Alekseĭ Alekseevich Abrikosov (On his sixtieth birthday)

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Academician Alekseĭ Alekseevich Abrikosov, a leading Soviet theoretical physicist, celebrated his 60th birthday on June 25. He has authored three books and about 150 scientific papers, and he has made two discoveries.

A. A. Abrikosov received his scientific training under the tutelage of L. D. Landau. In 1947 A. A. Abrikosov took the well-known theoretical-minimum examination; he defended his candidate's dissertation in 1951 and his doctoral dissertation in 1955. Still Alekseĭ Alekseevich's path into theoretical physics was not direct—he first entered the Moscow Engineering Institute; then he transferred to the Moscow State University and studied ferroelectricity experimentally in B. M. Vul's laboratory.

In the 1950s quantum electrodynamics and solid-state physics developed rapidly. A. A. Abrikosov was most interested in these fields at that time. Together with L. D. Landau and I. M. Khalatnikov he calculated the Green's functions at high energies, and then he calculated the effective cross sections of the Compton effect and the mutual scattering of electrons and positrons. This work played a fundamental role in understanding the relationship between the "bare" and true charges. The new computational methods developed at that time, based on the summation of the leading diagrams, were later employed to solve a number of problems in statistical physics. These methods, together with some other very beautiful ideas, for example, analytical continuation of temperature-dependent quantites to real frequencies in order to obtain the kinetic characteristics, formed the basis of a book, written together with L. P. Gor'kiĭ and I. E. Dzyaloshinskiĭ, which became a "bible" for theoretical physicists in many countries, where it was translated and published.

In 1957 A. A. Abrikosov published probably his best-known work, without which the physics and technology of superconductivity cannot be imagined. In this work the concept of superconductivity of the second kind was formulated, a theory of the magnetic properties of such superconductors, describing the existing experimental data, was constructed, and the existence of two critical fields and phases of the mixed state between them, where the magnetic field partially penetrates into a superconductor in the form of quantum current vortices, was discovered. The prediction of the correct lattice of such vortices, which was soon observed and was named after Abrikosov, was a brilliant theoretical prediction. This work is one of the most often cited papers in the international scientific literature.

Soon after the discovery of superconductivity of the second kind A. A. Abrikosov derived a number of very important results in the recently developed microscopic theory of superconductivity. They included the analysis of high-frequency properties of superconductors and the discovery of gapless superconductivity, the development of microscopic methods for studying electron scattering by impurities and the study of superconductors with magnetic impurities and explanation of the Knight shift and calculation of the intensity of Raman scattering of light in normal metals and superconductors.

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In the 1960s A. A. Abrikosov became interested in the theory of normal metals, semimetals, and semiconductors. He studied the Kondo problem and the conductivity of metals with magnetic impurities; he discovered that depending on the sign of exchange interaction the effective scattering either vanishes or increases strongly (this phenomenon is called the Abrikosov-Suhl resonance). Together with his colleagues A. A. Abrikosov developed a theory of semime-

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tals of the bismuth type and of gapless semiconductors. The crystalline structure of semimetals was described and the types of symmetries, allowing a gapless spectrum, were found; the spectrum of carriers and its behavior under pressure was analyzed; exciton phases in a magnetic field were also studied.

In the 1970s–1980s A. A. Abrikosov participated in the development of the theory of quasi-one-dimensional systems and he studied the properties of spin glasses. He constructed an original method for calculating the conductivity of a quasi-one-dimensional metal, making it possible to take into account the hopping of electrons between filaments, and scattering by phonons and impurities.

Any attempt to systematize A. A. Abrikosov's work encounters a definite difficulty—he gets carried away and changes his subject. Thus in 1954 he was interested in the properties of strongly compressed matter—hydrogen planets—and he was the first to calculate the equation of state of hydrogen. On other occasions he studied thermal diffusion in plasma and later spin waves in a ferromagnetic metal.

A. A. Abrikosov at times responds immediately to new and important problems arising in physics and the needs of experiment, with which his work is very closely related. Within a year after extensive studies of high-temperature superconductivity started, he solved together with his colleagues two problems in this field—he clarified the Raman scattering in anisotropic superconductors with a short correlation length and investigated the effect of twinning planes on the thermodynamic properties. At the same time he published an encyclopedic book on the theory of normal metals and semiconductors.

A. A. Abrikosov's papers are well known and have achieved wide acceptance. He is a recipient of the Lenin and State prizes as well as the F. London International prize. Today A. A. Abrikosov is at the peak of his powers—he is carrying out active scientific, organizational, and pedagogical work at the L. D. Landau Institute of Theoretical Physics, of which he is one of the founders, as well as in the Department of Theoretical Physics, which he heads, and at the Problem Laboratory of the Moscow Institute of Steels and Alloys. With his fine speaking abilities and excellent writing skill Alekseĭ Alekseevich not only delivers lectures himself and writes about important problems in modern physics, but he has encouraged many Soviet scientists to contribute reviews for the journal "Advances in Physics" which he edits. Everyone who has met A. A. Abrikosov, worked with him, and participated in regular symposia on theoretical physics organized by him, know well his erudition, honesty, and kindness, and his readiness to help in difficult life situations.

We take this opportunity to congratulate Alekseĭ Alekseevich on his birthday and to wish him new scientific results, health, and success.

Translated by M. E. Alferieff