BETA-DELAYED NEUTRON SPECTROSCOPY USING TRAPPED IONS

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The properties of beta-delayed neutron emission are of interest to both the pure and applied nuclear physics communities. For example, branching ratios are needed to determine how the short-lived neutron-rich isotopes synthesized in the astrophysical r process decay back to stability to become the isotopes we observe today. Also, neutron energy spectra and branching ratios are required for the design of nuclear reactors. Reliable measurements of the beta-delayed neutron properties can be performed with unprecedented precision using an ion trap surrounded by radiation detectors. When a radioactive ion decays in the trap, the recoil-daughter nucleus and emitted particles emerge from the ~ 1 mm^3 trap volume with minimal scattering. These properties allow the momentum and energy of the emitted neutron to be precisely reconstructed from the nuclear recoil. Spectroscopy of beta-delayed neutrons can be performed with high efficiency and energy resolutions approaching $\sim 3\%$. Results from a recent proof-of-principle experiment and future plans will be discussed.

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