Lifetime measurements in neutron-rich barium and cerium isotopes using the fast-timing technique

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The neutron-rich lanthanides are expected to exhibit octupole collectivity, which can lead to asymmetric nuclear shapes. The study of low-lying negative-parity states in the even-even nuclei in this region is key to understanding the magnitude of collectivity and whether the nucleus adopts a static or dynamic asymmetric shape. Lifetimes of these states are particularly sensitive to electric-dipole (E1) transition strengths, where an enhancement can signify octupole deformation.

The fast-timing technique is used to measure lifetimes of short-lived excited states in nuclei by analysing γ-γ and β-γ coincidences following radioactive decay. Combining lifetime information with gamma-ray branching ratios, reduced transition probabilities are calculated, allowing for the type and magnitude of deformation of nuclei to be inferred. In this work, lifetimes of low-lying states in barium and cerium isotopes with A = 146, 148, and 150 have been measured using the GRIFFIN spectrometer based at the ISAC-I facility at TRIUMF, Vancouver. Primary beams of caesium with A = 146, 148, and 150 were delivered on to a moving tape collector at the centre of the GRIFFIN spectrometer, which consists of an array of 16 HPGe clover detectors, supplemented with an array of 8 $LaBr_3$ scintillator detectors for fast timing, and a zero-degree scintillator for the detection of electrons emitted during β-decay.

This talk will present preliminary results of the lifetime measurements obtained using both the convoluted decay-curve method and the generalised centroid-shift method.