Biographical Encyclopedia of Astronomers

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Lobachevsky, Nikolai Ivanovich

Born in Nizhny Novgorod, Russia, 20 November/2 December 1792

Died in Kazan, Russia, 12/24 February 1856

Nikolai Lobachevsky is remembered as one of the founders of non-Euclidean geometry. Although he was born into a poor family (made even poorer by the death of his father when he was seven), Lobachevsky's mother ensured that he received a good education In 1802, he entered the Gymnasium in Kazan, a city at the confluence of the Kazanka and Volga rivers in Tatarstan, Russia. Lobachevsky remained at the school until 1806; the following year he gained admission to the recently founded Kazan University (1805). There, he was greatly influenced by the German mathematician Johann Martin Bartels, a former teacher of Carl Gauss. By 1812, Lobachevsky had been awarded his master's degree in physics and mathematics. Subsequently, he was appointed extraordinary professor of mathematics at the university (1814), ordinary professor (1822), and, in 1827, rector in Kazan, a position he held until 1846. In 1832, Lobachevsky married Varvara Aleksivna Moisieva; the couple had seven children.

Lobachevsky became interested in the problem of the parallel postulate in Euclidean geometry, a problem that had long taxed the finest mathematical minds in Europe. In his early years, he does not seem to have deviated from the standard geometrical thinking of those days, but in February 1826, Lobachevsky read a paper, "Exposition succincte des principes de la géométrie," to the Department of Physical and Mathematical Sciences at Kazan. This appears to have been the first public disclosure of non-Euclidean geometry and, with it, the solution to the parallel postulate problem Roughly speaking, this problem can be explained two-dimensionally as follows: The axioms of Euclidean geometry can be arranged in such a way that, by assuming up to, but not including, the last axiom (the parallel postulate), one can show that, given any line L and point P not on L, there exists at least one line through P parallel to L. It can then be shown that there are actually two (and only two) possibilities: Either there is a unique such line (which, if taken as the final axiom, produces Euclidean geometry) or else there are infinitely many such lines. If this latter possibility is considered, then the non-Euclidean geometry discovered by Lobachevsky results. The elegant axiomatic formulation of geometry referred to here is essentially that of the German mathematician, David Hilbert, who clarified this issue at the end of the 19th century

In 1829, Lobachevsky published an extended version of that paper in the *Kazanski vestnik* (Kazan Messenger), under the title, "On the Principles of Geometry." This paper also considered the physical geometry of space (i.e., whether it was Euclidean or non-Euclidean). Independently of Lobachevsky, a young Hungarian mathematician, János Bolyai, had arrived at similar conclusions but hesitated to publish them. When Bolyai did publish his results (in an appendix to the book, *Tentamen* [1831], written by his father Wolfgang), Lobachevsky's paper had been in print for two years. In any case, the mathematician, Gauss, had explored related possibilities even earlier but never published his findings

The firm rootedness of Euclidean geometry, together with the abstractions inherent in the new geometry, meant that, at first, little attention was paid to the work of Lobachevsky and Bolyai. However, the rather elegant formulations of this geometry later given by Felix Klein and Jules Poincaré helped its recognition by giving it some intuitive appeal. Further understanding of non-Euclidean geometry arose from the work of Georg Friedrich Bernhard Riemann (1866), who generalized the foundations of geometry and initiated the study of differential (or Riemannian) geometry. The final link in this chain was then provided by the axiomatic treatment of geometry given by Hilbert (as mentioned earlier).

In 1916, Albert Einstein's general theory of relativity, the most successful theory of gravity to date, took Riemannian geometry as its mathematical basis. In this sense, Lobachevsky (and Bolyai) were very important players in the development of modern physics and, indeed, in modern astronomy, since the initial (and successful) tests of Einstein's theory were essentially astronomical in nature. One of these tests resolved the long-standing problem associated with the orbit of the planet Mercury. Another involved the deflection of starlight at the edge of the Sun, and this was then witnessed during a total solar eclipse. The great English geometer, William Kingdon Clifford, called Lobachevsky the "Copernicus of Geometry."

During his lifetime, Lobachevsky achieved much more than just success in geometry. He reorganized the library and museum facilities in Kazan and was a major force in rebuilding the university after its disastrous fire of 1842. In that same year, he was elected to the Göttingen Society of Sciences for his work on non-Euclidean geometry. Strangely, and without explanation, he was removed from his professorship and rectorship in 1846. Toward the end of his life, Lobachevsky became blind; his last work, *Pangéométry*, had to be dictated to a scribe.

Graham Hall

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