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"Confined β-Soft (CBS) Insights into Rare-Earth Nuclei"

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Rare-earth isotopes of the nuclear chart, particularly the even-even ones of Dysprosium and Hafnium, provide an excellent platform for understanding some key aspects of nuclear structure, such as nuclear deformation, collective excitations, and shape-phase transitions. These elements exhibit significant collective behavior, and the analytical solution of the confined β-soft (CBS) rotor model, introduced by Pietralla and Dusling, allows for the investigation of nuclei lying between Iachello's X(5) solution for the Bohr-Hamiltonian for axially symmetric prolate ($\gamma \approx 0$) nuclei and the rigid rotor limit. This is achieved by assuming an infinite square-well potential in the quadrupole deformation parameter β and fitting to experimental data with only one structural parameter r_β.

In this study, the primary aim is to computationally reproduce the energies of the ground-band states and the B(E2) transitions, comparing the model's ability to follow the experimental values. Additionally, the β-band level energies are considered, where experimental data are rather limited. Comparison with the experimental data suggests good agreement with the CBS model, confirming the strong collective and rotational behaviour of axially symmetric rare-earth elements. The present results showcase the predictive power of the CBS model which lays the path for further studies of the β-bands in the full series of rare-earth isotopes.

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