

PRECISION β -DECAY AND β -DELAYED NEUTRON SPECTROSCOPY USING TRAPPED RADIOACTIVE IONS

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Radioactive ions held in an ion trap are an appealing source of activity for precise studies of nuclear β decay. When a radioactive ion decays in the trap, the recoil-daughter nucleus and emitted particles (β , α , γ , e^- , etc.) emerge from the $\sim 1 \text{ mm}^3$ trap volume and propagate through vacuum without scattering. Information about particles that are difficult or even impossible to detect can be obtained using conservation of momentum/energy from the determination of the nuclear recoil and β particle kinematics. There are (at least) two types of measurements that greatly benefit: measurements of β -decay angular correlations and β -delayed neutron spectroscopy. Measurements of ^8Li β -decay correlations by detecting the β and break-up α particles in coincidence are being performed to place tight constraints on or discover contributions from exotic particles and other phenomena beyond the Standard Model. Beta-delayed neutron spectroscopy for nuclei of interest to r-process nucleosynthesis, nuclear structure, nuclear energy, and stockpile stewardship applications can also be performed with high efficiency and excellent energy resolution by reconstructing the neutron momentum based on the time-of-flight of the recoil ions. At Argonne National Laboratory, a radiofrequency-quadrupole trap, the Beta-decay Paul Trap, has been developed with an open electrode geometry that allows a variety of radiation detectors to surround the cloud of trapped radioactive ions. Results from a recent ^8Li β -decay measurement and a proof-of-principle measurement of the β -delayed neutron spectrum of ^{137}I will be presented.

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Nuclear
Seminar

All interested
persons are
cordially
invited to
attend.