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Effects of an induced three-body force in the incident channel of (d,p) reactions

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A widely accepted practice for treating deuteron breakup in A(d,p)B reactions relies on solving a three-body A+n+p Schrodinger equation with pairwise A-n, A-p and n-p interactions. However, it was shown in [1] that projection of the many-body A+2 wave function into the three-body A+n+p channel results in a complicated three-body operator that cannot be reduced to a sum of pairwise potentials. It contains explicit contributions from terms that include interactions between the neutron and proton via excitation of the target A. Such terms are normally neglected. We estimate the first order contribution of these induced three-body terms and show that applying the adiabatic approximation to solving the A+n+p model results in a simple modification of the two-body nucleon optical potentials. We illustrate the role of these terms for the case of 40Ca(d,p)41Ca transfer reactions at incident deuteron energies of 11.8, 20 and 56 MeV, using several parameterisations of nonlocal optical potentials.

[1] R.C. Johnson and N.K. Timofeyuk, Phys. Rev. C 89, 024605 (2014).

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