Moiseĭ Semenovich Khaĭkin (Obituary)

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The prominent Soviet physicist, Corresponding Member of the Academy of Sciences of the USSR, principal scientist of the Institute of Physics Problems of the Academy of Sciences of the USSR Moiseĭ Semenovich Khaĭkin died on 7 December 1990 at age of 69 (he was born on 5 December 1921).

The scientific activity of M. S. Khaĭkin was devoted to investigations in the field of low-temperature physics and metal physics. He published approximately one hundred scientific articles, many of which have become classics, and he is the author of a discovery and a number of inventions. M. S. Khaĭkin was a student of the remarkable experimental physicists Aleksandr Iosifovich Shal'nikov and Ivan Vasil'evich Obreimov, and a considerable influence on his formation as a scientist and a man was exerted by his father, Semen Emmanuilovich Khaĭkin whose contribution to the development of the physics of our country is well known. Moiseĭ Semenovich carried on with distinction the work of his teachers by developing new fields of research, in the first instance UHF spectroscopy of metals at low and ultralow temperatures.

The entire scientific activity of M. S. Khaĭkin has been associated with the Institute of Physics Problems of the Academy of Sciences of the USSR where he came still as a student in 1945 and in which he worked until the last days of his life. He was able to develop in a brilliant manner his talent within the walls of the Institute of Physics Problems due to the inspiring atmosphere which was created by Petr Leonidovich Kapitza and which was maintained by the staff of the Institute. Moiseĭ Semenovich also played an important role in the life of the Institute because by his behavior based on principle, by strictness of evaluations and scientific activity he influenced his pupils and colleagues.

Already in his first independent publications on the investigation of the UHF impedance of superconductors he obtained fundamentally important results which entered into monographs on superconductivity (1950–1958). On the basis of these investigations M. S. Khaĭkin realized the first serious technical application of superconductivity, having constructed high-Q UHF cavities and a highly stable oscillator based on them with a record-setting stability for that time of $10^{-9}\,s^{-1}$ (1961). This methodological achievement enabled him to create an original method of frequency modulation for measuring the surface impedance of metals at low temperatures with a sensitivity of $10^{-4}\%$ (1961) and a dilatometer with a resolution of 10^{-4} Å (1968). He developed to perfection a method of growing oriented single crystals of metals having a specified shape, and this turned out to be a key circumstance in carrying out systematic precision investigations of cyclotron resonance in tin, indium, bismuth, lead, and aluminum (1959–1973), and in discovering and investigating trajectory dimensional effects of cut-off of cyclotron resonance and a jump in impedance when the diameter of the electron orbit becomes equal to the thickness of the sample (1961). On the basis of these investigations a result was obtained which was important for the theory of metals—it was established that the Fermi surfaces have a shape close to the model of almost free electrons, but the effective mass of the electrons is renormalized due to the electron-phonon interaction. By subtle experiments he discovered the dependence of this renormalization on the temperature (1970–1973).

MOISEĬ SEMENOVICH KHAĬKIN
(1921–1990)

In investigating the surface impedance of metals M. S. Khaĭkin discovered magnetic surface levels due to the quantization of the electron motion along orbits "jumping" over the surface of a sample on specular reflection (1960). This discovery forced a reexamination of the previously existing concept of the diffuse nature of reflection of electrons by a surface and acceptance of the model of specular reflection. His work on the discovery of magnetic surface levels and their investigation was rewarded by the M. V. Lomonosov Prize in 1970.

Among other investigations of M. S. Khaĭkin devoted to the study of metals we note the detailed study of magnetoplasma waves in bismuth (1963–1965), precision dilatometry of quantum oscillations of the dimensions of single crystals of tin under conditions of magnetic interaction and magnetic breakdown (1972–1974), and the discovery of cyclotron resonance on nonextremal orbits (1973).

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M. S. Khaĭkin made a big contribution to the physics of surface two-dimensional phenomena. He carried out elegant investigations of the stability of a charged surface of liquid helium, and he was the first to establish the existence of electron surface levels above liquid and solid hydrogen and neon (1976–1981). He discovered the superconductivity of the twinning plane in metals, which in a number of cases led to a considerable increase in the temperature of the superconducting transition (1978–1983).

M. S. Khaĭkin initiated work on scanning tunnelling microscopy in the USSR. He built the first in our country scanning tunnelling microscope of an original construction (1985) and used it to measure the energy gap in high-temperature superconductors, and its dependence on the composition and the technology of HTSC (1987). His last scientific paper, highly esteemed by specialists,—the investigation of the radiation of light accompanying inelastic tunnelling, associated with the excitation of surface plasmons in metals and with transitions in the spectra of molecules placed on the surface of a sample (1990).

Invaluable is the contribution of M. S. Khaĭkin both to the development of science and as the originator and guiding spirit of the journal "Pribory i tekhnika eksperimenta" [translated as "Instruments and Experimental Techniques (USSR)]. Having begun this activity together with A. I. Shal'nikov in 1956 he, until the very last days of his life, continued it, shaping the image of the journal and striving to maintain its high scientific level. It is to a large extent due to his efforts that this journal "PTÉ" has acquired the status of one of the most widely read and respected scientific journals.

It is necessary to note the pedagogic activity of M. S. Khaĭkin. He taught in the Physics Faculty of the Moscow State University and in the Moscow Physicotechnical Institute. Among his pupils there is more than a dozen of doctors and candidates of science. He provided considerable aid to the establishment and development of scientific research in countries of Eastern Europe, in India, and in Finland. In 1985 M. S. Khaĭkin was awarded an honorary doctorate by the Humboldt University in Berlin.

M. S. Khaĭkin won the well-deserved love and respect of his friends, pupils, and colleagues. He was one of those whose scientific output contributed to the high authority of our country's science. The bright memory of a remarkable man—Moiseĭ Semenovich Khaĭkin—will live in our hearts.

Translated by G. M. Volkoff