HAW14-2014-000112

Abstract for an Invited Paper
for the HAW14 Meeting of
the American Physical Society

Beta delayed neutrons for nuclear structure and astrophysics

ROBERT GRZYWACZ, University of Tennessee/ORNL

Beta-delayed neutron emission (βxn) is a significant or even dominant decay channel for the majority of very neutron-rich nuclei, especially for those on the r-process path. The recent theoretical models predicts that it may play more significant role then previously expected for astrophysics and this realization instigated a renewed experimental interest in this topic as a part of a larger scope of research on beta-decay strength distribution. Because studies of the decay strength directly probe relevant physics on the microscopic level, energy-resolved measurements of the beta-decay strength distribution is a better test of nuclear models than traditionally used experimental observables like half-lives and neutron branching ratios. A new detector system called the Versatile Array of Neutron Detectors at Low Energy (VANDLE) was constructed to directly address this issue. In its first experimental campaign at the Holifield Radioactive Ion Beam Facility neutron energy spectra in key regions of the nuclear chart were measured: near the shell closures at 78Ni and 132Sn, and for the deformed nuclei near 100Rb. In several cases, unexpectedly intense and concentrated, resonant-like, high-energy neutron structures were observed. These results were interpreted within shell model framework which clearly indicated that these neutron emission is driven by nuclear structure effects and are due to large Gamow-Teller type transition matrix elements. This research was sponsored in part by the National Nuclear Security Administration under the Stewardship Science Academic Alliances program through DOE Cooperative Agreement No. DE-FG52-08NA28552.