Chirality and wobbling in ^{135}Pr

N. Sensharma,[1,2,3] U. Garg,[3] Q. B. Chen,[4] S. Frauendorf,[3] J. Arroyo,[3] A. D. Ayangeakaa,[1,2] D. P. Burdette,[3] M. P. Carpenter,[5] P. Copp,[5] J. L. Cozzi,[3] S. S. Ghugre,[6] D. J. Hartley,[7] K. B. Howard,[3] R. V. F. Janssens,[1,2] F. G. Kondev,[5] T. Lauritsen,[5] J. Li,[5] R. Palit,[8] R. Rathod,[3] D. Seweryniak,[5] S. Weyhmiller,[3] and J. Wu[5]

[1]*Department of Physics and Astronomy, University of North Carolina Chapel Hill, NC 27599, USA*
[2]*Triangle Universities Nuclear Laboratory, Duke University, Durham, NC 27708, USA*
[3]*Physics Department, University of Notre Dame, Notre Dame, IN 46556, USA*
[4]*Department of Physics, East China Normal University, Shanghai 200241, China*
[5]*Physics Division, Argonne National Laboratory, Argonne, IL 60439, USA*
[6]*UGC-DAE Consortium for Scientific Research, Kolkata 700 064, India*
[7]*Department of Physics, United States Naval Academy, Annapolis, MD 21402, USA*
[8]*Department of Nuclear and Atomic Physics, Tata Institute of Fundamental Research, Mumbai 400 005, India*

Chirality and wobbling are the two unique signatures that characterize the rare triaxial shapes in nuclei. While both these modes have been separately established in a few regions of the nuclear chart, the coexistence of chirality and wobbling in a nucleus has never been observed so far. Using a high statistics Gammasphere experiment with the ^{123}Sb(^{16}O,4n)^{135}Pr reaction, the very first observation of co-existing chiral and wobbling modes in ^{135}Pr has been made. In addition to the previously established $n_\omega = 1$ and $n_\omega = 2$ wobbling bands, two chiral-partner bands with the configuration $\pi(1h_{11/2})^1 \otimes \nu(1h_{11/2})^{-2}$ have been observed in this nucleus. Angular distribution analyses of the $\Delta I = 1$ connecting transitions between the two chiral partners have revealed strong quadrupole mixing. Particle Rotor Model calculations have been found to be in good agreement with the experiment.

This work has been supported by the U.S. National Science Foundation [Grant No. PHY-1713857].