International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

Quasi-free proton and neutron knock-out from ^{20}O

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Nuclear single-particle models have been very successful in predicting the properties of the atomic nuclei. Nevertheless, it has been observed that the cross sections of nucleon knock-out reactions were smaller than the predictions of the single particle models, as if only a fraction of the nucleon wave function is present in the corresponding shell state [1]. Spectroscopic factors are defined [2] as the ratio of the experimental cross section to the single-particle-model prediction (with a mass-dependent coefficient), and may be used to give a measure of this fraction. The reduction of this ratio from unity is interpreted to be due to the inter-nucleon correlations, and hence provides a unique method of studying single-particle occupancies and their isospin dependence. An intriguing and puzzling problem about the reduction of spectroscopic factors is its dependence on the asymmetry between proton and neutron numbers in a nucleus [3]: the spectroscopic factors of the nucleons of the deficient species, which are more bound in the nucleus, are more quenched.

For a systematic study of this observation, an experiment was performed at the LAND-R3B setup, GSI, Germany. Cocktail beams of radioactive ions with atomic numbers 3 to 10 were produced using the Fragment Separator (FRS) to impinge on a reaction target, surrounded by an array of silicon trackers (SSDs) and a gamma calorimeter (Crystal Ball), as shown in Figure 1. After offline calibration, the kinematic variables of the reaction products were reconstructed using time-of-flight arrays (TFW and DTF) and tracking detectors, including two scintillating fibre detectors (GFIs) and two drift chambers (PDCs).

The ultimate goal of the experiment is to extract the spectroscopic factors of all oxygen isotopes, from ^{14}O to ^{24}O. In this work, the quasi-free knock-out reactions $p(^{20}\mathrm{O}, pp^{19}\mathrm{N})$ and $p(^{20}\mathrm{O}, n^{19}\mathrm{O})p$ are selected. A tracking programme has been employed to reconstruct the mass number and time of flight of the reaction products. These variables are used to calculate the momenta of all reaction products.

In this contribution, we report on the inclusive cross sections of the quasi-free knock-out reactions, and the momentum distributions of the reaction products.

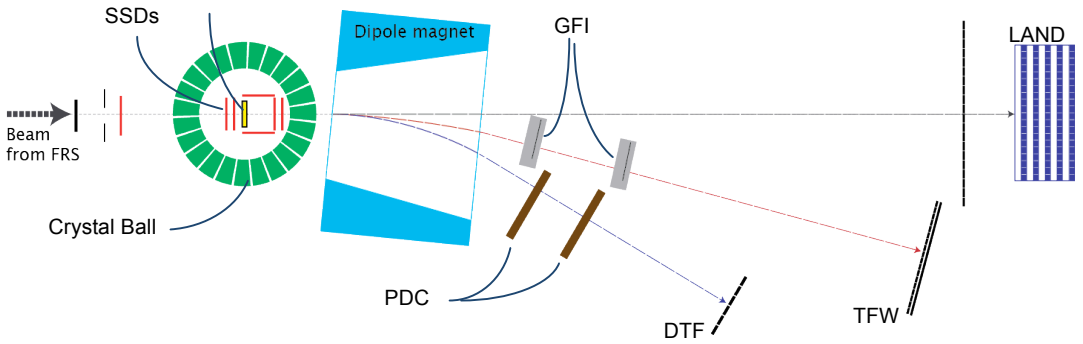

Figure 1: *The experimental setup at GSI, Germany. Ion beams were guided to the setup from left.*

[1] Pandharipande V. R., et. al. Rev. Mod. Phys. 69, 981 (1997);
[2] Brown B. A., et. al. Phys. Rev. C 65, 061601(R) (2002);
[3] Gade A., et. al. Phys. Rev. C 77, 044306 (2008).