SOVIET PHYSICS

JETP

A translation of the Journal of Experimental and Theoretical Physics of the USSR.

SOVIET PHYSICS—JETP VOL. 5, NO. 3, PP 345-525 OCTOBER, 1957

ANNOUNCEMENT

ABOUT two and one half years ago, the American Institute of Physics began the translation of the *Journal of Experimental and Theoretical Physics* under a grant from the National Science Foundation. At the time, this was a pioneering effort, as far as scientific societies in the United States were concerned. It was then estimated that the number of Russian pages would run to approximately 1600 per year.

Since that time, the Russian journal has twice expanded, and is now publishing at a rate of 4000 pages per year. At the same time, The American Institute of Physics has undertaken the translation of three other journals *(Journal of Technical Physics, Acoustics Journal* and the physics portion of the *Proceedings of the Academy of Sciences),* so that approximately 8000 pages are being translated annually. All of these journals are finding steadily increased support from subscribers.

Beginning with the next issue, *Soviet Physics JETP* will have a new editor, Prof. J. George Adashko of the City College of New York. It is my hope that the new editor will have the same generous support from translators and subscribers that was the good fortune of the retiring editor.

Robert T. Beyer

Grigorii Samuilovich Landsberg

J. Exptl. Theoret. Phys. (U.S.S.R.) **32**, 409-412 (March 1957)

THE outstanding Soviet physicist Grigorii Samuilovich Landsberg died in his 68th year on February 2, 1957 after a painful illness.

Physical science suffered an irreparable loss. G. S. Landsberg's great physical discoveries and his fruitful pedagogical and scientific activities, spanning more than 40 years, made him widely known in our country and abroad. A highly educated person, a scientist with most varied interests, Grigorii Samuilovich contributed much to the theory and practical application of physical optics, molecular physics, and atomic and molecular spectroscopy.

G. S. Landsberg was born on January 22 (new calendar), 1890 in the city of Vologda. He was graduated from the Moscow University in 1913, where he remained to prepare for a teaching career. This marked the beginning of his scientific and pedagogical activity.

In 1915 Grigorii Samuilovich was drafted into the army, and in 1917 he was assigned to the Laboratory of the Agricultural Union, where he first worked as a scientist, and then as deputy chief of this laboratory.

After teaching two years in the Omsk Agricultural

Institute (1918-1920) and after three years' work at the Institute of Physics and Biophysics in Moscow, Grigorii Samuilovich started his long scientific and pedagogical association with the Moscow State University. At the same time, during 1923-1931, he also lectured in general physics also at the Second Moscow University (now V. I. Lenin Pedagogical Institute). Grigorii Samuilovich worked more than 25 years at the Moscow State University. There he founded the optical laboratory and made many of his remarkable investigations.

When the Academy of Sciences moved to Moscow, Grigorii Samuilovich organized the Optical Laboratory of the P. N. Lebedev Physic Institute, to which most of his scientific activity shifted gradually. He headed this laboratory until his death. In recent years Grigorii Samuilovich taught at the Moscow Mechanical Institute, and then in the Moscow Physico-Technical Institute, where he established and headed the optics division.

Grigorii Samuilovich published his first scientific work in 1915. When L. I. Mandel'shtam, who influenced G. S. Landsberg greatly, moved to Moscow in 1925 the two started their joint prolonged work on molecular optics. This work led to fundamental discoveries.

The first great series of investigations was devoted to the study of molecular scattering of light in solids (quartz). This was before even the existence of such scattering in crystals was established. The experimental difficulties involved seemed insurmountable because the stray light was hundreds of times stronger than the molecularly-scattered light. Grigorii Samuilovich first succeeded in observing and measuring molecular scattering of light in solids because of his outstanding experimental skill in devising clever and elegant techniques that lead to success. This phenomenon was exhaustively studied quantitatively in subsequent works by G. S. Landsberg and his students. G. S. Landsberg, L. I. Mandel'shtam and their students created the theory of molecular scattering of light in solids. They observed and studied the anisotropy of the scattered light in crystals. All their experimental results were in full agreement with theory. Thanks to these investigations, scattering of light in crystals can now be considered a closed discipline, *i.e.*, one fairly well developed from both the experimental and theoretical aspects.

Immediately after the first reliable observations of molecular scattering of light in crystals, G. S. Landsberg and L. I. Mandel'shtam started a search for the fine line structure of the classical (Rayleigh) scattering, predicted by L. I. Mandel'shtam as early as 1918. This fine structure (splitting) is due to modulation of the scattered light by elastic thermal waves (hypersound). This line splitting was too fine to be observable with the apparatus available to Grigorii Samuilovich at that time. The experiments were therefore performed with extreme precision. The systematic investigation of the spectral composition of scattered light in crystals has led G. S. Landsberg and L. I. Mandel'shtam to the discovery in 1928 of an entirely new phenomenon of tremendous scientific and practical significance—the combination scattering of light (Raman effect). This discovery was destined to play an outstanding role in the history of science. The investigation of the new phenomenon distracted G. S. Landsberg somewhat from the initial problem, to which he returned only in 1930, when the modulation of scattered light by hypersound was indeed observed. This effect was studied subsequently in many laboratories in the world. It became evident in the course of this investigation in G. S. Landsberg's laboratory that precise measurements of the speed and absorption of ultrasound in liquids were necessary. Although such measurements were new and unusual for an optical laboratory, Grigorii Samuilovich included them in his laboratory's program without hesitation.

It was generally typical of Grigorii Samuilovich to have a broad and versatile approach to a solution of a problem. His study of all the problems connected with classical scattering of light led to results of great scientific significance. Grigorii Samuilovich retained interest in this topic, and continued to develop these investigations to his last days.

An investigation of certain aspects of resonant fluorescence led G. S. Landsberg and L. I. Mandel'shtam to the discovery of an entirely new phenomenon – selective scattering in mercury vapor. Grigorii Samuilovich displayed here a particular experimental virtuosity, leading to an unmistakable observation and to a thorough study of the effect not only qualitatively but also quantitatively.

The second great subject in which Grigorii Samuilovich engaged was the study and practical application of combination scattering of light. Combination scattering of light (Raman scattering) discovered by him jointly with L. I. Mandel'shtam in quartz crystals and discovered independently by Raman in liquids, is one of the greatest physical discoveries. G. S. Landsberg and L. I. Mandel'shtam grasped immediately the true nature of this phenomenon. Many of their investigations and those of their associates were devoted to exhaustive experi-

mental and theoretical studies of this scattering. They developed the classical and quantum theories of the phenomenon and studied the temperature behavior of the long-wave and short-wave satellites. The great significance of this phenomenon to physical and chemical problems was immediately appreciated. A new path was blazed in scientific research and many practical applications were found. Thus, G. S. Landsberg and his school used combination scattering to study exhaustively the so-called "hydrogen bond," which plays a particularly important role in many problems of molecular physics and chemistry. They performed the difficult investigation of second-order combination-scattering lines that characterize the nonlinearities of the intramolecular forces, and were the first to measure by interference the widths and the contours of the combination-scattering lines. The work by Grigorii Samuilovich and his students on the analytic application of conbination scattering of light has made this method a powerful precision tool for quantitative and qualitative analysis of complex organic mixtures. Shortly before his death, Grigorii Samuilovich and his students summarized the results of their research in this field in a special monograph.

G. S. Landsberg's all-around scientific activity was by no means limited to a study of the above scientific problems. His outstanding accomplishment is the development of the scientific foundations and methods for the application of emission analysis to metallurgy and to other branches of industry. Grigorii Samuilovich proceeded to develop and introduce spectral analysis at the very same time when some of the greatest spectroscopists in the world thought it impossible to apply spectral analysis to production. The persistent work by Grigorii Samuilovich and his school led to a solution of this problem, which he clearly understood to be important to the government, and now spectral analysis is widely used in many plants and enterprises of the country to the great benefit of the national economy.

Grigorii Samuilovich was also most influential in training of an entire army of spectroscopists and in launching a domestic industry of spectral instruments. He was the permanent head of the Commission on Spectroscopy, Academy of Sciences, USSR, and guided the policies of its important work.

As already mentioned, Grigorii Samuilovich's pedagogical activity began in 1918. He taught courses in general physics, in "Experimental Foundations of Atomic Theory," in "Scattering of Light," *etc.* His masterful lectures inspired in the listeners great interest in physics and love for science. His lectures were a creative process. Grigorii Samuilovich believed teaching to be his unswerving duty. He has trained many generations of Soviet physicists, who remember their teacher with respect and gratitude.

Grigorii Samuilovich's qualities as scientist and teacher are shown in his excellent *Optics*, which went through four editions, and in the three-volume *Elementary Textbook of Physics*, produced under his leadership, to which he devoted much of his labor. These books occupy an outstanding place in our physics literature.

Grigorii Samuilovich's tremendous scientific accomplishments, his scientific-organizational merits, and his activity as a Soviet patriot were highly esteemed. On November 30, 1946, G. S. Landsberg was elected an active member of the Academy of Sciences, USSR. He was awarded the Stalin prize for outstanding services in the development of spectral analysis. He was awarded two orders of Lenin and medals.

Grigorii Samuilovich was a man with a sense of duty, both as a scientist and a citizen. He never compromised with his conscience. His high principles, consistency, and courage in defending his point of view gained him universal respect. He was generous and responsive, but was feared by climbers and grabbers. Everyone who was genuinely devoted to science gained his support and unselfish aid.

The glowing memory of Grigorii Samuilovich will long be indentified with the idea of what a scientist's basic human qualities should be.

G. S. LANDSBERG'S PRINCIPAL WORKS

Molecular Scattering of Light in Solids: 1. Scattering of Light in Crystalline Quartz and its Temperature Dependence, Z. Physik 43, 773 (1927). – II. Temperature Dependence of Intensity of Scattered Light, Z. Physik 45, 442 (1927). – III. Intensity of Light Scattered by Crystalline Quartz (with K. S. Vul'fson), Z. Physik 58, 95 (1929). – IV. Intensity of Light Scattered by Rock Salt (with L. I. Mandel'shtam) Z. Physik 73, 502 (1931).

Discovery and Investigation of Combination Scattering of Light (with L. I. Mandel'shtam): Sixth Congress of Russian Physicists, Moscow, Gosizdat (1928); Journal of Russian Physical and Chemical Society, Physics Part 60, 335 (1928); Compt. rend. 187, 109 (1928); Z. Physik 50, 769 (1928); Naturwiss 16, 57 (1928); Uspekhi Fiz. Nauk 9 (1931).

Contributions to the Theory of Molecular Scattering of Light (with L. I. Mandel'shtam). Zh. prikl. fiz. 6, 155 (1929).

Concerning the Intensity and Temperature Dependence of Combined Scattering (with M. A. Leontovich), Z. Physik 53, 439 (1929).

Scattering of Light in Crystals at High Temperature (with L. I. Mandel'shtam), Z. Physik 58, 250 (1929); Z. Physik 60, 364 (1930).

On the Theory of Molecular Scattering of Light in Crystals (with L. I. Mandel'shtam and M. A. Leontovich), Z. Physik 60, 334 (1930).

Combination Scattering in Absorption and Fraunhoffer Lines (with F. S. Baryshanskaia), Naturwiss 18, 183 (1930).

Combination Scattering of Light and its Significance to Chemical Problems, Uspekhi Khimii 1, 464 (1932).

Absorption of Light by Ammonia (with A. S. Predvoditelev), Z. Physik 31, 594 (1925).

Fundamental Works on Spectral Analysis of Metals: J. Tech. Phys. (U.S.S.R.) 3, 771 (1933) (with S. L. Mandel'shtam and S. M. Raiskii); Uch. zap. Moscow State Univ. 1, 26 (1933) (with S. L. Mandel'shtam and S. M. Raiskii); Liteinoe delo 5, 9 (1933); J. Techn. Phys. U.S.S.R. 2, 574 (1935); Zavodskaia laboratoriia 4, 1220 (1935) (with L. I. Mandel'shtam, S. V. Tuliankin, and V. V. Tseiden).

Selective Scattering of Light in Mercury Vapor (with L. I. Mandel'shtam) Phys. Z. Sowjetun. 8, 378 (1935).

Second-Order Lines in Combined Scattering (with V. L. Malyshev). Dokl. Adad. Nauk SSSR 3, 365 (1936).

Frequency of Hydroxyl Group of Methyl Alcohol and its Dependence on Density (with S. A. Ukholin), Dokl. Akad. Nauk SSSR 16, 399 (1937).

Intermolecular Forces in Combination Scattering of Light. Izv. Akad. Nauk SSSR, Ser. Fiz 3, 373 (1938).

Combination Scattering of Heavy-Water Solutions (with V. I. Malyshev and V. E. Solov'ev), Dokl. Akad. Nauk SSSR 24, 873 (1939).

Scattering of Light in Unevenly Heated Crystal (with A. A. Shubin), J. Exptl. Theoret. Phys. (U.S.S.R.) 9, 1309 (1939).

Concerning the Heat Conduction of Crystals (with A. A. Shubin), J. Exptl. Theoret. Phys. (U.S.S.R.) 10, 247 (1940).

Combination Scattering of Light in Crystalline Hydroxides and the Hydrogen Bond (with F. S. Baryshanskaia), Izv. Akad. Nauk SSSR, Ser. Fiz. 10, 509 (1946). J. Phys. 11, 101 (1947).

Scattering of Light in KH_2PO_4 and $(NH_4)H_2PO_4$ and its Use in the Theory of Ferroelectrics (with F. S. Baryshanskaia), Dokl. Akad. Nauk SSSR 61, 1027 (1948).

The Doppler-Fizeau Phenomenon and Molecular Motion, Uspekhi Fiz. Nauk 36, 284 (1948).

Effect of Temperature on the Scattering Spectrum of Crystals Containing OH-Groups (with F. S. Baryshanskaia), Memorial Collection to S. I. Vavilov, Moscow, Academy of Sciences, USSR 1952, Page 147.

Basic Work on Molecular Spectral Analysis of Organic Mixtures: Transactions of All-Union Conference on Chemistry and Processing of Petroleum, Baku, Azerbaydzhan SSR Academy of Sciences, 7 (1953); Transactions of Committee on Hydrocarbons, Moscow (1944); Izv. Adad Nauk SSSR, OKhN 1, 9 (1941) (with N. D. Zelinskii); Izv. Akad Nauk SSSR, Ser. Fiz 4, 158 (1940) (with P. A. Bazhulin, U. V. Rozenberg, and A. S. Eliner).

Fluctuating Spectra of Diphenyl and Deka-Deutorodiphenyl (with A. I. Shatenshtein, G. V. Perogudov, E. E. Izrailevich, and L. A. Novikova), Optika i spektroscopiia 1, 34 (1956).

Basic Parameters of Spectra of Combination Scattering of Hydrocarbons (with P. A. Bazhulin and and M. M. Sushchinskii), Moscow, Academy of Sciences, USSR (1956).

Translated By J. G. Adashko
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