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A study of the nuclear structure in the even-even Yb isotopes

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The medium-to-heavy mass ytterbium isotopes ($_{70}$Yb) in the rare-earth mass region are known to be well-deformed nuclei, which can be populated to very high spin. Spectroscopic information becomes scarcer as the neutron number increases, impeding the understanding of nuclear structure in this mass region, where interesting phenomena, such as shape coexistence, have been predicted. The lack of any experimental information on the structure of the neutron-rich ^{180}Yb isotope and the lifetime of the 2_1^+ state of ^{178}Yb have greatly motivated this study inlaying the path for near-future experimental endeavors. In this work, energy levels, deformation parameters β_2, reduced transition probabilities $B(E2)$ and transition quadrupole moments Q for even-even Yb isotopes have been calculated using a Phenomenological Model and the Interacting Boson Approximation 1. Additional results are presented using the following theoretical models: the Finite-Range Droplet Model, the Hartree-Fock BCS Model with MSk7 force, the Hartree-Fock-Bogoliubov Model with Gogny D1S force, the Relativistic Hartree Bogoliubov Model with the covariant energy density functional NL3*, the Hartree-Fock-Bogoliubov Model with UNEDF1, the Proxy SU(3) and the Pseudo SU(3) models. Also, numerical results for energy ratios for the Yb isotopes, with the Exactly Separable Davidson (ESD), Exactly Separable Morse, Exactly Separable Woods-Saxon, Deformation Dependent Mass Davidson (DDMD) and Deformation Dependent Mass Kratzer (DDMK) analytical solutions of the Bohr Hamiltonian have been obtained. Along these lines, the results for even-even $^{164-178}$Yb isotopes are compared to available experimental data, serving as benchmarks. An overall good agreement was found between available adopted data and theoretical predictions.

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