

DOI: 10.1134/S1063778810070227

## Yuriĭ Vladimirovich Gaponov



Professor Yuriĭ Vladimirovich Gaponov, an eminent theoretical physicist, doctor in mathematical and physical sciences, passed away suddenly on December 21, 2009. He was a deputy director in science of the Institute of Molecular Physics at the Russian Research Centre Kurchatov Institute and head of the Laboratory of the Theory of Electromagnetic and Weak Processes.

Yu.V. Gaponov was born on September 3, 1934, in Sverdlovsk. In 1952, Gaponov entered Moscow State University, where he became a student at the Department of Physics, and graduated from it in 1958. Gaponov was a disciple of two outstanding Soviet theoretical physicists, I.S. Shapiro and A.B. Migdal. He learned much from each of them but developed a highly original scientific style peculiar to him.

His first scientific study, which was devoted to analyzing beta–gamma correlations in the beta decay of nuclei, has not lost its significance to the present time.

Gaponov's study in which he calculated the cross section for the neutrino dissociation of the deuteron in the neutral channel, which was discovered eight years later, was of paramount importance for the development of particle physics. Unique experiments aimed at studying neutrino oscillations were performed at the SNO neutrino observatory (Canada) on the basis of this process, which was first considered by Gaponov. Later, the results of those experiments led to solving the problem of a solar-neutrino deficit.

In 1963, Gaponov joined the Kurchatov Institute, where he worked under the supervision of Migdal. There, he took an active part in developing the theory of the nucleus on the basis of the theory of finite Fermi systems. His prediction of a giant Gamow–Teller resonance was a step of fundamental importance in obtaining deeper insight into the nature of collective nuclear states and made it possible to calculate efficiently processes involving neutrino–nucleus interaction and processes accompanying the beta de-

cay of nuclei and to forecast the properties of nuclei characterized by a large neutron excess, including isotopes of superheavy elements. This theory is used in nuclear astrophysics to calculate the synthesis of chemical elements under astrophysical conditions, in reactor physics, and in simulations of pulsed nuclear processes. Gaponov's simultaneous investigation of the so-called analogous and the Gamow–Teller resonance led to the conclusion that broken Wigner  $SU(4)$  symmetry is restored in the region of nuclear excitations. Gaponov put forth a bold hypothesis of the restoration of this symmetry in the ground states of heavy nuclei as well. Experiments confirmed it compellingly, and this made it possible to develop a new precise method for describing the masses of nuclei.

The range of Gaponov's scientific interests was extremely wide. He gave much attention to the development of scientific cooperation, actively collaborating with Joint Institute of Nuclear Research (JINR, Dubna) and other large research centers. He performed important studies in which addressed problems of neutrino physics, nuclear beta decay, double-beta decay, mathematical physics, and isotope physics. His investigations into the application of isotopes in fundamental physics were aimed at searches for phenomena beyond the existing particle theories. In recent years, Gaponov proposed a new approach to the theory of the Majorana neutrino. He was able to show that, within this approach, which relies on the application of Pauli symmetry, a normal hierarchy of neutrino masses is the most probable and to estimate the absolute values of these masses. Concurrently, he derived new constraints on the values of neutrino mixing angles.

The contribution of Gaponov to the development of investigations into the history of the Soviet atomic project was of great value. It was owing to efforts initiated by him that two international scientific conferences, one in Dubna (1996) and one in Vienna (1999), were held and three volumes of their proceedings, containing the recollections of participants of the atomic project, were published. For this activity, Gaponov was awarded an I.V. Kurchatov prize. For many years of his work at the Kurchatov Institute, Gaponov was nominated as Veteran of Atomic Power Engineering and Industry. Also, he was among those who initiated the creation of a regularly held seminar on the history of the atomic project at the Institute for the History of Natural Sciences and Technologies at the Russian Academy of Sciences.

With all creative energy inherent in him, Gaponov took part in social activities. He was one of the organizers of student construction teams and was dec-

orated with a Medal for Development of Virgin and Unused Lands. Gaponov was among those who initiated the Physicist's Day feast at the Department of Physics at Moscow State University and at the Kurchatov Institute. On May 12, 1961, such luminaries of nuclear science as Niels Bohr and Lev Landau took part in the Physicist's Day feast, where the opera *Archimedes* was performed. For many years, Gaponov was head of the Archimedes physicist's creative studio. With great interest, he took part in the creation of the Evening-Course Department of the Moscow Engineering Physics Institute at the Kurchatov Institute of Atomic Energy. A man of versatile talents, Gaponov published, in the journal *Issues of History of Natural Sciences and Technologies*, remarkable recollections that concern his student life at the Department of Physics at Moscow State University and which are full of subtle humor and observations of great interest.

The studies of Gaponov are held in high esteem in Russia and are universally recognized worldwide. Many of his disciples work in leading research centers, taking part in studies along the most important lines of nuclear and particle physics. He was an outstanding teacher; his tactfulness, considerateness, benevolence, and desire to disseminate his knowledge were a source of inspiration for addressing the most difficult problems. Yu.V. Gaponov will live long in his studies and in the memory of his friends and colleagues.

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