Biographical Encyclopedia of Astronomers

Manfredi, Eustachio

Born Bologna, (Italy), 20 September 1674

Died Bologna, (Italy), 15 February 1739

Eustachio Manfredi, a skilled observer of the heavens, a geographer, and a geodesist, oversaw the restoration and continued development of astronomy in Italy following the departure of Giovanni Cassini to Paris.

The son of Alfonso Manfredi, a notary from Lugo di Romagna, and Anna Maria Fiorini, Eustachio was the eldest of a family of scholars devoted to science and mathematics. Manfredi completed his early studies at the Jesuit school in Bologna, focusing on philosophy. In 1692, he graduated with a degree in civil and canon law, but never practiced. At Bologna, Manfredi studied mathematics and hydraulics with Domenico Guglielmini, and together with his childhood friend Vittorio Francesco Stancari, he became interested in astronomy.

After Cassini left for Paris and Geminiano Montanari for Padua, Italian astronomy at universities faded. Lecturers focused mainly on hydraulics and the science of numbers, and few studied astronomy. Cassini's meridian line of San Petronio was no longer in use. Manfredi and Stancari—who were essentially self-taught—conducted observations with the meridian, and at Stancari's house they set up a small observatory with a sextant and several telescopes. From 1698 to 1702, they undertook systematic observations of the relative positions of stars; studied planetary movements; and observed lunar and solar eclipses, the eclipses of Jupiter's satellites, and lunar occultations—doing so to accurately determine Bologna's geographical position

In 1690, Manfredi, Stancari, and others, including the famous physician Giovanni Battista Morgagni, founded the *Accademia degli Inquieti*, which became a driving force for Bolognese culture. The institution turned its attention to the physical sciences, studying new systems such as those of René Descartes, Gottfried Leibniz, and Isaac Newton, focusing in particular on experimental and observational reality. The Accademia contributed decisively to the establishment of the *Istituto delle Scienze*, founded by Count Luigi Ferdinando Marsili, a member of one of Bologna's most illustrious families. Marsili, a valiant general and a scientist, believed that scientific research was the cornerstone of technological progress. His military experiences gave him opportunities to collect scientific and documentary material in order to establish a center in Bologna. Astronomy played a predominant role in the Accademia, representing the basic element of reform for a scientific alternative to Aristotelian thought As a result, in 1702 Marsili appointed Manfredi and Stancari to oversee the construction of an observatory in Bologna, in his own palazzo. Instruments were ordered from the Lusverg family in Rome: two movable quadrants, a mural semicircle (currently exhibited at the Astronomical Museum of the University of Bologna), and a 3-ft. telescope.

During this period, Manfredi also studied sunspots, noting that there were far fewer than those observed by earlier astronomers. This phenomenon is now referred to as the Maunder minimum. In 1703, Manfredi wrote a pamphlet entitled *Descrizione d'alcune macchie scoperte nel Sole*, publishing his observations, from which he also calculated the value of the inclination of the rotational axis of the Sun on the ecliptic. In 1699, he was appointed lecturer in mathematics, and in 1704 he was appointed rector of a Pontifical College and was named Superintendent of Waters, a position he held until his death

In 1712, Marsili donated all his instruments and collections to the Bologna Senate, and on 13 March 1714, with the financial support of Pope Clement XI, the Istituto delle Scienze was inaugurated in Palazzo Poggi (now the seat of the University of Bologna). The Istituto incorporated the Accademia, renamed Accademia delle Scienze, and the Accademia delle Belle Arti. Manfredi was one of the institute's inspirations and, in drawing up its program, looked to Cassini, with whom he corresponded. A new observatory alongside the Istituto delle Scienze was planned, and construction began in 1712 under Manfredi's supervision, but was not completed until 1725; the main instruments were installed in 1727.

In 1715, Manfredi compiled the *Bolognese ephemerides* for the years 1715-1725 based on Cassini's tables, completed in Paris and previously unpublished. They included tables of the planets' transit time across the meridian, the eclipses of Jupiter's satellites, and the lunar conjunctions, as well as maps of the regions on Earth where solar eclipses would take place. The *Ephemerides*, considered among the best in Europe for several decades, were accompanied by a valuable book of instructions, *Introductio in Ephemerides*, detailing their use. The ephemerides for the period of 1726–1750 were subsequently published in 1725.

At this time, with the help of several assistants, including his two sisters, Manfredi undertook systematic observations to verify if there were perceptible shifts in the positions of the stars. If observed, these displacements would allow him to measure stellar parallax and confirm the Earth's annual revolution around the Sun; the issue of heliocentric and geocentric systems was still being debated The initial observations revealed small shifts in the positions of the stars, yet these were not attributable to the parallactic displacement. The results were published in 1729 in *De annuis inerrantium aberrationibus.* That year, James Bradley offered the correct explanation for this phenomenon, later called "annual aberration of starlight," after the title of Manfredi's publication. Two years later, in *Tome I* of the *Commentarii dell'Accademia delle Scienze*, Manfredi published a treatise entitled *De novissimis circa fixorum siderum errores observationibus*, adding other observations to those of Bradley. Manfredi was the first to confirm Bradley's hypotheses. He did not explicitly express an opinion that would link him too closely to Bradley's explanations, due to the local political and religious situation. (Bologna was part of the Papal States.) Nevertheless, it was the first evidence of the Earth's movement around the Sun.

In 1736, Manfredi published *De gnomone meridiano Bononiensi ad Divi Petronii*, in which he included the history and description of Cassini's meridian, as well as all observations made since the instrument was created in 1655. His analysis of nearly 80 years of observations revealed a progressive decrease of one second per year in the obliqueness of the ecliptic. Although the actual value is approximately half a second, this nevertheless revealed and

measured—for the very first time—a process that, if it continued unchanged, would abolish the seasons in less than 2,000 centuries

The following year, Manfredi oversaw the publication of Francesco Bianchini's *Astronomicae ac geographicae observationes selectae*. He had also previously organized and completed Stancari's notes, published as *Schedae mathematicae et observationes astronomicae*. His university lectures were collected into a considerable work, *Instituzioni astronomiche*, published posthumously in 1749.

In 1738, Manfredi asked Jonathan Sisson to make a new set of instruments. However, the astronomer died two years before the instruments were delivered. Sisson's instruments, installed and used by Manfredi's successor Eustachio Zanotti, are also exhibited at the Astronomical Museum. Because of his scientific merit, Manfredi was honored as a member of the Paris Académie des sciences and London's Royal Society.

Manfredi's manuscripts and the astronomical logbooks are in the Historical Archive of the Department of Astronomy, University of Bologna

Fabrizio Bonoli

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