APR11-2011-000388

Abstract for an Invited Paper
for the APR11 Meeting of
the American Physical Society

Transfer reactions with HELIOS[1]

ALAN H. WUOSMAA, Western Michigan University

Nucleon-transfer reactions have formed the backbone of nuclear- structure studies for several decades, providing a wealth of information about the energies, quantum numbers, and wave functions of single-particle states in nuclei throughout the nuclear chart. Current trends in nuclear-structure physics and the modern emphasis on properties of neutron-rich nuclei far from stability have renewed interest in such transfer reactions with radioactive beams. Here, the usual combination of light beam and heavy target cannot be used, and measurements must be performed in "inverse kinematics," with a heavy, unstable beam incident on a light target. This arrangement introduces several technical difficulties, including the identification of the reaction products and the resolution of the states of interest in the residual nuclei. A new device, HELIOS (the HELIcal Orbit Spectrometer) at the ATLAS facility at Argonne National Laboratory, solves many of the problems encountered with inverse kinematics including particle identification and energy resolution in the center-of-mass frame. The device utilizes the uniform magnetic field of a large, superconducting solenoid to transport light reaction products from the target to a linear array of position-sensitive silicon detectors. The properties of HELIOS will be described, and examples from the initial research program that focuses on neutron transfer with the (d,p) reaction, using both stable and unstable beams with mass A=11 to 136, will be presented.

[1]Work supported by the U. S. Department of Energy, Office of Nuclear Physics under contract numbers DE-FG02-04ER41320 (WMU) and DE-AC02-06CH11357 (ANL).