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Study of continuum excitation by light weakly bound projectiles on proton target

A study of continuum excitation was performed by using as a tool the breakup of light projectiles on a target in inverse kinematics. In this context a complete study of the ^{6}Li+p and ^{7}Li+p systems was pursued by measuring not only the breakup but also elastic scattering and other reaction channels with significant probability under the same experimental conditions. The relevant experiments were performed at the MAGNEX facility at the INFN-LNS in Catania. Angular distributions were obtained for all reaction products and were considered within the Continuum Discretized Coupled Channel (CDCC) framework. The results of the CDCC calculations were found in a very good agreement with all measured cross sections presenting a strong evidence for the important influence of coupling to breakup on the elastic channel. Since the emphasis of this work was on the continuum excitation, a new algorithm, MULTIP, was invoked and will be presented in detail. MULTIP is a Monte Carlo algorithm which gives the possibility of following up the decay of the particle in two or more constituent particles from the rest frame of the nucleus itself to the laboratory frame. The philosophy of the code, in what concerns the excitation energy of the parent nucleus in its rest frame, lies on the fact that the same continuum level scheme as the one used in the CDCC calculation is also adopted in the simulation. Simulated and experimental energy spectra for the breakup were found in excellent agreement for both ^{6}Li and ^{7}Li on proton, not only validating experimentally the philosophy behind the CDCC approach but gave us the possibility of decoupling the resonant and non-resonant excitations. For both systems under study, the influence of the resonant and non-resonant breakup on the elastic channel was investigated, concluding that the dominant effect on elastic scattering was due to coupling to the sequential breakup via the first 3+ and 7/2- resonances for ^{6}Li and ^{7}Li respectively.

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