

Competing reaction channels in $^{6,7}\text{Li}$ -induced reactions at below the Coulomb barrier

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Experiments with weakly bound nuclei have demonstrated that breakup significantly affects the reaction outcomes with the observed suppression of fusion ($\sim 30\%$) in reactions of Li and Be generally associated with their low breakup threshold energies [2–6] (1.48 MeV for $^6\text{Li} \rightarrow \alpha + d$, 2.47 MeV for $^7\text{Li} \rightarrow \alpha + t$, and 2.46 MeV for $^9\text{Be} \rightarrow \alpha + ^5\text{He}$, respectively). For ^9Be , measurements of sub-barrier breakup fragments [7] indicated a link between fusion suppression and prompt breakup (prior to reaching the fusion barrier), which reduces the flux of ^9Be projectile nuclei available to participate in fusion.

Understanding of the competing reaction channels requires the study of the inclusive and exclusive cross-sections for particles emitted during interaction. The experimental methods to enable the separation of inclusive and exclusive cross-sections will be described as well as the observable that gives information on the timescales for certain processes, thus enabling a clear characterization of prompt and delayed breakup in the reactions of weakly-bound nuclei [8].

These measurements have given a complete picture of competing reaction channels, at energy below the Coulomb barrier, in the reactions of the weakly-bound stable nuclei $^{6,7}\text{Li}$. Cluster transfer is found to play an important role along side breakup, which is found to be triggered predominantly n-stripping for ^6Li , and p-pickup for ^7Li . The demonstration of competing reaction channels is a key insight for understanding and predicting reactions of weakly-bound nuclei near the limits of nuclear existence.

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