IVAN VASYLYOVYCH BLONSKYI
(to the 60-th anniversary of his birthday)

On June 23, the known physicist, the Head of the Department of Photon Processes at the Institute of Physics of the National Academy of Sciences of Ukraine (IP NASU), the Head of the Center for collective use of "Laser femtosecond complex", a winner of two State Prizes of Ukraine in science and engineering, a Corresponding Member of the NASU, Doctor of Science in physics and mathematics, Professor Ivan Vasylyovych Blonskyi is at the age of 60.

Ivan Vasylyovych was born at a village of Serafyntsi (the Gorodenka district of the Stanislav – now Ivano-Frankivsk – region). After finishing the Serafyntsi secondary school in 1967 with a gold medal, he entered the Faculty of Physics of the Chernivitsi State University, from which he graduated in 1972. The same year, he entered the postgraduate study at the IP NASU and, after the termination of the postgraduate study, he is working permanently at the IP NASU, consequently occupying the posts of junior scientific researcher, scientific researcher, senior scientific researcher, leading scientific researcher, the Head of Laboratory of Photoacoustics and Optics, the Deputy Director in scientific activity (1994–2004), the major scientific researcher, the Head of the Department of Photon Processes, and the Head of the Center for collective use of "Laser femtosecond complex" at the IP NASU (since 2005 till now).

In 1978, I.V. Blonskyi defended his Ph.D. and, in 1990, Doctoral dissertations. The subject of his dissertation works was the physics of exciton phenomena in quasi-two-dimensional semiconductors. In 1993, he was awarded the rank of Professor and then the rank of Soros Professor. In 1997, Ivan Vasylyovych was elected a Corresponding Member of the NASU in the speciality "Experimental solid-state physics".

Among the main achievements which were obtained with the participation of I.V. Blonskyi, the following ones are to be marked.

The basic mechanisms which govern the regularities of the light excitonic absorption in a class of semiconductors with layered structure are established. For the first time, the attention is drawn to the fact that the structural features of the materials which occupy the intermediate place between ionic-covalent and organic semiconductors, as well as two- and three-dimensional structures, reveal themselves in the dynamic properties of the electron-hole interaction in an exciton rather than in the character of this interaction.

It is shown that the anomalies experimentally discovered in the excitonic light absorption are caused by a pronounced low-temperature phonon anharmonicity, the presence of low-energy optical phonons, and the strong exciton-phonon interaction.

In crystals with a moderate strength of the electron-phonon coupling, a specific type of excitonic excitations

– mobile exciton states weakly coupled with a lattice deformation – is revealed. Using the excitonic spectroscopy methods, the kinetics of inter-polytype transitions is studied.

The influence of the anisotropy factor on the interaction of excitons accompanied by the formation of collective exciton phases is studied.

The results of those researches were systematized in two monographies: M.S. Brodin and I.V. Blonskii, *Excitonic Processes in Layered Crystals* (Naukova Dumka, Kyiv, 1986) and M.S. Brodin, I.V. Blonskii, B.M. Nitsovich, and V.V. Nitsovich, *Dynamic Effects in a Multicomponent Gas of Quasiparticles* (Naukova Dumka, Kyiv, 1990).

After defending the thesis for Doctor's degree, Ivan Vasylyovych started to develop a new promising direction, photoacoustics of heterostructures, at the Institute. He proposed a model of pulse photoacoustic response of multilayered structures, which was later used in the creation of an original photoacoustic spectrometer and a thermowave introscope. Within the developed method, the optical, thermal, and elastic properties of porous silicon (por-Si) layers that make a mechanical contact with monolithic silicon were studied for the first time in the depth profiling mode. For the first time, the effect of photo-induced generation of sound with a giant intensity at the pulsed photoexcitation of CdS nanoparticles incorporated into internal voids of zeolite matrices was observed. Together with the Department of Theoretical Physics, I.V. Blonskyi developed a model that explained the effect observed from a viewpoint of the generation of "breathing" acoustic modes in an ensemble of overheated thermally isolated semiconductor nanoparticles (the State Prize of Ukraine in 1994).

In the mid-1990s, I.V. Blonskyi, together with his disciples and colleagues, entered actively into the problems of nanostructure physics. Having combined photo-, thermally stimulated, and tunneling luminescence methods, they studied a combined influence of the quantum confinement factor and the factor of structural disordering on the generation, transport, and recombination in nanostructures of the inorganic or organic origin. For silicon nanoparticles, the size dependence of the Auger electron scattering efficiency was discovered and studied, as well as new mechanisms of electron excitation localization which are inherent to quantum dots and wires. For quantum dots, the effect of "two-stroke charge piston", whose driving force is an electron Auger-process (a doubled electron transition) that induces the "self-ejection" of charge carriers from photoexcited silicon nanoparticles and their subsequent localization on peripheral shells of oxides, was suggested and experimentally verified. The discovered effect turned out important for understanding the nature of charge carrier separation in photoexcited structurally inhomogeneous nanoparticles, charge accumulation in SiO_x peripheral layers, and size dependence of the quantum yield of radiation. In quantum wires, a new type of charge carrier localization by "topological" traps genetically related to fluctuations of the wire diameter along the wire length was revealed. For the first time, the temperature dependence of the Becquerel index for tunneling luminescence decay in inorganic and organic semiconductor quantum wires was found to be nonmonotonic. This phenomenon was explained by the realization of a "diffusion cluster" in the ensemble of trap states, the tunnel transport over which is governed by the recapture mechanism.

A wide-range laser femtosecond complex which is unique for Ukraine and corresponds to the most progressive world standards was put into operation. With the help of this complex, the influence of the spatial confinement on dynamic electronic processes was studied for precious metal nanoparticles as an example. In Cu nanoparticles incorporated into a SiO_2 matrix and irradiated with femtosecond laser pulses, a dynamic polarization splitting of surface plasmons was found for the first time. A model was proposed, which explained the results obtained by specific features of the evolution of a dielectric response of such a composite medium due to the Kerr effect which manifested itself under conditions of the giant amplification of a local field.

The specific features of the propagation of femtosecond laser pulses in isotropic media were studied: proceeding from the moment, when the development of an optical Kerr non-linearity started, passing the stages of focusing, plasma generation, and beam filamentation (a split of the beam into discrete tracks), and till the material destruction which is accompanied by the appearance and propagation of shock waves. Original time-resolved high-speed techniques of induced absorption microscopy and femtosecond optical polarigraphy were used for measurements. The formation and the time evolution of a filamented femtosecond pulse in fused quartz were studied. The energy of a field localized in a filament, laser-induced plasma density, and variations of the refractive index of a medium were determined. Immediately in the real space and time, the variation of the trailing edge shape of a laser pulse caused by the "pushing " of light from the region occupied with plasma and resulting in the formation of a structure of the swallow-tail type was directly observed. The results obtained are not of only fundamental value, but they are also important for the improvement of precision techniques for the laser treatment of substances in bulk.

The fundamentals of the physics of laser-induced breakdown of transparent media were developed and applied to solve the problems of precision microtreatment of transparent materials (grants of the Science and Technology Center in Ukraine (STCU), contracts with the Institute of Optics, Fine Mechanics and Physics of the Academy of Sciences of China, and the LG-Electronics company, the State Prize of Ukraine in 2003).

Ivan Vasylyovych pays much attention to the managerial and pedagogical activities. Under the leadership of I.V. Blonskyi, the Center for collective use of "Laser femtosecond complex" was created in 2005, and, in the same year, a new scientific department, the Department of Photon Processes, was organized.

Nowadays, I.V. Blonskyi is a vice-chairman of the Advisory council in physics of the Higher Examination Board of Ukraine; a councillor of the Fundamental Researches State Fund of the Ministry of Education and Science of Ukraine; a national expert of CIS countries on lasers and laser technologies; a member of scientific councils of the NASU on the problems "Laser physics and laser technologies", "Semiconductor physics", and "Solid-state physics"; a member of the working group of the NASU program "Nanosystems, nanomaterials, nanotechnologies"; a member of editorial boards of journals "Ukrainian Journal of Physics", "Semiconductor Physics, Quantum Electronics, Optoelectronics" and others. I.V. Blonskyi is a Professor of the Chair of General Physics at the Faculty of Physics of the Taras Shevchenko National University of Kyiv (part-time job). He was a supervisor of one Doctoral and nine Ph.D. theses, the Head and a participant of projects fulfilled in the framework of a number of grants awarded by STCU, CRDF, and others.

I.V. Blonskyi was awarded with a distinction of the NASU for scientific achievements and a Certificate of honor of Presidium of the NASU.

At present, Ivan Vasylyovych is at the peak of his creative and physical strengths. He is full of energy, new plans, and creative inspiration.

M.S. Brodyn, A.G. Naumovets, S.G. Odoulov, E.A. Pashitskyi, Yu.G. Ptushinskyi, S.M. Ryabchenko, M.S. Soskin, P.M. Tomchuk, L.P. Yatsenko, V.S. Manzhara, A.M. Negriiko, O.G. Sarbey, V.M. Poroshin