A CONSISTENT QUADRUPOLE-OCTUPOLE COLLECTIVE APPROACH

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Within this work we will present a consistent approach to quadrupole-octupole collective vibrations coupled with the rotational motion.

A realistic collective Hamiltonian with variable mass-parameter tensor and potential obtained through the macroscopic-microscopic Strutinsky-like method with particle-number-projected BCS approach in full vibrational and rotational, nine-dimensional collective space is diagonalized in the basis of projected harmonic oscillator eigensolutions.

This orthogonal basis of zero-, one-, two- and three-phonon oscillator-like functions in vibrational part, coupled with the corresponding Wigner function is , in addition, symmetrized with respect to the so called symmetrization group (in the presented model it is D_4 group), appropriate to the collective space of the model. This symmetrization procedure is applied in order to provide the uniqueness of the Hamiltonian eigensolutions with respect to the laboratory coordinate system. The symmetrization is obtained using the projection onto the irreducible representation technique.

The model is then applied to generate the quadrupole ground-state spectrum as well as the lowest negative parity spectrum in 156Gd nucleus. The inter-band and intra-band B(E1) and B(E2) reduced transition probabilities are also calculated within those bands and compared with the recent experimental results.