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In memory of Vadim L'vovich Gurevich

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Vadim L'vovich Gurevich, well-known theoretical physicist, corresponding member of the Russian Academy of Sciences (RAS), and chief researcher at the A F Ioffe Institute of Physics and Technology (IPT) RAS, passed away on December 19, 2021.

Vadim L'vovich was born on June 4, 1934 in Leningrad. He was the son of the well-known physicist Lev Emmanuilovich Gurevich. In 1956, V L Gurevich graduated from the Physical Department of Leningrad State University and began working at the Institute of Semiconductors of the USSR Academy of Sciences (ISAS). In 1960, he defended his candidate thesis and, in 1965, his doctoral thesis; in 1971, he was conferred the rank of professor. The same year, Vadim L'vovich organized the Sector of Physical Kinetics at ISAS. After the ISAS and the A F Ioffe Physical Technical Institute united in 1972, this sector moved over to PTI, where V L Gurevich had been working till the end of his life.

His most well-known achievements in theoretical physics (together with Yu A Firsov) include the prediction in 1961 of magnetophonon resonance — a new type of oscillation of a conductor's kinetic coefficients in a strong magnetic field due to resonant energy absorption upon the transition of charge carriers between Landau levels with the participation of longitudinal optical phonons. As a result, specific magnetophonon oscillations of magnetic resonance, periodic in magnitude, inverse magnetic field, were observed in some semiconductors. This important phenomenon was found in a whole number of materials and underlay the method of magnetophonon spectroscopy of electrons and phonons. Studies of magnetophonon resonance in semiconductors, carried out together with experimentalists, were reported by A V Gurevich in 1964–1965 at academician P L Kapitza's seminars at the Institute of Physical Problems, at FIAN, and at a section of the Division of General and Applied Physics of the USSR Academy of Sciences. In recent years, studies of magnetophonon oscillations have been concentrated on two-dimensional nanostructures and other low-dimensional systems, e.g., graphene.

Together with V G Skobov and Yu A Firsov, Vadim L'vovich predicted giant ultrasound absorption oscillations in metals in a magnetic field and developed a theory of this effect. This interesting and at first glance unexpected effect turned out also to be important for a certain type of electromagnetic wave — so-called helicons.

Well known are studies by Vadim L'vovich and his co-authors on the theory of ultrasound amplification by the drift of charge carriers in semiconductors. In these works, he formulated a consistent linear and nonlinear theory of the amplification effect in different regimes. For a series of studies on the development of theoretical bases of acousto-electronics, V L Gurevich (along with I A Viktorov, Yu V Gulyaev, and V I Pustovoit) was awarded the 1974 State Prize of the USSR.

Vadim L'vovich Gurevich
(04.06.1934 – 19.12.2021)

The abovementioned studies do not at all exhaust the scientific achievements of V L Gurevich. Studies on theory fluctuations, the theory of dielectric relaxation, the theory of low-temperature properties of dielectric and metal glasses, superconductor kinetics, and others should also be mentioned.

In a series of studies, V L Gurevich and his disciples S V Gantsevich and R V Katilyus constructed a consistent theory of fluctuations near a nonequilibrium but stationary state. A specific correlation of fluctuations due to electron-electron interaction was examined.

An important role was played by V L Gurevich's works conducted together with his disciple A K Tagantsev on the dielectric relaxation theory, developing the theory of high-frequency losses in dielectric (and ferroelectric) crystals. A systematic analysis for crystals of different symmetries is presented in the frequently cited review in the journal *Advances in Physics* and also in V L Gurevich's monograph,

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"Kinetics of phonon systems." This systematic analysis proved to be important from both fundamental and applied viewpoints.

Studies carried out by V L Gurevich and his disciples (B D Laikhtman, Yu M Gal'perin, D A Parshin, and V I Kozub) on the physics of dielectric and metallic glasses provided insight into the importance of localized low-energy excitations in amorphous materials for the formation of the thermodynamic and kinetic properties of the latter. In particular, formulated was a nonlinear theory of ultrasound relaxational absorption in amorphous materials, allowing an interpretation of the accessible experimental results. A very important result of the works on glass physics was the development of the theory of the so-called boson peak — a universal feature of the density of states of amorphous materials. The theoretical model elaborated by V L Gurevich's group with the participation of the German physicist H R Schober made it possible to explain a whole number of experimental results. Thus, several important problems were solved.

In the physics of superconductors, V L Gurevich, together with A G Aronov, Yu M Gal'perin, and V I Kozub, formulated a theory on the response of pure superconductors to electromagnetic and elastic fields slowly varying in time and space. The obtained system of coupled equations for a superconducting order parameter and the distribution function of quasi-particles made it possible to predict and analyze peculiar acoustoelectric and thermoelectric effects in superconductors.

In the 1990s, V L Gurevich, along with V V Afonin and the Finnish physicist R Laiho, developed a theory of photoinduced surface current and photomagnetism in normal metals.

The abovementioned work played an important role in the modern condensed state theory. As acknowledgement of Vadim L'vovich's achievements, he was elected a corresponding member of RAS in 2000.

The scale of scientific interests and general culture allowed V L Gurevich to combine active research work in the forefront of modern physics and an overview of the general picture of extensive areas of science. This overview explained his intension to fill in the 'blanks' left by researchers. These qualities made Vadim L'vovich an indispensable tutor for young research workers. In V L Gurevich's sector, anyone could be engaged in any field of physics, provided it was reasonable and interesting.

The creative atmosphere at seminars of the sector was promoted by the free and informal exchange of opinions. Speakers from scientific organizations from other cities frequently gave talks at the seminars. On the other hand, it was thought to be good form to give talks at seminars at leading scientific organizations, for example, at the Institute of Physical Problems of the USSR Academy of Sciences (Moscow) and the Institute of Theoretical Physics RAS (Chernogolovka). All this fostered the formation of the scientific school, whose representatives are now working successfully in various scientific organizations.

We will remember Vadim L'vovich Gurevich not only as a prominent scientist whose work exerted influence on modern condensed state physics. He was a versatile, bright, and well-disposed man with an excellent sense of humor, which often smoothed over the hardships of life both at work and in numerous difficult tourist expeditions. This is how we and his disciples will remember him.

E B Aleksandrov, A F Andreev, Yu M Gal'perin, Yu V Gulyaev, A G Zabrodskii, S V Ivanov, E L Ivchenko, A A Kaplyanskii, R V Parfen'ev, R A Suris, D E Khmel'nitskii, I A Shcherbakov