CDCC analysis for breakup of three-body projectiles

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Light neutron rich nuclei near the neutron drip line are constructed as a core nucleus around weakly binding one or two valence neutrons. Breakup reactions involving such nuclei have played key roles in investigating properties between the core and valence neutrons such as the soft-dipole resonance and spectroscopic factor. One of the important observables is the differential cross section into the breakup continuum, $d\sigma/d\epsilon$, which is reflected in wave functions not only of the bound but also of continuum states including resonances. Therefore in order to understand the structure properties from the observables, an accurate analysis for describing the breakup mechanism is highly desirable.

One of the most reliable methods for treating breakup processes in the wide range of incident energies is the continuum-discretized coupled-channels method (CDCC) [1]. CDCC has been proposed at first to solve three-body scattering problems involving a two-body breakup projectile. Recently, we developed CDCC to describe four-body breakup systems, where the projectile breaks up into three constituents. This approach is called four-body CDCC [2]. Furthermore we proposed a new calculation [3] for continuum breakup cross sections of many-body projectiles by using the complex-scaling method [4].

In this work, we analyse elastic and breakup cross sections of $^6$He on various targets, and discuss mechanisms for Coulomb and nuclear breakup processes. Furthermore we report analyses for breakup reactions of various neutron-rich nuclei systematically.

References