Biographical Encyclopedia of Astronomers

Gregory, James

Born Drumoak near Aberdeen, Scotland, November 1638

Died Edinburgh, Scotland, October 1675

Telescope designer James Gregory was the third son of Reverend John Gregory, Minister of Drumoak in the County of Aberdeen, Scotland, and his wife, Janet Anderson. Gregory attended a grammar school and later graduated from Marischal College. From an early age, Gregory displayed extraordinary mathematical talent

In 1663, Gregory published a treatise entitled *Optica Promota*, in which he submitted a novel design for a reflecting telescope. The Gregorian reflector consists of a centrally perforated concave parabolic primary mirror, combined with a smaller concave ellipsoidal secondary mirror. By placing the secondary mirror within the diverging cone of light beyond the focal point of the primary mirror, the secondary mirror reflects a converging beam to the final focal point, located on the opposite side of the primary mirror, where it is magnified by an eyepiece. This relatively compact optical configuration is theoretically sound and provides an erect image suitable for terrestrial use. Unfortunately, the precise figuring of the aspherical conic sections of the mirrors proved to be beyond the capabilities of contemporary opticians. After several abortive attempts were made by London opticians to fabricate a working example, Gregory abandoned the pursuit

The simpler form of reflecting telescope proposed by Isaac Newton, which replaced Gregory's concave ellipsoidal secondary mirror with a planar mirror inclined at 45° to the optical axis, proved far more practical. The first working example of a reflecting telescope of the Newtonian form was demonstrated in 1668 and presented to the Royal Society of London in 1672.

A successful Gregorian reflector was not produced until 1674, when the versatile English polymath Robert Hooke constructed an operative telescope on the Gregorian principle. During the 1730s, optician James Short mastered the art of figuring aspherical mirrors. Short figured many fine Gregorian reflectors with apertures as large as 18 inches. Yet, the Gregorian design was largely abandoned during the 19th century in favor of the more compact Cassegrain form, in which a convex hyperboloidal secondary mirror is placed in front of the focus of the telescope's concave parabolic primary mirror

Gregorian reflectors were revived in the 20th century, however, as the chosen design for NASA's Orbiting Solar Observatories [OSOs]. Because the concentration of sunlight (in a converging beam) could be potentially harmful to the secondary mirror of a Cassegrain system, Gregory's design was adopted for the Solar Maximum Mission and related solar telescopes.

In 1664, Gregory traveled to Italy, where he spent the majority of his time at the University of Padua. There, he derived the binomial series expansion and the underlying principles of calculus independently of Newton. Gregory also published two mathematical treatises while in

Italy. He returned to Great Britain around Easter of 1668 and was elected a Fellow of the Royal Society.

Later that year, Gregory was appointed to the Regius Chair of Mathematics at Saint Andrews University, Scotland, where he carried out important mathematical and astronomical work. He independently derived the Taylor series expansions for several trigonometric and logarithmic functions. His observations of the interaction of sunlight with a seabird's feather anticipated the principle and invention of diffraction grating. In 1669, Gregory married Mary (née) Jamieson, the widow of Peter Burnet. The couple had three children.

On one occasion, Gregory returned to Aberdeen and held a collection outside of church doors to raise money for an observatory—the first in Great Britain. He also collaborated with French colleagues to observe a lunar eclipse in a successful attempt to determine the longitude difference between Saint Andrews and Paris

In 1674, Gregory departed from Saint Andrews for Edinburgh University, where he acquired that institution's first chair of mathematics. Within a year of assuming the post, however, he suffered a stroke that left him blind. He died several days later.

His manuscripts are held at the Saint Andrews University Library.

Thomas A. Dobbins

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