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PERSONALIA

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In memory of Alexander Alekseevich Levchenko

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On 7 May 2026, in his 71st year, Alexander Alekseevich Levchenko passed away. He was an outstanding Russian scientist, a specialist in the physics of quantum liquids and crystals and in the physics of nonlinear phenomena in condensed media, Director of the Osipyan Institute of Solid State Physics of the Russian Academy of Sciences (ISSP RAS), Editor-in-Chief of the Journal *Poverkhnost'. Rentgenovskie, sinkhrotronnye i neitronnye issledovaniya* (Surface. X-ray, Synchrotron, and Neutron Research), and a Corresponding Member of the RAS.

A.A. Levchenko's deep passion for science was remarkable: he directed the work of the Laboratory of Quantum Crystals while personally taking part in the experiments carried out at low temperatures. He was the author and co-author of more than 160 papers in reviewed journals; he took part in developing the course plans for undergraduate and postgraduate students studying at the ISSP RAS and at the base departments of the Moscow Institute of Physics and Technology (MIPT), the Higher School of Economics (HSE), and Astrakhan State University; and he was editor-in-chief of a scientific journal.

Alexander Alekseevich Levchenko was born in the village of Marfino in the Astrakhan region, to a family of Aleksei Georgievich Levchenko, the director of one of the large state farms on the banks of Volga. There he also finished secondary school. The open expanses of Volga, fishing and evening campfires on its banks, the lotuses blooming in the shallows where Volga flows into the Caspian Sea — all this shaped the young man's character and interests. Later in life he regularly returned to his native region so that he could go boating on the Volga.

Alexander Alekseevich received his higher education at MIPT. From his fourth year he, like all the students of his group No. 328 at the Faculty of General and Applied Physics (FGAP), had his research training at the Institute of Solid State Physics. His research supervisor was the experimental physicist Leonid Pavlovich Mezhov-Deglin. Alexander Alekseevich's research career began in 1979 in the Low Temperature Physics Laboratory of the ISSP, where he was hired immediately after graduating from MIPT.

In 1984, A.A. Levchenko defended his Candidate thesis, "Phonon scattering by dislocations, and recovery processes in plastically deformed helium samples," and in 2003 his Doctoral thesis, "Dynamic and nonstationary phenomena on the surface and in the bulk of condensed hydrogen." The diffusion of freshly introduced dislocations, which appear when an initially perfect crystal of solid helium grown from pure helium is bent, is controlled by the interaction of the dislocations with vacancies, and this makes it possible to infer the properties not only of the dislocations but also of the vacancies in a quantum crystal. The vacancy mechanism of diffusion of microscopic defects is also the main one for the motion of injected charged defects (positively charged helium or hydrogen balls and negatively charged electron bubbles) in crystals of solid helium and hydrogen at low pressures. The next series of A.A. Levchenko's experiments was also devoted to studying the mechanisms of motion of charged point defects in crystals of helium and para- and orthohydrogen. These results were presented in papers by A.A. Levchenko and co-authors that examined the diffusion of microscopic defects (dislocations, charged defects) in quantum crystals with a narrow vacancy band.



Alexander Alekseevich Levchenko
(24.10.1955 – 07.05.2026)

A.A. Levchenko's Doctoral thesis included the results of observations of the reconstruction of a charged planar surface of liquid-hydrogen and liquid-helium layers in strong electric fields in the gravitational field of the Earth. To develop this line of research, a series of studies of kinetic phenomena on a free surface of layers of condensed media under microgravity was carried out in the institute's laboratory within a joint

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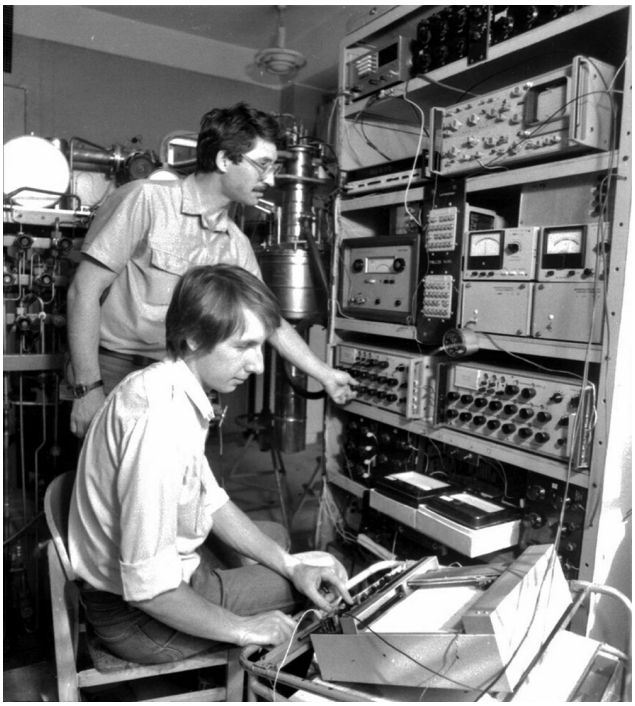

Young experimentalists and MIPT graduates Aleksandr Levchenko and Andrei Golov at work on a setup designed for studying the motion of microscopic defects in solid helium crystals, in the Low Temperature Physics Laboratory at ISSP, the USSR Academy of Sciences (mid-1980s).

project of the ISSP (the USSR Academy of Sciences) and NASA (USA). A.A. Levchenko's report on the results of this work was presented at the international conference "Condensed Matter Physics under Microgravity" held at the ISSP RAS.

For many years A.A. Levchenko took an active part in the work of the Space Materials Science Section of Roscosmos. On his initiative, studies of the properties of semiconductor crystals grown by Russian cosmonauts in orbit aboard the International Space Station (ISS) were carried out in the ISSP laboratories, where researchers from the ISSP and from NASA studied the properties of thin films of two-dimensional crystals under microgravity.

In recent decades, A.A. Levchenko carried out experimental studies of wave and vortex turbulence on the surface of water (a classical viscous liquid) and liquid hydrogen and helium-4 at low pressures (semiclassical liquids, as defined by academician A.F. Andreev) and investigated nonlinear waves and vortices on the surface and in the bulk of liquid helium-4 layers in closed vessels in the normal (He-I) and superfluid (He-II) states.

A A Levchenko's principal scientific results in the physics of nonlinear phenomena are as follows. A developed "Kolmogorov distribution" in a system of capillary waves over a wide frequency range, as well as the appearance of a 'bottleneck' in the turbulent cascade, caused by the discreteness of the surface-wave spectrum were observed for the first time. For the first time it proved possible to record the high-frequency edge of the inertial range, in which a turbulent cascade is formed, and to estimate the characteristic time of the nonlinear interaction of capillary waves. A new damping scenario, not previously discussed in theory, was discovered; it is associated with the effect of the finite viscosity of the liquid on the dynamics of turbulence decay on the liquid surface. The formation of vorticity by nonlinear waves on the surface of water and of superfluid helium was observed experimentally.

He succeeded in involving researchers from the Landau Institute for Theoretical Physics (ITP) in the discussion of the results of these experiments. In the newly established joint laboratory "Modern Hydrodynamics," A.A. Levchenko was elected chief researcher at the ITP on a part-time basis. The main lines of work of this laboratory include the study of interaction of surface waves with near-surface vortex flows in condensed media and vortex flows in a rotating liquid. A brilliant review written by members of this laboratory — S.S. Vergeles, A.A. Levchenko, and V.M. Parfenyev, "Nonlinear generation of currents by waves on a liquid surface" — was published in 2025 in the journal *Uspekhi Fizicheskikh Nauk* (*Usp. Fiz. Nauk* **195** 1199–1220 (2025); *Phys. Usp.* **68** 1131–1150 (2025)).

A.A. Levchenko carried out extensive scientific and organizational work. He was elected a Corresponding Member of the Russian Academy of Sciences and served as Deputy Academician-Secretary of the Division of Physical Sciences of the RAS; he was a member of the RAS Commission for Monitoring and Evaluating the Performance of Research Organizations and Higher Education Institutions of the Russian Federation, a member of the RAS Council on Space, and a permanent member of the organizing committee of the International Conference on Cryocrystals and Quantum Crystals.

In 2024, for his major contribution to the development of Russian science, for many years of fruitful work, and in connection with the 300th anniversary of the founding of the Russian Academy of Sciences, A.A. Levchenko was awarded the Medal of the Order "For Merit to the Fatherland," 2nd class. For his major personal contribution to implementation of the priority projects of the Roscosmos State Corporation he was awarded the V.P. Barmin Jubilee Medal, and in 2025 he received the medal of the Ministry of Science and Higher Education of Russia "For Impeccable Work and Distinction."

The high standards Alexander Alekseevich set for himself, his kind and attentive attitude toward those around him, and the integrity of his character always commanded the respect of his colleagues. He was a reliable and modest man who knew how to gather around him a circle of friends whose company was engaging and joyful. The cherished memory of Alexander Alekseevich Levchenko will remain forever in our hearts.

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I.Yu. Ibragimova, V.V. Kveder, N.N. Kolesnikov,
I.V. Kolokolov, E.A. Kuznetsov, V.V. Lebedev,
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