
IN MEMORY OF KOSTYANTYN MYKOLAIOVYCH STEPANOV



On April 19, 2012, Kostyantyn Mykolaiovych Stepanov, Chief scientific researcher of Institute of Plasma Physics of the National Science Center 'Kharkiv Institute of Physics and Technology' (NSC KIPT), Doctor of Phys.-Math. Sci., Professor, Corresponding Member of the National Academy of Sciences of Ukraine, Honored Worker of Science and Technology, a winner of State's Prize of Ukraine, passed away.

Kostyantyn Mykolaiovych was born in Leningrad on March 24, 1930. In 1952, he graduated from the Nuclear Department of Kharkiv State University and bound up his scientific activity with Kharkiv Institute of Physics and Technology. K.M. Stepanov defended the candidate dissertation in 1958 and the doctoral one in 1965. Since 1967 till 1976, K.M. Stepanov headed a laboratory, and than, from 1976, a department of Kharkiv Institute of Physics and Technology.

He was among those top-level researchers who built the foundation of the theory of high-temperature magnetized plasmas. His first scientific works concerned the

theory of motion of ions and electrons in linear accelerators. He took participation in the development of the project of a linear 4-GeV electron accelerator.

The main scientific activity of K.M. Stepanov was related to plasma physics and controlled nuclear fusion. A landmark in the development of plasma physics became his calculation of the dielectric permittivity tensor of a magnetoactive plasma based on the kinetic equation with self-consistent field, which allowed him to determine the decay of the known branches of electromagnetic waves caused by the electron and ion cyclotron resonances and the Cherenkov resonance in a plasma with low kinetic pressure of a gas and to calculate the dispersion and decrements of new branches at a finite value of pressure. The approach developed was generalized further to the inhomogeneous plasma, plasma with fluxes of charged particles, plasma in an electromagnetic field, and plasma with account for Coulomb collisions.

The study of the wave conversion, which was performed by K.M. Stepanov, became an important contribution to the theory of inhomogeneous plasmas. Together with disciples and colleagues, he developed the nonlocal theory of absorption of waves by a plasma in an inhomogeneous magnetic field in the ion cyclotron range of frequencies. These results are applied to the heating of a plasma in tokamaks, stellarators, and adiabatic traps and are promising for the development of a magnetic thermonuclear reactor.

An important feature of the theoretical works by Kostyantyn Mykolaiovych is their orientation to practical problems. He is a co-author of the idea of a two-component thermonuclear reactor, in which the high-energy component of ions is formed due to the excitation of fast magnetosound waves which are transforming into small-scale decaying cyclotron oscillations. The size of such a reactor and its power are significantly less than those of an ordinary reactor with the same temperatures of deuterium and tritium.

K.M. Stepanov obtained a number of important results concerning the excitation of waves in a magnetoactive plasma by the fluxes of charged particles, parametric instabilities and the turbulence of a plasma in magnetic and variable low-frequency electric fields, and turbulence of an inhomogeneous plasma and a plasma with anisotropic distribution of particles over velocities. He is a co-author of the theory of formation of a spiral structure of galaxies due to the injection of a substance into the gravitational field of the axially asymmetric rotating core. This theory explains the appearance of various types of the spiral structure.

K.M. Stepanov collaborated actively with experimenters. Together with them, the comprehensive studies of the plasma production and the high-frequency heating in open and toroidal magnetic traps were made at Kharkiv Institute of Physics and Technology and on tokamak T-10 at I.V. Kurchatov Institute of Atomic Energy.

As a physicist-theorist possessing the outstanding talent, K.M. Stepanov was an extremely hard-working person. He was the author and co-author of more than 700 scientific works, including five monographs. Under his guidance, 26 candidate dissertations and 14 doctoral ones were defended. For more than 40 years, Professor K.M. Stepanov carried on the scientific and teaching work at V.N. Karazin Kharkiv National University. At NSC KIPT and V.N. Karazin Kharkiv National University, K.M. Stepanov created the scientific school on plasma physics known by its recognized advantages in the theory of confinement, heating, and stability of a plasma in magnetic traps, as well as in the theory of collective and turbulent phenomena. Numerous representatives of Stepanov's school are working now at many scientific centers over the world.

The works of K.M. Stepanov underlie the electrodynamics of a plasma in a magnetic field, and his results

entered many monographs and textbooks and are used in the fields of controlled fusion, plasma technologies, radiophysics, geophysics, and astrophysics.

K.M. Stepanov was awarded the Order of the Red Banner of Labour, medals and a Deed of the Verkhovna Rada Presidium of UkrSSR, and was given the rank of "Honored Worker in Science and Technique of Ukraine". The pedagogical activity of Kostyantyn Mykolaiovych was marked by the ranks of Honored Doctor of V.N. Karazin Kharkiv National University and Soros Professor and the "Honored Teacher of Ukraine" decoration.

K.M. Stepanov was the Head of the scientific council "Plasma Physics and Plasma Electronics" of the National Academy of Sciences of Ukraine and, for many years, a member of the Joined Bureau of Councils on Problems of Plasma Physics of the Soviet and Russian Academies of Sciences. K.M. Stepanov was a member of the editorial boards of scientific journals "Plasma Physics Reports", "Problems of Atomic Science and Technology", and "Journal of Kharkiv National University. Ser.: Nuclei, Particles, Fields".

The blessed memory of Kostyantyn Mykolaiovych, the world-wide known researcher, knight of science, excellent person and teacher, will be always present in the hearts of his colleagues and disciples.

*M.O. Azarenkov, V.G. Bar'yakhtar, A.G. Zagorodny,
I.M. Neklyudov, S.V. Peletminsky, M.F. Shul'ga,
O.M. Egorov, I.I. Zalyubovsky, A.A. Rukhadze,
V.P. Silin, V.T. Tolok, I.O. Anisimov,
V.S. Voitsenya, I.E. Garkusha, I.O. Girka,
O.A. Goncharov, D.L. Grekov, A.M. Dovbnya,
V.D. Egorenkov, V.I. Zasenkov, S.V. Kasilov,
V.I. Karas, V.S. Mykhailenko, Ya.I. Kolesnichenko,
V.V. Nemov, I.M. Onyshchenko, K.P. Shamrai,
colleagues, disciples, friends*