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Two-body force in three-body system: a case of (d,p) reactions

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One-neutron transfer reactions A(d,p)B are often described by a three-body n+p+A model due to importance of deuteron breakup. All models used to treat this breakup assume that the two-body n-A and p-A interactions are described by the corresponding local optical potentials taken at half the deuteron energy. The present talk shows that projection of the n+p+A many-body function into the three-body channel leads to the p-A and n-A interactions different to those used in these models. Such interactions are given by complicated non-local energy-dependent optical operators. However, in the particular case of (d,p) reactions, it is possible to make reasonable simplifications of the n-A and p-A optical potentials reducing them to non-local energy-dependent nucleon optical potentials calculated at half the deuteron energy plus an expectation value of the n-p kinetic energy over the range of the n-p interaction. This shifts the nucleon energies used in three-body calculations of (d,p) reactions thus affecting the theoretical (d,p) cross sections and the spectroscopic factors extracted comparison between the theoretical and experimental cross sections of these reactions. A few examples demonstrating this effect in A(d,p)B will be presented.

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