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TO THE 115th ANNIVERSARY
OF THE BIRTH OF MYKOLA BOGOLYUBOV

On August 21, we mark the 115th anniversary of the birth of the outstanding scientist Mykola Mykolayovych Bogolyubov. During the current times of severe trials for our country caused by the war, we obtain moral support by recalling the selfless activity of this remarkable person. His life was devoted to science, and he made an invaluable contribution to the development of physics and mathematics in Ukraine.

Mykola Bogolyubov's scientific career started rapidly in his youth, in times of rapid and painful changes in society. When he was 13 years of age, his father introduced him to the eminent scientist Professor of Kyiv University, Academician Dmytro Grave. Mykola attended his scientific seminar for six months, and within a year he began to work purposefully with Professor Mykola Krylov. Mykola Bogolyubov wrote his first scientific work in 1924 at the age of fifteen. The next year, by a special decision of the Council of People's Commissars of the Ukrainian SSR, he was enrolled in postgraduate studies at the Depart-

ment of Mathematical Physics of the All-Ukrainian Academy of Sciences (AUAS). He successfully completed his postgraduate studies in 1928 by having defended his thesis. Two years later, on the basis of a set of his works, AUAS awarded Mykola Bogolyubov an academic degree of Dr.Sci. in mathematics.

Soon, Mykola Bogolyubov together with Mykola Krylov began to study nonlinear oscillations, the relevance of which was associated with the development of radio technology. The scientists proposed the methods of asymptotic integration of nonlinear equations describing oscillatory processes and developed the theory of dynamic systems. Mykola Bogolyubov recalled: "M.M. Krylov – together with me, his student and colleague – turned to the study of actual problems in the theory of nonlinear oscillatory processes. Here, by combining profound theoretical constructions and practical orientation, which was typical of him, M.M. Krylov managed to lay the foundations of a new branch in mathematical physics, nonlinear mechanics." In 1935–1936, M.M. Bogolyubov lectured on the theory of nonlinear oscillations at the Henri Poincaré Institute in France and the Belgian Mathematical Society.

Before WW2, in 1934–1941, M.M. Bogolyubov lectured at Kyiv University, where he was awarded the academic rank of Professor. At the same time, in 1940–1941, he worked at Chernivtsi University. In addition, he gave lectures to the students of the faculty of physics at Lviv University and Kyiv Technological University of Food Industry.

In the summer of 1941, M.M. Bogolyubov was evacuated from Kyiv as a member of the Academy of Sciences. He continued theoretical research on nonlinear mechanics and participated in works on defense topics. M.M. Bogolyubov returned to Kyiv at the beginning of 1944. This city is associated with the fruitful periods of his work. At the same time, he continued to work at the Institute of Mathematics (1945–1956) and lectured at Kyiv University (1944–1949).

In 1946, his well-known monograph *Problems of Dynamic Theory in Statistical Physics* was published. Originally, it was a manuscript of a scientific report of the Institute of Mathematics. This work opened new approaches to the justification of statistical mechanics. Based on the equations of microscopic motions of particles and by performing a set of elegant transformations, a set of equations for multiparticle distribution functions was formulated. Under the assumption of a hierarchy of different time scales, M.M. Bogolyubov derived a kinetic equation for single-particle distribution functions both in a neutral gas with short-range interaction between molecules and for plasma particles with the Coulomb interaction.

In 1947, the fundamental work of M.M. Bogolyubov *To the Theory of Superfluidity* was published in the Collection of works of the Institute of Mathematics. Here, for the first time, the microscopic theory of this quantum phenomenon was formulated on the basis of an original mathematical method, which was later coined as the Bogolyubov canonical transformation. Afterwards in 1957, M.M. Bogolyubov applied this transformation to construct the theory of superconductivity. The next well-known work of M.M. Bogolyubov was *Lectures on Quantum Statistics* (1949).

An important step in the development of quantum field theory was the substantiation of the so-called Bogolyubov–Parasyuk subtraction procedure, which had an impact on the development of high-energy physics. The results mentioned above are mainly associated with the Kyiv period of M.M. Bogolyubov's work.

Mykola Bogolyubov was among the founders of the direction that was called the axiomatic field theory. New possibilities to describe the interaction processes of elementary particles were demonstrated in his works on dispersion relationships for scattering amplitudes. In 1964–1966, his works devoted to the symmetry theory and quark models of elementary particles were published. The quantum number that is now widely known as the quark color was proposed by him and his disciples.

Besides an outstanding scientist, Mykola Bogolyubov was also a talented science manager. Earlier, we mentioned universities where he gave lectures, and where the directions of research initiated by him later developed. He was the initiator, founder, and the first director (1966–1973) of the Institute for Theoretical Physics in Kyiv, which is now named after him. He formed the initial directions of the institute's activity, such as the theory of elementary particles, the theory of the nucleus and nuclear reactions, and statistical physics. He attracted outstanding scientists to the work at the Institute. Two subdivisions of the Institute were created in Lviv and Uzhgorod. The Institute for Condensed Matter Physics of the National Academy of Sciences of Ukraine was later established on the basis of the Lviv department. Owing to the organization of international conferences, such as the Rochester Conference on High Energy Physics and International Conferences on plasma theory, the Institute became well known outside Ukraine. In the future, there appeared new scientific directions, but they were also connected with the ideas of Mykola Bogolyubov.

The scope of his scientific achievements cannot fail to impress. He managed to make a fundamental contribution to various fields of physics and mathematics not only due to his natural abilities but also due to his extraordinary work capacity. He saw the unity of theories related to different branches of physics and contributed to a deeper penetration of mathematical methods into physics, as well as a more rigorous approach to the formulation of physical problems.

The life and work of Mykola Bogolyubov from the first years of his life till his last days were closely connected with Ukraine. Being brought up in an atmosphere of love for Ukraine, he felt great respect for the land where he spent his childhood and youth, where he was formed as a scientist and gained world recognition. With a desire to share the destiny of the Ukrainian people in everything, he considered himself a Ukrainian and declared this in various questionnaires and personal papers. A detailed description and interesting details of the life and work of Mykola Mykolayovych can be found in books [1, 2].

To celebrate the 115th anniversary of the birth of our outstanding scientist, the meetings of the sections of the Kyiv Bogolyubov conference will be held on September 24–26, 2024 at the Bogolyubov Institute for Theoretical Physics and the Institute of Mathematics. The articles published in this issue of the *Ukrainian Journal of Physics* are also devoted to this event.

1. B.E. Paton, A.G. Zagorodny *et al.* (Eds.). *Creator of theoretical and mathematical physics. To the 110 th anniversary of Academician M.M. Bogolyubov* (Akademperiodyka, 2019) (in Ukrainian).
2. I. Mryglod, V. Ignatyuk, Yu. Holovatch. *Mykola Bogolyubov and Ukraine* (Evrosvit, 2009) (in Ukrainian).