Chiral-like doublet band structure and octupole correlations in ^{104}Ag

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The nature of the yrast negative-parity band and its chiral-like partner band in ^{104}Ag is investigated experimentally and theoretically. Lifetimes of states in the negative-parity yrast band and positive-parity band based on the 4424-keV level are measured using Doppler shift attenuation technique. Lifetimes of three more states have been determined along with the upper limit for the lifetime of the highest observed yrast states. Further, lifetimes known from earlier studies are determined with better precision. The level scheme of ^{104}Ag has also been extended with the addition of new enhanced $E1$ transitions linking the positive-parity band based on the 4424-keV levels and the yrast negative-parity and its partner band. $B(E1)$ and/or $B(E1)/B(M1)$ values for the transitions from the positive-parity band to the yrast and its partner band have been determined for the first time; these suggest strong octupole correlation between the positive-parity and the negative-parity bands. Calculations based on the triaxial projected shell model (TPSM) and covariant density functional theory (CDFT) have been performed to unravel the intrinsic structures of the partner band and the excited positive-parity band. TPSM calculations predict that doublet bands have significant angular momentum contributions along the three principle axes, suggesting that bands could have chiral symmetry breaking origin. The CDFT calculations predict a $\pi(g_{9/2})^{-1} \otimes \nu(h_{11/2})(g_{7/2}, d_{5/2})^2$ aligned quasiparticle configuration for the negative-parity doublet bands with deformation parameters $\beta \approx 0.20$ and $\gamma \approx 5^\circ$. The partner band could be interpreted as a chiral vibration mode built on top of the yrast band. The excited positive-parity band is predicted to have aligned four quasiparticle configurations, namely, $\pi(g_{9/2})^{-1} \otimes \nu(h_{11/2})^2 (g_{7/2}, d_{5/2})^1$. Further, these calculations predict significant octupole softness in ^{104}Ag which could be the reason for enhanced $E1$ transitions between the four quasiparticle positive-parity bands and the doublet negative-parity bands.

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I. INTRODUCTION

The structure of nuclei in the $A \approx 100$ region exhibits single-particle and a variety of collective features. The rich band structures observed and the transitions among them render this region an ideal laboratory to test various nuclear structure models and the approximations used therein. Apart from the usual collective rotation of a deformed nucleus, many magnetic rotational (MR) and antimagnetic rotational (AMR) bands have also been reported in nuclei in this region [1–4]. These bands are observed in nuclei near the shell closures having small deformation values. The MR bands are understood as arising from the coupling of neutron and proton angular momenta oriented almost perpendicular to each other

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