Isaak Konstantinovich Kikoin (on his seventieth birthday)

A. P. Alexandrov, E. P. Velikhov, B. B. Kadomtsev, and V. A. Legasov

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March 28, 1978 marks the seventieth birthday of Academician Isaak Konstantinovich Kikoin.

I. K. Kikoin belongs to the galaxy of physicists that has played a special role in the development of Soviet science. The new physics was being born in two cities in our land, in Moscow and in Leningrad, in the early twenties of this century. Talented young people were gathering from many cities of the land that was just beginning to recover from the civil war. In Leningrad the nucleus for such a "condensation" was formed by the Physical-Technical Institute directed by A. F. Ioffe. The atmosphere of unusually solicitous attitude towards youth and the high level of scientific demands led to the creation in the PTI of a Soviet school of physicists.

I. K. Kikoin came to the Physical-Technical Institute, as did many of his contemporaries, from the provinces. He was born in the small town of Zhigara in the family of a school teacher of mathematics. I. K. Kikoin began his education in the city of Pskov where he attended both a secondary school and an agricultural technical school. In 1925 he went to Leningrad where until 1930 he studied at the Polytechnical Institute whose instructors were closely associated with the Physical-Technical Institute. The instructors carefully selected able people and attracted them to scientific activity in the Physical-Technical Institute. Students participated actively in the seminars of the Institute and assisted in the laboratories. I. K. Kikoin was among these students. In addition to the "scientific" seminars of the Physical-Technical Institute there also were special student seminars where D. A. Rozhanskiĭ and Ya. I. Frenkel' assigned students to grapple with the most modern physical theories. Such a program carefully thought out by them yielded a rich harvest. It is not surprising that students reached the end of their studies with already developed scientific interests and with an ability to see in the majestic edifice of physics particular fields in which it made sense to test their strength.

I. K. Kikoin came to the Physical-Technical Institute with his own problem the idea of which arose in a seminar of Ya. I. Frenkel'. At that time great discussions were taking place in connection with the measurement of the Hall effect and of the electrical conductivity in a magnetic field in liquid metals. The point is that it followed from the quantum theory of electrical conductivity created not long before that by Sommerfeld that the Hall constant is determined only by the density

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of the conduction electrons independently of the nature of the location of ions. However, Nernst and Drude had concluded from their experiments that the Hall effect is absent in liquid metals. In a series of papers during 1931-1935 I. K. Kikoin completely untangled this very involved situation, found the reasons for the lack of success of earlier experimenters and brought the experimental data into agreement with the predictions of theory.

The first major successes defined for many years the style of the work of I. K. Kikoin. The study of the effect of a magnetic field and later of other external factors on the electromagnetic properties of condensed media became a field in which the name of I. K. Kikoin stands among the most recognized of authorities.

A second series of papers carried out during 1933-1934 (together with M. M. Noskov) represented work on the investigation of the influence of an electric field on photoelectric effects in semiconductors. The discovery of a new effect—the photomagnetic effect—made this work classic.

In 1936 I. K. Kikoin transferred to Sverdlovsk where a new physics centre was being created—the Ural Physical-Technical Institute. The first work in Ural was a continuation of the investigation of the Hall effect. Already in Leningrad in experiments with paramagnetic

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metals it was found that this effect is determined not only by the value of the magnetic induction but also by the magnetization. The cycle of the work in Ural was culminated by the work on the gyromagnetic ratio in superconductors brilliant in its experimental mastery.

At the beginning of the war another characteristic of I. K. Kikoin vividly manifested itself—his ability to utilize the achievements of physics in the development of new directions of technology. The first practical work the success of which was rewarded by the State Prize of the USSR was the creation of a new type of ammeter for the measurement of very high currents.

Work in industry and the experience of fruitful organizational work in the Urals led to the fact that from the very beginning of atomic technology in our country I. K. Kikoin headed one of the leading directions in this field. I. K. Kikoin became one of the organizers of the Atomic Energy Institute where since 1943 he headed a large group which successfully solved a series of the most difficult scientific and technological problems. During this period of his activity the talent of I. K. Kikoin as an engineer and an industrial organizer became manifest. Boldly accepting tremendous responsibility he acted as a scientific director who understood well the needs of industry in a period of a scientific-technological revolution. The results of this work were recognized by the award to him of the title of Hero of Socialist Labor, and by the award to him of a Lenin and a State Prize.

In the mid-fifties, the interests of I. K. Kikoin again returned to investigations in pure physics. After a long interruption he again turned to the photomagnetic effect. The investigation of this effect in single crystals of silicon and germanium laid the foundations for the study of the relation between the symmetry of a crystal and the photomagnetic effect. The work on the discovery and the investigation of the anisotropy of photomagnetic effects can serve as an example of fineness and elegance in carrying out experiments; the results of this work made a big contribution to the physics of semiconductors.

The discovery in 1966 of quantum oscillations of the photomagnetic effect with variation of the magnetic field led to a radical reconstruction of the theory of photoeffects at low temperatures. The work of I. K. Kikoin and his collaborators was at the forefront of this field. Replacing the effect of the magnetic field by deformation I. K. Kikoin discovered a new effect named the photopiezoelectric effect: the appearance of a potential difference in an illuminated semiconductor subjected to a deformation. From that time a new cycle of physical investigations began which were developed along several directions.

A continuation of the "ferromagnetic" work was the discovery of the anomalously large Hall effect in a chromium-tellurium alloy and the study of the anomalous Hall effect in ferromagnetics.

The knack of utilizing technical possibilities enabled I. K. Kikoin to carry out a measurement of the electric properties of mercury vapour at high temperatures and pressures. In these experiments the phase transition metal-dielectric was studied for the first time in such systems. This work made possible the establishment of the equation of state of mercury vapour in the transcritical region. This work became classic and stimulated the development of a new direction associated with the experimental investigation of a nonideal plasma.

Without dwelling on the interesting papers in plasma physics (diagnostics) which fall outside the general line of development, we can go over to a series of papers carried out in recent years and devoted to the measurement of electromagnetic properties of semiconductors acted upon by ionizing particles. This work led to the discovery of new effects named the radiative electromagnetic and piezoelectric effects. The experimental setup follows the setup of experiments in which the photomagnetic and the photopiezoelectric effects were discovered, but in place of light in the new experiments, ionizing particles were utilized: alpha-particles and protons. The physical nature of these effects turned out to be new and requires still further study.

Very beautiful experiments on the viscosity of molecular gases and of the effect on it of a magnetic field opened up a new direction in quantum kinetics.

There are still many other papers which we have not mentioned, but even from this brief list one can discern the definite directedness of all the efforts of I. K. Kikoin. Having been brought up on the beneficial soil of classical physics, I. K. Kikoin retained in all his work the physical clarity in the formulation of the problem and the simplicity of experiment that is so characteristic of classical physics and he brought it with him into modern physics.

The investigations of I. K. Kikoin in physics and his intensive scientific activity do not exhaust all his contributions to the development of Soviet science. From the very beginning of his work he strove to preserve the succession of generations and to remain true to the precepts of his teachers. I. K. Kikoin devoted much effort to work with students, he lectured at the Polytechnical Institute in Leningrad, at the Polytechnical Institute at Sverdlovsk, in the Moscow Engineering Physics Insititute and in Moscow University. His favorite course was "general physics". He put into it all his physical intuition, and all his experience, telling students about the general aim of physics and of its principal directions of development. I. K. Kikoin set for himself still bigger tasks in recent years, joining in the work on the reform of the teaching of physics in schools and on the development of a system of discovering young talent. Here, as in other fields of his activity, I. K. Kikoin embraced a very wide range of problems. For many years he headed the committee on school Olympics. Together with Academician I. N. Kolmogorv, I. K. Kikoin organized the first Physical-Mathematical School in the country, into which were selected talented young men and women from schools outside Moscow. He spent much time on the creation of new school programs. He published a textbook in

physics for the eighth class of schools; under his editorship there was published a book in physics for the ninth class of schools. I. K. Kikoin not only wrote programs for the textbooks, but also devoted much effort to their popularization. Just as in industry, here also he strove to see the ideas through to the final product. He lectured to teachers; he conducted classes in schools and, returning to what has been written, he again and again reworked the textbooks striving for clarity and brevity of presentation. In parallel with this, I. K. Kikoin in the same years organized the publication of the first physical-mathematical journal for school pupils. Today the journal "Kvant" (Quantum), of which he is the principal editor, has achieved the widest popularity, and not only among school pupils. The work on school reform is very time-consuming, but the experiment being conducted by I. K. Kikoin has already provided so much new material on the different aspects of school instruction, that it can be deservedly placed alongside the investigation and discovery of new physical effects.

In congratulating Isaak Konstantinovich on his seventieth birthday, we wish him health, vigor and further creative successes in the development of science for the benefit of our motherland.

Translated by G. Volkoff