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Bohr-Mottelson Hamiltonian with octic potential and the shape coexistence phenomenon

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Abstract

The Bohr-Mottelson Hamiltonian [1,2] has been numerically solved for an octic potential in the β variable for both axial and γ-unstable deformations [3,4]. The Bessel functions of the first kind are used as a basis of diagonalization involving the methods developed in Refs. [5–8]. The model, due to the ability of the octic potential to simulate different scenarios of deformations, is suitable to describe ground-state shape phase transitions and critical points, respectively shape coexistence and mixing phenomena. Preliminary applications for the experimental data of the $^{98-106}$Ru and $^{106-116}$Cd isotopic chains [3, 4], respectively of the ^{96}Zr, ^{96}Mo, ^{96}Ru isobars [9] come to support this ability of the model. Moreover, recent results obtained for the ^{52,54}Cr isotopes [10] indicate the possibility of the model to describe anomalous $B(E2)$ transitions in the ground state band.

References

[1] A. Bohr, *Mat. Fys. Medd. Dan. Vid. Selsk.* **26** (1952) 1-40.
[2] A. Bohr and B. R. Mottelson, *Mat. Fys. Medd. Dan. Vid. Selsk.* **27** (1953) 1-174.
[3] P. Buganu and R. Budaca, *Nucl. Phys. A* **1067** (2026) 123311.
[4] R. Budaca, P. Buganu, F. El Ouardi and A. Lahbas, *Phys. Rev. C* (2026) accepted for publication; arXiv:2603.07194v1 [nucl-th].
[5] H. Taşeli and A. Zafer, *Int. J. Quant. Chem.* **63** (1997) 935.
[6] R. Budaca, P. Buganu and A. I. Budaca, *Phys. Lett. B* **776** (2018) 26-31.
[7] R. Budaca, P. Buganu and A. I. Budaca, *Nucl. Phys. A* **990** (2019) 137-148.
[8] R. Budaca, A. I. Budaca and P. Buganu, *J. Phys. G: Nucl. Part. Phys.* **46** (2019) 125102.
[9] R. Budaca, P. Buganu, F. El Ouardi and A. Lahbas, *arXiv:2605.15302 [nucl-th].*
[10] R. Benjedi and P. Buganu, *Phys. Rev. C* (2026) accepted for publication.