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Rotational excitations in rare-earth nuclei: a comparative study within different cranking models

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High-spin rotational bands in rare-earth Er, Tm and Yb isotopes are investigated by (1) the cranked relativistic Hartree-Bogoliubov approach with Lipkin-Nogami method, (2) the cranking covariant density functional theory with pairing correlations treated by a shell-model-like approach or the so called particle-number conserving (PNC) method, and (3) cranked shell model (CSM) with pairing correlations treated by the PNC method. A detailed comparison between these three models in the description of the ground state bands of even-even Er and Yb isotopes is performed. The similarities and differences between these models in the description of the moments of inertia, the band crossings, equilibrium deformations and pairing energies of even-even nuclei under study are discussed. On average, a comparable accuracy of the description of available experimental data is achieved in these models. However, the differences between model predictions become larger above the first band crossings. Because of time-consuming nature of the two CDFT-based models, systematic study of the rotational properties of both ground state and excited state bands in odd-mass Tm nuclei is carried out only by the PNC-SCM. With few exceptions, the rotational properties of experimental 1-quasiparticle and 3-quasiparticle bands in ^{165,167,169,171}Tm are reproduced reasonably well.

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