

New results concerning the wobbling properties of $^{183,187}\text{Au}$

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1 Introduction

Two wobbling sequences have been identified in ^{183}Au by Nandi et. al. [1]. One sequence has two bands with states of negative parity (built on top of the odd $h_{9/2}$ proton) and two bands with states of positive parity (built on top of the odd $i_{13/2}$ proton). Both sequences are considered to have $n_w = 0$ for the *yrast* band and $n_w = 1$ for the one-phonon wobbling band.

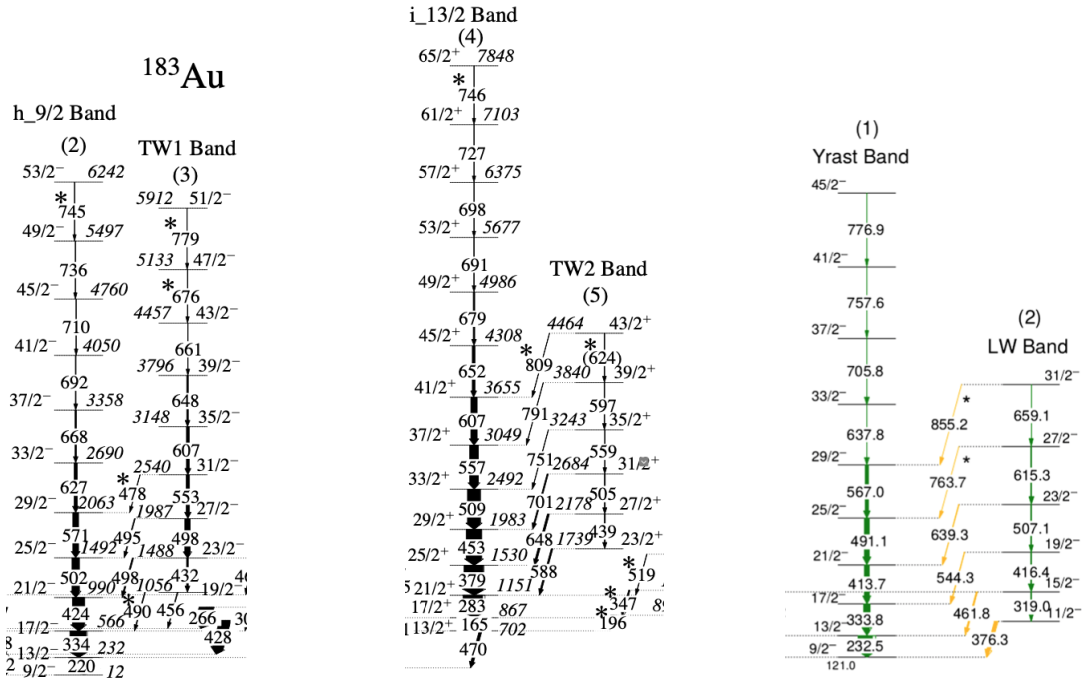


Figure 1: **Left:** ^{183}Au : negative parity states based on $j = 9/2$. **Middle:** ^{183}Au : positive parity states based on $j = 13/2$. **Right:** The wobbling structure in ^{187}Au .

On the other hand, Sensharma et. al. [2] has confirmed wobbling motion in ^{187}Au , with the identification of two such bands, show in figure 1.

2 Numerical application

By using the same formalism as the one applied for ^{163}Lu in [3]. Namely, the both positive and negative wobbling sequences from ^{183}Au were described with the same analytical expressions for the *excitation energies*.

$$E_{\text{exc}}(I) = \varepsilon_j + \mathcal{H}_{\text{min}}(I) + \Omega_1^I (n_{w_1} + 1) + \Omega_2^I (n_{w_2} + 1) , \quad (1)$$

such that $E_{\text{exc}}(I) = \mathcal{F}(I, j; \mathcal{P})$, where $\mathcal{P} = [\mathcal{I}_1, \mathcal{I}_2, \mathcal{I}_3, V, \gamma]$ is the **free parameter set**.

The wobbling frequencies Ω_1 and Ω_2 are the solutions of the algebraic equation:

$$\Omega^4 + B\Omega^2 + C = 0 \quad (2)$$

and

$$\Omega_1 = \sqrt{\frac{1}{2} \left(-B + \sqrt{B^2 - 4C} \right)} \quad (3)$$

$$\Omega_2 = \sqrt{\frac{1}{2} \left(-B - \sqrt{B^2 - 4C} \right)}. \quad (4)$$

3 Coupling schemes

3.1 ^{183}Au - positive parity

The spin states with positive parity are created by the coupling of the even-even rotor \vec{R} with the odd-proton $i_{j=13/2}$. As such, the yrast band emerges from a rotor with even angular momentum $\vec{R} = 0, 2, 4, \dots$, while the first excited wobbling band emerges from the coupling of the same j but with a rotor with odd spin sequence $\vec{R} = 1, 3, 5, \dots$.

References

- [1] S Nandi, G Mukherjee, QB Chen, S Frauendorf, R Banik, Soumik Bhattacharya, Shabir Dar, S Bhattacharyya, C Bhattacharya, S Chatterjee, and et al. First observation of multiple transverse wobbling bands of different kinds in ^{183}Au . *Physical Review Letters*, 125(13):132501, 2020.
- [2] N Sensharma, U Garg, QB Chen, S Frauendorf, DP Burdette, JL Cozzi, KB Howard, S Zhu, MP Carpenter, P Copp, and et al. Longitudinal wobbling motion in ^{187}Au . *Physical review letters*, 124(5):052501, 2020.
- [3] R Poenaru and AA Raduta. Parity partner bands in ^{163}Lu : A novel approach for describing the negative parity states from a triaxial super-deformed band. *International Journal of Modern Physics E*, page 2150033, 2021.