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Interplay of core excitation and nonlocality in few-cluster reactions

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The dynamics of quantum few- and many-body systems is often modeled with local interaction models, mainly due to simplicity, though more microscopic or fundamental approaches yield nonlocal interactions. For few-cluster nuclear reactions the interactions usually are given in the local form of real binding and complex optical potentials. We made a two-fold extension of that standard dynamics by developing a new nonlocal form of binding and optical potentials and simultaneously including the excitation of the nuclear core. Exact three-body Faddeev-type equations in momentum-space are solved for the description of nucleon transfer reactions (d,p) and (p,d) and deuteron inelastic scattering (d,d'). Example results for 10Be and 24Mg nuclei demonstrate a good reproduction of the experimental data and an improved consistency between the two-body (elastic and inelastic nucleon-nucleus scattering) and three-body description [1,2].

The description is being extended to nucleon knockout reactions with simultaneous excitation of the core into states absent in the initial nucleus, and thereby beyond the reach of the DWIA. Examples are 12C(p,2p)11B reactions leading to high-spin 5/2- or 7/2- states of 11B.

1. A. Deltuva, D. Jurčiukonis, Physics Letters B 840, 137867 (2023).
2. A. Deltuva, D. Jurčiukonis, Phys. Rev. C 107, 064602 (2023).

Collaboration

Primary author: Dr DELTUVA, Arnoldas (Vilnius University)

Co-author: Dr JURČIUKONIS, Darius

Presenter: Dr DELTUVA, Arnoldas (Vilnius University)

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