Transfer Reactions with Radioactive Ion Beams at HRIBF *

Jolie A. Cizewski
Department of Physics and Astronomy, Rutgers University, New Brunswick, NJ 08903

It is well-known that the order of single-particle orbitals changes as a function of neutron and proton number. In addition, the presence of deformation fragments the single-particle strengths. It is, therefore, critical to study single-particle transfer reactions on nuclei away from the valley of stability to probe the ordering of single-particle energy levels, single-particle spectroscopic factors, and the fragmentation of these strengths as a probe of deformation.

For nuclei away from the valley of stability such transfer reaction studies can only be performed in inverse kinematics, with a beam of the radioactive species hitting a hydrogenic target, for example. Such studies have been successfully performed at the ATLAS facility at Argonne, where a radioactive ^{56}Ni beam impinged on a thin CD_2 target with the mass/charge of energy-degraded beam-like residues selected by the Fragment Mass Analyzer and reaction protons from the (d,p) reaction were detected in a large, annular Si detector array at back angles in the target chamber. [1]

Two experiments have been approved to study transfer reactions in inverse kinematics using beams of ^{56}Ni and ^{92,94}Sr from HRIBF in which the heavy residues would be analyzed with the Recoil Mass Separator and light residues would be detected with position-sensitive Si detectors in the target chamber of the RMS. The present talk would discuss the experimental challenges as well as the prospects for transfer reactions with radioactive ion beams at HRIBF and in the future at RIA.

1. K. E. Rehm et al., Phys. Rev. Lett. **80**, 676 (1998).

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