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Studies of Pear-Shaped Nuclei

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For certain combinations of protons and neutrons it is expected that the shape of atomic nuclei can undergo octupole deformation, which would give rise to reflection asymmetry or a “pear shape”. In this talk I will review the experimental evidence for octupole instability in medium-mass and heavy nuclei, including the results of recent experiments carried out at CERN using REX-ISOLDE [1] and HIE-ISOLDE [2,3,4]. The behaviour of the rotational levels and the E3 matrix elements suggests that only a few radium isotopes have stable pear shapes, although there remain some challenges for theory to reproduce the observed trend of the values of the E1 and E3 transition moments with neutron number. I will also discuss the future prospects for this field.

[1] L.P. Gaffney et al., Nature 497 (2013) 199
[2] P.A. Butler at al., Phys. Rev. Lett. 124 (2020) 042503
[3] P.A. Butler et al., Nat. Comm. 10 (2019) 2473, Nat. Comm. 11 (2020) 3560
[4] P. Spagnoletti et al., Phys. Rev. C 105 (2022) 024323

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