# Dmitriĭ Nikolaevich Zubarev (Obituary)

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Professor Dmitriĭ Nikolaevich Zubarev, distinguished scientist of the Russian Federation, Doctor of Physico-mathematical sciences, and a remarkable person died prematurely on July 29, 1992.

D. N. Zubarev's scientific works cover a wide range of problems in modern science—equilibrium and nonequilibrium statistical mechanics, thermodynamics, nonlinear oscillations, plasma theory, and turbulence. In each of these fields he contributed basic, fundamental pioneering works, which have been widely recognized by scientists.

D. N. Zubarev was born on November 27, 1917 in Moscow into the family of an engineer. In 1941 he graduated from the Department of Physics at Moscow State University. On June 25, 1941 he volunteered for duty in the Eighth Division of the People's Militia and participated in the defence of Moscow. At the end of the war Dmitriĭ Nikolaevich was in Berlin with the 47th Army of the First Bellorussian Front. He was awarded the Red Star for participation in mine clearing in Berlin.

After the war worked for several years on important defence problems at the "object," now known as the All-Russian Scientific-Research Institute of Experimental Physics or Arzamas-16. For these works Dmitriĭ Nikolaevich was awarded the Order of the Red Banner of Labor. His association during this period with N. N. Bogolyubov and A. D. Sakharov greatly influenced his scientific career. From 1954 to the end of his life D. N. Zubarev worked at the V. A. Steklov Institute of Mathematics of the Russian Academy of Sciences.

Dmitriĭ Nikolaevich's first works concerned important applied problems in plasma theory. Together with V. N. Klimov he investigated stationary states of a thermonuclear reactor and constructed a theory of the temperature jump at the boundary of the plasma in a magnetic field.

D. N. Zubarev (together with N. N. Bogolyubov) obtained several fundamental results, which determined the course of a number of major scientific fields. In the theory of nonlinear oscillations he developed an asymptotic method for systems with rapidly rotating phase, using this method he investigated the motion of charged particles in a magnetic field. He developed the method of collective variables, which he used to calculate the configurational integrals for a system of charged classical particles, found the wave functions of the lowest state of a system of interacting bosons and their distribution function at zero temperature, and investigated a system of charged fermions. The method of collective variables is now widely used both in our country and abroad. In 1957 D. N. Zubarev participated, under the direction of N. N. Bogolyubuv, in the development of a microscopic theory of superconductivity.

Dmitriĭ Nikolaevich made a significant contribution to the theory of two-time temperature Green's functions, based on which he obtained a number of important results in the theory of superconductivity and magnetism. D. N. Zubarev's paper ("Two-time Green's functions in statistical physics" (Usp. Fiz. Nauk **71**, 71–116 (1960)) is world famous: This paper made Dmitriĭ Nikolaevich twice a "citation classic" according to the American edition of *Current Contents*.

From 1961 to 1965 Dmitriĭ Nikolaevich developed the method of nonequilibrium statistical operator (NSO) method, which is now a classical method in the statistical

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theory of nonequilibrium processes. The NSO method made it possible to incorporate naturally, in the spirit of the fundamental ideas of Gibbs, nonequilibrium phenomena within statistical mechanics. Dmitriĭ Nikolaevich essentially created nonequilibrium statistical thermodynamics—just as universal as equilibrium statistical mechanics. D. N. Zubarev used the NSO method to obtain a number of significant results. He constructed statistical relativistic thermodynamics and hydrodynamics, the statistical theory of transport for systems of particles with internal degrees of freedom, and the statistical thermodynamics of turbulent transport processes.

The NSO method is universally recognized both in our country and abroad. It is used in the theory of paramagnetic resonance, the theory "hot" electrons in semiconductors, the theory of laser systems, the theory of light scattering, etc. The NSO method has also been successfully used for deriving kinetic equations for different physical systems as well as for constructing the hydrodynamics of a superfluid liquid, liquid crystals, etc. D. N. Zubarev gives a marvelous exposition of the NSO method and its numerous applications in his monograph *Nonequilibrium Statistical Thermodynamics* (Nauka, Moscow, 1971). This book is recognized worldwide; it has been translated into English, German, Japanese, and Polish languages.

Dmitriĭ Nikolaevich was not only the originator of a number of scientific fields, but he also founded an important scientific school. Many of his students—both in our country and abroad—have become Candidates and Doctors of Science. Dmitriĭ Nikolaevich made a significant contribution to the training of scientists, and for many years he directed a seminar in the Division of Statistical Mechanics of MIRAN, which attracted theoretical physicists from the entire country. Many physicists, studying problems in statistical mechanics and the theory of solids, considered approval of their scientific work at the "Zubarev's seminar in Steklov" as a criterion of quality of their work. Significantly, well known specialists as well as beginning students could make a report at the seminar, and Dmitriĭ Nikolaevich's criticism was always valid, good natured, and constructive.

Dmitriĭ Nikolaevich devoted much effort to improving education in the field of theoretical physics in our country. At his initiative the books of many foreign authors, including the works of Gibbs and the books of Feynman, de Groot and Mazur, Kubo, Mayer, Fudjita, Goetze, and others were translated, the translations being edited by Dmitriĭ Nikolaevich. Dmitriĭ Nikolaevich played an invariable role as a permanent scientific consultant and author for many very important articles in The Great Soviet Encyclopedia as well as The Physics Encyclopedia, currently being published, where he edited the sections on statistical physics and thermodynamics.

Due to his fundamental knowledge, enormous scientific erudition, extremely high scientific standards, and adherence to principle Dmitriĭ Nikolaevich enjoyed exceedingly high prestige among scientists in this country and abroad. Dmitriĭ Nikolaevich was a member of the editorial staff of *Theoretical and Mathematical Physics*, a member of the International Editorial staffs of the journals *Physica A and Physics Letters A* as well as a member of the expert council of VAK.

Dmitriĭ Nikolaevich had an unusual talent for social intercourse, which attracted people to him. He exhibited the traits of a true Russian intellectual—live interest and openness to anything new in science and in life, honesty and fairness, softness, delicacy, unselfishness and constant readiness to help people, but at the same time he was strict and uncompromising in the search for scientific truth and he unfailingly adhered to strict scientific ethics. The true scope of D. N. Zubarev's personality and his role in the development of science in this country and worldwide has yet to be assessed. For those of us who were closely acquainted with Dmitriĭ Nikolaevich, he will remain in our memory as a fine example of a real scientist and human being.

Translated by M. E. Alferieff