Igor' Borisovich Teplov (Obituary)

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Moscow State University and our country's scientific community have suffered a grave loss. On 15 December 1991 Igor'Borisovich Teplov died after a serious illness. He was a prominent scientist, the director of the Scientific Research Institute of Nuclear Physics of Moscow State University, the head of the division of nuclear physics of the physics department, head of a department of the institute, a professor, and a doctor of physical and mathematical sciences. He died at the height of his powers; he was only 63 years old. It is difficult to reconcile oneself to the fact that he is no longer here. He was a close, dear friend and a good and responsive human being.

Teplov was born on 31 May 1928 in Moscow into the family of B. M. Teplov, one of our country's most prominent psychologists and scientists, a member of the Academy of Pedagogical Sciences and a professor at Moscow State University. In the first days of World War II father and son were members of the Moscow State University brigade to extinguish incendiary bombs. In December 1941 the family was evacuated together with the Moscow State University to Ashkhabad and then to Sverdlovsk, where in the winter of 1942–1943 I. B. Teplov worked as the senior assistant to Professor Kalashnikov at the Moscow State University. In May 1943 Teplov's family returned to Moscow. Teplov continued to work in workshops and study at the school for working youth, and then for two years in the Energy Technical School. When he graduated with a gold medal in 1946, he entered the physics department of Moscow State University, and from that time Teplov's life was continuously linked with Moscow University.

After Teplov graduated from the physics department in 1951, he was recommended for graduate work, where his adviser was S. S. Vasil'ev, an experimental physicist and talented science organizer well-known at Moscow State University and in the country. In 1955 Teplov successfully defended his candidate's dissertation.

In his candidate's dissertation and in subsequent publications Teplov studied (d,p) reactions in several light nuclei and measured the angular distributions of groups of protons associated with various states of product nuclei. As a result he obtained information, much of it the first information, on the characteristics of the ground and excited states formed as the result of (d,p) reactions. In the study of these reactions he also stated the problem of verifying the correctness of the description of experimental data by the theory of the stripping process. To study the effect of the Coulomb field of a nucleus on the angular distributions of emitted protons, measurements were made at various deuteron energies (from 1 to 4 MeV). The results which Teplov obtained in 1954–1958 were significant for the verification of theoretical notions of the shell model of the nucleus.

Since the early 1960s Teplov's scientific interests have been associated with the study of the mechanism of reactions

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involving α particles. In these studies Teplov obtained significant experimental material on the (α,p), (α,d), and (α,t) reactions involving the nuclei of the 1p shell in the energy range $E_\alpha \lesssim 25$ MeV. It should be stressed that a study of the characteristics of reactions with α particles required, first of all, implementation of a new means of separating reaction products by mass, which made it possible to identify reliably the final channels of the reaction and to obtain reliable experimental data on the angular distributions and energy dependences of the product particles.

Experimental data were obtained for the first time in the studied energy interval for the (α,d) and (α,t) reactions. The data made it possible to establish the characteristic features of reactions involving α particles on light nuclei (the dependence of the cross sections on the number of transferred nucleons, rules governing the energy dependences, etc.). The plane waves approximation was used to examine the role of very simple direct processes in (α,p) and (α,d) reactions, and conclusions were reached about the role of processes involving the formation of a compound nucleus and very simple direct mechanisms: cluster stripping and substitution caused by the dissociation of target nuclei. These studies were included in Teplov's doctoral dissertation (1971). In studies he conducted in the 60s he showed that in the dissociation of a target nucleus along with substitution yet another mechanism occurs which is associated with the direct transfer of a heavy cluster from this nucleus

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to the incident particle, the so-called heavy stripping mechanism. Teplov was the first to obtain theoretical expressions for the angular dependences of reaction cross sections in the proposal of this mechanism and the plane waves approximation and showed that the mechanism of heavy stripping causes significant inverse cross section maxima not only in elastic scattering, but also in reactions. As a result, the main direction of the scientific career of Teplov in the 70s and 80s was a study of inverse cross section maxima in reactions with α particles. He was the first to obtain systematic experimental data on the behavior of reaction cross sections in the region of large emission angles for product particles for (α,p), (α,d) and (α,t) reactions on nuclei from lithium to cobalt.

For theoretical analysis of the results which Teplov and his students obtained, the vehicle of the generalized method of distorted waves with a finite interaction radius was created for the first time in the USSR. Detailed development of this method was done on the basis of the use of integral equations in the many-body problem. Consistency in the solution of the many-body problem is the basic advantage of this method. As a result, all his assumptions could be evaluated from the point of view of a single microscopic approach, and the mechanism of the reaction could be examined in close relation to the cluster structure of the nuclei. This technique was implemented by creating a set of computer programs which have no analog in the world literature.

The analysis of reactions with α particles on light nuclei conducted with this method has shown that the decisive contribution to the cross section of these reactions is made by relatively simple mechanisms: direct processes associated with the dissociation of incident particles and exchange processes associated with the breakdown of target nuclei. The cross sections of the direct and exchange processes are comparable in value and only as a whole do they describe the experimental angular distributions. The exchange processes quantitatively explain the inverse cross section maxima, as well as the cross sections for transitions to those states of the product nuclei whose formation is forbidden or suppressed by selection rules in direct processes. In other words, the ideas are intuitively understandable, but without the introduction of exchange processes one cannot adequately reconstruct the mechanisms by which reactions with complex particles occur. Teplov and his students obtained reliable quantitative confirmation in their studies.

In recent years Teplov and his students proposed and theoretically justified a new method of determining the characteristics of excited states of nuclei from an analysis of measured functions of angular correlation of product particles-reaction products and γ quanta. Priority establishing results were obtained concerning the exact details of the structure of nuclei which are excited in the reaction.

An important direction in the career of Teplov is the study of practical issues in nuclear physics. Under his direction the institute created a base for work in the area of space materials (science and conducted studies on modeling the effect of cosmic radiation on spacecraft. In 1979 Teplov was awarded the title of Laureate of the State Prize for this research.

Teplov is the author of three monographs and coauthor of over 150 scientific articles published in the Soviet and foreign press.

At Moscow University Teplov spent much time and effort in the preparation of scientific personnel for the development of nuclear physics in our country and in partner-countries abroad. Under his direction ten candidate's dissertations were defended, and two of his students became doctors of science.

Teplov always tried not to limit himself to only scientific work. He was attracted to problems of organization and planning of scientific research. He made a great contribution to the development of a number of new scientific directions at the institute, as well as the creation of a modern base for work in high-energy physics. He was the head of the laboratory, and the director of one of the largest scientific divisions of the institute. In 1969 Teplov became the deputy director of scientific work of the institute, and in September 1982, he became the director of the Scientific Research Institute of Nuclear Physics of Moscow State University, and head of the department of nuclear physics of the physics department of Moscow State University. Over the years as director at the institute, Teplov managed to preserve and develop the atmosphere of active scientific research created at the institute by Academicians D. V. Skobel'tsyn and S. N. Vernov, as well as the intrinsic unity of the fundamental and applied scientific research undergoing development and the problems of improving the preparation of scientific personnel.

Teplov's scientific and organizational activity outside the walls of Moscow State University were multifaceted. He was the chairman of the nuclear physics section of the Scientific and Technical Council of the USSR State Committee on National Education, a member of the bureau of the Scientific Council of the USSR Academy of Sciences, of two specialized councils of the USSR Higher Certification Commission on the Defense of Doctoral Dissertations, and an editor of the journal *Vestnik MGU*. For several years he taught a course he created on the foundations of space and nuclear physics at the Moscow Institute of Electronic Machine Building.

Teplov was awarded the Order of the Red Flag of Labor, and several medals, including the medal "For the Defense of Moscow."

His love for science, the high requirements he placed on himself and his colleagues, his kindness and benevolence to all who worked conscientiously were the main traits which distinguished Teplov. All who knew him experienced joy from their contact with him and this makes the bitterness of this irreplaceable loss all the greater.

Translated by C. Gallant