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Shape coexistence and octupole correlation in proton-rich Se isotope

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Abstract

Atomic nuclei are unique quantum-body systems where the spontaneous symmetry breaking phenomena enrich a variety of shapes and structures. In recent years, the nuclei lying in the vicinity of the mid-shell region have attracted considerable attention as it exhibits a class of remarkable phenomena such as shape coexistence, shape evolution, octupole correlations, chirality, etc. The advancements in the detection technology with high resolution detector arrays like Indian National Gamma Array(INGA) [**?**], AGATA etc, have revolutionized the experimental scope of studying nuclear structure on the basis of such exotic phenomena. In the present work, high-spin excited states of ^{72}Se nucleus have been populated using ^{50}Cr(^{28}Si, $\alpha 2p$)^{72}Se fusion evaporation reaction at a beam energy of 90 MeV. The de-exciting -rays were detected using the Indian National Gamma Array (INGA) at IUAC, New Delhi. The well-determined shape coexistence feature of ^{72}Se isotope has been further studied using the R_{DCO}-Polarization method which was conveniently used to determine the M1/E2 character of ΔI = 0, 454.5-keV transition. Additionally, ^{72}Se isotope, having Z = 34, lies in the octupole coupling region of the single particle level orbitals. The first observation of enhanced *E1* transitions, in A $\approx$ 70 mass region, decaying from the levels in the lowest negative parity band to first excited 0_2^+ band has been

reported in this study. The energy separation parameter [ΔE(I)] and frequency ratio between positive and negative parity bands further supports the observation of such reflection asymmetric structure. The experimental observations are also interpreted in terms of total Routhian surface calculations, providing evidence of shape coexistence.

References

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