Three-body approach to direct nuclear reactions involving weakly bound systems

ANTÓNIO C. FONSECA, Centro de Física Nuclear Universidade de Lisboa, Av Prof. Gama Pinto 2, 1649-003 Lisboa, Portugal — The Faddeev type Alt, Grassberger and Sandhas (AGS) equations for transition operators were, in recent years, consistently applied to study direct nuclear reactions using realistic nucleon-nucleus optical potentials together with modern nucleon-nucleon interactions. The equations are solved numerically using momentum-space partial-wave basis. The Coulomb interaction between charged particles is included using a novel implementation of the screening and renormalization method. The AGS equations have been successfully used to study elastic, transfer, and breakup reactions in three-body-like nuclear systems. Examples are deuteron scattering on stable nuclei $^4\text{He}$, $^{10}\text{Be}$, $^{12}\text{C}$, $^{14}\text{C}$, $^{16}\text{O}$, $^{40}\text{Ca}$, and $^{58}\text{Ni}$ and proton scattering on weakly bound two-body system such as $^{11}\text{Be}$, $^{13}\text{C}$, $^{15}\text{C}$, and $^{17}\text{O}$. These calculations allow to evaluate the accuracy of traditional approximate nuclear reaction approaches like the continuum-discretized coupled-channels (CDCC) method but also to test novel dynamical models such as energy dependent and nonlocal optical potentials.

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