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Can 3N force affect spectroscopic factors extracted from transfer and knockout reactions?

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The direct reaction theory widely used to study single-particle spectroscopic strength in nucleon transfer experiments is based on a Hamiltonian with two-nucleon interactions only. We point out that in reactions where three-body effects are important, for example, such as (d, p) and $(p, 2p)$, an additional three-body force arises due to three-nucleon $(3N)$ interaction between nucleons belonging to different fragments. We develop calculations of this $3N$-induced force for one-nucleon removal reactions thus making an essential step towards bringing together nuclear structure theory, where 3N force is routinely used, and nuclear direct reaction theory, based on two-nucleon interactions only.

We study the effects of the $3N$ force on nucleon transfer in (d, p) and (d, n) reactions on ^{56}Ni, ^{48}Ca, ^{26m}Al and ^{24}O targets at deuteron incident energies between 4 and 40 MeV/nucleon. Deuteron breakup is treated exactly within a continuum discretized coupled-channel approach. We found that an additional three-body force can noticeably alter the angular distributions at forward angles, with consequences for spectroscopic factors' studies. We also present the study of transfer to $2p$ continuum in the ^{25}F$(p, 2p)^{24}$O reaction, involving the same overlap function as in the ^{24}O$(d, n)^{25}$F case, quantifyng the differences in the spectroscopic factors due to additional $3N$-induced force.

Collaboration

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