Immanuil Lazarevich Fabelinskiĭ (on his eightieth birthday)

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Molecular scattering of light is a fundamental phenomenon which has been studied already for several decades. The early investigators of this phenomenon include such prominent physicists as Rayleigh, Smoluchowski, Einstein, Mandel'shtam, Brillouin, Raman, and Landsberg. The reason that the attention and interest of physicists and of scientists in adjacent fields of science has been drawn to light scattering is associated with the fact that the spatial-temporal, polarization, spectral and other characteristics of this phenomenon contain a rich, frequently unique, information on the aggregate structure of matter and on its dynamic and molecular-kinetic properties.

It appeared that towards the middle of the present century the investigations of the above-mentioned and many other scientists had already elucidated the principal features of the phenomenon. However, it soon turned out that this was far from being so, and this became particularly clear when, starting with the middle of the 1960's, laser light sources began to be used for the investigation of molecular scattering of light. It turned out to be possible not only to carry out a number of previously inaccessible important measurements and investigations, but also to discover new effects in this field of physics.

IMMANUIL LAZAREVICH FABELINSKIĬ

I. L. Fabelinskiĭ whose eightieth birthday is being celebrated this year made a significant contribution to the study of light scattering.

I. L. Fabelinskiĭ was born on 27 January 1911 into the family of a physician in the city of Garaevo in Belostok province of the Russia of that day. He graduated from school and for two years worked as a lathe operator in a factory. In 1936 he graduated from the physics faculty of the M. V. Lomonosov Moscow State University. Since 1936 the scientific work of I. L. Fabelinskiĭ is associated with the name of G. S. Landsberg under whose guidance he defended in 1942 his dissertation for the degree of candidate of science. Later, when he was already a member of the optics laboratory of the P. N. Lebedev Physics Institute of the Academy of Sciences of the USSR, the director of which was G. S. Landsberg, Fabelinskiĭ defended his doctoral dissertation. The entire subsequent scientific activity of I. L. Fabelinskiĭ up to the present time has been associated with the P. N. Lebedev Physics Institute.

Due to his encyclopedic and deep knowledge, the subtle and inventive experimenter I. L. Fabelinskiĭ knows how to see, to find, and to solve complex experimental problems. This gave him the possibility of carrying out important and difficult investigations and to observe a number of new physics phenomena.

Even before the appearance of lasers Fabelinskiĭ carried out subtle experiments which enabled him to connect and to utilize data on the spectrum of light scattering (the Mandel'shtam–Brillouin doublet) with molecular acoustics. By comparing the velocities of hypersound (sound with frequencies in the range of 10^9–10^{10} Hz) and the velocity of ultrasound of significantly lower frequency he discovered the dispersion of the velocity of sound in many molecular liquids, and this opened up a new method for investigating the kinetics of propagation of sound in condensed media. The application of lasers, the radiation from which has high directivity and a narrow spectral width, enabled Fabelinskiĭ and his collaborators not only to make more precise, and to expand the range of measurements of the velocity of hypersound, but also to measure the spectral width of the Mandel'shtam–Brillouin components and thereby to determine the coefficient of the damping of hypersound in molecular liquids. These measurements enabled him to determine the acoustic characteristics of many substances and to check the applicability of relaxation theory to these liquids, and also to determine the relaxation times of the coefficient of bulk viscosity.

Fabelinskiĭ's investigations by ultra-acoustic and optical (using Mandel'shtam–Brillouin scattering) methods of highly viscous fluids over a wide range of variation of their viscosity right up to the vitreous state are also closely associated with molecular acoustics. It was shown that in such media the relaxation theory of sound propagation is inappli-

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cable, and new basic regularities for describing them were formulated.

Already prior to the appearance of lasers in studying the spectrum of depolarized light scattering (the wing of the Rayleigh line) Fabelinskiĭ showed that in order to describe this phenomenon it is necessary to introduce at least two relaxation processes and he determined for a number of liquids, the relaxation times characteristic for them. The use of lasers enabled him and his collaborators not only to expand and increase in depth the corresponding investigations, but also to discover a new phenomenon—the fine structure of the wing of the Rayleigh line which arose as a result of the connection of the fluctuations of deformation with the orientational mode of molecular motion in a medium. The discovery of this phenomenon in liquids of low viscosity where the transverse shear waves cannot propagate was unexpected and so essential that it required a reexamination of the basic tenets of the dynamic theory of liquids. At high viscosities, when conditions for the propagation of transverse hypersound arise, Fabelinskiĭ and his collaborators discovered (also for the first time) a triplet in the wing of the Rayleigh line. The discovery of the fine structure of the wing of the Rayleigh line led to a new direction both in optical and in acoustic investigations, which are now successfully being developed in different laboratories of the world.

These, and a number of other investigations were carried out with low-power lasers, when light scattering is due to thermal fluctuations in the medium, while light has practically no effect on these fluctuations. In using powerful light beams from solid state lasers the intensity of radiation is so great that it, together with the initially weak scattered light, begins to affect in a significant manner the Fourier-components of thermal fluctuations which gave rise to the initial scattering, amplifying them and giving rise to powerful induced light scattering. Fabelinskiĭ with his collaborators discovered the phenomenon of induced scattering of the light from the wing of the Rayleigh line and of induced temperature (entropic) light scattering arising as a result of the amplification of the corresponding forms of scattering by the fluctuations of anisotropy and entropy. The investigation of these phenomena, the discovery and investigation of induced Mandel'shtam–Brillouin scattering by the longitudinal hypersound in gases and by the transverse hypersound in quartz crystals and a number of other investigations have now become inseparable part of classical nonlinear optics.

Without any doubt the success of Fabelinskiĭ's investigations is also due to his deep penetration into the essence of each phenomenon which was reflected in his many reviews, and in the fundamental monograph "Molecular scattering of light" published in 1965 which appeared with considerable addition to an English translation in 1968.

The recent investigations of Fabelinskiĭ and his collaborators (by the method of correlation spectroscopy) of binary solutions, that have a double critical point, were a new step in the study of the nature of critical phenomena and opened up new possibilities for the study of systems with highly developed fluctuations.

Immanuil Lazarevich Fabelinskiĭ is the author of more than 100 scientific articles, the majority of which have become classics and have been incorporated in textbooks on molecular spectroscopy. He was engaged in extensive pedagogical work, taught in Moscow University and in other post-secondary educational institutions of our country. He has created a school of Soviet physicists in the field of molecular spectroscopy; his pupils are working in many cities of our country. Under his guidance a large number of candidate dissertations have been defended. Several of his former pupils have defended their doctoral dissertations and their publications are now also widely known in the entire world. I. L. Fabelinskiĭ has been awarded the M. V. Lomonosov prize and in 1979 he was elected a corresponding-member of the Academy of Sciences of the USSR.

His friends and colleagues offer their sincere and ardent congratulations to Immanuil Lazarevich on the occasion of his eightieth birthday and wish him good health, indefatigability, invariable vigor, activity, and further successes in science which he loves so wholeheartedly.

Translated by G. M. Volkoff