A QUADRUPOLE-OCTUPOLE COLLECTIVE APPROACH

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Within this work we consider the quadrupole-octupole nuclear vibrational collective model coupled with the rotational motion, where the nuclear surface is described by real multipole deformation parameters, as used in many known macroscopic-microscopic mean-field approaches. Such a choice of collective space leads to the D4 point intrinsic symmetrization group (compare with the octahedral group for the quadrupole (β,γ) motion). This symmetry group, which ensures the uniqueness of the collective solutions with respect to the laboratory coordinate system, determines the form of the basis functions in which a realistic collective wave function can be developed. Here, we limit ourselves to the zero- and one-phonon vibrational octupole excitations only while for the quadrupole motion in the ground-state band also two-phonon oscillator states are considered. The rotational basis is constructed from standard Wigner functions of the SO(3) group. The vibrational basis states are projected out from the six-dimensional harmonic oscillator eigenstates with shifted arguments, corresponding to the minimum-energy configurations.

In the following, some preliminary analysis of the collective states obtained through the diagonalization of a realistic quadrupole-octupole-vibrational collective Hamiltonian based on the macroscopic-microscopic potential and calculated within those states electromagnetic transitions in 156Gd are presented and compared with recent experimental measurements.