

From the History of Physics*MIKHAIL FEDOROVICH SPASSKIĬ – EMINENT RUSSIAN PHYSICIST AND METEOROLOGIST  
OF THE 19TH CENTURY*

(On his 150th birthday and the 100th anniversary of his death)

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FEBRUARY 1959 marked the 100th anniversary of the death of the outstanding Russian physicist and meteorologist of the 19th century, one who continued Lomonosov's traditions at the Moscow University, Mikhail Fedorovich Spasskiĭ.

Spasskiĭ was born in 1809 in the village Zakharovo in the Livny district of the Orlov province; his father was the village deacon. After completing the Orlov Theological Seminary he was sent in 1829 to study in the recently opened Main Pedagogical Institute of St. Petersburg, from which he was successfully graduated in 1835 and awarded a silver medal. At the Pedagogical Institute he attended the lectures of the outstanding Russian scientists Ostrogradskiĭ, Kupfer, Hess, Lentz, and others. Even as a student he started his scientific research at the St. Petersburg Academy of Sciences, in the field of meteorology, under the leadership of academicians Lentz and Kupfer. During his student years he translated from French into Russian the "Manual on Performance of Meteorological and Magnetic Observations," written by academician Kupfer for the observatories and meteorological stations of Russia. He also published in his student years several research papers on meteorology.

The Main Pedagogical Institute was at that time one of the most democratic institutions of learning in Russia. It is this institution that the acrimonious Princess Tugovskaya referred in "Grief of Mind" when she said that "the professors train there in schisms and dissidence..." A student body from all ranks and the democratic spirit of free teaching of materialistic science made the Main Pedagogical Institute kin to the Moscow University, where Spasskiĭ was to work later on.

From 1836 through 1838 Spasskiĭ studied in the Königsberg and Berlin Universities, where he attended the lectures of the outstanding German scientists: Jacobi, Neumann, Bessel, Dove, Magnus, and others.

Returning from abroad, Spasskiĭ delivered on

December 1, 1938, in the Conference Hall of the Petersburg Academy, the required test lecture, which was devoted to "An Explanation of the Phenomena of Diffraction of Light on the Basis of Wave Theory." Kupfer wrote concerning this lecture: "Spasskiĭ made fortuitous use of everything that he could gather in the field of physical knowledge during the time of his trip abroad."

On February 7th 1839, Spasskiĭ was appointed adjunct of the Moscow University, in the Faculty of Physics and Physical Geography. In 1848, after successfully defending a doctoral dissertation "On the Climate of Moscow" he was awarded the degree of Doctor of Physics and Chemistry and appointed extraordinary professor, and in 1850 he was appointed ordinary professor of the Moscow University. From 1853 to the end of his life he was elected dean of the Physical-Mathematical faculty.

In his scientific and pedagogical activity Spasskiĭ followed the great Russian scientist M. V. Lomonosov. He studied Lomonosov's work, spread and developed his ideas, and defended the priority of his scientific discoveries. In his lectures in the 40's and 50's of the 19th century, he taught Lomonosov's molecular-kinetic theory of heat, although during that time the theory of phlogiston was still generally recognized. In talking of atmospheric electricity, Spasskiĭ adhered to Lomonosov's point of view of the origin of atmospheric electricity, i.e., he ascribed it to the ascending and descending vertical streams of air in the atmosphere. In 1851 he delivered a lecture "On the Advances in Meteorology," in which he gave due credit to the great works of Lomonosov, who blazed the way to further development of the physics of the atmosphere.

His natural-science and philosophical views were expounded in the splendid work "On the Climate of Moscow" in the Society's lectures "On Advances in Meteorology," "On the Modern Trend in Physical Research and on the Significance of the Laws of Nature," and also in numerous articles and remarks published in journals and newspapers. In his courses on experi-

mental and theoretical physics he drew general philosophical conclusions on the basis of new discoveries in natural sciences.

In 1848 Spasskiĭ translated from the French and published the extensive survey of physics by the British scientist Grove, "On the Mutual Relationships between the Different Physical Agents or Forces." These survey lectures were devoted to an examination of the problem of the conversion of various types of energy and on the mechanism of mutual transitions. These lectures by Grove were favorably reviewed by Engels. The translation of Grove's lectures into Russian made them accessible to a large circle of readers. This way Spasskiĭ undoubtedly contributed to the dissemination of the advanced materialistic ideas, which were then formulated in science under the influence of the latest discoveries in the field of physics.

In the middle of the 19th century spiritism was the vogue among a certain fraction of the Russian intelligentsia. In "Letter to the Editor of the Moscow Medical Journal" published in the journal "Moskvitianin" No. 12, 1853, Spasskiĭ decisively took a position against the absurd spirit writing.

Spasskiĭ as a physicist-materialist, played a leading role in the struggle for a materialistic point of view in natural sciences. He many times met with the author of the famous "Letters on the Study of Nature," Herten, and had discussions with him on natural-scientific and philosophical topics.

A bright example of Spasskiĭ's enlightening activities, aimed at disseminating his physical and materialistic views, was the public demonstration of Foucault's experiment in 1851. Foucault's experiment, showing the rotation of the plane of oscillations of a pendulum in the direction of the visible motion of the sun, which is a clear and simple demonstration of the earth's rotation about its axis, has attracted attention of the entire educated world. The Paris Academy of Sciences was engaged in examination of Foucault's experiment on February 3, 1851, and in July of the same year Spasskiĭ mounted a Foucault pendulum in the new building of the Moscow University. Foucault's experiment, which Spasskiĭ demonstrated at the Moscow University, was correctly considered as refuting the dogma of the geocentric structure of the universe and of the stationary earth, which was the basis of the teachings of the Church. This physical experiment played a substantial role in the propagation of a materialistic point of view. At the present time the Foucault pendulum is located in Leningrad in the Isaac Cathedral.

Of great scientific interest were Spasskiĭ's experiments on Nicol prisms, published (in German)

in 1838. Investigating the polarization of light by a Nicol prism, Spasskiĭ has established that color bands are visible in the prism at certain angles of incidence. For example, if the rays of light strike the prism at an angle of 40 — 44°, a red band is visible, since an ordinary red ray is transmitted by the prism in this case. The plane of polarization of the rays emerging from the Nicol prism was determined by Spasskiĭ from the interference of the converging polarized beams. For this purpose he transmitted polarized light through a crystal plate, ground perpendicular to the optical axis, and observed the interference pattern through the investigated Nicol prism, which served as an analyzer. When the polarizer and analyzer were crossed and the phenomenon was observed in white convergent light, a pattern was obtained, consisting of differently-colored concentric rings, intersected by a black cross. In the case of parallel Nicol prisms the cross was white and the rings were colored in the complementary colors. In his experiments Spasskiĭ was able to reverse the colors (from the complementary ones) in the interference pattern not by rotating the principal Nicol plane through 90°, but by changing the angle of incidence of the rays emerging from the crystal plate on the input face of the Nicol prism.

Spasskiĭ deserves great credit as the climatologist of the 19th century. His principal work "On the Climate of Moscow" always retains its value as the outstanding product of Russian climatological literature of the first half of the 19th century. Spasskiĭ is the creator of modern procedure of processing of climatological data.

The principal idea of Spasskiĭ's book "On the Climate of Moscow" is that the atmosphere surrounding the earth is the site of a constant struggle between two air flows — polar and tropic. He proposed that the polar flow of air brings clear weather and high atmospheric pressure, while the tropical flow, with a prevailing direction from southwest, brings heat, cloudy weather, and a reduction in atmospheric pressure. This idea was later forgotten, but now it is again accepted by the scientists of the whole world and serves as the basis of climatology.

Spasskiĭ approached the phenomena in the atmosphere from the physicist's point of view. He assumed that physical laws could explain exhaustively all the "atmospheric changes" i.e., all the processes in the atmosphere. He introduced the term "physics of the atmosphere," which is more correct than "meteorology." He formulated the principal physical laws of the processes that comprise climate.

The first six laws pertain to the heat balance be-

tween the atmosphere and the underlying surface. These take into account the role of the albedo, specific heat, and heat conduction of the underlying surface, which is particularly important for an explanation of the differences between the climates on dry land and on the sea. In other laws, Spasskiĭ considers the interaction between two adjacent air masses of different temperature, the resultant circulation, evaporation, and condensation, as well as melting and freezing. The most interesting is the law of adiabatic variation of the temperature. Spasskiĭ applies this law to ascending and descending streams of air. As is known, Lomonosov attached great significance to these streams when he explained the causes of formation of atmospheric electricity. Spasskiĭ considered them one of the causes of formation of clouds.

The physical laws formulated by Spasskiĭ have placed climatology on a rational basis. These were used directly by Voeĭkov for a qualitative explanation of the climates of the earth's sphere, and in our time the Soviet school of theoretical meteorologists has made these principles the basis of quantitative theory of climate.

Spasskiĭ's "On the Climate of Moscow" was published in November 1847. Spasskiĭ defended it as a doctoral dissertation on February 6, 1848 in the Great Auditorium of the Moscow University.

The 1848 Moscow journal "Moskvitianin" wrote as follows concerning this interesting defense: "Judging from all responses, this work is not only new, but also contentful and purposeful. It is pleasant to see that all our faculties believe in the advantages and importance of dissertations... The discussion lasted for two hours. All the professors of the faculty, competing with each other in favor of the candidate, raised objections. But 'On the Climate of Moscow' remained like an impenetrable fortress. All the objections concerned more general scientific truths, but not the substance of the dissertation, which is so interesting to us in its position, which is so close to every one of us, in the dependence which we have on it... The defender delivered his discussions meaningfully, not so much to insist on his opinion, but to explain the truth both to himself and to others by means of various objections to it: 'A good trait in a scientist'."

Spasskiĭ always was proud of the progress of Russian science and attached particular significance to the connection between science and practice. In a speech "On the Modern Trend of Physical Research and on the Significance of Laws of Nature" he said: "A study of the phenomena of the physical world, the investigation of the laws of nature has never attained such amazing rapid success as in

our time. One can state without exaggeration that now every year brings new, more or less brilliant discoveries, very important and fruitful either because of their significance to science or because of the applications which they bring to the practical life of the educated nations. We see before our eyes the realization of such wonderful events which previously were believed possible only by the most daring and most fervid imagination. It is enough to recall the wonderful tools that steam and electricity together with magnetism, have become in human hands in recent time... By becoming acquainted for the first time with the physical and chemical workers in an even greater variety of applications to technical works, by being amazed at the simplicity and ease with which an uninformed but skilled master controls and uses these applications at will, these persons imagine that the first application of new agents would be easy in practice; they do not take the effort to think of the preliminary research and analysis which a detailed study of all the properties of each of these agents involves, how many difficulties must be avoided or overcome by the scientists in the quiet of his study before any kind of novelty acquires the right of citizenship in the noisy machine shop of some commercial institution."

Spasskiĭ taught remarkable students — fighters for advanced materialistic Russian science. Among his students were the great Russian scientists A. G. Stoletov, I. M. Sechenov, F. A. Bredikhin, N. V. Manevskii, and many others, who raised highly the banner of materialistic science, founded by the great Russian scientist M. V. Lomonosov.

Spasskiĭ was all his life an active fighter for the flourishing of advanced science. His memory must be cherished for ages together with the names of the great Russian scientists.

#### Spasskiĭ's Principal Published Papers

1. On the Dulong Formula for the Pressure of Water Vapor at Various Temperatures, Poggend. Ann. **30**, 331 (1833).
2. Calculation of Observations of the Temperature of Artesian Wells, Dug in the Vicinity of Vienna, Poggend. Ann. **31**, 365 (1834).
3. Note on Nicol's Prism. Poggend. Ann. **34**, 168 (1838).
4. Brief Report of the Meteorological Observations Carried out in St. Petersburg during 1832-1833, Записки Академии наук в Петербурге (Notes of the Academy of Sciences in Petersburg), 111 (1838).
5. Note on the Absolute Intensity of the (Horizontal) Force of Magnetism in St. Petersburg,

- Bull. Sci. Acad. Sci. St.-Peter. 5, No.13, 197 (1839).
6. Lectures on Meteorology by L. F. Kemptz, Professor of Physics in Halle, translated by M. Spasskiĭ, Volumes I—II, Moscow, 1841.
  7. О климате Москвы, Критическое исследование (On the Climate of Moscow, Critical Investigation) Moscow, 1847.
  8. Thunder in Moscow on 24 June 1848, "Moskvitianin," No. 7 part IV, p. 69, 1848.
  9. Thunder in Moscow on 8/20 October 1848, "Moscow News," No. 134, Nov. 6, 1848; "Moskvitianin," No. 11, p. 17, 1848.
  10. Mutual Relation between Various Physical Agents or Forces: I—"Moskvitianin," No. 7, p. 52, 1848; II—No. 8, p. 96; III—No. 9, p. 28; IV—No. 10, p. 21; V—No. 11, p. 11.
  11. Speech on the Progress of Meteorology, delivered at the Official Convocation of the Moscow University on January 12, 1851. Moscow, 1851.
  12. Convincing Truth of the Rotation of the Earth about its Axis. Repetition of the Foucault Experiments at the Moscow University. Moscow, 1851.
  13. Remark on the Winter Blizzard which Caused Great Distress in Kaluga, Tula, and Kursk on November 29 (December 11) 1850. (Report at the session of 18/13 January 1851), Bull. Mos. Gen. Inst. Pedag. vol. 24, No. 1, 341 1851.
  14. The Atmosphere of the Earth, Journal of Earth Science, v. 1, Moscow, 1852.
  15. On the Purpose and Use of the Barometer, Journal of Earth Science and Travel, v. 1, Moscow, 1852.
  16. Letter to the Editor of the Moscow Medical Journal on Table Lifting, "Moskvitianin" part III, p. 97, 1853; published separately Moscow, 1853.
  17. On the Effect of External Conditions on Longevity, Statistical Collection, Bull. Russ. Geogr. Soc., v. II, St. Petersburg, 1854.
  18. Note sur la marche annuelle de la temperature de Moscou, Nouv. Mem. Soc. Imp. Nat. Moscou, 8 (XVI), 325, 1855.
  19. Modern Trend in Physical Research and the Significance of the Laws of Nature, Speech on August 31, 1856; Moscow, 1856; "Moscow Medical Journal, Book 3, 1856.
- Literature on M. F. Spasskiĭ
1. The Brockhaus and Efron Dictionary, v. 61, p. 150, Spasskiĭ, Mikhail Fedorovich.
  2. A. I. Polunin, Obituary of the Ordinary Professor, "Moscow Medical Journal," book 5, p. 249, 1859.
  3. Russian Bibliographical Dictionary, St. Petersburg, 1909, pp. 181-182, "Spasskiĭ, M. F." (The end of the biography contains literature on his life and activity).
  4. A. Kh. Khrgian. Life and Activity of M. F. Spasskiĭ. In the book "Избранные работы по физике атмосферы" (Selected Works on the Physics of the Atmosphere), Moscow, 1951.
  5. A. Kh. Khrgian. Михаил Федорович Спасский Mikhail Fedorovich Spasskiĭ. Series: "Outstanding Scientists of the Moscow University," Moscow, 1955.
  6. A. F. Kononkov, История физики в Московском университете (History of Physics in the Moscow University), Moscow, 1955 pp. 190-234, 247-248, 269-278, 293-296.
  7. S. I. Vavilov, Собрание сочинений (Collected Works) Vol III, p. 283, 1956.

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