PERSONALIA

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In memory of Immanuil Lazarevich Fabelinskiĭ

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Immanuil Lazarevich Fabelinskiĭ, Corresponding Member of the Russian Academy of Sciences, outstanding physicist, expert of standing reputation in physical and nonlinear optics, light scattering, and physical acoustics, and the doyen of the P N Lebedev Physics Institute (FIAN) of the Academy of Sciences, died on August 2, 2004, as he approached his 94th birthday.

Fabelinskiĭ was born on January 27, 1911 in Graevo of the Belostok province, into a doctor's family. In 1929, he graduated from a nine-year secondary school in L'gov. Upon graduation he worked for two years as lathe operator at the C Liebknecht sugar factory in Peny, a settlement in the Kursk province. In 1931, he enrolled in the Physics Department of Moscow State University and graduated in 1936. He stayed at the department as teaching assistant and researcher at the optics laboratory headed by the then AS Corresponding Member G S Landsberg.

From October 1941 to 1943 Fabelinskiĭ was in evacuation in Kazan' where he worked at the Institute of Theoretical Geophysics. In 1943 he transferred to Landsberg's Optics Laboratory of the P N Lebedev Physics Institute of the USSR Academy of Sciences. From that time till his last day he worked successfully at FIAN, first as senior researcher, then head of a sector; during recent years he supervised a research group as an adviser to the Russian Academy of Sciences.

Fabelinskiĭ presented and defended his candidate thesis in 1942, and his doctoral thesis in 1955, receiving the rank of professor in 1969, and in 1979 was elected Corresponding Member of the USSR Academy of Sciences.

Fabelinskiĭ devoted his scientific career to studying the molecular scattering of light — a fundamental field of physics to which much attention was paid in Russia. By the mid-20th century it appeared that the main body of research had been completed, and the major laws established. It became clear, however, that this was not so. Owing to his encyclopedic and profound knowledge, Fabelinskiĭ, a subtle and inventive experimenter, managed to formulate and solve intricate optical problems, which allowed him to discover and observe a number of novel physical phenomena.

Thus, he was able to show quite early that the spectroscopy of scattered light (in particular, Mandelstam – Brillouin scattering) can be used for studying acoustic and kinetic properties of gases, liquids, and solids.

He was the first to measure the speed and absorption of hypersound (sound frequency above 10^9 Hz), applying spectroscopic methods to scattered light and, having compared the speed of propagation of hypersound to that of ultrasound, detected dispersion of the speed of sound in many liquids. This approach has opened a new method of studying the kinetics of sound propagation in condensed media.

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Immanuil Lazarevich Fabelinskiĭ
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Fabelinskiĭ was also the first to observe Mandelstam – Brillouin components in viscous liquids, which allowed him to determine the speed of hyperacoustic waves in these liquids over a broad range of temperatures (and, hence, viscosities) down to the vitreous state. It should be noted that attempts to detect Mandelstam – Brillouin components in viscous liquids and glasses failed in many laboratories and that rather plausible explanations were offered as to why this was impossible.

Fabelinskiĭ experimentally investigated the spectrum of depolarized light scattering in liquids and developed the method of extracting the anisotropy relaxation time from the spectra obtained. He established that, as a rule, liquids possess two anisotropic relaxation times falling within the interval of $10^{-11} – 10^{-13}$ s.

The creation of lasers and the understanding of the new opportunities that their use as light sources offered in spectral studies inspired Fabelinskiĭ to stage new experiments. As a result, his group designed one of the first experimental He – Ne lasers that formed a basis of a new experimental setup for spectral measurements in the laboratory.

This has made it possible not only to expand the range of research and to improve the accuracy of earlier results, but it also enabled Fabelinskiĭ to determine the hypersound attenuation coefficient in liquids from the width of Mandelstam – Brillouin components, to test the applicability of the relaxation theory, and to determine the bulk viscosity relaxation time.

The ultrasonic research into viscous liquids, conducted under Fabelinskiĭ's guidance, has shown that the propagation of sound in them cannot be described by a simple relaxation theory. The study led to the formulation of the basic laws of the phenomenon and to the development of a new theory of sound propagation in viscous media.

Enormous experience and an exceptional experimenter's intuition allowed Fabelinskiĭ and his colleagues to discover a new phenomenon — a fine structure of the wing of the Rayleigh line, arising as a result of the interrelation between strain fluctuations and the orientation mode of molecular motions in the liquid. This phenomenon, observed in labile liquids where shear waves cannot propagate, made it imperative to reconsider the foundations of the dynamical theory of the liquid state. At greater viscosities (at low temperatures) in the same media, Mandelstam – Brillouin components were detected for scattering by transverse hypersonic waves. These unexpected results stimulated a flood of experimental and theoretical publications in many countries.

Two factors — the advent of Q-modulated lasers as sources of high-power radiation, and an exceptionally penetrative understanding of the physics of molecular scattering of light — enabled Fabelinskiĭ to devise a powerful ruby-rod-based laser in his laboratory. This step triggered a whole line of work in which he and his group discovered a number of quite novel effects.

Two novel phenomena were thus discovered: the stimulated scattering on the wing of the Rayleigh line, and the stimulated entropic (thermal) scattering of light in liquids.

Of special interest was the pioneering observation of the stimulated Mandelstam – Brillouin scattering in compressed gases. Earlier work in this field (in India) failed to detect Mandelstam – Brillouin components in compressed gases, and it was even stated that, in principle, these cannot be detected. Contrary to this belief, Mandelstam – Brillouin components due to scattering by longitudinal hypersonic waves were then observed in two compressed gases, which was an important success for classical nonlinear optics.

Much of the work of Fabelinskiĭ and his group was devoted to studying nonlinear phenomena in solids. For instance, they were the first to observe the stimulated Mandelstam – Brillouin scattering by a transverse hypersonic wave in crystalline quartz, and stimulated scattering in silicate glasses.

Recently, Fabelinskiĭ, together with his disciples and colleagues, had extended experimental studies of phase transitions and critical phenomena in demixing solutions. Important new results were obtained, especially concerning the temperature dependence of speed and the absorption of hypersound in the region of criticality and outside it in solutions with a closed region of stratification. This work constituted an important new step in studying the nature of critical phenomena and led to the formulation of a series of new questions and new problems for further experimental and theoretical research.

The success of Fabelinskiĭ's research had undoubtedly resulted from his profound understanding of physical phenomena. This aspect is so obvious in his numerous review papers and in his classical fundamental monograph *Molecular Scattering of Light*, published as early as 1965. An enlarged edition of this book appeared in English, translated and published by Plenum Press, in 1968. All in all, Fabelinskiĭ published more than 150 papers, most of which were incorporated into optics textbooks and monographs.

Fabelinskiĭ lectured at various times at the Physics Department of Moscow State University, the Moscow Institute of Engineering Physics, the Moscow Power Engineering Institute, and the Moscow Physics and Technology Institute.

Fabelinskiĭ's research effort had received prestigious academic awards — the M V Lomonosov Prize (1966), the L I Mandelshtam Prize (1991), the S I Vavilov Gold Medal (2000), and the A R Beruni State Prize of Uzbekistan (1983).

His devotion to science knew no bounds and he could never imagine himself doing anything else. Whether in the lab, at home, or on vacation he was constantly mulling over science problems. He was always a font of new ideas, which allowed him to create a scientific school in the spectroscopy of the molecular scattering of light. 'Graduates' of this school — Candidates and Doctors of science — continue their research work in Moscow, Kemerovo, and Samarkand. A person of impeccable honesty and the highest principles, he generated around himself an atmosphere of genuine scientific creativity.

Friends, disciples, and colleagues of Immanuil Lazarevich Fabelinskiĭ grieve this irreparable loss — the loss of a friend, teacher, and truly remarkable person.

E A Aleksandrov, V F Andreev, L V Vaĭnshteĭn, V L Ginzburg, A I Golovashkin, A V Gurevich, S V Krivokhizha, O N Krokhin, I I Sobel'man, E L Feĭnberg, I A Chaban, L L Chaĭkov