Nucleon Transfer Reactions With Exotic Beams at ATLAS

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The availability of exotic beams has widely extended the range of nuclei that can be studied using so-called traditional nuclear physics techniques. At the ATLAS accelerator facility at Argonne National Laboratory, the In-Flight beam production facility [1] makes available a wide variety of beams of light, unstable nuclei with intensities between 10^4 and 10^6 particles per second on target, with emittance and purity that make them directly useful for studying nucleon transfer reactions. Such reactions have in the past been used to address the single-particle properties of states in nuclei throughout throughout the periodic table. These methods are again being applied at many laboratories to test modern "*ab-initio*" theories of nuclear structure for exotic nuclei, to probe shell behavior at the extremes of nuclear stability, and to study reactions that are of interest for nuclear astrophysics.

We will focus on the results of recent studies of the structure of light nuclei populated through single nucleon transfer, primarily with the (d, p) reaction. The selectivity and ease of interpretation of this reaction have made it one of the most heavily used reactions for the determination of quantum numbers, and for probing the wave functions of single-particle states in nuclei. For nuclei with A$\leq$12, the data can be compared with the predictions of modern theoretical methods such as the Quantum Monte Carlo (QMC)approach [2] and the No-Core Shell Model [3]. Recent results from ATLAS have been obtained for the ^{2}H(^{8}Li,p)^{9}Li [4] and ^{2}H(^{6}He,p)^{7}He [5] reactions, using ^{8}Li and ^{6}He beams. The neutron spectroscopic factors obtained from these data are in good agreement with the values obtained from *ab-initio* nuclear structure calculations (see Fig. 1). These results, as well as other examples of single-nucleon transfer reactions will be discussed.

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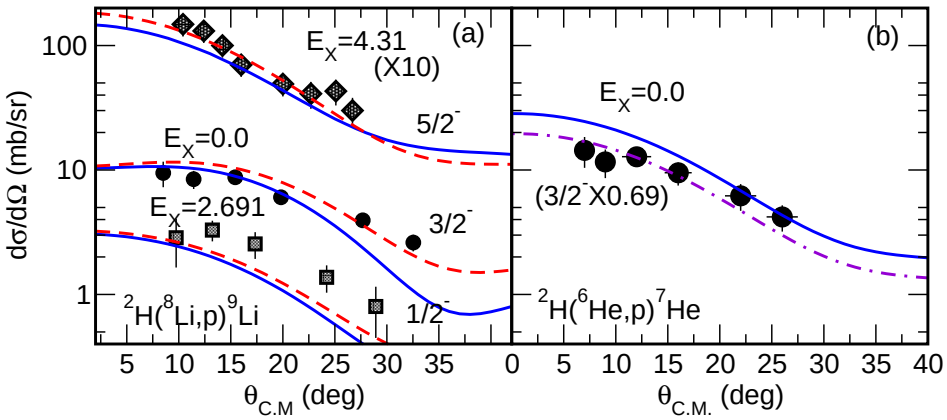

Figure 1: *Angular distribution data for (a)* ^{2}*H(*^{8}*Li,p)*^{9}*Li and (b)* ^{2}*H(*^{6}*He,p)*^{7}*He with QMC predictions.*

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