Biographical Encyclopedia of Astronomers

Herschel, John Frederick William

Born Slough, Berkshire, England, 7 March 1792

Died Collingwood near Hawkhurst, Kent, England, 5 November 1871

One of the best-known natural philosophers of his time, John Herschel supplemented his father's extensive observations of the Northern Celestial Hemisphere with his own campaign to chart the southern sky. John was the only child of William Herschel and his wife, Mary Pitt (née Baldwin). The family home was the site of the largest telescope in the world, constructed and used by Sir William, assisted by his sister, Caroline Herschel, with whom John shared a warm relationship. John was educated at Eton College and private schools. In 1809, he entered Saint John's College, Cambridge, where, with fellow mathematicians Charles Babbage and George Peacock, he formed the Analytical Society to advocate the adoption of continental notation for calculus In 1813, Herschel achieved first place (senior wrangler) in the university mathematics degree examination (the *tripos*) and won the Smith's Prize. A mathematical paper submitted through his father to the Royal Society brought him election to a fellowship (on 27 May 1813) at an unusually early age; later mathematical papers yielded the society's highest scientific award, the Copley Medal (1821).

In 1829, Herschel married Margaret Brodie Stewart, daughter of a Scottish Presbyterian divine and Gaelic scholar. The bride, still less than 19 years old, would prove a formidable character and capable partner. The marriage was extremely happy, producing

three sons, of whom John Herschel, Jr. became an astronomer and Alexander Herschel became an astronomer and meteorologist, as well as nine daughters, who mostly married into the more elevated sections of British social and intellectual society

Searching for a life occupation in his early years, Herschel briefly turned to chemistry, an interest terminated by a failed application for the chair of chemistry at Cambridge. He then tried law as a profession in London, where he met astronomer James South, before returning to Cambridge, first as a subtutor in mathematics. In 1816, when Herschel took his master's degree, he was elected a fellow of Saint John's College; in that same year, his ailing father appealed to John to carry on his work. Before fully doing so, John published extensively on mathematics, light, and chemistry. Treatises on geometrical optics and lens design appeared in encyclopedias and journals. Studies of crystals and physical optics, including polarization and interference, buttressed the adoption of the wave theory of light. Following his father's discovery of infrared radiation, John experimented with practical measures of intensities

The importance of John Herschel's discovery of sodium thiosulfate's capacity to dissolve silver salts would be fully realized later in the rise of photography. In the 1820s, the great 40-ft. telescope was falling into decay because nobody could face the task of polishing and refiguring the main mirror; it lasted long enough to be portrayed in 1830 in the first-ever glass negative photograph

John took up his father's last project, the discovery and observation of double stars. Originally, William had targeted them in the hope that if a stellar pair consisted of one very remote component accidentally nearly aligned with a nearer one, this fortuitous coincidence could help determine the parallax of the nearer star. William's work demonstrated instead that double stars are mostly close pairs gravitationally bound; the goal of extending this project was the discovery of orbital motions. Herschel and South used refractors fitted with positional circles for making observations that led to their catalog of 380 double stars published in 1824, earning them the Gold Medal of the Astronomical Society and the Lalande Prize of the Paris Academy of Sciences. The Astronomical Society, founded in London in 1820 by a group of active astronomers, including John Herschel, met early opposition from the Royal Society of London, but a Royal Charter was granted in 1831

After William's death in 1822, Caroline retired to her native Hanover, where she remained in vigorous health and in regular correspondence with John until her death. John found time for several extensive Grand Tours throughout Europe, the first with his friend Babbage. Herschel was received with great honors by many of Europe's most famous scientists and astronomers, and climbed many mountains, usually with a *camera lucida*, sketchbook, and other instruments, such as a barometer

From 1825 to 1833, Herschel was deeply involved in astronomical observations, using one of the refractors obtained from South and a 20-foot reflector with an 18-inch aperture, still the world's largest telescope. The observations involved a prodigious amount of work, leading to the publication in a series of papers listing a total of 5,075 double stars, arranged in order of right ascension for 1830 and North Polar Distance, together with the general catalogue of nebulae and clusters derived from observations covering the entire northern sky using the sweeping survey technique devised by his father. This was updated in 1888 by John Dreyer to the *New General Catalogue*, and many galaxies and star clusters are still known by their NGC numbers. John continued to write for popular audiences, on the methods of natural philosophy and on astronomy.

Herschel's mother died in 1832, leaving him free to pursue a long-delayed project: the observation of the sky of the Southern Hemisphere, thereby supplementing his father's work on the northern sky. The Herschels, their three children, a nanny, and an astronomical assistant embarked in November 1833 for a two-month voyage to South Africa, during which John made almost every plausible kind of marine, meteorological, and astronomical observation

At Cape Town, Herschel purchased an estate where he installed his telescopes. During his four-year stay, Herschel surveyed the entire southern sky for nebulae and clusters with the 20-foot reflector and for double stars with a refractor. He made detailed studies of the Magellanic Clouds and of the Orion and Carinae nebulae. He also conducted a first effort at precision stellar photometry, in which the brightness of a star seen with the naked eye could be compared with a point image of the full moon produced in a steel ball moved to such a distance that the two matched

In South Africa, Herschel measured the intensity of infrared radiation using large-bulb thermometers filled with a dark liquid. He sent a steady stream of short communications to

London for publication, including a manual for meteorologists. He made geological and botanical notes, and drawings using the camera lucida. Many of these drawings survive, those of plants and flowers often colored by Lady Herschel. He took part in observations of the tides and of the Earth's magnetism. In public affairs, Herschel offered advice on the colony's educational system

Herschel was a bulwark in many of the difficult tasks assigned to Thomas Maclear, director of the Cape Observatory; a major one was a repetition of Nicolas de La Caille's meridian arc measurement with its anomalous result. Maclear's first reliable assistant was Charles Smyth, who arrived at age 16 in October 1835 to begin a brilliant but often eccentric career, deeply influenced by his devotion to Herschel. Though admittedly difficult, the South African years were, according to Herschel, the happiest of his life

Upon his return to England, and eager to accomplish the formidable task of reducing and preparing for publication the results of his African observations, Herschel declined many honors but did accept the presidency of the now Royal Astronomical Society for several years (1839–1841; 1847–1849). A proposal for a reform of the system of constellations with their convoluted boundaries to one based instead on a standard sky coordinate system did not gain general approval until enforced in 1922 by the International Astronomical Union.

In 1839, alerted to developments on the Continent, Herschel engaged in a series of researches in photography and photochemistry that lasted until 1844; it included, among many other investigations, the development of a technique for fixing an image using sodium thiosulfate, the concept of a negative, and the demonstration that the spectrum extends beyond the visible violet. Much of his work dealt with color registration and the use of dyes

Herschel gave up the Slough residence in 1840, marked by a sentimental farewell to the tube of the great dismantled telescope, and moved to Kent. The South African researches were published in 1847. Diverse activities in science, publication of encyclopedia articles, and affairs of the Royal Astronomical Society fully occupied his time. In 1850, he accepted the office of Master of the Mint, once held by Isaac Newton, and unsuccessfully advocated decimalization of the British coinage, getting no further than the introduction of the florin coin, equal to one-tenth of a pound. Herschel resigned in 1856 and retreated increasingly into private life, with deteriorating health. He died at his home; Margaret followed him in 1884

By the time of his marriage, Herschel was already widely celebrated. Shortly thereafter, in 1831, he was accorded the honor of knighthood; on the occasion of the coronation of Queen Victoria in 1838, he was raised to the baronetcy. In South Africa, the site of the 20-foot reflector was later marked by a commemorative obelisk. Herschel was a member of many scientific societies and carried on an extensive correspondence with a wide range of people; nearly 15,000 letters are known and summarized. Like many of the greatest figures in English history, he was buried in Westminster Abbey, next to Newton, reflecting the great esteem in which his contemporaries held him.

Several of John Herschel's manuscript diaries and other papers are deposited at the Harry Ransom Humanities Research Center, Austin, Texas.

David S. Evans

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