THE POPULATION OF ISOMERIC STATES IN FUSION AND TRANSFER REACTIONS WITH BEAMS OF WEAKLY BOUND NUCLEI NEAR THE COULOMB BARRIER

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Fusion reactions with stable nuclei at sub-barrier energies are now well studied. In particular, much effort has been devoted to studying nuclear isomers and isomeric cross section ratios (σ_m/σ_g) clarifying the main factors affecting isomeric state feeding [1]. However, studies of isomerism in reactions involving weakly bound nuclei are not sufficient; neither are experimental results for reactions induced by weakly bound nuclei consistent with theoretical descriptions.

The compound nuclei formation is a great theoretical and experimental challenge in case with weakly bound and halo nuclei [2]. Loosely bound nucleons or entire clusters can be captured by the target nuclei in the sub-barrier energy region, like in reactions involving deuterons and the ^{6}Li nuclei [3].

The work aims at further investigation of fusion and transfer reactions of weakly bound nuclei d and ^{3}He and cluster nuclei ^{6}Li and ^{6}He with light and heavy target nuclei, leading to population of high-spin isomeric and ground states in evaporation residues, neutron and cluster transfer to both the target and projectile nuclei.

The conclusions drawn both from the present investigation and the previous studies are as follows. The behavior of excitation functions and isomeric ratios for the products of fusion reactions with neutron evaporation can be explained within the compound nucleus models of nuclear reactions (usually characterized by energy dependence of the isomer ratios). A comparison of experimental cross sections and σ_m/σ_g obtained in various reactions through charged-particle emission shows a great difference in the behavior of excitation functions and isomeric ratios for fusion and direct reactions. Isomeric ratio is usually low in direct transfer reactions. Reactions involving nucleon transfer on incident particles are also for the most part characterized by low isomeric ratios essentially independent of energy. This behavior is mainly related to low-lying excited particle-hole states in the target nucleus.

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