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High-K isomer decay rates and the effect of β-deformation changes

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Abstract

The isomerism of high-K states depends on the conservation, or at least partial conservation, of the K quantum number, i.e. the angular momentum projection on the nuclear symmetry axis. Electromagnetic decay is called K-forbidden when the change in K-value, ΔK, exceeds the transition multipole order, λ. If the only decay pathways require transitions with large ΔK or large λ, then isomerism results. Half-lives range from nanoseconds to years.

Attempts to understand quantitatively the resulting isomer half-lives have been frustrated by the several degrees of freedom that govern K-mixing mechanisms, which in turn introduce K-allowed components into the decay transitions, and can lead to much shorter half-lives [1, 2]. Considerations include rotational (Coriolis) K-mixing; vibrational K-mixing; γ-deformation tunnelling; and chance near-degeneracies of states with the same spin and parity, but with different K-values.

Another potentially important variable is the β-deformation. Large changes in β-deformation would be expected to lead to longer, rather than shorter, half-lives. However, such effects on K-isomer decay rates have been little studied. The present work reviews current knowledge of β-deformation changes that influence the de-excitation rates of high-K isomers. New results for ^{174}Re are discussed.

References

[1] F.G. Kondev, G.D. Dracoulis, and T. Kibédi, *At. Data and Nucl. Data Tables* **103-104** (2015) 50-105.

[2] G.D. Dracoulis, P.M. Walker, and F.G. Kondev, *Rep. Prog. Phys.* **79** (2016) 076301.