Biographical Encyclopedia of Astronomers

Biot, Jean-Baptiste

Born Paris, France, 21 April 1774

Died Paris, France, 3 February 1862

Jean-Baptiste Biot's achievements in optics, geodesy, and geophysics improved the scientific grounding of astronomy. He proved the extraterrestrial origin of meteorites and helped to unify the precise mathematics of astronomy with the experimental techniques of physics. Biot's father, Joseph, a Parisian bourgeois, wanted him to go into commerce. However, around 1791, after taking humanities at the Collège Louis-le-Grand, Biot began to study analysis and calculus. Briefly enlisting in He fought as a gunner in the revolutionary army at the 1793 Battle of Hondschoote. The following year, he entered the École des Ponts et Chaussées. He transferred to the École Polytechnique as soon as it opened and shone as a student, gaining the respect of faculty members such as Gaspard Monge and Gaspard-Marie Riche de Prony. Upon graduation, Biot won a professorship of mathematics at Beauvais in February 1797 and then married Gabrielle Brisson, the 16-year-old sister of fellow Polytechnician Barnabé Brisson. Mentored first by the young mathematician Sylvestre Lacroix and then by the celebrated Pierre de Laplace, Biot wrote an arithmetic textbook and several scientific memoirs. In May 1800, backed by Lacroix, Joseph Lagrange, and Laplace, Biot joined the Institut de France as a nonresident associate of its First Class (later reborn as the Académie des sciences) and was elected a full member in 1803, replacing Jean Delambre. In November 1800, Biot became professor of mathematical physics at the Collège de France, allowing him to become one of the most active investigators of the First Class. In 1809, Biot was appointed professor of astronomy at the science faculty of the Université de France; he was dean from 1840 until his retirement in 1849. A member of the Société d'Arcueil, Biot espoused its cochair Laplace's hopes of bringing astronomical accuracy and the language of mathematics to French experimental physics.

In optics, Biot attempted to explain the polarization of light using corpuscular theory, but his experimental work also included measurements of terrestrial magnetism, gas densities, heat diffusion, and the speed of sound in various media. Research with Félix Savart following H. C. Oersted's discovery of the connection between electricity and magnetism yielded the Biot-Savart law, relating the intensity of the magnetic field set up by a current flowing through a wire to the distance from that same wire. Other investigations in mathematics, electricity, and plant physiology were of less consequence, but Biot lent vital support to young Louis Pasteur's work on the polarizing power of molecules, the first intimation of molecular chirality

It is unclear when Biot became interested in astronomy, though he later recounted that he first communicated with Laplace to read the unbound pages of his *Mécanique céleste* as they were printed. He repeated all the calculations and probably discussed the more difficult ones with Laplace. This led to the publication of his first significant astronomical work, the *Analyse du Traité de mécanique céleste de P. S. Laplace* in 1801.

Biot's first original research was a thorough investigation of the alleged fall of stones from the sky near l'Aigle in the Orne department in April 1803. When he reported back to the Institut in July, presenting testimonies, samples, and the results of chemical analyses, Biot established the reality of meteorites over the earlier objections of rationalists

Biot's most concrete contributions were in the field of geophysics and geodesy. A balloon ascent with J. L. Gay-Lussac in August 1804 tested the variation of the Earth's magnetic field with altitude and found no change up to 4,000 m. In a joint memoir with Alexander von Humboldt in 1804, Biot presented a theory of the magnetic field that agreed with part of Humboldt's readings and stimulated others to produce a better general theory. Biot later observed the lack of polarization of the aurora borealis, concluding that the phenomenon could not result from either reflection or refraction

In 1806, Biot and François Arago were commissioned by the Bureau des longitudes to measure an arc of the meridian in Spain to improve the value of the meter, still defined at that time as one ten-millionth of a meridian quadrant of the Earth. Biot had previously worked with Arago on the refractive indices of various gases, and their result for air matched Delambre's value derived from astronomical considerations with a high degree of precision. Biot would later return to the problem of atmospheric refraction

Between 1806 and 1825, Biot participated in several efforts to extend geodesic measurements from the Balearic Islands to the Shetland Islands and to make additional determinations of gravitational acceleration in several localities. The main results were included in the 1821 *Recueil d'observations géodésiques, astronomiques et physiques*, co-authored with Arago. The results of his later geodesic work in Italy and Sicily were published in an 1827 memoir. The pendulum observations along selected parallels of longitude did not confirm expectations, pointing out the inadequacy of the simple ellipsoidal theory of the Earth's shape

By 1822, however, Biot had developed an interest in ancient astronomy, which resulted in a paper on the Egyptian zodiac uncovered at Denderah. He went on to publish on ancient chronology and compare the astronomical notions of the ancient Egyptians, Chinese, and Chaldeans. A later work on Hindu astronomy sought to subordinate it to Chinese and Greek achievements, but its seemingly definitive conclusions relied overmuch on an atypical source. Biot's work on Chinese chronology is still cited occasionally, though 20th-century scholarship has invalidated some of its conclusions.

A noted textbook writer, Biot put out three editions of his *Traité élémentaire d'astronomie physique*, which grew to comprise six volumes and an atlas. While eschewing higher mathematics, the *Traité* was extremely detailed and incorporated the latest results of turn-of-the-century research. Sir George Airy, later head of Greenwich, cited it as the spark of his interest in astronomy

In later years, Biot's antiquarian work on Egyptian and Chinese astronomy won him election to the Académie des inscriptions et belles-lettres in 1841. His writings, mainly in the history of science, earned him a seat at the Académie française in 1856, making him one of the very few figures in the history of the Institut to have achieved triple recognition as scientist, historian, and author. Awarded the *Légion d'honneur* in 1814, Biot went on to become an officer (1823) and a commander (1849) of the order. He was elected a fellow of the Royal Society in 1815.

Biot's wife died before him, as did his son Édouard, who belonged to the Académie des inscriptions et belles-lettres. Biot completed the work on Chinese astronomy begun by and with his son

A conservative monarchist in later life, Biot mostly stayed aloof from party politics, within and outside the Institut, though he served as mayor of the small town of Nointel in the Oise department. Having long been a skeptic in religious matters, Biot gradually returned to the Catholic faith in his fifties.

Jean-Louis Trudel

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