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Test for octupole collectivity in light Barium isotopes

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Abstract

The Barium isotope ^{144}Ba and the near isotopes are of continuous increased interest in the nuclear structure study due to the octupole double-magic character of the proton and neutron numbers $Z = 56$ and $N = 88$ suggested by the shell model and associated with the appearance of strong octupole (reflection-asymmetric) correlations in the nucleus. While in ^{144,146}Ba the octupole deformation was experimentally proven to exist even in the ground state [1] the possible evolution of the reflection asymmetry along the isotopic chain remains to be a subject of examination for various experimental and theoretical groups. The present study provides a test of the structure of the yrast alternating-parity bands in the much lighter isotopes $^{118-124}$Ba within a collective quadrupole-octupole rotation model (QORM) [2]. The obtained results show a rather reasonable reproduction of the experimental levels in all considered isotopes corroborating the spectrum structure interpreted by the model as a manifestation of octupole collectivity. The study suggests that the $Z = 56$ “octupole magicity” may still govern the shape dynamics towards the low Barium masses. On the other hand it is clear that in this region different effects related to the intrinsic shell structure and the leading quadrupole deformation may take a competing role which suggests the need for a future complex nuclear structure study.

References

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[2] N. Minkov, P. Yotov, S. Drenska, W. Scheid, *J. Phys. G* **32** (2006) 497.