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Beta-delayed neutron spectroscopy using trapped radioactive ions

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Reliable measurements of beta-delayed neutron properties can be performed with precision by confining radioactive ions in an ion trap. When a radioactive ion decays in the trap, the recoil-daughter nucleus and emitted particles emerge from the <1 mm^3 trap volume without scattering and propagate unobstructed through vacuum. 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, energy resolutions approaching 3%, and virtually no background. By loading neutron-rich fission fragment beams from the Californium Rare Isotope Breeder Upgrade (CARIBU) facility at Argonne National Laboratory into a specially-designed radiofrequency quadrupole ion trap system, a program of beta-delayed neutron spectroscopy in this largely unexplored region of the nuclear chart can be performed. This recoil-ion technique will be described and the status of the current campaign and future prospects for the CARIBU experiment will be discussed.

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Primary author: SCIELZO, Nicholas D. (Lawrence Livermore National Laboratory)

Co-authors: PEREZ GALVAN, A.; LEVAND, A.F.; ZABRANSKY, B.J.; LASCAR, D.; NORMAN, E.B.; BUCHINGER, F.; LI, G.; SAVARD, G.; FALLIS, J.; VAN SCHELT, J.; CLARK, J.A.; SHARMA, K.S.; PEDRETTI, M.; STERNBERG, M.G.; BERTONE, P.F.; SEGEL, R.E.; YEE, R.M.; CALDWELL, S.; GULICK, S.

Presenter: SCIELZO, Nicholas D. (Lawrence Livermore National Laboratory)

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