to the position of répétiteur (teaching assistant) in the *École Polytechnique*, which was quite unusual. In 1802, Poisson was named deputy professor at the *École Polytechnique*, and in 1806, he was appointed to the professorship at the *École Polytechnique* which Jean Baptiste Joseph Fourier had vacated when he had been sent by Napoleon to Grenoble.[1,7] During this period Poisson studied problems relating to ordinary differential equations and partial differential equations. In 1808 he became astronomer to the Bureau des Longitudes and in 1809, when the Faculté des Sciences was instituted, he was appointed professor of rational mechanics. Poisson went on to become a member of the Institute in 1812, examiner at the *École Militaire* at Saint-Cyr in 1815, graduation examiner at the *École Polytechnique* in 1816, and geometer to the Bureau des Longitudes succeeding Pierre-Simon Laplace in 1827.

Mathematics instead of Politics

Throughout the Revolution, the Empire, and the following restoration, Poisson was not interested in politics, concentrating on mathematics. He was appointed to the dignity of baron in 1821; but he neither took out the diploma or used the title. The revolution of July 1830 threatened him with the loss of all his honours, but this was adroitly averted by François Jean Dominique Arago, and seven years later he was made a peer of France, not for political reasons, but as a representative of French science.

Applied Mathematics

Poisson's most important work concerned the application of mathematics to electricity and magnetism, mechanics, and other areas of physics. His *Traité de mécanique* (1811 and 1833) became the standard work in mechanics. In 1812 he provided an extensive treatment of electrostatics, based on Laplace's methods from planetary theory, by postulating that electricity is made up of two fluids in which like particles are repelled and unlike particles are attracted with a force that is inversely proportional to the square of the distance between them. Poisson also contributed to celestial mechanics by extending the work of Lagrange and Laplace on the stability of planetary orbits. He calculated the gravitational attraction exerted by spheroidal and ellipsoidal bodies and his results were used in the late 20th century for deducing details of the shape of the Earth from accurate measurements of the paths of orbiting satellites.[2]

The Poisson Distribution

In 1837, Poisson published his "*law of large numbers*," often referred to as the Poisson distribution. He used this law of probabilities to analyze the composition of juries and their reliability in returning truthful verdicts. For this purpose, he used French court statistics over a long period of time. His conclusion was that jury decisions should be made by a simple majority vote, which, for a jury of 12 persons, would be 7 to 5.[4]

A Prolific Author

Over his life Siméon Denis Poisson wrote about 300-400 articles and books on a variety of mathematical topics, including pure mathematics, the application of mathematics to physical problems, the probability of random events, the theory of electrostatics and magnetism, physical astronomy, and wave theory. Perhaps the most original, and certainly the most permanent in their influence, were his memoirs on the theory of electricity and magnetism, which virtually created a new branch of mathematical physics. Also as a teacher of mathematics Poisson is said to have been extraordinarily successful. As a scientific worker, his productivity has rarely if ever been equalled. However, he was not highly regarded by other French mathematicians either during his lifetime or after his death. His reputation was guaranteed by the esteem that he was held in by foreign mathematicians who seemed more able than his own colleagues to recognize the importance of his ideas.[1]

References and Further Reading:

- [1] O'Connor, John J.; Robertson, Edmund F., "[Siméon Denis Poisson](#)", MacTutor History of Mathematics archive, University of St Andrews.
- [2] [Siméon Denis Poisson](#), French Mathematician, at Britannica Online
- [3] [Poisson, Siméon-Denis](#). Complete Dictionary of Scientific Biography. 2008. Encyclopedia.com
- [4] [Siméon Denis Poisson](#) at TheNewWorldEncyclopedia.com
- [5] [Pierre Simon de Laplace and his true love for Astronomy and Mathematics](#), SciHi Blog
- [6] [Joseph-Louis Lagrange and the Celestial Mechanics](#), SciHi Blog
- [7] [Joseph Fourier and the Greenhouse Effect](#), SciHi Blog
- [8] [Siméon Denis Poisson at zbMATH](#)
- [9] [Siméon Denis Poisson at Mathematics Genealogy Project](#)

- [10] [Siméon Denis Poisson at Wikidata](#)
- [11] John Tsitsiklis, [14. Poisson Process I](#), MIT 6.041 Probabilistic Systems Analysis and Applied Probability, Fall 2010, MIT OpenCourseWare @ youtube
- [12] Chisholm, Hugh, ed. (1911). “[Poisson, Siméon Denis](#)“. *Encyclopædia Britannica*. Vol. 21 (11th ed.). Cambridge University Press. p. 896.
- [13] [Timeline for Siméon Denis Poisson, via Wikidata](#)