INFLUENCE OF THE STRUCTURE OF LIGHT WEAKLY BOUND NUCLEI ON THE BEHAVIOR OF NUCLEAR REACTIONS

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Reactions involving light atomic nuclei have been of particular interest. In light nuclei with a large (small) N/Z ratio, a neutron (proton) surface weakly bound layer responsible for the halo structure was observed. All these features of the structure of light nuclear projectiles affect their participation in nuclear reactions.

The report analyzes the results of experiments on the study of cross sections for fusion and transfer reactions using beams of weakly bound (^{3}He), cluster (^{6}Li, ^{7}Li), and halo (^{6}He, ^{8}B) nuclei by bombarding nuclei of light and heavy elements. In reactions involving weakly bound nuclei, we identified specific behavior peculiarities of the formation cross sections of evaporating recoiling nuclei in fusion reactions and the transfer reaction products at energies close to the Coulomb barrier [1]. In particular, an increase in the cross sections of fusion and transfer reactions with halo nuclei in near-barrier energy regions was observed. The cross sections of neutron or light cluster transfer reactions involving halo and cluster nuclei reached their maximum at the energy close to the Coulomb barrier [2].

The report also analyzes the influence of various channels of nuclear reactions involving these light nuclear projectiles on the population of the ^{44m}Sc (6^{+}), ^{195m}Hg and ^{197m}Hg ($7/2^{-}$), ^{198m}Tl and ^{196m}Tl (7^{+}), ^{196m}Au and ^{198m}Au (12^{-}) isomeric nuclear states. The behavior of excitation functions and high isomeric ratios (σ_m/σ_g) for the products of nuclear reactions proceeding through a compound nucleus and followed by neutron evaporation were explained within compound nucleus models. The reactions accompanied by neutron and proton transfer are as a rule characterized by low isomeric ratios whose behavior depends on the type of direct reactions (stripping versus pick-up reactions) and varies as the energy changes. The reactions involving charged particle emission and cluster transfer result in intermediate values of isomeric ratios.

1. Yu.E.Penionzhkevich // Phys. Atomic Nuclei. 2016. V.79. P.549; Yad. Fiz. 2016. V.79. P.362.
2. N.K.Skobelev // Phys. Atomic Nuclei. 2014. V.**77**. P.1415; Yad. Fiz. 2014. V.77. P.1490.