

**OUTSTANDING PHYSICIST AND PROMINENT PERSONALITY OF MOLDOVA  
PROFESSOR SVEATOSLAV MOSKALENKO AT HIS 80<sup>TH</sup> ANNIVERSARY**



On September 26, 2008, Full Member of the Academy of Sciences of Moldova, Professor Sveatoslav Moskalenko (Moscalenco), Head of the Section on Theory of Semiconductors and Quantum Electronics of the Institute of Applied Physics of the Academy of Sciences of Moldova, Laureate of the National Prize in Science and Technologies, has turned 80 years of age. His eightieth birthday is a special occasion for scientific community of Moldova to share our admiration for our excellent colleague and outstanding scientist. Professor Sveatoslav Moskalenko is a theoretical physicist — a label too narrow and restrictive to describe his output and methods of working, somebody who with safety and elegance trod forward at the boundary between mathematics and physics, mastering the subtleties of the former and understanding deeply the meaning of the latter. Without any hesitation we can state that professor Sveatoslav Moskalenko together with his twin brother professor Vsevolod Moskalenko is a bright scientist both of the World and Moldovan physical community.

The start of scientific carrier of academician S. Moskalenko overlaps the period of the fifties of the last century - the world “explosion” of investigations in physics of semiconductors being up till now a component of condensed matter physics. Thus, it is not in reason to expect our “ambitious” junior researcher, S. Moskalenko to be not involved in this world physics mainstream. The first scientific investigation of young researcher was related to the model of F-center in solid state materials and in this context it is curious to note that his twin brother, academician Vsevolod Moskalenko, has started his own investigation with the same subject.

In 1956 he became a postgraduate student of the Institute of Physics of the Academy of Sciences of the Ukraine - one of the biggest scientific centers in the South-West part of the former USSR, and began his sufficiently long own path in physics excitons and related quasiparticles in solid state materials. His very early papers on investigation of the individual properties of the excitons in semiconductors were highly appreciated by the physics community. In those works he explained a vast variety of peculiarities of absorption spectra of excitons in the  $\text{Cu}_2\text{O}$  crystals, as well as the influence of the permanent electric and magnetic fields and of the fields of deformation on the properties of the exciton states.

Invention of laser in the sixtieths of XX century allowed using it for the higher excitation of semiconductors and to putting forward new problems, related to the physical properties of crystals at such high level of excitation. There were predicted and experimentally discovered a number of new nonlinear optical phenomena, which were due to the strong dependence of the parameters of crystals on the intensity of the laser radiation (phenomena of two-photon and multiphoton light absorption, the second and higher harmonic generation, parametric processes of luminescence, gain and light generation and others). Professor S. Moskalenko has investigated in detail the processes of two- and three photon light absorption by excitons and determined the selection rules for it.

The investigations of S. Moskalenko dealing with the collective properties of excitons at high level of excitation of crystals brought him the world recognition. It was in 1958 when professor S. Moskalenko firstly predicted the possibility of occurring in materials of a new quasiparticle - the excitonic molecule (biexciton), which looks like the hydrogen molecule. Investigating the potential energy of exciton-exciton interaction S. Moskalenko came to conclusion that the Coulomb interaction can result in the binding them into biexciton at low temperatures and moderate exciton density. This results in the significant change of the absorption and luminescence spectra of the crystal. This prediction was sonly confirmed experimentally and since that moment the biexciton, as well as the exciton, triumphally marches in the world science greatly evidencing itself in the properties of semiconductors. As opposed to exciton the fate of the biexciton appears to be luckier. It was discovered faster and at once was accepted by the scientists.

A great interest to the biexciton problematics occurred in the 70-80 of the XX century, when the scientific school of professor S. Moskalenko reached impressive scientific results in the investigation of excitons and biexcitons in semiconductors at high level of excitation and acquired international recognition. There were investigated the new collective effects of the exciton-light interaction, the new absorption and emission bands, which were provided by the exciton-exciton, exciton-electron, exciton-hole, exciton-biexciton and biexciton-biexciton interactions, were predicted and investigated. Simultaneously, the new absorption and luminescence bands were investigated, which appear due to the optical exciton-biexciton conversion and due to two-photon excitation of biexcitons from the ground state of the crystal and are characterized by the giant oscillator strength. Each new band is characterized by the inherent kinetics depending on type and level of excitation, by the time evolution of the light intensity and by the significant rise of the temperatures of exciton and biexciton subsystem in comparison with the lattice temperature. It was found that the biexciton states give rise to the brighter behavior of the multiwave processes.

Another remarkable collective phenomenon predicted firstly by S. Moskalenko in early sixties and studied intensively in the 70-80 of the XX century was the phenomenon of Bose-Einstein condensation (BEC) of excitons (biexcitons) in semiconductors. The great

interest to this phenomenon is explained by the fact that its experimental discovery would lead to the solution of the important problem related to the energy transfer of the electronic excitations on the large distance without dissipation.

In the eighties and nineties of the XX century emergent fields of physics of low dimensional solid-state structures provided by great successes in the semiconductor high technologies, named later nanotechnologies, led to the fabrication of the semiconductor low dimensional micro- and nanostructures, such as the quantum wells, quantum wires, and quantum dots. A lot of intense researches of the properties of excitons and biexcitons in such systems related to the investigating of the energy spectrum of excitons and biexcitons in dependence on the structure configurations and dimensions are carried out by S. Moskalenko and his scientific team. A possibility in principle of simultaneous existence of two induced Bose-condensations of excitons and biexcitons in GaAs/AlGaAs quantum wells was proved.

A great interest to the collective coherent phenomena has led professor S. Moskalenko to the investigation of the effects of coherent nonlinear propagation of the short and supershort pulses of resonant laser radiation in semiconductors in the high density system of excitons and biexcitons. He proved a possibility in principle of the existence of the self-induced transparency phenomenon and propagation of the soliton wave packets in the system of excitons and biexcitons.

Thus, the milestones of the personality of the academician S. Moskalenko can be arranged in the following portrait dimensions:

- outstanding physicists, whose studies in the physics of excitons and quantum optics have greatest impact on our current understanding of collective quantum phenomena in solids;
- excellent lecturer and supervisor of young scientists, whose talks are full of charm and passion for science;
- founder of scientific school and the “creator” of a large physical family, involved in the world science circuit.

At his honorable age of eighty years, academician S. Moskalenko is full of ideas and forces, ever before, continuing and developing original investigations in physics of excitons and non-linear quantum optics, he is closely collaborating with many scientific groups from all around the world. With the same enthusiasm as 40-50 years ago he is continuing the activity of education and training of a new generation of physicists. As a truth scientist he possesses the quality to reveal the abilities for scientific activity of the young students, to develop their possibilities for science activity. S. Moskalenko generously transfers his knowledge, ideas, and experience to young researchers.

The editorial board of the Moldavian Journal of Physical Sciences and all physics community of R. Moldova sincerely congratulate Academician Sveatoslav Moskalenko, one of the brightest members of the Division of Physics and Engineering of the Academy of Sciences of Moldova, with his honorary anniversary and wish him health and new successful climbing on the enormous mountain of modern theory of condensed matter. We consider that the best gift for a recognized scientist as Professor Sveatoslav Moskalenko is scientific papers dedicated to him. This journal issue includes several papers with new results of some leading researchers and disciples working in relevant fields of professional activity of Academician Sveatoslav Moskalenko.

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