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Shape Coexistence and Octupole Correlations in 72Se

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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) [1], AGATA etc, have revolutionised the experimental scope of studying nuclear strucuture on the basis of such exotic phenomena. In the present work, high-spin excited states of 72Se nucleus have been populated using 50Cr(28Si, α2p)72Se fusion evaporation reaction at a beam energy of 90 MeV. The de-exciting ɣ-rays were detected using the Indian National Gamma Array (INGA) at IUAC, New Delhi. The well-determined shape coexistence feature of 72Se isotope has been further studied using the RDCO-Polarization method which was conveniently used to determine the M1/E2 character of ΔI = 0, 454.5-keV transition. Additionally, 72Se 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 ≈ 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 cranked Nilsson-Strutinsky model and total Routhian surface calculations, providing evidence of shape coexistence.

REFERENCES
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Primary author: MUKHERJEE, Arunita (Guru Ghasidas Vishwavidyalaya, Bilaspur(C.G), India)

Presenter: MUKHERJEE, Arunita (Guru Ghasidas Vishwavidyalaya, Bilaspur(C.G), India)

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