VADYM MYKHAILOVYCH LOKTEV
(on his 60th Birthday)

On May 3, the known Ukrainian physicist-theorist, Academician of the National Academy of Sciences of Ukraine (NASU), Academician-Secretary of the Physics and Astronomy Branch of the NASU, Professor, an Honored worker in science and engineering of Ukraine, Vadym Mykhailovych Loktev was sixty last birthday.

V.M. Loktev was born in Kyiv in the family of employees. After leaving secondary school No. 100 in Kyiv, he entered the Shevchenko Kyiv State University in 1963 and graduated from it in 1968, having taken an M. Sc. degree in theoretical physics. Being still the student, V.M. Loktev started his scientific researches. He carried out his degree work under the guidance of Academician of the Academy of Sciences of UkrSSR A.S. Davydov. The further scientific activity of V.M. Loktev has been connected with the Bogolyubov Institute for Theoretical Physics of the NASU. In 1968–1971, he was a postgraduate student of this Institute. He defended the Ph.D. dissertation, written under the supervision of A.S. Davydov and E.G. Petrov in 1971, before the termination of postgraduate study, and the doctoral one in 1983. In 1987, Vadym Mykhailovych stood at the Head of the Laboratory of Electronic Processes in Molecular Ordered Structures, which was a part of the Department of Theory of Many-Particle Systems, headed at that time by Academician A.S. Davydov. Later on, in 1993, V.M. Loktev was elected the Head of the Department of Nonlinear Physics of Condensed Matter. During V.M. Loktev's being at this position, his managerial abilities, his skill to select a staff, to form creative teams of experts in various branches of science to tackle important physical problems, often recruiting experimenters, have revealed themselves.

Vadym Mykhailovych excellently takes bearings in modern physical researches. The field of his scientific interests is extremely wide and includes the most challenging problems of theoretical physics, from the issues of molecular and magnetic excitons to the mechanisms of high-temperature superconductivity (HTSC). He obtained a lot of fundamental results in the area of solid-state physics, the overwhelming majority of which have found the experimental confirmation.

The important results were obtained by V.M. Loktev while studying cryocrystals and their interaction with light. For example, on the basis of the theoretical studies of the solid oxygen spectra, he together with Yu.B. Gaididei forecasted the splitting of biexciton absorption bands in antiferromagnetic insulators, the phenomenon that was confirmed experimentally by absorption spectra of the low-temperature phase of solid oxygen. He also predicted the magnetic structure of β-oxygen, which is known nowadays as the Loktev structure. In 1977, for his theoretical researches of the solid oxygen spectra, V.M. Loktev won the State Prize of Ukraine in the area of science and engineering (together with A.F. Prykhotko, Yu.B. Gaididei, and others). On the basis of those works and with other co-authors,

he wrote and published the monography "Cryocrystals" (Kyiv: Naukova Dumka, 1983).

The uppermost position among V.M. Loktev's scientific contributions belongs to studying magnetic systems, in particular, excitons and spin excitations in isotropic and anisotropic ferromagnets. In the early 1970s, he in collaboration with Yu.B. Gaididei and E.G. Petrov developed the theory of excitonic states in antiferromagnetically ordered crystals. Calculations of the dependence of the integral intensity of exciton–magnon transitions in antiferrodielectrics on the external magnetic field corresponded to experimental data with a high accuracy.

The works on the theory of anisotropic magnetic crystals (carried out together with V.S. Ostrovskyi) made it possible to predict a new magnetooptical effect which is linear in the external magnetic field and resulted from a variation of the diagonal components of kinetic coefficients. This effect, which strangely enough had been considered forbidden before, made it possible to visualize collinear 180°-domains in antiferromagnets. In 1985, for the theory of this effect and for other works dealing with the studies of strongly anisotropic crystals, V.M. Loktev together with V.V. Eremenko and M.F. Kharchenko was awarded the K.D. Synelnykov Prize of the Academy of Sciences of UkrSSR.

V.M. Loktev created the theory of the Rashba effect in antiferromagnets. In particular, he together with M.O. Ivanov and Yu.G. Pogorelov demonstrated that the collective reconstruction of the spectrum in such systems was possible irrespective of the impurity concentration, with the external magnetic field being able to "switch on" and "off" the magnetic interaction between impurities. These works stimulated experimental studies at the Institute of Low-Temperature Physics and Technologies of the NASU and other scientific laboratories (including those in Germany, Austria, and United Kingdom). Nowadays, the theory of impurity states with a large radius in crystals is known as the Ivanov–Loktev–Pogorelov theory.

V.M. Loktev created the theory of spin excitations in disordered magnets with strong single-ion anisotropy, the theory of spin waves, and (in collaboration with V.G. Bar'yakhtar and V.G. Ryabchenko) the theory of the formation of a magnetoelastic gap in quasi-two-dimensional antiferromagnets. On the basis of V.M. Loktev's research of strongly anisotropic magnetic impurities in ferro- and antiferromagnetic matrices, the concept of "orthogonal impurity centers", which are characterized by a very low energy of excitation and a nonlinear dependence on the matrix magnetization, has been introduced. In addition to the "orthogonal impurity" concept, other new terms such as "splitting crossover" and "coherent and non-coherent reconstruction to the spectrum" came into being on the basis of V.M. Loktev's works as well. In 1990, for the theoretical research of anisotropic magnetic crystals, the results of which had been corroborated experimentally in full, V.M. Loktev and I.P. Dzyub together with experimenters from Kharkiv and Moscow were awarded the State Prize of Ukraine.

Vadym Mykhailovych has extremely interested in a new discovered phenomenon of HTSC. He began to intensively investigate the magnetic properties and the electron structures of those materials. In particular, the contributions of various p- and d-states of charge carriers in the formation of valence and conduction bands in metal-oxide ceramics were determined. As a result of these researches, V.M. Loktev succeeded in constructing the phase diagram of high-temperature superconductors in the "the critical temperature of superconducting transition" versus "the concentration of charge carriers" coordinates, which was in a qualitative agreement with experimental data. Together with V.P. Gusynin and S.G. Sharapov, he has calculated the quantum fluctuations of the phase, which were responsible for the pseudogap formation. Vadym Mykhailovych has also proposed a new model that described impurity centers in high-temperature superconductors, the main effect of which consisted in that superconducting particles are strongly influenced by neighbor copper ions even in the vicinity of a non-magnetic impurity. It would result in a substantial reduction in the order parameter at distances far from the center and the appearance of a narrow resonance in the density of states at small energies; those conclusions turned out to be in a qualitative and quantitative agreement with experimental data. The urgency of these works is certainly connected to the quest for the physical mechanism of the HTSC phenomenon.

An important part of V.M. Loktev's physical contribution is the elucidation of general physical conditions for a nonhomogeneous or a multidomain state to arise in a condensed system in the vicinity of its phase transition point, as well as the study of the role of long-range elastic interactions, which become responsible for the emergence of nonhomogeneous equilibrium states in the crystals of finite dimensions, owing to the incommensurability between the surface and volume deformations. At the transitions, which result from the spontaneous symmetry lowering, a low-

symmetry phase exists, as a rule, in the form of various domains, i.e. macroscopic regions that possess an identical symmetry but are oriented differently with respect to the crystallographic axes of the initial phase. In the absence of external or internal fields, which can be induced due to natural defects or technological treatment of the crystal in a high-symmetry phase, all domains are energetically equivalent and have the same chemical potential. These results were taken as the basis of the works carried out by V.M. Loktev and O.V. Gomonai and devoted to the consideration of the influence of the domain structure of crystals on their behavior in such external fields that abolish the domain degeneration, i.e. make them nonequivalent. The influence of the domain structure on the hysteresis was studied, and, on the basis of experimental data, obtained by S.M. Ryabchenko and his colleagues, on the existence of the domain structure and its rearrangement under the action of either external magnetic fields or mechanical stresses in such systems, a mechanism of the formation of a domain structure in antiferromagnets was proposed. V.M. Loktev clarified the origins of the formation of a thermodynamically equilibrium domain structure of compensated antiferromagnets. In particular, it was demonstrated that this structure is formed in such a way that the vector of the magnetic moment averaged over the specimen be directed in parallel to the specimen surface, so that a reduction in the magnetostatic energy of the induced magnetic field in the external space should compensate the energy gain related to the emergence of domain walls. Studying the translational and orientational domains made it possible to establish the conditions, under which the twinning of a uniformly deformed specimen becomes possible, and to calculate the critical dimensions of the latter, with the results turning out to be in a good agreement with experimental observations. Exotic highly symmetrical fullerene molecules and fullerene-based compounds, the so-called fullerites, did not escape Vadym Mykhailovych's attention. He together with E.O. Pashitskii studied Jahn–Teller oscillations in fullerite films and established their important role in the mechanism of emergence of HTSC in such films.

We should also mention V.M. Loktev's research concerning the peculiarities of dislocation motion in the field of an ultrasonic wave. It was shown that a growth of the wave amplitude resulted in a qualitative modification of the dislocation motion: instead of linear, it became nonlinear, so that the transition from one mode to the other should possess a threshold. On the basis of those researches, V.M. Loktev and Yu.M. Khalak have proposed an explanation of the acousto-luminescence phenomenon.

V.M. Loktev is the author of over two hundred scientific works published in Ukrainian editions and abroad. These works possess high citation indices. He gave invited reports at many international conferences and symposia. The election of Vadym Mykhailovych Loktev as a full member of the European Academy of Sciences and Arts evidences for the international recognition of his contribution to the development of world science.

Vadym Mykhailovych Loktev fulfills a large body of the managerial job, being a member of the Presidium of the NASU, Academician-Secretary of the Physics and Astronomy Branch, Head of the Superconductivity Physics Section of the Academic Council of solid state physics of the NASU. He is also a member of a number of editorial boards of scientific journals and collected volumes.

V.M. Loktev gives the extremely great attention to the education of a new scientific staff. He is a supervisor of the term papers, the degree and Ph.D. works of young scientists. He does his best in stimulating them to devote themselves to theoretical physics. With the purpose to popularize his favorite science and to promote its development, V.M. Loktev stood at the head of the Chair of Theoretical and General Physics of the Faculty of Fhysics and Mathematics at the National Technical University of Ukraine "Kyiv Polytechnic Institute".

The scientific community, the colleagues, and the friends sincerely congratulate Vadym Mykhailovych upon his jubilee and wish him a sound health, happiness, new creative successes, and that his dreams and numerous creative projects, with which Vadym Mykhailovych meets this anniversary in the prime of life, come true.

M.S. Brodyn, V.G. Bar'yakhtar, V.V. Eremenko, V.G. Manzhelii, A.G. Naumovets, O.S. Parasyuk, A.G. Zagorodny, E.G. Petrov, S.M. Ryabchenko, P.I. Fomin, Yu.B. Gaididei, G.F. Filippov, V.Ya. Antonchenko, L.S. Brizhik, V.I. Zasenko, V.M. Khryapa