Studies of Heavy Pear-Shaped Nuclei at ISOLDE

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Introduction Rotations of radon nuclei E3 moments in radon, radium Future prospects





Octupole vibrational

Octupole deformed

Radioactive Ion Beams (RIB) at ISOLDE, CERN



Detects γ -rays from excited nuclei

Octupole behaviour of radon nuclei









Rotating pear shapes



 $\Delta \boldsymbol{i}_x(\hbar)$

Transition moments from Coulex with high intensity RIB





 $\langle 0^+ | | \mathcal{M}(E2) | | 2^+ \rangle = \sqrt{5/16\pi} Q_2$

 $\langle 0^+ | | \mathcal{M}(E3) | | 3^- \rangle = \sqrt{7/16\pi} Q_3$

Behaviour of Q_3 with I_i , I_f



 $\langle I_i | | \mathcal{M}(E3) | | I_f \rangle = \sqrt{7/16\pi (2I_i + 1)} (I_i 030 | I_f 0) Q_3$

Calculated nuclear shapes: radon & radium





Octupole enhanced atomic EDM moment



²²³Rn EDM TRIUMF

²²⁵Ra EDM Argonne/FRIB

²²⁵Ra Miniball simulation





Summary

Pear-shaped nuclei exhibit well-defined behaviour of electric-octupole transitions, together with rotational behaviour.

We have identified three cases in nature: ^{222,224,226}Ra.

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