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Octupole correlations and Collective Couplings in the rare earth nucleus ¹⁵⁴Dy

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Abstract content
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There is currently less information available on the structure of ¹⁵⁴Dy at low spins. The question still remains whether at low spins the structure exhibits permanent octupole deformation [1] or aligned tidal wave octupole phonons [2]. Intermediate spins of the nucleus ¹⁵⁴Dy were populated via the ¹⁵⁵Gd (3He, 4n) ¹⁵⁴Dy reaction at 45 MeV at iThemba LABS using AFRODITE array spectrometer. The even-even nucleus ¹⁵⁴Dy with 6 neutrons and 2 protons outside the closed shell is nearly spherical. The N = 88 isotones have remarkable features; They are at a peak in the |M(E3)| ² transition strength of 0⁺₁ → 3⁻₁ transitions for even-even nuclei as a function of neutron number usually called octupole vibration [34]. This was first stated by Chasman theoretically [1] whereby the first excited states in some nuclei have an octupole deformed first excited state with a quadruple deformation in the ground state and shown experimentally for ¹⁵⁴Gd₈₈ [4]. The strong E3 properties have been described and explained as due to the nearness of &Delta J^{&pi}=3⁻ shell model orbits to the Fermi surface. They also have very strong E0 transitions from the band built on the 0 ⁺₂ states to the ground state bands [3, 5]. The measurements we have made on ¹⁵⁴Dy are motivated by the findings from our studies of the isotones ¹⁵²Gd and ¹⁵⁰Sm from [6] where we observed octupole correlations between the 0 ⁺₂ states and the lowest-lying negative parity band, commonly known as the octupole band.

References

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