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STRUCTURE AND PROPERTIES OF NUCLEAR ISOMERS. ON THE 100TH ANNIVERSARY OF THE DISCOVERY OF NUCLEAR ISOMERISM

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In some nuclei, there are metastable states with "anomaly" long lifetimes, called nuclear isomers [1]. The report mentions the main events of the history of the discovery and research of the phenomenon of nuclear isomerism. The properties of isomeric states with a lifetime of more than 1 second (605 isomers in 548 nuclides) are considered on the base of the ENSDF 2021 file [2].
Studying the isomer properties is an excellent test of the correctness of our ideas about the structure of the nucleus. It is possible to distinguish isomerism by spin (in deformed nuclei –by the spin projection), by the equilibrium form, in particular the intruder states and fission isomers, and by the excitation energy. In the latter case, the transition energy is so small, for example, at ^{235}U or ^{229}Th, that the electromagnetic lifetime becomes large even in the absence of other prohibitions.
Nuclear isomers are energy accumulators, so the search for controlled deexcitation methods would open the way to a new energy source [3]. The discovery of the neutron acceleration in an "isomeric" medium, when thermal neutrons, inelastic scattering on isomers, carry away their energy, proves that such a statement of the question makes sense. The cross-section of such a process at the isomeric state of ^{180m}Hf is $_{in} = 52(13)$ bn [4].
The excitation of isomers in the neutron capture allows us to study the influence of the resonant environment on their lifetime. For example, for the ^{119m2}Sn isomer, an increase in the observed lifetime of 5% was obtained, depending on the increase in the concentration of tin nuclei and the creation of Moessbauer resonance conditions [5]. The continuation of these studies opens up new prospects for the use of this phenomenon in nuclear technologies.

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