Role of cluster structure of ^{7}Li in the dynamics of fragment capture

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In weakly bound nuclear systems, correlation among nucleons and pairing are manifested, among others, as an emergence of strong clustering and exotic shapes [1]. Lithium isotopes present a unique example of nuclear clustering, with lighter isotopes (^{6,7}Li) having a well-known α + x cluster structure and the heaviest bound isotope (^{11}Li) exhibiting a two neutron Borromean structure. ^{9}Li has been described as ^{6}He + t in a recent work. ^{7}Li is an equally interesting case with its well-known weakly bound α + t structure as well as less studied more strongly bound clusters, ^{6}He + p and ^{5}He + d. Recent studies with weakly bound nuclei have also focused on the understanding of the role of novel structures in the reaction dynamics [2]. Dominant reaction modes in nuclei with low binding energies, involve inelastic excitation to low lying states in the continuum or transfer/capture of one of the cluster fragments from their bound/unbound states to the colliding partner nucleus [3].

We have performed exclusive particle-gamma coincidence measurements in the ^{7}Li +^{198}Pt system to study the dynamics of the process of fragment capture for the various cluster structures (α + t, ^{6}He + p and ^{5}He + d) of ^{7}Li, at energy near the Coulomb barrier. Recent dynamic classical trajectory calculations [3], constrained by the measured fusion, α and t capture cross–sections have been used to explain the excitation energy dependence of the residue cross–sections. Comparison of results from the calculations with the measured data, illustrating the role played by the cluster structures of ^{7}Li in understanding the reaction dynamics will be presented

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