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PERSONALIA

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Viktor Pavlovich Silin (on his 90th birthday)

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May 26, 2016 was the 90th birthday of Viktor Pavlovich Silin, the well-known brilliant theoretical physicist, Chief Researcher at the P N Lebedev Physical Institute of the Russian Academy of Sciences (RAS), and Corresponding Member of RAS, who made a significant contribution to the development of plasma physics and solid-state physics.

V P Silin's whole life has been related to the P N Lebedev Physical Institute (FIAN *in Russ. abbr.*) where he began working immediately after graduation in1949 from Moscow State University (MSU). At FIAN, he moved from Junior Researcher to Head of the Division of Solid State Physics (1989–1995). In those years, he published over 700 scientific papers on different branches of physics and four monographs widely known to plasma physicists.

During the first ten years that he worked in the Theory Department of FIAN, V P Silin was occupied with quantum field theory and the theory of elementary particles. Among the work done in this area, we should mention the extension of the Tamm–Dankov approximation, which then provided deeper insight into the nature of nuclear interactions. At that time, V P Silin became engaged in many-body theory and obtained a number of results on the theory of Fermi-particle gas with weak interaction, the results that laid the basis of the Fermi liquid theory. On the one hand, the development of this area resulted in the formulation of normal metal theory and, on the other hand, this trend fostered another line of research associated with gas plasma physics. V P Silin has gone on developing these two directions up to the present time.

V P Silin's work on metal physics was developed by his numerous followers. This concerns not only his works on the theory of electron liquids in normal metals but also the work on the theory of sound absorption in metals, on the quantum theory of transport phenomena in a magnetic field, on the theory of quantum electron spin-acoustic waves, and on the theory of electron liquids in magnetically ordered metals. Now, V P Silin is working actively on the theory of Josephson junctions.

Among the work on gas plasma physics, the following should be mentioned: on the theory of charged-particle collision integral in rapidly varying and strong fields, which allowed formulation in the 1960s of the kinetic theory of a wide class of transport phenomena; on the relativistic plasma theory; on the theory of fluctuations of microscopic distributions; on the theory of ion-acoustic driven transport; on the kinetic theory of drift dissipative instabilities, and on the kinetic theory of plasma wave interaction.

In 1965, V P Silin published a paper on parametric resonance in plasma, which became well known all over the world and became the starting point for numerous studies. Since that time, V P Silin's scientific interest has been related to the development of the theory of parametric instabilities and parametric turbulence, as well as the application of this theory to the interaction of high-power laser radiation with plasma. Among the studies on laser plasma theory, noteworthy are those on the generation of laser radiation harmonics that V P Silin started in the 1960s and has been conducting up to the present time.

Viktor Pavlovich Silin

One of the nonlinear processes affecting the magnitude of radiation absorption, which has long been attractive to researchers, is nonlinear inverse bremsstrahlung absorption which takes place when the amplitude of the electron oscillation velocity in the electromagnetic wave field exceeds its thermal velocity. Since the effective collision frequency is inversely proportional to the cube of electron velocity, the corresponding nonlinear field dependence of the effective electron–ion collision frequency determines energy dissipation owing to the nonlinear inverse bremsstrahlung effect. Besides such a nonlinear dependence, a logarithmic dependence occurs due to a field-induced variation of the minimum impact parameter and also to the presence of low electron velocity in a linearly polarized wave during the oscillation period. All these phenomena were revealed in the framework of the classic kinetic equation, and later on a consistent quantum theory of these phenomena was formulated.

A considerable contribution was made to the study of ion fluctuation-driven transformations of electromagnetic waves

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to longitudinal perturbations that efficiently transfer their energy to electrons owing to Cherenkov absorption. The formulation of the quantitative theory of ion-acoustic turbulence resulted in establishing an analytical law for angular distribution of turbulent pulsations. This law remained unknown for a long time. The frequency distribution established before by Kadomtsev and Petviashvili was confirmed. An important fact was also ascertained that at a high level of turbulent pulsations an intense Brillouin scattering occurs along with ion-acoustic absorption. This scattering can lead to a considerable increase in the fraction of reflected radiation comparable to the fraction of radiation absorbed by ion-acoustic pulsations in the presence of rather long waves in the turbulence spectrum, and the conditions of realization of such a situation were determined under the high-power radiation effect on plasma.

Another series of V P Silin's studies in nonlinear plasma electrodynamics is devoted to the theory of strong electromagnetic field penetration into plasma (self-consistent nonlinear waveguides, nonstationary theory of the dynamic effect of high-power radiation on moving plasma). Many of the results predicted in this work have been experimentally confirmed.

For his research work, V P Silin twice was awarded the State Prize of the USSR: in 1970 for work on the Fermi liquid theory, and in 1987 for work on nonlinear plasma theory. For his activity, V P Silin has received a number of government awards, including two Orders of the Red Banner of Labor. He was conferred the rank of 'Honored worker of science of the RSFSR'. V P Silin is a member of the editorial boards of several scientific journals and a member of academic councils and of the Scientific Council on Plasma Physics. The attitude of the scientific community to Viktor Pavlovich is seen from an acrostic by V D Shafranov, which he devoted to the young V P Silin and published in the book *Nonscientific Transactions* (Moscow: RRC 'Kurchatov Institute,' 2009). Here it is.

V.P. Silin
Soviet physics theorist
Investigator of difficult tasks
Lets us have a different vision of
Issues of any conditions and who
Never leaves problems with masks.

Practically from the very beginning of his scientific activity, Viktor Pavlovich was engaged in teaching: first at the Faculty of Physics of MSU and then at the Moscow Engineering Physics Institute (MEPI). He brought up quite a number of undergraduate students and postgraduates. V P Silin and his disciples trained a large number of well-known specialists now working in the USA, Europe and Asia. Many physicists from the USSR and even in the whole world, who were not his students or postgraduates, all the same think of him as their teacher, because they learnt by his work, manuals, and monographs (V P Silin, A A Rukhadze *Electromagnetic Properties of Plasma and Plasma-like Media*, V P Silin *Introduction to the Kinetic Theory of Gases*, and others) or simply ask for his advice and socialize with him. V P Silin is founder of the Sector of Plasma Phenomena at FIAN. He set up a large scientific school. More than 30 of his disciples are Candidates of Science, and ten became Doctors of Science. For many years, Viktor Pavlovich has been head of the seminar on plasma and solid state physics, where one can learn much, become motivated to work, and get to know a lot of new things from history, literature, and politics.

Being a socially active person, V P Silin has worked in various nongovernmental organizations and occupied supervisory positions in science.

However, his unfading interest in physics and his passion to understand new things did not allow him to step aside from science. And now, as in his young years, he is working with enthusiasm. He is surrounded not only with young people, students, and postgraduates, but also with already mature former disciples. V P Silin has shown particular concern, so important in recent years that have been difficult for domestic science, for scientific youth, trying not only to support them financially but also to impart to them his interest in and devotion to science.

Victor Pavlovich meets his jubilee full of ideas and aspirations. We are sure that his great internal strength and powerful intellect will conquer his aging and we will be happy to live and work for many years taking advice from this wise scientist and man. We heartily wish him sound health and long years of creative life.

N E Andreev, A V Gurevich, V I Karas',
L V Keldysh, N N Kolachevsky, A S Kondrat'ev,
O N Krokhin, V I Okulov, S V Peletminsky,
V Yu Popov, A A Rukhadze, S A Uryupin