Medium energy RNB scattering from hydrogen; a tool to study the spectroscopy of exotic nuclei.

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Abstract

Advanced methods of analysis of the scattering of low and medium energy nuclei scattering from hydrogen can now provide predictions of cross sections and spin measurables. The results compare well with observed data when quality nucleon-based models of nuclear structure are used. At low energies, where channel coupling of the scattering system is important, a multichannel algebraic scattering theory described in another paper presented at this conference is relevant. For higher energies, energies at which the compound system is well in its continuum, a g-folding method has proved very successful. Crucially both approaches account for the Pauli principle and the g-folding method utilizes a well-established complex, medium and energy dependent, effective two-nucleon force with which no modifying phenomenological parameter or function is required to define the nonlocal, complex optical potential for elastic scattering. Inelastic scattering data provide additional sensitivities of whatever structure is chosen to describe the nucleus. Analyses using the distorted wave approximation (DWA), with distorted waves generated by the g-folding model optical potentials and with the same effective two-nucleon interaction being the transition operator, also predict results that compare well with data (again when the input structure information is good). The g-folding and DWA methods will be briefly described; applications where predictions have shown the applicability of the methods given, and new results for a set of GANIL data on the scattering from hydrogen of ^{8}He, ^{10,11}C, and of ^{18,20,22}O will be presented and discussed. Time permitting, reaction cross sections from a set of nuclei described by Skyrme-Hartree-Fock wave functions will be presented that show measurable energy and mass trends.