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Effect of valence-core destruction in the dependence on isospin asymmetry for single-nucleon knockout "quenching" factors

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Single-nucleon knockout reactions at intermediate energies with ^{9}Be and ^{12}C targets have proven of great value to extract spectroscopic information from exotic atomic nuclei. In the early 2000s, a trend was noticed [1] in the so-called "quenching" factors (the ratio between experimental and theoretical cross sections) for these reactions, in which the knockout of the deficient species in an asymmetric nucleus presented significantly more reduction than the knockout of the abundant species. This trend has not been observed in transfer or removal reactions with proton targets (p, pN) [2], as would be expected if it originated in the description of the structure of the nuclei. This prompts a revision of the description of the knockout reactions, to explore how it affects this dependence on the isospin asymmetry of the nuclei.

In this work, we study the interaction of the core (the residual nucleus after the removal of the nucleon) due to its final-state interaction with the knocked-out nucleon after it has been removed from the projectile. This interaction can lead to the core being excited to energies above its breakup threshold, which leads to its destruction and therefore, a reduction in the knockout cross section, which requires the survival of the core. We describe these effects via an eikonal description of the reaction, where the destruction of the core is modelled via an effective density, which is reduced in the nuclear interior, so that deeply-bound nucleons are more affected by core destruction. We find a significant reduction in the isospin-asymmetry dependence of the "quenching" factors [3] when considering the core destruction effect, which points to this reaction mechanism being fundamental for the correct description of the single-nucleon knockout process.

Collaboration

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