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Octupole collectivity in 220Rn and 224Ra

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The notion that nuclei can assume reflection asymmetric shapes, arising from the octupole degree of freedom, has been supported by a considerable amount of theoretical and experimental evidence for some time. The strongest octupole correlations occur near the proton numbers Z=34, 56 and 88 and the neutron numbers N=34, 56, 88 and 134 where, for the heaviest nuclei, an octupole deformation can occur in the ground state.

Experiments to quantify the deformation in the region where octupole correlations are strongest, have been too difficult to perform until very recently. The only observable that provides unambiguous and direct evidence for enhanced octupole collectivity is the E3 matrix element or more specifically, in the ground state, the B(E3; 0+ ⟶ 3-). Coulomb excitation is the preferred methodology for directly measuring these observables and so far, the B(E3) strength has only been measured in 226Ra, with its comparatively long half life of 1600y. However, with the recent advances in ISOL technology, specifically the post-acceleration of high-intensity radioactive beams, it is now possible to study these nuclei at REX-ISOLDE. Beams of 220Rn (July 2011) and 224Ra (August 2010 and August 2011) have been successfully delivered to MINIBALL at 2.83A.MeV and Coulomb excited on Sn, Cd and Ni targets. The data obtained should now be sufficient to measure the octupole collectivity on these nuclei for the first time.

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