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# Systematics study of octupole bands in rotating even-even nuclei to reveal rigid or soft octupole shape

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The systematic study of octupole bands in rotating even-even nuclei has gained interest in understanding features of the octupole deformation, including octupole rigidity and softness. Furthermore, one could study how nuclear rotation influences this rigidity or softness and how experimental data from gamma-ray spectroscopy aligns with theoretical predictions for octupole deformation. Nuclear with octupole shape resembles the shape of a pear. They show pairs of alternating parity bands, providing evidence of octupole correlation that influences macroscopic and collective features of nuclear matter and fundamental nuclear properties. Rotation is a distinct motion in both classical and quantum mechanics. Assuming a constant moment of inertia, the excitation energy is proportional to the square of the angular momentum operator, and the gamma-ray energies are directly proportional to the angular momentum, I, and inversely proportional to the moment of inertia, J. Moreover, nuclei can show both quadrupole and octupole deformations, a property often seen in heavy nuclei within the A ≈ 240 mass region. The presence of ground-state bands and their associated 3-octupole bands indicates the existence of octupole correlations. At present, researchers often apply the alignments analysis to identify whether a nucleus maintains a rigid octupole shape or displays octupole softness, (octupole vibration). This alignment analysis relies on input dependent parameters like Harris parameters, which introduces limitations in understanding nuclear shapes clearly. To overcome this, a new Coriolis technique is introduced, offering a parameter-free approach to analyze experimental data obtained from the National Nuclear Data Center (NNDC). This analysis represents a technique to study octupole deformations across different isotopes and compare results with existing techniques. Such Coriolis analysis is used to identify whether a nucleus has a rigid octupole shape or a soft octupole shape (vibration).

keywords: Octupole deformation, Gamma-ray, Coriolis technique, Rigid octupole & Soft octupole

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