

Lie – Lobachevsky Colloquium

Tartu, 26 – 30 Oct. 1992

dedicated to the anniversaries of birth:

Marius Sophus Lie 150

Nikolai Ivanovich Lobachevsky 200

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MARIUS SOPHUS LIE

1842 – 1899

Observances in Norway

In Oslo the Department of Mathematics, University of Oslo, and the Norwegian Academy of Science and Letters organized the

Sophus Lie Memorial Week

August 17 – 22, 1992.

The program began with opening of the Sophus Lie Exhibition. Its prefatory text in essential part was published as a separate issue "*Sophus Lie 1842 – 1899*" by Elin Strøm. The same author had prepared as a preprint a discussion "*Feliz Klein, Friedrich Engel, and the myth about Sophus Lie.*"

A reception was held by the City of Oslo on the occasion of this Week.

The scientific "*Sophus Lie Symposium*" was held on August 17 – 21 in the main building of the Academy.

A special program was held in Nordfjordeid, in the birthplace of Sophus Lie (ca 500 km from Oslo), where a ceremony for unveiling of a Sophus Lie monument took place on August 23.

Scientific works of Sophus Lie

In 1900, a year after S. Lie's death, a commission was formed to publish his collected scientific works. The necessary finances were found only in 1912 after an advance subscription campaign was successfully carried out by the publisher Teubner. After World War

I, support from Norwegian Storting (National Assembly) was sought in order to continue the work. [The appeal to Storting was signed by A. V. Bäcklund (Lund), L. Bianchi (Pisa), F. Klein (Göttingen), E. Vessiot (Paris), E. Study (Bonn) and others.]

The volumes of "*Gesammelte Abhandlungen*," edited by F. Engel and P. Heegaard, appeared in the following succession:

Abhandlungen zur Differentialgleichungen (Band 3, 1922; Band 4, 1929),

Abhandlungen zur Transformationsgruppen (Band 5, 1924; Band 6, 1927),

Geometrische Abhandlungen (Band 1, 1934; Band 2, Teil I, 1935; Teil II, 1937),

Fünfunddreissig Abhandlungen aus dem Nachlass (Band 7, 1960).

The first editions of the monographs were published as follows:

S. Lie, F. Engel. *Theorie der Transformationsgruppen*. Leipzig, I, 1888; II, 1890; III, 1893.

S. Lie, G. Scheffers. *Vorlesungen über Differentialgleichungen mit bekannten infinitesimalen Transformationen*. Leipzig, 1891.

S. Lie, G. Scheffers. *Vorlesungen über kontinuierliche Gruppen mit geometrischen und anderen Anwendungen*. Leipzig, 1893.

S. Lie, G. Scheffers. *Geometrie der Berührungstransformationen*. Leipzig, 1896.

Obituaries and surveys

Immediately after Sophus Lie's death, many obituaries appeared:

- France: by G. Darboux in *Comptes rendus* (also translated and published in Kazan),
England: by W. Burnside in *Proc. London Math. Soc.*,
Italy: by E. Beltrami, L. Cremona, L. Bianchi in *Rend. Ac. Naz. Lincei*,
by C. Segre in *Atti Ac. sc. Torino*,
USA: G. B. Halstedt in *Amer. Math. Month.*

Obituaries appeared also in Norway (by L. Sylow) and in Poland (by K. Zorawski).

The first more detailed surveys on S. Lie's life and work were articles published by

F. Engel in *Jahresber. d. Deutsch. Math. Ver.*, B. 8, 1900, S. 30-96,

M. Noether in *Math. Ann.*, B. 53, 1900, S. 1-41.

The only book, containing S. Lie's biography and an analysis of all aspects of his scientific activity, is written in Russian:

E. M. Polishchuk. *Sophus Lie 1842 - 1899* (Editor J. D. Burago). Leningrad: Nauka, 1983, 213 p.

Sophus Lie and Russia, Estonia, Tartu (Dorpat)

In 1893 the Kazan Physico-Mathematical Society published a book "*On Foundations of Geometry*" (Ob osnovanyah geometrii), dedicated to Lobachevsky's 100th birthday anniversary. Besides the Russian translations of the classical works by Beltrami, Riemann, Helmholtz and Poincaré, also a paper by Lie, "*Bemerkungen zu V. Helmholtz' Arbeit über die Tatsachen die der Geometrie zu Grunde liegen*," was translated.

For the 100th anniversary of Lobachevsky's death a new extended edition of this book was published in 1956, containing the same translation of S. Lie's "*Bemerkungen ...*" and also a translation of the evaluation by F. Klein: "*Gutachten, betreffend der dritten Band der Theorie der Transformationsgruppen von Sophus Lie anlässlich der ersten Verteilung des Lobatchewsky-Preises,*" written at the request of Russian mathematicians. The International Lobachevsky prize had been founded in 1893 in Kazan with wide support from abroad. The first prize-winner was Sophus Lie in 1898, the next ones were W. Killing, D. Hilbert, F. Schur, H. Weyl, E. Cartan.

In 1899, the year of Lie's death, the Kazan Phys.-Math. Soc. published a little volume "*In memoriam Sophus Lie*" (Pamyati Sofusa Li), which contained in Russian translations the obituary by G. Darboux, a survey by F. Klein "*Geometry of spheres and complexes by Lie*" and a list of Lie's works.

The fourth Lobachevsky prize-winner F. Schur was a post-doctoral assistant of S. Lie in Leipzig and was among the first to continue Lie's investigations. For four years 1888 - 1892 he worked at the University of Tartu (Dorpat) as a full professor of mathematics. From here he sent some of his papers on transformation groups for publication in German journals (see the survey by L. Maurer, H. Burkhardt in *Enzykl. d. math. Wiss. B II A6*, 1900).

In 1889 the Pulkovo observatory celebrated its 50th anniversary. University of Tartu sent its congratulations in the form of a reprint of Fr. Schur's work, to which was added a special dedication title-page and a concluding passage by the author, expressing the hope that the theory of transformation groups would be useful also in the

study of the movement of celestial bodies.

Theodor Molien, a young dozent at University of Tartu, worked in close contact with the research group led by S. Lie at the University of Leipzig. He spent seven of his vacations (summer 1886, summer and winter 1887 and summer 1888, summer 1889) in Leipzig and participated in S. Lie's seminars. Molien was interested in the investigations of S. Lie, W. Killing, F. Schur, and others, in the new theory of hypercomplex numbers. In 1892 in Tartu, he defended his doctoral thesis "*Über Systeme höherer complexer Zahlen*" (Math. Ann., B. 41, 1893, s. 83-156), which is now considered a classic work in the structural theory of algebras. The first high evaluation of Molien's work was given by Sophus Lie (with F. Engel and G. Scheffers) in "*Theorie der Transformationsgruppen*" (Band III, 1893) and "*Vorlesungen über continuierliche Gruppen ...*" (1893).



A black and white portrait of a man in a military uniform, likely a general, with a high collar and medals on his chest. The man has dark hair and is looking slightly to the right. The background is a light, textured grey. The image is a high-contrast, woodcut-style illustration.

NIKOLAI IVANOVICH LOBACHEVSKY

1792 – 1856

Observances in Kazan

In 18 – 28 August 1992 an International Scientific Conference "Lobachevsky and Contemporary Geometry" was organized at Kazan State University. At this conference a plenary lecture "Nicolas Ivanovich Lobachevsky bicentennial 1792 – 1992" was read by Ch. Duffy (Massachusetts Maritime Academy, USA). A special anniversary booklet "N. I. Lobachevsky 200" was published in English, containing a short survey of Lobachevsky's life and work (with a list of the most important dates) and many illustrations: Gauss' medal sent to Lobachevsky by the Göttingen Royal Society (1856), Lobachevsky's monument in Kazan, etc.

Scientific works of N. I. Lobachevsky

The geometrical works by Lobachevsky were first collected on occasion of his 50th anniversary of birth and published in Kazan in 1883 in two volumes. Two main works, translated into German by F. Engel (with notes and a biography), appeared in one volume in Leipzig in 1898. H. Liebmann translated into German the treatises on imaginary geometry and its applications which were published in one volume in Leipzig in 1904.

When the 150th anniversary of Lobachevsky's birth was celebrated in Russia during most difficult war time, it was decided in 1943 to compile a complete collection

of Lobachevsky's works. The volumes of this complete collection (N. I. Lobachevsky. *Polnoye sobranie sochinenii*; chief editor V. F. Kagan) appeared in Russian in the following succession:

Volume 1, 1946: *Geometrical investigations on the theory of parallel lines* (original in German 1840). *On beginnings of geometry* (first edition 1829 - 1830).

Volume 2, 1949: *Geometry* (first edition 1909, written 1823). *New beginnings* (first edition 1835 - 1838).

Volume 3, 1951: *Imaginary Geometry* (first edition 1835). *Applications of imaginary geometry* (first edition 1836).

Volume 4, 1948: *Works on algebra* (first editions 1834). *Pangeometry* (first edition 1855).

Volume 5, 1951: *Works on calculus, probability and astronomy*.

Later, in 1956, Academic Publishing in Moscow issued "*Selected works on geometry*" and "*Three works on geometry*." Publication of Lobachevsky's writings was completed in 1976 with the volume "*Scientific-pedagogical heritage. Administrative work at the University of Kazan. Fragments. Letters*."

Literature on Lobachevsky

All biographical materials concerning Lobachevsky known until 1948, were collected by L. B. Modzalevsky and published in Russian in a voluminous book "*Materials for N. I. Lobachevsky's biography*."

A popular survey on Lobachevsky and his work was published by P. S. Aleksandrov in 1946 (Estonian translation 1948); second edition 1956.

The famous monograph by V. F. Kagan "*Lobachevsky*" appeared in 1948; an improved edition in 1974 (translated into French).

A cycle of papers dedicated to the 100th anniversary of Lobachevsky's death contains the IX volume of "*Historico-mathematical investigations*" (Istoriko-matematicheskie issledovaniya, 1956). In particular it contained a posthumous paper by A. A. Andronov proving conclusively that N. I. Lobachevsky was born on Nov. 20 (Dec. 1), 1792, rather than Oct. 20, 1793, as previously believed.

When the 150th anniversary of Lobachevskian geometry was celebrated by a scientific conference in Kazan in 1976, a monograph "*N. I. Lobachevsky*" by B. L. Laptev was issued for this occasion.

There are several fictional treatments of Lobachevsky's life and activity; by I. Zabotin (1956), M. Kolesnikov (1956), D. Tardzhemanov (1968, 1976), and others.

Lobachevsky and Tartu (Dorpat, Jurjev)

Martin Bartels (1769 – 1836), who was C. Fr. Gauss' mathematics teacher in elementary school in Braunschweig, and who later at Kazan University provided the mathematical education of Lobachevsky and through lectures on the history of mathematics awakened Lobachevsky's interest in the problem of parallel lines, was from 1821 on a professor of mathematics at University of Tartu (Dorpat). The department of rare books and manuscripts of the *Bibliotheca Universitatis Tartuensis* has a compendium of Lobachevsky's works with a dedication signed by the author and addressed to M. Bartels. It is possible that these works were brought to Tartu

by Lobachevsky himself; namely in December of 1836 the curator of the Kazan educational district received a dispatch: "The Minister of Education has given to the rector of Kazan University, Lobachevsky, sojourning in St. Petersburg, permission to stay in St. Petersburg and Dorpat [now Tartu - *Ü.L.*] until 25th of this month."

In several papers a hypothesis has been advanced that the ideas of non-Euclidean geometry might have been transmitted from Gauss to Lobachevsky through Bartels. The analysis of Bartels' letters to Gauss, partly from Tartu (replies to which have not yet been found), and of the memoirs of Bartels' grandchild O. Struwe, shows that Bartels had never mentioned non-Euclidean geometry and that he could not appreciate Lobachevsky's works.

Nevertheless, in Kazan, the first person to commend Lobachevsky's achievement was P. I. Kotelnikov in his assembly speech in 1842 (the year when Lobachevsky was elected a corresponding member of the Göttingen Royal Society, at Gauss' proposal). During the years 1828 - 1833 Kotelnikov had done post-graduate study in Tartu under Bartels.

Ferdinand Minding (1806 - 1883) worked in Tartu (Dorpat) from 1843; in 1840 he published a paper in Berlin proving that the trigonometry on a surface of constant negative Gaussian curvature coincides with the trigonometry on the "sphere" of imaginary radius. Lobachevsky had already shown in 1829 an analogous connection between his geometry and such a "sphere." Due to his illness he did not read the volume where Minding's paper was published; his only book in German came out in 1840, when Minding's paper had already been sent to the publisher, and did not attract Minding's attention. So it happened that it took 28 more years until

E. Beltrami pointed out that Lobachevsky's planimetry can be realized on surfaces with constant negative curvature, the first examples of which had been found by Minding.

Later in 1877 Minding proposed the detailed study of the trigonometry of such surfaces as the prize topic. The gold medal for work on this topic was won by a student in Tartu, J. Amelung.

At the end of the 19th century in Tartu (Jurjev) some writings on Lobachevskian geometry were also published by professors L. K. Lahtin and V. G. Alekseyev.

An expanded analytical treatment of Lobachevskian geometry in n -dimensional space was given in Tartu by Jüri Nunt (1892 - 1952) with original applications in cosmology (an explanation of the red shift by the "falling" horosphere in 4-dimensional Lobachevskian space).

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