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Probing nuclear properties of imbalanced fermi systems with quasi-free proton knock-out reactions

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Quasi-free knockout reactions in inverse kinematics offer great opportunities to probe the mean-field properties of imbalanced nuclei. We have developed a reaction model for quasi-free A(p, pN)B reactions with unstable nuclei. Such a model makes it possible to connect experimental data from (p, pN) measurements in inverse kinematics at radioactive-beam facilities, to the mean-field properties (spectroscopic factors and single-particle wave functions). The cross sections are calculated in a factorised way. To incorporate the effect of the soft initial- and final-state interactions, a Relativistic Multiple Scattering Glauber Approximation (RMSGA) is used. Soft interactions are calculated in an eikonal approximation using the free scattering cross sections. The role of charge-exchange effects is computed in a semi-classical way. The single-particle wave functions for the momentum distributions are from a mean-field shell-model calculation. The results of the model are compared to the momentum distributions for (p, 2p) reactions on 9–16C isotopes at 250 MeV/A, obtained at the HIMAC accelerator in Chiba, Japan. By comparing the theoretical cross sections to these distributions, we can study the evolution of the shell-model parameters as a function of Z/N. The model that is developed can serve to analyse the resulting data from experiments with relativistic radioactive beams conducted at GSI.

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