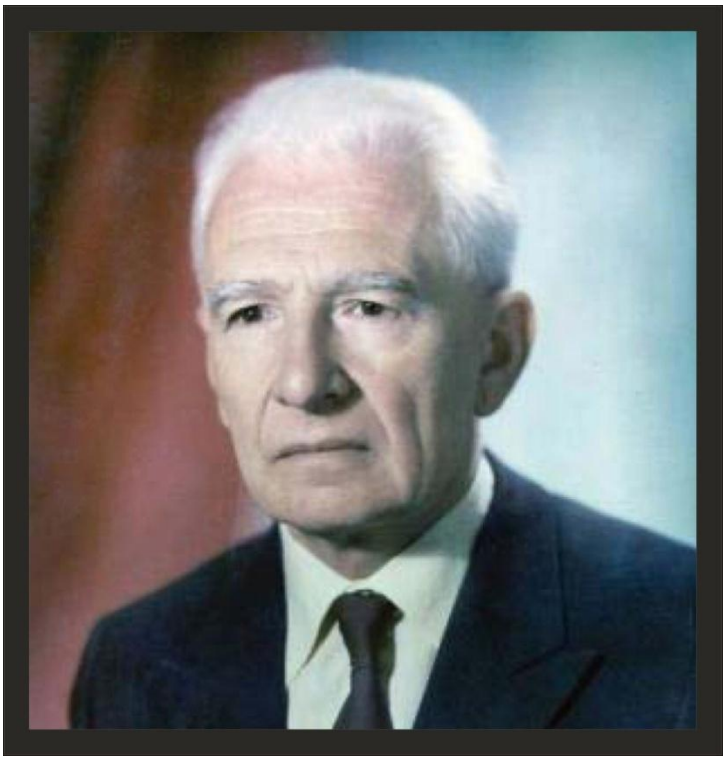
IN MEMORIAM OF ACADEMICIAN VSEVOLOD MOSKALENKO



(September 26, 1928–April 2, 2018)

On the 2nd of April, 2018, the Moldovan and international scientific community lost an outstanding member of highest value and a person of great integrity—academician Vsevolod Moskalenko. For those who knew him, he will remain an example to look up to in many respects, while his scientific and public legacy accumulating over 60 years of dedicated work will remain a source of inspiration and a model to follow for many generations of physicists to come. Being one of the founders of the school of theoretical and mathematical physics in Moldova, Vsevolod Moskalenko was a teacher, a colleague, a leader, and a friend to many of us. Science was the passion of his entire life also because the uncompromising search for truth and beauty was one of the defining features of his personality. He was never concerned with looking for easy paths or ways to achieve a guaranteed success; on the contrary, he was always attracted by the hardest problems and was never discouraged by difficulties. It was his talent, solid education, will power, and hard work that every time drove him through the apparently unsurmountable complexity to reveal, in the end, the beauty hidden behind a scientific puzzle. For me, as a fresh applicant for postgraduate studentship about 35 years ago, the encounter with his style of work was an unforgettable experience right from the beginning. In the introductory discussion, he briefly told that, together with his team, they were studying a completely new type of disorder in magnetic systems, referred to as spin glasses, which can not be explained in terms of standard quantum statistics. I was told that there is no overall magnetization, but still the state seems to have some hidden long-range order in it, and that some researchers—Edwards and Anderson—proposed a "replica trick" that could allow grappling with this puzzle. Until I could get hold of any details in

this “before the Google” era and after many “from scratch” attempts to derive what this “trick” might be about, my curiosity was fully ignited. The years that followed were a journey full of hard work and new paradoxes in this fascinating field, during which Vsevolod Moskalenko led us by his own example and enthusiasm. He developed an original and rigorous field theoretic method for understanding the phenomena taking place in this fundamental state, which later found numerous interesting and unexpected applications. For instance, starting from the Hopfield model of the neural cell, it turned out to be important for understanding the mechanisms of associative memory and properties of neural networks, which later evolved into a distinct research field. It is yet another example of how the value of a deep mind can be appreciated even more with the passage of time.

Twin brothers Vsevolod and Sveatoslav Moskalenko were born on the 26th of September, 1928 in the village of Bravicea of the Orhei county of Romania (at present, the Republic of Moldova). The village is about 70 km away from Chisinau; by that time, it had a population of a few thousands and a primary school where the brothers studied in 1935–1939. Then, they studied in “B.P. Hasdeu” high school and later in “A. Russo” high school in Chisinau until 1944, when the school was evacuated to Craiova, where they continued their studies at “Carol I” National College (1944–1945). After World War II, they came back to Orhei, where they finished a secondary school with excellence in 1946. In summer of the same year, their fascination with natural sciences brought them to Chisinau State University and they became students of the Faculty of Physical and Mathematical Sciences. However, in that period, the joy of studies came with tremendous hardships for their family: they had already lost their father who was arrested in 1940 and died in the dungeons of NKVD in 1941; after the war, they suffered from poor living conditions and severe illnesses that posed a real threat to their physical existence. Still, the strength and independence of their character crystallized from the turmoil of this dramatic life experience.

After graduating from the Chisinau State University with excellency in 1951, Vsevolod Moskalenko worked at the university, first as an assistant and later as a lecturer; he taught regular and special courses in Theoretical Physics for the next 10 years (1951–1960). During this period, he continued the studies as a trainee and then as a postgraduate student (1957–1959) of famous academician N.N. Bogolubov and professor S.V. Tyablikov at Moscow State university and at Steklov Institute of Mathematics of the USSR Academy of Sciences. It was the time when the puzzle of superconductivity was being unraveled by the joint effort of the elite theorists including the scientific supervisors of the young postgraduate student. In 1958, shortly after the Nobel winning BCS theory of superconductivity and the insightful formulation by N.N. Bogolubov were published, Vsevolod Moskalenko submited his milestone work, in which, unlike the BCS, superconducting charge carriers belong to different energy bands, for publication. A year later, a similar work was submitted to Physical Review Letters by Suhl, Matthias, and Walker, and the two papers were published in 1959. In the same year, Vsevolod Moskalenko defended his candidate's dissertation at Steklov institute. The elegant theory of multiple-band superconductivity proposed by him was later developed by him together with several generations of his students and colleagues in Chisinau. In some important aspects, this theory predicted a behavior even qualitatively different from BCS (e.g., sensitivity to nonmagnetic impurities). Quite recently, after the discovery of novel materials, the theory has received a brilliant experimental confirmation; at present, it plays a key role in the upsurge of research on some priority topics, such as unconventional and high-Tc superconductors.

In 1961, Vsevolod Moskalenko became Head of the Department of Theoretical Physics of the newly-formed Institute of Physics and Mathematics of the Moldovan Academy of Sciences.

Being a member of the "Bogolyubov's school," Vsevolod Moskalenko built up what will later become a "school" of his name in Chisinau and thus established a strong relationship between the two schools. Their scientific collaboration continued actually until the last years of academician N.N. Bogolubov, when their common work on the existence of superconductivity in the Hubbard model was published in the Theoretical and Mathematical Physics journal (1991). In 1964–1966, Vsevolod Moskalenko carried out post-doctoral studies under supervision of N.N. Bogolubov at Moscow State University and then defended his doctoral dissertation in physics and mathematics at Steklov institute in 1967. These close contacts contributed to the broadening of collaboration in both scientific and organizational areas. With the natural growth of the Academy, the Department changed its name for the Department of Statistical Physics of Institute of Applied Physics. Moldova received support for training of young researchers in new areas, such as Elementary Particles Physics and Nuclear Physics, in connection with ongoing research at Joint Institute for Nuclear Research in Dubna (JINR, Russia). Numerous visits and direct collaborations with many renowned scientists, among which D.N. Zubarev, Y.A. Tserkovnikov, N.M. Plakida, E.E. Tareeva, and V.M. Loktev, and participation at conferences and seminars provided an invaluable boost to the development of theoretical physics in Moldova. Vsevolod Moskalenko became a member of the USSR Academy of Sciences Scientific Councils on Solid State Theory and Low Temperature Physics. In 1970 Vsevolod Moskalenko was elected corresponding-member of the Moldovan Academy of Sciences; in 1976, he became full member; in 1971 he received the title of Professor in Physics and Mathematics. In 1972 the bureau of the Mathematical Section of the USSR Academy of Sciences chaired by academician N.N. Bogolubov had a session in Chisinau in recognition of the achievements of Moldovan colleagues. Vsevolod Moskalenko used the authority he earned to promote international collaboration with important international scientific centers, such as JINR (Russia), National Institute of Physics and Nuclear Engineering (Romania), Duisburg University (Germany), North-Eastern University of China, International Center for Theoretical Physics in Trieste, and the University of Salerno (Italy). For over a decade (1990–2004) academician Vsevolod Moskalenko was the Plenipotentiary representative of the Republic of Moldova and a member of the Scientific Council of the JINR. In appreciation of his long-time contribution, he received the title of "Doctor Honoris Causa" of the Joint Institute for Nuclear Research (Russia, 2009).

His educational activity spread from the organization of regular scientific seminars at Institute of Applied Physics till direct involvement, at the school level, as Chairman of the Scientific Society of Schoolchildren "Viitorul." I have this experience of my own and remember well what an important role was played by the stimulating atmosphere created in those times for the upbringing of young researchers. It was at one of these seminars in the 1980s when we learned about the recent discovery of high-temperature superconductors. The exceptional importance of this discovery was immediately clear then. Still, up till present days, the problem of the mechanism of high-Tc phenomenon remains one of the central topics in physics, multiple-band superconductivity being one of the lines of thought. Nevertheless, Vsevolod Moskalenko initiated the exploration of the completely new paradigm requiring a deep revision of the basics of the standard condensed matter theory: strongly correlated electronic states and inapplicability of the single-particle picture of excitations and the concept of Fermi liquid. This courageous decision was motivated by the necessity to understand the anomalous properties of the new materials in their normal phase first. He developed an original and rigorous field-theoretic diagram perturbation method, which allowed him to implement this paradigm and study many aspects of these systems, such as magnetic and charge ordering, Mott–Hubbard metal–insulator transition, interaction with phonons, and some features of the superconducting transition.

Vsevolod Moskalenko was a scientific adviser for 20 doctoral and 5 doctor habilitation theses; he published over 200 scientific papers and 6 monographs in various domains of the Quantum Theory of Solids to which his major scientific achievements belong: theory of polaron, bipolaron; theory of low temperature superconductors with energy bands overlapping on the Fermi surface and superconducting alloys; coexistence of superconductivity CDW, SDW, and spin glass phases; methods of quantum Green's functions; theory of spin and quadrupole glasses; theory of high-Tc superconductivity and strongly correlated electron systems based on the new diagram technique with application to one- and three-band Hubbard Model, Periodic Anderson Model and Hubbard–Holstein electron–phonon systems; using this theory, he showed a possibility of a new mechanism of superconducting pairing for strong electron–phonon coupling due to exchange of phonon clouds between polarons. His lifelong merits were praised by highest national distinctions, such as the State Prize for Science and Technology of the SSRM (1981), Order of Honour and „Dimitrie Cantemir" Medal, Order of the Republic (1996), and honorary title "Om Emerit" ("Emeritus Person") of the Republic of Moldova.

Despite poor health and immense complexity of the scientific task, he continued to work on his new theory till the last days giving us an ultimate example of the victory of spirit over flesh. Academician Vsevolod Moskalenko, through his works and through his spiritual example, will remain part of the national heritage for the generations to come.

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