Yrast Spectra of Odd-A Nuclei from the Full Solution of Quadrupole-Octupole Model

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We develop a nuclear collective model whose Hamiltonian consists of vibrational and rotational parts in the axial quadrupole (β_2) and octupole (β_3) degrees of freedom. Under certain limitations, which especially imply equal (coherent) quadrupole and octupole oscillator frequencies ω_2 and ω_3, analytic solutions for the energies and wave functions could be found. Beyond this coherent limit the full model solution can be obtained by numerical diagonalization of the unrestricted Hamiltonian in the basis provided by the analytic solution.

This formalism was successfully applied to the description of energy levels and transition probabilities in the yrast positive and negative parity bands of several even-even rare earth and actinide nuclei.

In the present work the full model solution is extended to describe yrast spectra (quasi parity-doublet bands) in odd-A nuclei. The model parameters are adjusted to experimental data and lead to a uniquely determined quadrupol-octupole potential and ground state wave function. It will be shown that the model prediction for deformation expectation values are close to experiment. The diagonalization method also allows to obtain solutions for Hamiltonians extended with further terms. This possibility will be discussed.