Biographical Encyclopedia of Astronomers

Lambert, Johann Heinrich [Jean Henry]

Born Mülhausen, (Mulhouse, Haut-Rhin), France, 26 August 1728

Died Berlin, (Germany), 25 September 1777

Johann Lambert was a physicist known for pioneering work in photometry and in astronomy for his ideas of the nature of the Milky Way. In physics, Lambert is remembered by the unit for illumination density and a number of laws that bear his name

Lambert was born the son of Lukas Lambert, a tailor, and Elisabeth Schmerber. The family lived in very modest, if not poor, conditions. He had to help his father and at the age of 12 was taken out of school to learn the trade. Instead, his younger brother became a tailor, leaving Lambert time for private study of literature, Latin and French, calculus, and elementary sciences. About this time, he became interested in astronomy and began to observe the sky.

Lambert gained employment with the Mulhouse town chronicler named Reber for a modest income, and in 1743 he became a bookkeeper for an ironworks at Seppois. He observed the bright comet C/1743 X1 (Klinkenberg-de Chéseaux) and attempted to calculate its orbit. In 1745, Lambert went to Basel to act as a science writer for Professor Johann Rudolf Iselin and to continue his studies in science and philosophy

In 1748, Lambert accepted a position as a teacher in the home of Count Peter von Salis in Chur, Switzerland, where he stayed for eight years. During this time, he undertook many investigations that became the foundation of his later scientific and philosophical work, including the 1749 idea of a disk-shaped Milky Way. In 1753, Lambert became a member of the Helvetic Society and in 1754 of the Physical-Mathematical Society in Basel, for which he published his first paper, the results of meteorological observations, in 1755.

In 1756, Lambert left Chur to travel through western Europe with two students. Their first destination was Göttingen where they made academic contacts: In 1757, Lambert was elected a member of the Göttingen Society. In the following two years, they were based in Utrecht, the Netherlands, and from there visited academics throughout the country. After further journeys to France and Italy, Lambert returned to the Salis family in late 1758.

In May 1759, Lambert visited Zurich, where he worked with Johannes Gessner and published his *Freye Perspektive* (Free Perspective). From there he returned to Mulhouse to stay with his mother, sisters, and brothers. When his mother died soon afterward, Lambert moved to Augsburg, where he published some of his most important works: *Photometria* (1760), a foundation of photometry; *Eigenschaften über Kometenbahnen* (1761), a geometrical method to determine cometary orbits; and *Cosmologische Briefe* (1761), a theoretical-philosophical discussion of the Universe and, in particular, the Milky Way

Lambert was among the scientists who tried to establish a Bavarian Academy of Sciences. His work at this academy included a fundamental theory of cartography. In 1762, because of trouble

over the nomination of a professor, Lambert left the academy but remained a correspondent. He returned to Chur, where he stayed until autumn 1763 and completed his philosophical work, Neues Organon, then traveled *via* Augsburg to Leipzig, where he found a publisher for this work

In January 1764, Lambert arrived in Berlin. On the recommendation of his Swiss compatriots Sulzer and Leonhard Euler, he was introduced to King Frederick II, but it took about a year until the king became convinced of his abilities and made him a member of the Berlin Academy of Sciences in January 1765. At the Berlin Academy, Lambert busily continued his work in philosophy, mathematics, and physical sciences, including astronomy, and published numerous papers. In philosophy, he was a representative of rationalism and contributed to the theory of knowledge. In mathematics, he worked on the theory of conic sections, trigonometric functions for complex variables (Demoivre's theorem), and hyperbolic functions. In 1765, he found a proof for the irrationality of the numbers π and e

Lambert continued his meteorological studies and, in 1771, proposed a world meteorological organization. He included the winds in his considerations, and in 1775, published *Hygrometrie*, a treatise on air humidity. In 1774, he founded the *Astronomisches Jahrbuch* together with Johann Bode. In 1775, Lambert became ill but refused medical treatment. Despite increasing health problems, in May 1777 he finally completed his *Pyrometrie*, a treatise on the theory of heat

In astronomy, Lambert's early observations and calculations on the comet of 1744 led to a geometrical method for determining its orbital path (*Properties of Cometary Paths*, 1761). He calculated orbits for the comets Messier (C/1769 P1), Lexell (D/1770 L1), and Messier (C/1773 T1). In 1773 he noted that the changes to some cometary orbits differ slightly from what is expected from gravity alone (Lambert's theorem of cometary motion).

In his *Cosmological Letters*, Lambert gives a theoretical description of the Universe as it was known at his time. He wished to extend Newtonian physics, well established for the planets, to comets and the stellar universe. Moreover, Lambert gives a hierarchical theory of cosmology. Like his contemporaries, he had a "teleological" view of the Universe, assuming *somebody* who defines a *purpose* for everything. Perhaps the most important part of this work, based on his 1749 idea is the theory of the Milky Way as a disk, a system formed by thousands of stars surrounding the Sun, with the Milky Way plane resembling the "ecliptic for the stars." Lambert thought that every star is a sun with a planetary system. He also assumed that there may be other Milky Way systems, potentially forming a higher-order system. When he published his theory in 1761, Lambert was unaware of similar ideas by Thomas Wright (1750) and Immanuel Kant (1755), of which he only learned after his publication. There are some differences, however: Lambert was inconclusive on the nature of the "nebulae," sometimes viewing them as extragalactic stellar systems (as Kant always did), and at other times as central bodies for galactic substructures. Also unlike Kant, Lambert argued for a finite cosmos. But like Kant and Wright, he assumed that all celestial bodies, even the Sun and comets, are inhabited. Lambert's theory of diffuse reflection, developed in *Photometria*, introduced the important term albedo for the fraction of diffusely reflected light by surfaces. He also wrote on aurorae, zodiacal light, lunar topography, and the (nonexistent) satellite of Venus. The *Astronomisches Jahrbuch* he

founded in 1774 became an important periodical under the direction of Bode. Lambert died unmarried.

Hartmut Frommert

Selected References

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