Personalia

LEV IL'ICH RUSINOV

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ON May 18, 1960 Lev Il'ich Rusinov, the 54-year old great Soviet scientist, and distinguished specialist in the field of nuclear physics, died after a difficult illness.

L. I. Rusinov was born on April 21, 1907 in Minsk. During the civil war the Rusinov family moved to Simferopol'. There Rusinov completed in 1924 the general technical school, and was directed by the district committee of the comsomol to work in the experimental model school of the Krymsotsvos.

Between the years 1926 and 1930 he studied at the Physico-Mechanical Faculty of the Leningrad Polytechnic Institute. After being graduated from the institute, he entered as a graduate student the laboratory of I. V. Kurchatov at the Leningrad Physico-Technical Institute.

Even in the first stages of Rusinov's scientific activity he was distinguished by his uncommon ability, independence, and initiative. His series of works on the production and explanation of the mechanism of self-regulating carborundum resistors, completed under the direction of I. V. Kurchatov, became the basis of his candidate's dissertation which he successfully defended in 1934. As a result of this work the first carborundum arresters for the protection of high-voltage transmission lines were developed and produced in this country. Describing his work at that time, Kurchatov spoke of it highly and expressed his conviction that Rusinov will in the future develop into a physicist of standing.

Towards the end of 1934 work on nuclear physics began to be developed intensively in Kurchatov's laboratory. Rusinov became deeply interested and attracted by this new field of research. He began experiments on the interaction of neutrons with nuclei, since the work conducted by E. Fermi and his co-workers in 1934 indicated that bombardment of various substances by slow neutrons opens wide possibilities for the study of artificial radioactivity. Of the results that were soon obtained, the data on the anomalous radioactivity of bromine turned out to be of particular interest. It was established that the radioactivity of bromine is characterized by three half-lives, in spite of the fact that in the bombardment of bromine (which has two stable isotopes) by neutrons it was natural to expect the appearance of two radioactive isotopes. The work of I. V. Kurchatov, B. V. Kurchatov, L. V. Mysovskii, and L. I. Rusinov on the investigation of the radioactivity of bromine was published in April 1935.

The unusual properties of the radioactive bromine nuclei obtained from ethyl bromide irradiated by neutrons, confronted the investigators with a problem the solution of which led to the discovery of one of the most interesting phenomena of nuclear physics — the isomerism of artificially radioactive nuclei. However, the aforementioned work did not exclude certain possibilities of explaining the observed facts without the use of new concepts. In particular, it was argued that one of the radioactive isotopes of bromine is the result of the (n, 2n) threshold reaction. Subsequently Rusinov showed experimentally that reactions giving rise to the activity of bromine have no energy threshold, and all the three β activities of bromine occur as a result of reactions in which a neutron is captured. In 1936 I. V. Kurchatov finally announced the new phenomenon, the isomerism of artificially radioactive nuclei as observed in radioactive bromine.

At the end of 1936 an assumption was expressed by Weizsäcker that nuclear isomerism is connected with metastable states that appear when the excitation energy of the nucleus is comparatively low, and that the difference in the angular momenta of the ground and excited state is considerable. As a result of this work specific methods were first set up for the use of the study of nuclear isomerism so as to determine structure of nuclei.

Rusinov began systematic and detailed investigations of the emission of isomer nuclei. In 1938 he and his co-worker A. A. Yuzefovich succeeded in showing that the isomer transition in bromine is accompanied by emission of essentially soft electron radiation. They were also able to confirm experimentally I. V. Kurchatov's assumption that the emission of soft electrons in the decay of isomer nuclei is connected with the process of internal conversion.

The theoretical calculations of internal-conversion coefficients published in 1938 showed that transitions of high degree of multipolarity should be mainly realized by emission of conversion electrons. Thus the investigations of the soft radiation of bromine were the first experimental confirmation of the hypothesis that a metastable nuclear state is the basis for the phenomenon of nuclear isomerism.

During those years the study of nuclear isomerism began to develop quickly in many laboratories. The investigation of the conversion radiation opened up wide possibilities for a detailed verification of the theoretical concepts of Bohr, Weizsäcker, Bethe, and Sachs on nuclear isomerism, and for a study of the structure and properties of low-lying excited nuclear states.

In 1941, Rusinov analyzed in detail, in the first survey article "Nuclear Isomerism," the accumulated experimental and theoretical data on nuclear isomerism, along with the discrepancies and difficulties entailed in a comparison of the two. Simultaneously, Rusinov investigated widely the interaction of neutrons and gamma rays with nuclei. In 1936 he investigated the photoeffect and (n, 2n) reactions in beryllium.

In Khar'kov he investigated with A. I. Leĭpunskii the absorption of thermal neutrons in silver, cadmium, and boron at various temperatures. These investigations indicated that the capture of thermal neutrons by some elements does not obey the 1/v law, that the energy of the neutrons passing through hydrogen-containing substances is determined at various temperatures by the interaction with the protons bound in the lattice, and that their velocity distribution at a given temperature is not Maxwellian. Special mention must be made of the 1930 and 1940 experiments of L. I. Rusinov and G. N. Flerov on the fission of uranium; independently and simultaneously with investigators abroad they showed that the number of neutrons emitted in one act of fission is 3 ± 1, and that the light uranium isotope is fissioned by the thermal neutrons, while the capture of neutrons by the heavy isotope leads to the formation of the transuranic elements. This work was of very great significance in the determination of the conditions for the realization of the chain reaction.

During world war II Rusinov worked on defense problems. In 1944 he defended his dissertation for the degree of doctor of physico-mathematical sciences on "The Investigation of Nuclear Isomerism." In 1948 he was awarded the title of Professor of Experimental Physics. In 1946 he worked on a series of problems connected with the establishment of a new branch of industry. The obtained results were highly valued.

After the war he also continued his investigations on nuclear isomerism. In 1947-1949 he completed with A. S. Karamyan a series of investigations aimed at developing new methods of separating nuclear isomers.

Considerable progress in understanding nuclear isomerism was attained in nuclear physics thanks to the development of the shell model, and subsequently also of the unified model of the nucleus. The fundamental laws established for nuclear isomers, such as the existence of "isomer islands" near the critical numbers of nucleons in the nucleus, the large groups of like isomer transitions with high multipolarity, and others were of great significance for concepts of the nuclear shell model.

The experimental verification of the conclusions from the shell model became an important problem. Rusinov and his laboratory staff conducted extensive work in this direction. Investigations of the isomerism of zinc, selenium, niobium, rhodium, and barium showed that in a number of cases the notion of pure single-particle motion in the nucleus turns out to be insufficient, and allowance for nucleon interaction is essential.

Rusinov paid particular attention to the extensive investigation of the probabilities of nuclear gamma transitions, which yield information on extremely fine features of intranuclear motion and details of nuclear structure. Thus, in his work with V. S. Gvozdev on the isomerism of hafnium he first investigated the K-forbidden isomer transition whose probability, as a result of the coupling of the rotation of the nucleus with the motion of the individual nucleons, turns out to be 10^{16} times less than estimated with the single-particle model.

Under his direction investigations were carried out on the nuclear isomerism of bismuth-210, whose metastable alpha-active state has a lifetime of $\sim 10^6$ years. The study of this nucleus was also of special interest because of the possibility it offered to verify and confirm the theoretical calculations of the level characteristics that were made at the Physico-Technical Institute.

Rusinov devoted much effort to the publication of experimental and theoretical work on nuclear isomerism. His concise survey articles and lectures at scientific conferences on nuclear spectroscopy are well known.

He devoted special attention to the development of experimental facilities in Leningrad, initiated the construction of a research reactor of the water-moderated water-cooled type at the Physico-Technical Institute, and began to work energetically in the field of reactor construction. Under his initiative the design of the standard reactor was revised, and a modern reactor with high neutron parameters and wide research capabilities was planned. Directing the planning, construction, the physical experiments, and the start-up of the reactor, he also took a most active and creative part in the investigations and work.

Rusinov devoted much attention and effort to the selection and training of cadres of young scientific workers. The group directed by him solved successfully a whole series of scientific problems connected with the construction of the reactor. As the scientific director of the reactor of the Physico-Technical Institute of the U.S.S.R. Academy of Sciences he worked out an extraordinarily interesting program of physical investigations with the reactor. His work constituted a large creative contribution to the development and construction of water-moderated water-cooled reactors in the Soviet Union.

His fruitful scientific activity was intimately connected with party and public work, distinguished by its high-principled quality, broad interests, and his thoughtful attitude to people.

The Soviet government valued his achievements highly, awarding him orders and medals. The memory of L. I. Rusinov, scientist and communist, indefatigable scientific worker will always be cherished in the hearts of his friends and pupils.

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