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# NIKOLAĬ EVGEN'EVICH ALEKSEEVSKIĬ

(On his Sixtieth Birthday)

A. S. BOROVIK-ROMANOV, N. B. BRANDT, P. L. KAPITZA, I. M. LIFSHITZ, and Yu. V. SHARVIN

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ON May 23, 1972, the prominent experimental physicist Nikolaĭ Evgen'evich Alekseevskiĭ, a specialist in the fields of low-temperature physics, the physics of metals, and superconductivity and a corresponding Member of the USSR Academy of Sciences, celebrated his 60th birthday.

Alekseevskiĭ completed his studies at the Leningrad Polytechnic Institute in 1936. After graduation, he worked in the Ukrainian Physico-technical Institute at Khar'kov. In 1938, he was detached to the Institute of Physics Problems to work on his candidate's thesis, which he defended in 1940. From 1942 on, all of Alekseevskiĭ's scientific activity was inseparably associated with the Institute of Physics Problems. In 1946, he defended his doctorate thesis, and since 1949 he has been the head of one of the Institute's Laboratories.

Most of Nikolaĭ Evgen'evich Alekseevskiĭ's scientific activity has been devoted to the physics of low temperatures. His great erudition, originality in the design of research, and his talents as an experimental physicist account for the wide range of his scientific interests. His works fall into cycles permeated by a common idea or working hypothesis, a pattern that has resulted in high scientific productivity.

Here we should first take note of his papers on the superconductive properties of pure metals and metal alloys, which made a major contribution to the development of this fundamental area of low-temperature physics.

In his studies of the kinetics of superconductive transitions, Alekseevskiĭ established that the breakdown of superconductors by current is associated with the appearance of an intermediate state and that the transition to the intermediate state takes place in nonequilibrium fashion.

On the basis of this research, he suggested a nucleation mechanism for the transition. The rate of motion of the boundary between phases in ths superconductive transition was determined in original experiments.

In studying the critical fields of superconductive films, he used an ingenious technique based on measurement of the magnetic moment of the films; this enabled him to exclude the influence of the contacts that are inevitable in electrical measurements and to simplify the work. In addition, measurement of the critical fields by a method different from the conventional method of measuring electrical resistance was of great fundamental importance at the time.

Alekseevskiĭ's cycle of papers devoted to new superconductive alloys is original and interesting.

Working from the hypothesis that superconductors might be formed at a certain "optimum" electron concentration, he turned to alloys of the nonsuperconductive semimetal bismuth with nonsuperconductive metals having high carrier concentrations, expecting the role of the bismuth in superconductive alloys to be similar to that of chromium or manganese in ferromagnetic alloys. A large number of new superconductive alloys were discovered as a result of these studies.

The same idea runs through Alekseevskiĭ's cycle of research papers on the influence of isostatic pressure and elastic uniaxial deformations on the superconductive properties of metals and alloys, which produced interesting results that included the observation of different signs of the change in superconductive-transition temperature under the influence of pressure. Alekseevskiĭ's papers on the influence of ion mass on superconductivity should be included in the same series.

His next major cycle of papers, and perhaps the most interesting, was devoted to the investigation of the galvanomagnetic properties of pure metals in strong magnetic fields at low temperatures.

The electrical properties of metals placed in a strong magnetic field have long attracted the interest of investigators. For a long time, the complexity and variety of the experimental data make it impossible to explain them, or even to describe the behavior of different metals in terms of common laws. An exception was the simple law of linear resistance increase in strong magnetic fields that was discovered by P. L. Kapitza back in 1928 and is valid for polycrystalline specimens of many metals. However, it had not been possible to establish a relation between this law and other properties of the metals.

In 1958, Alekseevskiĭ and his co-workers began work on a systematic and thorough study of the dependence of the resistivity-tensor components on the magnitude and direction of the magnetic field for a whole series of metals. Single crystals of extremely pure metals were investigated at liquid-helium temperatures.

These studies served as an experimental support and confirmation of the theory of the galvanomagnetic properties of metals in strong magnetic fields that was developed concurrently with these studies by I. M. Lifshitz and his school and solves the problem completely.

In the very first studies of the galvanomagnetic properties of gold, it was possible to find a mechanism that explains the linear resistance increase in polycrystalline specimens (Kapitza's law).

Subsequent research transformed the observation of complex galvanomagnetic-property anisotropy into a powerful tool for study of a fundamental characteristic of the electronic structure of metals—the Fermi surface.

Thanks to the works of Alekseevskiĭ, we obtained a general conception of the Fermi-surface topology of real metals. They were first to establish that most metals have open Fermi surfaces in the form of complex space lattices that extend without limit over the entire momentum space. Gold, copper, silver, magnesium, tin, gallium, platinum, lead, palladium, cadmium, zinc, thallium, chromium, and rhenium exhibit these properties. Not only the topology, but also certain characteristic dimensions of the Fermi surfaces were determined for a number of metals. A series of the most recent papers in this cycle is devoted to the phenomenon known as "magnetic puncture" of Fermi surfaces, i.e., tunnelling of electrons from one part of the Fermi surface to another, the probability of which may become considerable in a strong magnetic field.

The studies of the galvanomagnetic properties of metals carried out by Alekseevskiĭ and his coworkers constitute an important chapter in the physics of metals, are of unquestionable fundamental importance, and stimulated the subsequent development of the theory of the solid state.

In recent years, Alekseevskiĭ has given a great deal of attention to type II superconductors. In 1965, working with N. V. Ageev, he discovered superconductivity in a ternary Nb-Al-Ge alloy, which was later found to have a record-high superconductive-transition temperature, above 20°K.

Alekseevskiĭ proposed an original method of producing ribbon that is suitable for the manufacture of superconductive coils and contains a layer of the compound $Sb_3Sn$, which is formed by diffusion of tin into a niobium ribbon.

The methodological studies of Alekseevskiĭ are distinguished by extensive use of modern laboratory technique, great experimental inventiveness, and originality.

Alekseevskiĭ made a major contribution to experimental technique in the way of methods for ultra-low temperature research. He was the first in the Soviet Union to obtain a temperature of 0.05°K and develop a method for the study of metals at this temperature.

Alekseevskiĭ was honored with a State Prize and awarded two orders and three medals for his fruitful scientific activity. In 1951, the Presidium of the USSR Academy of Sciences awarded him the N. D. Papaleksi prize.

For many years, Alekseevskiĭ carried a heavy teaching burden as professor in the Department of Low Temperature Physics in the Moscow State University Physics Faculty and as head of the Experimental Physics Department at the Moscow Physico-technical Institute. He trained a large group of young Soviet Scientists to work in the areas that he had opened up.

Alekseevskiĭ is an active participant in the scientific-social activity of a number of scientific councils and commissions of the USSR Academy of Sciences. He is council chairman of the International Laboratory of Strong Magnetic Fields and Low Temperatures, which was created on his initiative at Wroclaw in Poland. From 1950 through 1952, Alekseevskiĭ was a Deputy of the Moscow City Council of Labor Deputies.

A man of enormous energy and capacity for work and limitless devotion to science, Nikolaĭ Evgen'evich Alekseevskiĭ is in his creative prime and capable of doing much more for the development of Soviet science, to which he has dedicated his entire life in selfless service.

Translated by R. W. Bowers