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Studies of (p,2p) and (p,pn) quasi-free knockout reactions in inverse kinematics

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We hereby address selected experiments at the R3B-LAND setup (at GSI in Darmstadt, Germany), dedicated to investigations of nuclear structure with proton-induced quasi-free scattering reactions in inverse kinematics at relativistic energies. Kinematically complete measurements were undertaken, which allow for analysis of (p,2p) and (p,pn) reactions. Similar technique with an upgraded setup will be used for the future R3B program at FAIR/GSI, for studies of the single-particle structure and the role of N-N correlations in very exotic nuclei.

The QFS signature of the studied reactions has been observed by angular correlations of the knocked out nucleon and the recoiled target proton at large scattering angles. Cross sections for knocking out a proton/neutron from corresponding single-particle states have been measured. In combination with a reaction theory, they provide information on the reduction of spectroscopic strength for relevant states. Momentum distributions of the projectile-like reaction fragments are also reconstructed and compared to model calculations.

The discussion will include a benchmark case of quasi-free knockout reactions on 12C as well as the neutron-deficient 11C, 10C isotopes. Measurements of nucleon knockout to different final bound states, using in-flight gamma-ray spectroscopy, and the possibility of studying deeper lying states with the invariant mass method will be presented. It will be followed by a discussion of an experiment with the Oxygen isotopic chain (14O to 24O), allowing for systematic studies of the spectroscopic strength within a wide range of isospin asymmetry. Six isotopes have been analyzed so far and the preliminary results will be presented. Additionally, we will report on measurements of the proton- and neutron- spectroscopic strengths in the heavier, unstable 57Ni nucleus. The deduced spectroscopic / reduction factors will be compared to the existing data in literature.

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