

In memory of Viktor Pavlovich Silin

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One of our oldest colleagues at the Lebedev Physical Institute (FIAN), an outstanding scientist, corresponding member of the Russian Academy of Sciences (RAS), professor, doctor of physico-mathematical sciences, principal research fellow of the Sector of Plasma Phenomena Theory at FIAN, professor at the Moscow Engineering Physics Institute (MEPhI), Viktor Pavlovich Silin, died on 12 January 2019.

V P Silin graduated from the Physical Faculty of Lomonosov Moscow State University (MSU). His diploma thesis advisor was D I Blokhintsev. V P Silin's whole life in science was associated with the Lebedev Physical Institute, where he began working in 1949 immediately after he graduated from MSU and where he moved from junior research worker to head of the Department of Solid State Physics (1989–1995). During that time, he published over 700 scientific papers in various fields of physics. He is the author of four monographs fairly popular among specialists in plasma physics and the physics of condensed matter.

The brilliant talent of Viktor Pavlovich became apparent as far back as the early 1950s, when he worked in the Department of Theoretical Physics at FIAN. Work on the development of the Tamm–Dankov method that had provided deeper insight into the nature of nuclear interactions appeared in that period. Simultaneously, he became engaged in the quantum many-body theory. Together with Yu L Klimontovich, he derived the kinetic self-consistent field equation describing a weakly ideal quantum Fermi gas. Using this equation, V P Silin predicted the existence of undamped oscillations in Fermi gas near the temperature of absolute zero. After L D Landau formulated the general theory of a Fermi liquid, these undamped oscillations were called zero sound.

V P Silin also applied the Fermi-liquid theory to describe the properties of metals. The equation derived by him and known as the Landau–Silin equation became the basis of the description of collective effects in metals and allowed the prediction of cyclotron and spin waves in normal metals, a description of sound wave absorption in normal metals and conducting magnets, and the prediction of quantum spin waves. In 1970, V P Silin was awarded the USSR State Prize for the formulation of the theory of an electron Fermi liquid.

Viktor Pavlovich remained interested in condensed matter physics in subsequent years. In the mid-1960s, he and P S Zyryanov conducted a large series of studies on the theory of waves in quantizing magnetic fields. These studies are well known to specialists in the field of semiconductor physics. A little later, V P Silin, together with younger disciples, developed a new approach to the description of magnetic and elastic properties of invar alloys, predicted surface



Viktor Pavlovich Silin
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quantum waves, and investigated collective excitations in ferro- and antiferromagnets.

One of the last areas of study in solid-state physics, to which Viktor Pavlovich had given attention till his last days, was working out the nonlocal electrodynamics of Josephson junctions and layered Josephson systems. He also obtained results of paramount importance in this area. The possibility of the existence of a whole range of new nonlinear vortex Josephson structures was predicted, the effect of quantization of Josephson vortex velocities was discovered, fast vortices were predicted, and the theory of Cherenkov radiation by vortices and vortex chains was formulated.

In the late 1950s–early 1960s, V P Silin's scientific interests involved the rapidly developing plasma physics. The remarkable monograph by V P Silin and A A Rukhadze devoted to the problems of the electrodynamics of plasma and plasma-like media appeared in 1961. The monograph became a handbook for many generations of physicists and has recently been reissued. Almost immediately, a large series of papers appeared with N N Bogoliubov's ideas carried over to plasma physics. A number of new collision integrals in quantizing magnetic fields and in strong high-frequency

fields were obtained, and the kinetics of quick-varying processes was developed. V P Silin's work on the derivation of collision integrals in strong electric and magnetic fields obtained worldwide recognition. These collision integrals allowed obtaining brilliant results on the theory of absorption of high-frequency radiation, on the transport theory in strong magnetic fields, and on the theory of higher harmonic generation.

Work on the drift wave theory played an important role in the development of the physics of inhomogeneous magnetoactive plasma. Fundamental studies of the kinetic theory of plasma stability were conducted. V P Silin's work on parametric resonance in plasma, published in 1965, was of paramount importance for understanding the properties of plasma in a strong electromagnetic field. V P Silin and his disciples laid the basis of the theory of parametric instabilities and parametric turbulence as applied to the interaction of high-power laser radiation with plasma. For the series of studies devoted to the study of the nonlinear properties of plasma in strong fields, V P Silin, together with other well-known physicists, was again awarded the USSR State Prize in 1987.

A 1973 monograph by V P Silin presented the results of theoretical studies of the effect of high-power electromagnetic radiation on plasma. A year before, a fundamental review on nonlinear plasma electrodynamics, prepared together with his disciple V V Pustovalov, was published in *Trudy FIAN*. The development of the analytical theory of ion-acoustic turbulence began in the late 1970s and lasted till recently. After a large series of studies done by Viktor Pavlovich together with his followers, it became possible to speak of the development of a theory which will allow a quantitative description of an anomalous charge and heat transfer, turbulent electron and ion heating, and the spectrum of ion-acoustic turbulence.

Along with intense scientific activity, V P Silin paid much attention to training young scientists. For many years, he conducted pedagogical work, beginning with the period when, although quite young, he (together with L D Landau) checked the exams of MSU students. From 1963, he taught at MEPhI, and from 1964, he was Professor of the Sub-Faculty of Theoretical Nuclear Physics at MEPhI. He delivered the courses Hydrogasdynamics and Physical Kinetics that brought several generations of students to the level where they could readily get engaged in active creative work in the field of many-body physics. And his excellent monograph *Introduction to the Kinetic Theory of Gases* (1971) has for many years been an indispensable textbook for MEPhI students and for those wanting to have deeper insight into the basic elements of kinetic theory. He organized a large scientific school with more than 30 candidates and more than ten doctors of sciences. V P Silin was the founder of FIAN's Sector of the Theory of Plasma Phenomena. He was one of the initiators of the journal *Kratkie Soobshcheniya po Fizike* (FIAN) (*Bulletin of Lebedev Physical Institute*) and a long-time assistant-editor-in-chief from the time of the journal's appearance. V P Silin was also a member of the editorial board of the journal *Fizika Metallov i Metallovedenie* (*Physics of Metals and Metallurgy*). For many years, he was the main inspirer and organizer of the All-Union Conference on electromagnetic wave-plasma interaction and a member of the organizing committees of a number of large international conferences on plasma physics.

For his activities, V P Silin was awarded two Orders of the Red Banner of Labor and several medals. In 1981, he received

the title of "honored man of science of the Russian Federation."

The memory of Viktor Pavlovich as a brilliant scientist and man endowed by Nature with unique qualities will remain in the hearts of those who knew him, and his books and scientific work will teach and inspire generations of numerous followers.

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