

## Vladislav Borisovich Timofeev (on his 80th birthday)

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The twenty-second of September 2016 is the 80th birthday of Vladislav Borisovich Timofeev, a Full Member of the Russian Academy of Sciences (RAS). Vladislav Borisovich is an outstanding experimental physicist, well known for his scientific results in the field of semiconductors and solid state physics. He has published over 200 scientific papers, including 16 reviews and two monographs.

V B Timofeev graduated from the Faculty of Physics of Kiev State University in 1959 and stayed at the Department of Optics as a senior laboratory assistant. In 1962, he was appointed a senior research worker. In the following year, he was invited to the Chair of Optics at the University of Chernovitsy, where he took the position of Assistant Professor. In 1959, Vladislav Borisovich began active studies on the optical properties of semiconductors, with a particular emphasis on the examination of exciton–phonon spectra of cuprous oxide and phenomena related to spatial dispersion in the exciton region. The results obtained were acknowledged by the scientific community and underlay the Candidate's degree thesis, “Quasiline absorption spectra of inorganic crystals”, which he defended in 1964. Beginning in 1966, V B Timofeev carried out some investigations concerned with the methods of precision spectrum interferential measurements and with holography, where he proposed methods of reference-free holographing.

In 1967, V B Timofeev was invited to work as a Senior Researcher at the newly founded Institute of Solid State Physics (ISSP) RAS in Chernogolovka, not far from Moscow, which in due course became one of the leading research centers in Russia. V B Timofeev's entire further scientific activity and career are inseparably linked with ISSP RAS.

At ISSP RAS, V B Timofeev has intensely and successfully developed a new direction related to the study of collective interactions in a system of nonequilibrium carriers and high-density excitons in semiconductors. V B Timofeev carried out research into nonequilibrium high-density electron–hole systems in direct band semiconductors (cadmium sulfide) and in semiconductors with an indirect forbidden band (germanium, silicon), in which he discovered basically new phenomena, namely, the exciton condensation to an electron–hole liquid in a polar direct-band semiconductor, a giant jump in photoconductivity under exciton metallization (Mott transition) in germanium, and exciton molecules in strained germanium and silicon crystals. He realized experimentally a new quantum object—a spin-oriented exciton gas—and examined its quantum statistical properties at high densities. V B Timofeev comprehensively analyzed gas–liquid phase diagrams under exciton dielectric gas condensation to a metallic electron–hole liquid and, thus, laid the basis of the



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thermodynamics of nonequilibrium electron–hole systems. He revealed the giant probabilities of radiative recombination of exciton–impurity complexes in direct band semiconductors, as well as the phenomenon of their decay induced by the emission of acoustic phonons. V B Timofeev became a recognized leader in this new area in semiconductor physics. Part of the results of these studies was included in his Doctor's degree thesis, “Recombination emission of high-density excitons and nonequilibrium carriers”, successfully defended in 1975.

V B Timofeev has often acutely changed the directions of his studies and has always achieved success. For instance, he was the first in the field of optical spectroscopy of high-temperature superconductors who carried out the study of inelastic light scattering attendant to the overgap excitations in oxide superconductors and revealed a strong scattering anisotropy resulting from the anisotropy of the superconducting gap. In the late 1980s, the scientific interests of V B Timofeev moved towards low-dimensional electron–hole and exciton systems in semiconductor heterostructures. Here, he discovered the effects of fractional quantization of

Hall resistance in silicon field transistors, proposed and realized a spectroscopic method of measuring Coulomb gaps in the regime of the fractional quantum Hall effect, revealed Wigner crystallization of two-dimensional electrons in a single heterojunction, and examined Coulomb correlation effects in systems with spatially separated electron-hole layers. V B Timofeev's work on magneto-optics of low-dimensional systems gained worldwide recognition.

In recent years, V B Timofeev has successfully developed the line of inquiry associated with strongly correlated electron and exciton systems. He studied Bose-Einstein condensation in a quasi-two-dimensional system of interwell excitons in lateral traps created by an inhomogeneous electric field and found the critical conditions of interwell exciton condensation in the lateral traps obtained using a metal mask layer on the surface of a GaAs/AlGaAs heterostructure with double quantum wells. In those studies, the exciton Bose condensate was found to possess large-scale spatial coherence, and the high spatial directivity of exciton condensate emission, as well as spatially periodic structures in its luminescence, was shown to occur due to such coherence.

V B Timofeev's findings gained wide recognition of the scientific community in Russia and abroad. In 1990, V B Timofeev was elected a Corresponding Member of the USSR Academy of Sciences, and in 2000 a Full Member of the Russian Academy of Sciences. For the series of research work "Multiexciton complexes in semiconductors," V B Timofeev was awarded the 1988 USSR State Prize in science and technology. In 1994, he won the Alexander von Humboldt Foundation research award. On receiving a research grant from The Landau Network—Centro Volta in 1998, V B Timofeev carried out investigations as an invited professor at the University of Rome, Italy. In 2000, he received the Roentgen Professorship Award and worked as an invited professor in Germany at the University of Würzburg. In 2003, V B Timofeev was given the rank of Honorary Member of the Ioffe Physical-Technical Institute. In 2006, he was awarded the prize of the Publishing House MAIK Nauka/Interperiodika for the best publication of 2006.

In 2016, V B Timofeev was awarded the E F Gross Medal established by the D S Rozhdestvensky Optical Society for outstanding achievements in the spectroscopy of semiconductors and insulators, as well as nanostructures based on them.

In 1976, V B Timofeev organized a Laboratory of Non-equilibrium Electron Processes at ISSP RAS and headed it for many years. At the present time, he is a Chief Researcher of this Laboratory. During the time of the existence of the Laboratory, a scientific school was founded there by Academician V B Timofeev, who has been its continual head. The scientific problems of the school focus on complex optical and magneto-transport investigations of collective electron and electron-hole interactions in low-dimensional semiconductor nanostructures. The studies made by the leading researchers of the school have a high citation index in Russian and international databases, which shows their worldwide reputation and recognition. Since 1994, the leading research workers of the school have given over 60 invited academic talks, including plenary ones, at the most prestigious international conferences on physics and technology of semiconductors and semiconductor nanostructures.

Along with the research activity, the interests of V B Timofeev's scientific school have always been concen-

trated on teaching, scientific and technical education, and training young highly qualified personnel. The main sources of young specialists have always been MPTI (Dolgoprudny) and Lomonosov MSU (Moscow). For the last 20 years, this scientific school has prepared over 50 high-skilled researchers in physics. The most talented graduate students continued training as postgraduates. The average age of workers in the scientific school has not exceeded 35 years for a long time, which is indicative of a constant inlet of young people and guarantees viability and success in the future. Among the disciples of Vladislav Borisovich, there are 20 Candidates of Sciences, seven of whom became Doctors of Science and two Corresponding Members of RAS. For many years, Vladislav Borisovich has headed the seminar on semiconductor optics that he organized at ISSP RAS. The scientific discussions at this seminar are always held at a high level and are a brilliant school for young scientists.

V B Timofeev is known for his intense scientific and organizational activity. For many years, he has been Chairman and Vice Chairman of the Academic Council of RAS on Semiconductor Physics, a member of the Bureau of the RAS Committee on Spectroscopy, Vice Chairman of the Academic Council of the Intersectoral Scientific and Technical Program of Russia titled 'Physics of Solid-State Nanostructures', and of the Scientific and Technical Committee of the Intergovernmental Russian-Ukrainian Scientific and Technical Program titled 'Nanophysics and Nanoelectronics', a member of the Presidium of the RAS Research Center in Chernogolovka, and a member of the Commission on Physics for Development of the International Union of Pure and Applied Physics (IUPAP). He is also the Head of the program committee of Russian conferences on semiconductor physics and was a member of the editorial board of the journal *Fizika i Tekhnika Poluprovodnikov (Semiconductors)*. At the present time, he is a member of the Program Committees of the International Conference on Semiconductor Physics, the International Symposium Nanophysics and Nanoelectronics, the domestic Conference 'Strongly Correlated Electron Systems and Quantum Critical Phenomena', and the editorial board of the journal *Fizika Tverdogo Tela (Solid State Physics)*. He is Vice Chairman of the Dissertation Committee on specialty 01.04.07 (solid state physics) of ISSP RAS and a member of the Academic Council of ISSP RAS.

From the very beginning of his work, V B Timofeev successfully combined scientific and pedagogical work. As an Assistant Professor at the University of Chernovitsy in 1963–1967, he delivered the general courses *Optics and Atomic Physics* and the special courses *Spectral Devices and the Technique of Spectroscopy, Atomic and Molecular Spectroscopy, Optical Quantum Generators, and Introduction to Nonlinear Optics*. Beginning in 1976, Vladislav Borisovich was a Professor at MPTI for many years and delivered to MPTI students the splendid lecture course *Optical Spectroscopy of Semiconductors and Insulators*, which he himself originated. Those lectures laid the basis of a textbook for students, postgraduates, and research workers, and was issued in 2015. The lecture course that he delivered in the town of Sarov and that reflects the latest achievements in condensed matter physics was published in 2014 in the series *Vysshaya Shkola Fiziki*.

The firm and imperturbable position of V B Timofeev concerning the most important problems of science and its development has won the great respect of his colleagues in our country and abroad.

On behalf of his numerous colleagues, disciples, and friends, we heartily extend best wishes to Vladislav Borisovich Timofeev on his jubilee! We wish him good health, happiness, inextinguishable energy, and new advances in science.

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