Direct and resonant reactions near and beyond the drip-line at low energy

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At Isol facilities such as Spiral at Ganil, Louvain La Neuve, Isac at Triumf, Rex-Isolde at Cern, the ORNL and the gas-stopper-post-accelerator under construction at the NSCL/MSU, typical beam energies of 0.1-10 MeV/n are or will be available. Transfer reactions may have very high cross-sections, up to 1 barn, in this energy domain, due to the good momentum matching of initial and final state in the case of loosely bound particles. We have studied reactions induced by light beams, such as ^{6}He, ^{8}He, and ^{11}Li on hydrogen targets. In this energy domain and for these beams, as well direct transfer, as well as resonant scattering may occur. Transfer reaction channels show a smooth behavior, and absolute cross-sections can be well reproduced by DWBA calculations. The resonant scattering will be illustrated by the ^{6}He(p,n) via the Isobaric Analogue Resonance as measured with the active target MAYA. This case can be considered as a test-case for analyzing the data, because the properties of ^{6}He+n are quite well established, and the resonance corresponding to the ground state of ^{7}He is sharp. Spin attribution by the on-resonance cross-section will be discussed. The ^{8}He(p,n), giving information about the IAS of ^{9}He, was studied in a similar way. The properties of ^{9}He are still subject to active studies, and it is important to get new and independent information. Two resonances at low energy were observed, and their spin, parity, and spectroscopic factors will be discussed. The proton elastic scattering was measured in the same energy domain. The interpretation of these elastic scattering data has some ambiguity, due to the interference between potential and resonance scattering. Different "standard" optical model parameterizations give opposite signs of interference, and over-predict the resonance effects with respect to experience.

Some preliminary results (thesis work of T. Roger) on the ^{11}Li(p,p) reaction in the region of the IAS of ^{12}Li will shown.

The experimental aspects of the study of these reactions with an active target will be discussed in some detail.