MEASUREMENTS OF BETA-DELAYED NEUTRON EMISSION USING TRAPPED IONS

N.D. Scielzo[1], A. Aprahamian[2], J.A. Clark[3], A. Czeszumska[1,4], S.T. Marley[5], E.B. Norman[1,4], S. Padgett[1], G. Savard[3,6], K.S. Sharma[7], K. Siegl[2], S. Strauss[2], B. Wang[4]
[1]Lawrence Livermore National Laboratory
[2]University of Notre Dame
[3]Argonne National Laboratory
[4]University of California, Berkeley
[5]Louisiana State University
[6]University of Chicago
[7]University of Manitoba

Neutrons emitted following the β decay of neutron-rich isotopes play an important role in many fields of basic and applied science. Studies of these β-delayed neutrons are needed to better understand the structure of exotic nuclei and how the isotopes synthesized in r-process environments decay back to stability to produce the isotopic abundances observed today. In addition, precise studies of fission products provide valuable information for nuclear-energy and stockpile-stewardship applications. Radioactive ions held in an ion trap are an appealing source of activity for improved studies of this β-delayed neutron emission process. When a radioactive ion decays in the trap, the recoil-daughter nucleus and emitted particles emerge from the trap volume with minimal scattering and propagate unobstructed through vacuum. These properties allow, for the first time, the momentum and energy of the emitted neutron to be reconstructed from the nuclear recoil. Measurements of β-delayed neutron emission energy spectra and branching ratios were performed by loading neutron-rich fission-product beams from the CARIBU facility at Argonne National Laboratory into the Beta-decay Paul Trap (BPT), a specially-designed radiofrequency quadrupole ion trap system. This recoil-ion technique will be described and results from recent measurements at CARIBU and future prospects will be discussed.

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