Il'ya Mikhaĭlovich Lifshitz (on his sixtieth birthday)

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One of our nation's foremost theoretical physicists, Academician Il'ya Mikhaĭlovich Lifshitz, celebrated his sixtieth birthday on January 13, 1977.

The name of a prominent scientist is usually associated with a scientific field to which he has made a decisive contribution. Lifshitz's name is essentially linked to the period of rapid development in solid-state physics that spans the last few decades. This period has been marked by the direct outgrowth of solid-state physics into engineering and by extremely important experimental discoveries. The work of Lifshitz and his students has always been done in close contact with experimenters.

In its contemporary form, the quantum theory of solids owes many of its advances to ideas and results for which Lifshitz is credited.

One of the fundamental problems of solid-state physics is that of determining the energy spectra of solids. Lifshitz originated the idea of reconstructing the energy spectrum from experimental data and laid the groundwork for a possible solution of this problem based on the idea of quasiparticles—bosons and fermions—that describe the elementary motions of atomic and subatomic particles in the solid. He showed that it is possible in principle to reconstruct the Bose branches from the temperature dependence of the thermodynamic characteristics. Reconstruction of the Fermi branches of the spectra of metals (dispersion law of conduction electrons) is much more difficult and required the development of a research program on subtle effects in the magnetic field. The work of Lifshitz and his students in the electronic theory of metals completely revolutionized this vigorously developing field of solid state physics. The most visible recognition of a scientist's work is practical assimilation and development of his achievements and discoveries. The geometric language used to formulate the results—the language in which everyone concerned with the physics of metals thinks—was developed in its entirety by Lifshitz and his students. A kind of spectroscopy of metals that uses the properties of metals in strong magnetic fields has emerged and is being developed actively. Today we are as familiar with the electronic energy spectra of metals as we are with the spectra of atoms and molecules.

The contemporary dynamic theory of solids is the theory of real crystals, which contain impurities, dislocations, and other irregularities. Lifshitz's research has done much to determine the development of this currently interesting field of physics. He was first to analyze the phonon and electron spectra of crystals with defects, discovering, among other things, the local and quasilocal levels. The approach to the problem that he developed and his mathematical formalism remain the basis for all modern research in this area. He offered a theory of twinning—one of the basic processes in plastic deformation—and a theory of the diffusive viscous flow of polycrystalline solids.

The great interest now being shown in study of quantum crystals of solid helium has arisen largely out of the fundamental results obtained by Lifshitz. He showed that two types of motions, which are respectively characteristic for the solid and the liquid, are possible in quantum crystals. This makes it possible to speak of a unique state of matter intermediate between the liquid and the solid. According to Lifshitz, defects and impurities in quantum crystals behave as free quasiparticles, thus producing the quantum-diffusion phenomenon. Quantum diffusion has now been observed experimentally.

Lifshitz has always been deeply interested in the theory of phase transitions. He predicted the curious phase transitions known as transitions of order two and a half, which have now been observed in experiment and are related to restructuring of the Fermi branches of the energy spectrum. He explained the highly distinct kinetics of second-order phase transitions and the kinetics of transitions of metals from the superconducting to the normal state under the action of magnetic fields. He produced a theory of first-order quantum transitions at low temperatures, when quantum tunneling processes rather than the usual thermal-activation mechanism assume the principal role in the nucleation of the new phase.

His interest in the theory of phase transitions naturally led Lifshitz to phase transitions in polymers—long molecules consisting of macroscopic numbers of links. As usual, Lifshitz's attention to the new field was accompanied by development of a fundamentally new approach based on the physically profound idea of treating the polymer chain as a partly equilibrated statistical system with volume interaction and linear memory. His series of papers on this subject, which are oriented to the physics of biopolymers, is at the center of attention of specialists in polymer physics and molecular biology. Molecular biologists are drawn to Lifshitz's work not only by the specific content of his most recent papers, but also by his deep general understanding of the physical problems underlying the functioning of cells, biological evolution, etc.

In 1967, Lifshitz was honored with the Lenin Prize for his work on the electronic theory of metals, as well as the international Simon Prize, which is awarded by the British Physical Society. The Presidium of the USSR Academy of Sciences awarded Lifshitz the Mandel'shtam Prize for his work on crystal lattice vibrations.

Lifshitz has always regarded himself as a member of the Landau School, to which he is linked by many years of scientific and personal friendship. Lifshitz has many students. His students and their students in turn are continually aware of their bond to Lifshitz, who never declines to take an interest in their work and give useful adivce. Lifshitz spent ten years of creative and teaching activity at Khar'kov. It is therefore natural that most of his students, whose scientific activity has not abated since his transfer to Moscow, should be concentrated at Khar'kov. It is Lifshitz's students who are responsible for the high level of solid-state theory at Khar'kov and who make Khar'kov one of the centers for theoretical physics.

Lifshitz is a full member of the Ukrainian Academy of Sciences. His removal to Moscow has not broken his bonds to the Ukrainian Academy or to its scientific institutes. He is essentially the chief Khar'kov solid-state theoretician.

Since 1969, Lifshitz has headed the theoretical division of the USSR Academy of Sciences Institute of Semiconductor Physics and taught in the Moscow State University Physics Department, where he organized the Solid State Theory specialty and has now guided it to maturity. Lifshitz carries a heavy scientific-organizational workload. He is chairman of the Scientific Council on the "Solid State Theory" problem in the Presidium of the USSR Academy of Sciences.

Many are familiar with the latitude, benevolence, kindliness, and availability of Il'ya Mikhaĭlovich and at the same time know him as a stern critic. His profound understanding of physics and his subtle intuition make conversations with him helpful even when they concern problems that would appear to be remote from theoretical physics. He has the ability to find the "theoretical-physics kernel" in a problem and to formulate problems rigorously in fields in which only intuitive, often not quite correct conceptions had existed before he turned his attention to them. Thus one may encounter metallurgical engineers, biologists, and, of course, theoretical physicists in his office in the Institute of Physical Problems, the entrance to which is never blocked by bureaucratic obstacles.

His colleagues, friends, and students extend their love, admiration, and respect to Il'ya Mikhaĭlovich on his birthday, wish him good health and happiness, and await new examples of his brilliance.

Translated by R. W. Bowers

Anatoliĭ Alekseevich Logunov (on his fiftieth birthday)

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December 30, 1976 was the fiftieth birthday of the prominent Soviet physicist and Academician Anatoliĭ Alekseevich Logunov. Logunov's scientific career has been organically interwoven with the origin and development of a promising new field of science—the physics of elementary particles.

Logunov's first scientific papers were devoted to the mechanisms of diffusion and acceleration of cosmic particles in the magnetized intergalactic medium. The analytic equations derived in these studies are widely used in investigating the propagation of cosmic particles.

During the 1950's, the dispersion-relation (d. r.) method was developed and substantiated for meson–nucleon scattering processes, making it possible to estab-