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Nonlocality of Separable Nucleon-Nucleus Potentials for (d,p) Reaction Calculations

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Deuteron induced reactions serve as useful tools for extracting nuclear structure information, as well as for describing astrophysically relevant sites. These (d,p) reactions can be understood using a three-body (proton + neutron + target) Hamiltonian, which contains the nucleon-nucleon interaction as well as an effective nucleon-nucleus potential. Separable potentials simplify these reaction calculations; in particular, separable potentials produced via the Ernst-Shakin-Thaler (EST) scheme have been shown to give good descriptions of scattering observables. However, separable potentials are nonlocal by definition, which has significant effects on deuteron induced reaction calculations. We systematically study the nonlocality of EST separable potentials, and its dependence on parameters in the EST scheme, using separable representations of optical model potentials for several $n + A$ scattering systems including n-^{48}Ca and n-^{208}Pb with several incident neutron energies.

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