Biographical Encyclopedia of Astronomers

Flamsteed, John

Born Denby, Derbyshire, England, 19 August 1646

Died Greenwich, England, 31 December 1719

John Flamsteed was the premier star cataloger of his time and the first Astronomer Royal of England. As a youth, his interest in astronomy was sparked by a group of pre-Civil War north-country astronomers including William Gascoigne, from whom he learned

how to apply eyepiece micrometry and screw-gauge telescope adjustments for accurate measurement. From Jeremiah Horrocks's manuscripts he gained a realistic view of solar-system dimensions as well as (via William Crabtree) an improved lunar theory

In 1674, Flamsteed was granted an honorary MA by Cambridge by warrant from Charles II, in appreciation of his useful astronomical studies. Two years later he was appointed the King's Observator, mandated to try and find longitude at sea, a task he could never fulfill. At Greenwich, Flamsteed was provided with an empty observatory and a salary of 100 pounds per annum. Eventually, his published stellar positions were accurate within 5 inches, as his final estimate of the Greenwich latitude at 51° 28′ 34″ was within 4 inches; Johannes Hevel, by comparison, had achieved only ½ inch in stellar-position accuracy. Flamsteed doubled the number of known stars. Longitude divisions of the globe came to be marked from his workplace as the first Greenwich Meridian, time was measured from the setting of his clock, and the stars received their numbers from his star catalog of 1725

From timing the diurnal meridian transits of Sirius, Flamsteed ascertained that the Earth rotated uniformly on its axis. (Johannes Kepler had its rate vary seasonally.) On the basis of this, he produced an equation of time that was accurate to about 12 seconds, as compared with the versions used by Thomas Streete and others earlier that had erred by 5 minutes. Flamsteed became the first to formulate a credible "mean time" as opposed to apparent time, and so Greenwich Mean Time began. Also, he became the first to formulate the Moon's 10-minute "annual equation," which presupposed the Earth's isochronous axial rotation. (Kepler had combined the two.)

Flamsteed improved upon Horrock's lunar theory, as well as its mean solar-lunar motions. Flamsteed brought this lunar theory—the first British astronomical theory—down from the Midlands and became its main advocate, getting it published in 1673. Observations of lunar diameter at apogee and perigee had convinced him of its veracity. Its errors, however, were too large to be of practical value in finding longitude, and so, despairingly, Flamsteed in 1683 advocated the study of Jupiter's satellites as the best way of finding universal time.

Isaac Newton's lunar theory was based on Horrock's as explained by Flamsteed, for which reason French historians have remained doubtful whether his lunar theory was derived from a theory of gravity. Flamsteed was the first person (with help from his assistant) to prepare tables based on the Newtonian theory, around 1706 But owing parhaps to his chagrin at not being adequately acknowledged by Newton as the source of both the lunar data and the Horroxian theory, he never realized how effective the theory was. Posthumously, his lunar theory, the tabular procedure for finding lunar longitude based on the Newtonian text—which was the basis of his employment—was found to have disappeared from Greenwich and was thus absent from the three volumes of the Historia Coelestis Britannica, but made a surprising reappearance in the hands of Pierre le Monnier in the 1740s, who published it. (It was presumably donated by Edmond Halley, Flamsteed's first friend and, finally, successor.)

In 1681, Flamsteed published his "Doctrine of the Sphere" containing tables of the equation of center for the lunar and solar (i.e., of the Earth) elliptical motions, derived from an exact solution of the Kepler equation, within 1 arcsecond or so. Thereby he became the first astronomer to apply Kepler's first and second laws of planetary motion. This was before Newton had begun to take Kepler's second law seriously, and when various ad hoc procedures were in use for constructing these tables

In his Gresham lecture of May 1681, Flamsteed gave the first-ever British account of the perihelion passage of a comet behind the Sun, that of comet C/1680 V1. Newton decided to reject the latter's view in favor of two separate comets. Owing to its close solar passage, this comet became the first for which a mathematical orbit could be reliably computed, thanks to Flamsteed's exact measurements.

Flamsteed decided to measure right ascension using sidereal time, which later became the "Greenwich Hour Angle." His star classification procedure became the basis of the Flamsteed numbers used in the British Catalogue for numbering the stars. He became (unknowingly) the first astronomer to log the passage of Uranus

With no ancient star maps to consult, Flamsteed brushed up his Greek to read the original Ptolemy and concluded (from arguments about right and left shoulders) that all the human constellation figures had to be turned round and that we perceive the globe of the Universe from the inside. His star maps became the most widely used in Europe in the 18th century. He developed a novel stereographic projection for the maps (the Samson-Flamsteed method).

Flamsteed can hardly be blamed for confounding stellar aberration of the Pole Star (which he discovered), of some 20 arcseconds magnitude each year, with the long-sought stellar parallax (due to the Earth's orbit). He published his conclusion in 1697. What Flamsteed found was (as Giovanni Cassini pointed out) 90° out of phase from where the parallax should have been. In contrast, his ascertaining of solar parallax (half the angle subtended by Earth from the Sun) of 10 arcseconds, the correct value being 9 arcseconds, was of profound importance. Horrocks had estimated it as 15 arcseconds, while Tycho Brahe retained the ancient value of 3 arcseconds. Solar distance relied upon this value. In Flamsteed's words, "The Sun is and ever was above ten times more remote than commonly esteemed."

Flamsteed assured Newton that Jupiter's satellites were exactly adhering to Kepler's third law, as appeared at the opening of the *Principia*'s Book III without acknowledgment. He collaborated with Newton to construct seasonally varying atmospheric refraction tables of much-improved accuracy. He composed a history of astronomy (in the preface to his *Historia*) in which he rejected trepidation, whereby the equinoctial points oscillated back and forth against the zodiac, which contemporaries such as Robert Hooke and Cassini still accepted, and established the value of precession at 1° per 72 years

From 1689, when Flamsteed acquired his precision mural arc, he was able to obtain the high-accuracy lunar transit measurements, whereby Newton discerned the feasibility of an improvement in the theory. Tradition holds that Flamsteed refused to cooperate, but in the first half of 1695, when Newton became immersed in the subject, Flamsteed kindly supplied him with over 150 high-precision readings (now lost). Newton was unable to derive the lunar irregularities from his theory of gravity. Flamsteed became his scapegoat for this and was forbidden to report that he had spent the best part of a year obtaining and processing these data

Flamsteed's hope for publishing his work, as the century turned, rested on his visually attractive star maps, which would appeal to the monarch, but the committee set up by Newton to oversee its publication, or possibly stall it, had other ideas. In 1712, Edmond Halley published Flamsteed's stolen observations on the justification that Newton needed the lunar data. Francis Baily argued against this view on the grounds that Newton had long since finished his lunar work and that there were no grounds to suppose Flamsteed had not cooperated. Baily admired Flamsteed's "pity, integrity, and independent spirit."

Nicholas Kollerstrom

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