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Octupole Collectivity: Coulomb Excitation of ²²⁴Ra at ISOLDE-CERN

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There is considerable theoretical and experimental evidence that atomic nuclei can assume reflection asymmetric shapes that arise from the octupole degree of freedom. From a microscopic point of view, the wave functions of low-lying 3- octupole excitations must contain components which include the intruding unique parity state (l , j). Because of the nature of the octupole-octupole interaction in nuclei, strong octupole correlations arise when the Fermi level lies between this intruder subshell and a subshell with Δj , Δl =3, giving rise to [l , j ; l -3, j -3] particle-hole configurations at relatively low excitation energies. The strongest 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. Indeed, at these values of Z and N , nuclei exhibit phenomena associated with reflection asymmetry such as odd-even staggering of the positive- and negative-parity yrast bands in even-even nuclei, parity doublets in odd mass nuclei, and enhanced E 1 moments due to a division of the centre of charge and centre of mass. The only observable that provides unambiguous and direct evidence for enhanced octupole correlations in nuclei is the E 3 matrix element, and the measure of octupole correlations in the ground state is the B(E 3; 0+ ⟶ 3-). In the mass region where octupole correlations are expected to be largest, i.e. at Z = 88 and N = 134, there is a lack of spectroscopic data on E 3 moments. So far, only for 226Ra, with its comparatively long half life of 1600 years, has it been possible to measure the B(E 3) strength using Coulomb excitation. This talk will present the current status and the first results from the recent Coulomb excitation the post-accelerated 224Ra beam at REX-ISOLDE facility, CERN, using the MINIBALL setup.

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