Nuclear Seminar

Spin Phenomena in Elastic Scattering of ^{6}He and ^{8}He off Protons

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The calculation and derivation of microscopic optical potentials for calculating scattering observables for elastic scattering from spin-zero nuclei has a long tradition. So-called microscopic `full-folding' models based on a nuclear density matrix and a fully-off-shell two-nucleon t-matrix have been developed mainly for closed shell nuclei heavier than Oxygen-16. Constructing microscopic optical potentials for the Helium-6 and Helium-8 isotopes poses a two-fold challenge: First, Helium-6 as well as Helium-8 are not closed-shell nuclei. Second, Helium-6 is a loosely bound nucleus consisting of an alpha-core and two valence neutrons. To address the first challenge, the Watson optical potential has been extended to incorporate the open-shell structure of Helium-6 and Helium-8. Both those effects on the differential cross section and the polarization are calculated for a set of energies, including 71 MeV/nucleon. For considering the second challenge, an optical potential based on the Watson first order multiple scattering ansatz is extended to accommodate the internal dynamics of a cluster model for the Helium-6 nucleus. Differential cross sections and analyzing powers are calculated for a set of energies and discussed.