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Pear-shaped nuclei measured via Coulomb excitation at REX-ISOLDE

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Pear-shaped nuclei, those having quadrupole-octupole deformation, are predicted to occur in around the octupole magic numbers of 34, 56, 88 and 134. At these numbers of neutrons and protons, the Fermi surface lies close to single-particle orbitals with quantum numbers [l,j] and [l-3,j-3]. This enhances particle-hole interactions in the octupole part of the nucleon-nucleon force and is the driver of octupole collectivity. In the heaviest nuclei (Z~88 and N~134), this interaction is expected to be the strongest leading to the largest octupole deformations. Here, 220Rn and 224Ra were studied in ground-breaking Coulomb excitation experiments at the Radioactive Ion Beam facility, REX-ISOLDE [1]. These experiments provided only the second measurements of E3 matrix elements in the radium isotopes (following 226Ra) and the first such measurement in radon. The results that will be presented in this talk are interpreted in terms of deformation and compared to state-of-the-art mean field calculations. The results are not only significant for nuclear structure, but also on the search for atomic EDMs. The consequence of our results for experiments designed to use octupole-deformed nuclei as a laboratory in their search for EDMs, will also be discussed. Additionally, the next steps in the project showing the first Coulomb-excitation experiments of an odd-mass nucleus in this region and plans for more sensitive measurements at HIE-ISOLDE, will be presented.

[1] L. P. Gaffney, Nature 497, 199 (2013).

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