Evidence of transverse wobbling motion in ^{151}Eu

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Transverse wobbling was investigated in the ^{151}Eu nucleus by populating the excited states using ^{148}Nd(^{7}Li, 4n) ^{151}Eu at a beam energy of 30 MeV. Three new interconnecting transitions have been placed between the two negative parity bands. The *M1*/*E2* character of the interconnecting $\Delta I = 1$ transitions between the negative parity bands was extracted from the mixing ratios using the R_{DCO} and linear polarization method. The spin and parity of the states of different bands have also been assigned. The dominant *E2* character of the interlinking transitions between the yrast and first phonon wobbling band and the dominant *M1* character between the yrast band and its signature partner band indicate the presence of transverse wobbling in the ^{151}Eu nucleus. It is further demonstrated that the triaxial projected shell model approach describes the observed experimental properties.

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I. INTRODUCTION

The nonaxial or triaxial nucleus with uneven density distribution along its three principal axes, medium (m), long (l), and short (s) axes, is energetically favored to rotate around the principal axis having the largest moment of inertia (MoI), i.e., $J_m \geqslant J_l \neq J_s$, respectively. The characteristic feature of such a triaxial nucleus is the presence of chiral rotation or wobbling motion. Initially, the wobbling motion of the even-even triaxially deformed nucleus was described by Bohr and Mottelson [1] without the inclusion of the intrinsic angular momentum. In case of the odd A nucleus, wobbling excitations can be induced from the alignment of high-j particles as explained by Hamamoto [2]. Further, Frauendorf and Dönau classified the wobbling motion of the triaxial nuclei into two categories viz. *longitudinal and transverse* wobbling [3]. The change in the pattern of wobbling energy (E_{wobb}) as a function of increasing spin is the primary criterion to distinguish between the two wobbling modes. The wobbling energy decreases (increases) with increasing spin for the transverse (longitudinal) wobbling mode. A triaxial nucleus showcases transverse wobbling motion when the quasiparticle (hole) emerging from the bottom (top) of a deformed shell aligns its angular momentum j with the s axis (l axis), whereas in the case of a longitudinal wobbler, the angular momentum of the odd particle aligns with the axis having the largest moment of inertia, i.e., the medium axis (m) [4].

The first experimental evidence of wobbling motion in the nucleus was observed in the ^{163}Lu isotope [5], which arises from the excitation of the wobbling phonon ($n_{\omega} = 1$) built on the aligned proton $i_{13/2}$ orbital. Following this breakthrough observation, one and (or) two phonon wobbling bands were simultaneously observed in the chain of odd mass Lu isotopes [6–9], ^{167}Ta [10], ^{135}Pr [11,12], ^{133}La [13], ^{127}Xe [14], ^{133}Ba [15], ^{183,187}Au [4,16], and ^{105}Pd [17] nuclei. Apart from these odd mass nuclei, ^{130}Ba [18,19] and ^{136}Nd [20,21] are the only two even-even nuclei in which wobbling motion was

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