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Probing nuclear properties of imbalanced Fermi systems with quasi-free proton knockout reactions

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We have developed a reaction model for quasi-free A(p, pN)B reactions with unstable nuclei. This model makes it possible to connect experimental data from (p, pN) measurements in inverse kinematics at radioactive-beam facilities [1], to the mean-field properties of imbalanced nuclei (spectroscopic factors and single-particle wave functions). The cross sections are calculated in a factorised way, following the approach developed in Refs. [2] and [3]. The general idea is to calculate the hard scattering part as a free pN scattering cross section with a phase-space correction, multiplied by the momentum probability distribution for the struck nucleon.

The effect of soft interactions with the spectator nucleons is accounted for by using a Relativistic Multiple Scattering Glauber Approximation (RMSGA) [3]. A semi-classical approximation accounts for the effect of single-charge exchange [4]. The RMSGA [5] is based on the eikonal approximation and uses free nucleon-nucleon scattering cross sections to calculate the attenuation.

The (p, pN) model has been tested against momentum distributions obtained at the HIMAC accelerator in the National Institute of Radiological Sciences in Chiba, Japan [6].

Short-range correlations (SRC) in imbalanced nuclei are highly interesting manifestations of beyond-mean-field properties. They can be experimentally probed with two-nucleon knockout reactions by selecting the appropriate kinematics. We have developed a reaction model for proton-induced SRC-driven two-nucleon knockout reactions A(p, pNN)B with unstable nuclei. The model is based on the factorization properties that have been confirmed in SRCdriven
A(e, e0NN) reactions [4, 7, 8]. Estimates of the expected cross sections for SRC-driven two-nucleon knockout reactions with unstable nuclei will be presented.

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