Ija Pavlovna Ipatova

the A. F. Ioffe Physico–Technical Institute of the Academy of Sciences of the USSR as a junior research staff member. On earning her doctorate in 1969, she became a senior, then a leading (1985), and finally a principal (1991) research staff member.

Ija was a productive condensed matter theorist with a wide range of interests. She made significant contributions to the theory of Fermi liquids, anharmonic vibrational properties of crystals, the effects of defects and disorder on the vibrations of crystals, the theory of space groups for phonons in superlattices, the group theory of second-order phase transitions at solid surfaces, and the surface-enhanced Raman effect. Particularly notable was her work, beginning in the early 1980s, on the scattering of light from electronic excitations in semiconductors—an effort that made it possible to obtain kinetic coefficients such as mobilities and thermal conductivities of those materials by purely optical (scattering) measurements. In the course of that research, she worked closely with experimentalists, namely, Bahish Bairamov at the Ioffe Institute and Manuel Cardona at the Max Planck Institute for Solid-State Research in Stuttgart, Germany; both scientists stimulated her research and confirmed its theoretical predictions.

Other significant contributions included her work on the instability of ternary and quaternary semiconductor compounds that are the basis of present-day semiconductor opto- and microelectronics, and the structures to which that instability gives rise. A new mechanism for the spontaneous formation of semiconductor superlattices, an idea generated by Ija and her students, was used by the Ioffe Institute to create a new type of laser diode.

A theorist who worked well with experimentalists, Ija also successfully interacted with international groups. Following the publication of her contribution to the second edition of *Theory of Lattice Dynamics in the Harmonic Approximation* (Academic Press, 1971), written by one of us (Maradudin) and others, she became the human embodiment of Russian condensed matter physics for many Western physicists. Her international colleagues missed her during the 1970s and early 1980s, when she was not allowed to travel to the West. As soon as she could, though, she resumed her interactions and visits to institutions around the world.

In addition to her research, Ija was committed to pedagogy. In 1973, she received a joint appointment, initially as associate professor, and then, in 1976, as professor, in the department of semiconductor physics and nanoelectronics at the Leningrad Polytechnic Institute (now the St. Petersburg State Polytechnical University). In those capacities, she changed the traditional approach to teaching classical physics by creating a new and original course of lectures, which led to the publication of a two-volume *General Physics* by the university in 2003 and *Introduction to Solid-State Electronics*, written with Vladimir Mitin, published in the US (Addison-Wesley) in 1996 and in Russia (Technical U. Press Center) in 1999. Ija received many awards for her teaching. However, not all of her teaching took place in the classroom. She gathered around her a group of graduate students and young collaborators actively working the area of the theory of semiconductors, and trained them very well.

Ija helped organize many Russian and international conferences and schools. She also chaired several scientific councils of the Academy of Sciences and served as a member of numerous scientific commissions and boards.

As a woman working in a field dominated by men, Ija was a great supporter of women scientists. She was one of the founders of the organization Women in Basic Science, which was established in 1999 within the Ioffe Institute.

Even during the most severe times in the Soviet Union, Ija maintained her integrity, clear-thinking manner, independence, and loyalty to universal human values in her relationships with colleagues. She was a truly decent human being—friend, colleague, teacher. Our memories of her will forever remain in our hearts and in the hearts of all who knew her.

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Mikael Levonovich Ter-Mikaelian

Mikael Levonovich Ter-Mikaelian, an important contributor to high-energy physics, laser physics, and nonlinear optics, died on 31 January 2004 in Yerevan, Armenia, from complications following gallbladder surgery.

Ter-Mikaelian was born in Tbilisi, Georgia, on 10 November 1923. His father, a railway engineer in czarist and Bolshevik Russia, published works on Fermat's problem and was the minister of communications in the first Republic of Armenia. His mother schooled him in music and languages, especially French. After his father's death in 1943, he, his mother, and his brother moved to Yerevan.

A graduate of the Yerevan State University (YSU) in 1948, he received a diploma in physics and mathematics. He went to Moscow, where he completed his *candidate* dissertation at the Lebedev Physical Institute in 1953 under the supervision of Evgeny Feinberg. During that period, he made the most important discovery of his career: the coherence-length effect in high-energy particle interactions with matter. He showed that with the increase of energy, the longitudinal size of the particle–matter interaction region increases to macroscopic dimensions even though the wavelength of radiation produced by the particles is shorter than the interatomic distances. As a result, the cross sections of bremsstrahlung and photon pair production are enhanced at high energies. His results have since found wide application in the fields of high-energy particle and radiation physics.

From 1954 to 1963, he was affiliated with the Yerevan Physics Institute (YerPhI), first as the head of the theoretical department, and then as the institute's deputy director. In 1954, he predicted that, due to the polarization of the medium, the Bethe–Heitler bremsstrahlung spectrum would be suppressed at certain

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photon energies. This phenomenon, now known as the Ter-Mikaelian or longitudinal density effect, resembles the Fermi density effect. During 1960–61, Ter-Mikaelian developed the theory of x-ray transition radiation produced in a stack of plates. He and his colleagues showed that XTR could be used to identify and measure the energy of single particles with energies much higher than is possible with Čerenkov detectors. XTR detectors first developed at YerPhI are now used in high-energy physics experiments all over the world. In 1962, Ter-Mikaelian received his doctorate in physics and mathematics from the Lebedev Institute.

His classic monograph *High-Energy Electromagnetic Processes in Condensed Media*, published in 1969 in Russian and in 1972 in English (Wiley-Interscience), has served as a virtual handbook on radiation processes since its publication. One of the most cited books in the field, it is famous for its clear exposition and breadth and depth of discussion. Among the many important subjects examined in that book is the radiation emitted by electrons passing through the planes of a crystal. In this process, the Weizsäcker–Williams pseudo-photons accompanying the electron are diffracted and emitted as real photons at angles close to the Bragg angle. This radiation was later "rediscovered" by other theorists and termed quasi Čerenkov or parametric x-ray radiation.

In 1963, Ter-Mikaelian left YerPhI and began new activities in quantum electronics at YSU. As the dean of the physics department, he founded four new chairs and organized the Joint Radiation Laboratory of the YSU and the Academy of Sciences of Armenia (ASA). Under his supervision, that laboratory produced the first solid-state lasers in the Soviet Union and, in 1968, became the Institute for Physical Research (IFI) of the ASA.

From 1968 to 1994, Ter-Mikaelian was director of IFI. For part of that time (1988–94), he served as academician-secretary of the ASA's department of physics and mathematics. He retired from IFI in 1994 and became honorary director of that institute; he also was appointed head of IFI's theoretical department, a position he held until his death.

The works of Ter-Mikaelian and his team at IFI were the basis of the monograph, written with Andrey Mikaelian and Yuri Turkov, entitled *Solid-State Optical Generators* (Soviet Radio, 1967)—the first book on laser physics in the Soviet Union. Even today, it is an extremely useful tool for physicists and engineers.

For their work in the field of quantum electronics and their initiatives in the industrial production of lasers and laser materials, Ter-Mikaelian and his associates were awarded the State Award of Armenia in 1980. They investigated new phenomena such as self-induced population inversion, three-component structure in resonance fluorescence, and two-photon effects on "dressed atoms." That work and studies of resonant interaction of laser radiation with atomic systems established Armenia as a world-class contributor to the field of laser physics and nonlinear optics. In his final years, Ter-Mikaelian revisited the field of high-energy radiation physics and had begun work on the second edition of his world-famous book.

Ter-Mikaelian was an academician of the ASA and received many honors in his career. But the most important accolades for him were the love and respect of the many scientists who flourished under his supervision.

Because of his high intelligence, significant scientific achievements, administrative leadership, personal charm, and good humor, Ter-Mikaelian is highly revered and mourned by his fellow Armenians and by the international scientific community at large. His many friends worldwide remember and greatly miss him.

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