Biographical Encyclopedia of Astronomers

Werner, Johannes

Born Nuremberg, (Germany), 14 February 1468

Died Nuremberg, (Germany), probably March to June 1522

Navigator Johannes Werner began his studies in Nuremberg and continued at the University of Ingolstadt (enrolled: 1484); from the very beginning he showed an inclination toward the exact sciences. In 1490, he was appointed chaplain in Herzogenaurach, Germany, but he spent the years 1493–1497 studying in Rome. Werner entered the career of a priest, but besides theological studies he substantially improved his knowledge of astronomy, mathematics, geography, and the Greek language, benefiting from discussions with many learned Italian men. After his return to Germany in 1498, he finally settled at St. John's Church in Nuremberg, where he remained until his death

In Nuremberg, Werner had frequent contacts with many scholars, including Albrecht Dürer, who sometimes needed advice on problems of mathematics and geometry. Werner also earned recognition abroad, and in 1503 he was invited to the emperor's court in Vienna. Later, Johannes Stabius, mathematician and historiographer at the Vienna court, prepared an edition of works on geography, which contained the writings of Werner (1514). Other texts by Werner were published separately, some remained in manuscripts, and some were lost.

In astronomy, Werner continued the practical work of Johann Müller (Regiomontanus). For example, he refined the Jacob's staff (radius), an instrument consisting of two or three wooden rules with scales, which Müller used for measuring the angular distances between stars or other celestial bodies

An invention of Werner's own was a nomographical tool called the "Meteoroscop" for easy numerical solving of spherical triangles, without the need for tables of trigonometric functions. It consisted of a metal plate with a pointer, divided into four quadrants. In two of them were circles corresponding to coordinate lines on the celestial sphere in the stereographic projection; another two with scales served to determine the sines, as is described in detail in the text *De Meteoroscopis*. The clock on the church in Herzogenaurach and sundials in Rosstal belong to the same category of Werner's handmade instruments.

In order to facilitate numerical computations using trigonometric functions, Werner derived the cosine formula and, for the first time, also the formula (originally in another, slightly cumbersome notation):

$$2(\sin)a \,.\, (\sin)b = \cos(a - b)\cos(a + b).$$

which was later used (before the invention of logarithms) for replacing multiplication by addition (e.g., by Tycho Brahe and Paul Wittich). His treatise on the motion of the eight spheres and the statement that precession is an irregular motion drew severe criticism from both Nicolaus Copernicus and Brahe. This treatise appeared in the collection of prints from 1522.

Werner's main achievement was his method of determining the difference of geographical longitudes between two places, later referred to as "the method of lunar distances," which became the principal method used in navigation at sea before reliable nautical chronometers came into use at the end of the 18th century If the measured angular distances between the Moon and selected bright stars along the ecliptic are compared with the values in tables of lunar motion, which had been computed in advance for the time of a reference meridian, then the difference between the local time and the time at the reference meridian equals the difference in longitudes between the observing place and the reference meridian. This method is explained in comments to Ptolemy's book on geography (contained in the collection of 1514), together with two other methods. One method, less precise, was based on measuring the lunar parallaxes from both places; according to the other, the difference in longitudes was equal to the difference in local times of both observers at the beginning or end of a lunar eclipse. The method of lunar distances triggered an effort to express the sophisticated lunar motion by means of mathematics, which gave strong impetus to the development of both mathematical analysis and celestial mechanics.

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