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Microscopic aspects of γ-softness in atomic nuclei

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How the collective features emerge from the microscopic degrees of freedom is one of the main research themes in quantum many-body systems. Using the microscopic approach of the triaxial projected shell model (TPSM), the authors demonstrate that admixing few quasiparticle excitations into the vacuum configuration with a fixed triaxiality parameter γ provides a quantitative description of the shape fluctuations of the γ-soft nuclei.

This is demonstrated by a detailed study of ^{104}Ru, which reproduces a large set of experimental energies and $BE2$ matrix elements measured by COULEX [1].

The collective features are elucidated using the quadrupole shape invariant analysis, and also the staggering phase classification of the γ-band. A systematic study of twenty-two nuclei has been carried out by means of the TPSM. The experimental energies of the yrast bands and γ bands as well as the pertaining experimental $B(E2)$ values for intra and inter band transitions are very well reproduced. The signatures of triaxiality softness, as the position of the 2_2^+ state relative to the 4_1^+ state, the energy staggering of the γ band, the position of the 0_2^+ state and its E2 decay are discussed.

[1] N. Nazir et al. Phys. Rev. C 107, L021303 (2023)

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