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Systematics study of ground-state bands in rotating even-even nuclei to reveal triaxial deformation at ground state

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The question of whether atomic nuclei can have triaxial shapes at their ground states is still an ongoing subject of debate. In this study, we systematically analyze the ground-state bands of rotating even-even nuclei to identify the presence of triaxiality across the nuclear chart using experimental data. We apply the newly proposed Coriolis analysis method, which involves plotting $E_\gamma = E(I) - E(I-2)$ as a function of spin I. Of particular interest is the value I_c at which the curve crosses the x-axis. Using this method, we analyzed over 600 deformed even-even rotating nuclei and obtained results for 268 of them. The results show that these nuclei exhibit three distinct shapes: axially symmetric, stable triaxial, and γ-unstable shapes. A comparison of these theoretical and our experimental results, predicted by different models like the FRLDM calculations, shows that several hundred nuclei are affected by triaxiality [1]. A good agreement was found between the theoretical and experimental results, providing further evidence that the proposed approach is reliable. The analysis provides detailed information about the nuclear shapes associated with the nuclear ground-state band, helping determine whether the shape is axially symmetric or triaxial.

Reference

[1] P. Möller, R. Bengtsson, B.G. Carlsson, P. Olivius, and T. Ichikawa. Global calculations of ground-state axial shape asymmetry of nuclei. Phys. Rev. Lett., vol. 97, p. 162502, Oct 2006. URL https://link.aps.org/doi/10.1103/PhysRevLett.97.162502.

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