WORLD RECOGNIZED PHYSIST AND BRIGHT PERSONALITY OF MOLDOVA PROFESSOR VSEVOLOD MOSKALENKO AT HIS 80TH ANNIVERSARY

On September 26, 2008, Full Member of the Academy of Sciences of Moldova, Professor Vsevolod Moskalenko (Moscalenco), Head of the Section of Statistical Physics of the Institute of Applied Physics of the Academy of Science of Moldova, Laureate of the National Prize in Science and Technologies, has celebrated his eightieth birthday.

This anniversary is an occasion for scientific community of Moldova to share our admiration for our outstanding colleague and teacher. His inquiring mind and passion for science, professionalism and scientific courage, will-power and diligence have earned him a high appreciation and esteem among colleagues. His openness to new ideas, readiness for a discussion, and deep erudition always attracted people. A fresh idea or an original point of view would immediately raise his enthusiasm, his face flashed with light: “Interesting, interesting”. A teacher himself, he is an ever learning person, eager to explore new perspectives, full of new ideas, willing to share them with the others. There is no doubt that professor Vsevolod Moskalenko together with his twin brother professor Sveatoslav Moskalenko are bright scientists both of World and Moldovan physical community.

Professor V. Moskalenko began (1955) his enough long own path in theoretical physics generalizing of the well known Bogoliubov (1950) adiabatic theory of polarons by considering two particles interacting with quantum scalar field of optical phonons; formulating the first systematic diagram technique treatment for electron-phonon systems with weak interaction and developing the theory of optical bands in materials with F-centers. In the context of last topics, it is curious to note that his twin brother, Sveatoslav Moskalenko, has started his own investigation with the same subject.

The start of his science carrier in the late fifties of XX century coincides with the beginning of the era of superconductivity, initiated by famous BCS (Bardeen, Cooper and Schrieffer) work, and he is fully involved in this areas of mysterious phenomenon of superconductivity being a postgraduate student of the Moscow State University and Steklov Mathematical Institute in the outstanding team of academician N.N. Bogoliubov. Starting from the Frohlich Hamiltonian of the electron-phonon system he obtained the thermodynamic potential of the electron subsystem, which included the retardation effect and studied the influence of the Coulomb interaction on the critical temperature of the superconductors. In the superconductivity investigations Professor V. Moskalenko has found his scientific niche and world recognition related to multiband theory of superconductivity. In this theory both intra- and inter-band interactions between electrons are taken into account and they lead to new features of superconductor behavior. The first paper of these investigations remains one of the most quoted among articles of Moldovan scientists.

A lot of new effects have been discovered during exploration of this approach to superconductivity up to present. Professor V. Moskalenko himself and his disciples, as well as many other authors continued to explore this research direction, which grew into a new field of theoretical and experimental metal physics and superconductivity. At present there exists a vast amount of literature on two and many-band theory of superconductivity. Many properties of multiband model of superconductors have been investigated in detail, including collective oscillations, thermodynamic, kinetic and electromagnetic properties. Recently, many experimental results have been reported on the superconductivity in MgB_2, confirming the theoretical concept of the two-band superconductivity. Existence of an overlap of energy bands was proved to lead to not only quantitatively but, in some cases, to qualitatively new results as compared to the case of one-band superconductors.

In the middle seventies the scientific community was confronted with a new challenge – the problem of spin glasses, disordered systems with a frustrated interaction. Many real materials with such properties have been discovered. It turned out that the glassy behavior is a general phenomenon, which is present not only in spin systems, but also in diverse bosonic and fermionic ones. V. Moskalenko proposed a new approach to this problem, which was based on the principle of stationarity of the free energy of spin glasses against the variation of the on-site magnetic moments. This approach was implemented through a novel field theoretical diagram perturbation method for disordered systems with quenched disorder, which served as reliable tool for the description of many properties of such materials. It allowed studying the spin wave excitations in spin glasses, the distribution of local magnetic fields, the dynamics in the presence of an external field, the clustering properties, and thermodynamic properties.

Two decades ago the major part of the physical world community was facing the hard challenge of the discovery of high temperature superconductivity. It is no wonder that V. Moskalenko could not stay aside and, together with his team, he has fully engaged in this new battle of superconductivity. It became clear from the very beginning that traditional methods are insufficient to handle the immense complexity of the problem.

One of the research directions was related to the development of the earlier investigations of the multi-band approach, which is suitable enough for high temperature oxide superconductors with a rich band structure. A detailed study of the influence of the peculiarities of the band structure on the HTSC materials was given on the basis of the multi-band approach.

A qualitatively new aspect of the HTSC problem was a significant role of the strong electron correlations in these materials, an argument first put forward by Anderson in 1987. In an attempt to address this fundamental difficulty, V. Moskalenko arrived to formulate a qualitatively new strong coupling diagram perturbation theory in which the kinetic energy of elec-

trons is the small parameter of the theory in agreement to the experimental situation. This required a radical reformulation of the whole tool of the perturbative approach, which is based on the generalized Wick theorem for statistical averages of Fermi operator products. This approach was further generalized to include the presence of antiferromagnetic correlations in HTSC materials as well as for the two-band Hubbard model. The effect of the coupling to phonons of a system of strongly correlated electrons has been investigated. The new diagram technique and canonical transformations have been developed and applied to a wide range of questions concerning the presence of the strong Coulomb repulsion of electrons and the strong interaction of electrons with phonons. The influence of this interaction on the parameters that control the metal-insulator or superconducting phase transition has been found. Special investigation has been directed to the problem of coupling of strongly correlated electrons with phonons. A new concept that the polarons exchanging phonon clouds can lead to polaron pairing and superconductivity has been elaborated.

Another vast activity of Professor V. Moskalenko deals with the cell representation of three-band Hubbard model. The new conception of diagonalizing fermions for oxygen holes has been introduced. The diagonalization of this subsystem is realized before the introducing of the Wannier orthogonalized orbitals of the holes, which results in lower energy of the systems. A new approach to periodic Anderson model using new diagram technique has been elaborated in normal and superconducting phases. The hopping perturbation treatment of the periodic Anderson model has been elaborated with special canonical transformation method for treating the atomic limit of this model.

Thus, the main signatures of the portrait of the academician V. Moskalenko, can be summarized in the following dimensions of the figure of scientist and personality:

- outstanding physicist, whose investigations in the superconductivity and strong correlated systems have tremendous impact on our current understanding of cooperative quantum macroscopic phenomena;
- excellent teacher and tutor of young researchers, whose lecturers have a mesmeric charm and full of passion for science;
- founder of scientific school and the “father” of a large physical community, integrated in the world science.

At his honorable age of eighty years, academician V. Moskalenko is as active as ever before continuing and developing original investigations in condensed matter physics, he is closely collaborating with many scientific groups from all around the world, such as JINR (Dubna, Russia), Northeast Normal University of Changchun, People’s Republic of China, Duisburg University (Germany), Salerno University (Italy), International Center for Theoretical Physics in Trieste (Italy), Institute of Physics and Nuclear Engineering, Bucharest, Romania.

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

Valeriu Kantser
Editor-in-chief of MJPS