# Model Mechanism for Radiative Decay of the 7.8 eV Isomer in $^{229}$Th

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The B(M1) and B(E2) reduced probabilities for radiative decay of the 7.8 eV $K = 3/2^+$ isomer to the $K = 5/2^+$ ground state of $^{229}$Th, known as "nuclear clock decay", are predicted in the framework of the model of coherent quadrupole-octupole (QO) motion connected to reflection-asymmetric deformed shell model with BCS pairing interaction [1]. The prediction is obtained together with a detailed description of the low-lying positive- and negative-parity excited levels and transition probabilities observed in this nucleus. The two states are considered as almost degenerate quasi-particle bandheads with a superposed collective QO vibration-rotation mode giving raise to yrast $K = 5/2^+$ and non-yrast $K = 3/2^+$ quasi parity-doublet structures. The isomer decay is obtained as the result of a Coriolis mixing emerging from a remarkably fine interplay between the coherent QO motion of the core and the single-nucleon motion within a reflection-asymmetric deformed potential. We find that the magnetic dipole transition probability which determines the radiative lifetime of the isomer is considerably smaller than the presently estimated in the literature. The good reproduction of the available intra- and inter-band transition probabilities suggests that the predicted isomer-decay probabilities are obtained within the same (good) accuracy limits. On this basis the proposed new range for the isomer-decay probabilities in $^{229}$Th could serve as a clearly determined accuracy target for further experiments.

## References

[1] N. Minkov and A. Pálffy, *Phys. Rev. Lett.* **118** (2017) 212501; arXiv:1704.07919 [nucl-th] (2017).