EXOTIC NUCLEAR EXCITATIONS:

THE TRANSVERSE WOBBLING MODE IN ^{135}Pr

Abstract

by

James Till Matta

The exotic collective excitation transverse wobbling has been investigated in the nucleus, ^{135}Pr. A pair of zero and one-phonon wobbling bands has been observed. The nature of these wobbling bands was confirmed by the $\Delta I = 1, E2$ nature of the $n_w = 1 \rightarrow n_w = 0$ interband transitions making ^{135}Pr the first nucleus observed to exhibit wobbling behavior other than five nuclei in the $A \sim 160$. Additionally, a possible two-phonon wobbling band has been observed and its nature has been partially confirmed by measuring the $\Delta I = 1, E2$ nature of the $n_w = 2 \rightarrow n_w = 1$ interband transitions. The theory of transverse wobbling was proposed to explain contradictions in the wobbling energy predicted by previous quasiparticle plus triaxial rotor calculations; this theory has been confirmed. In this model, the quasiparticle aligns with an axis perpendicular to the axis with maximal moment of inertia (in contrast to previous theories, which aligned the quasiparticle with the axis with maximum moment of inertia). With this modification the fall in the energy of the wobbling phonon, observed in experiment, is now correctly predicted by theory. This confirmation of theory suggests a reevaluation of the previously discovered wobbling nuclei in the $A \sim 160$ region in the framework of transverse wobbling as well.