

Partial dynamical symmetry and persistent vibrational structure in $^{110-116}\text{Cd}$

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Abstract

The cadmium isotopes ($Z = 48$) since long have been considered as textbook examples of spherical-vibrator nuclei and U(5) dynamical symmetry. On the other hand, detailed studies, using complementary spectroscopic methods, have provided evidence for marked deviations from such a structural paradigm [1, 2]. Two approaches have been proposed to address these unexpected findings. The first questions the spherical-vibrational character of the $^{110,112}\text{Cd}$ isotopes, replacing it with multiple coexistence of states with different deformed shapes in the same nucleus, a view qualitatively supported by a beyond-mean-field calculation with the Gogny D1S energy density functional [3, 4]. A second approach is based on the recognition that the reported deviations from a spherical-vibrator behavior show up in selected states, while most states retain their vibrational character. In the terminology of symmetry, this implies that the symmetry in question is broken only in a subset of states, hence is partial [5]. Such a U(5) partial dynamical symmetry (PDS) approach was applied in Ref. [6] to describe the properties of ^{110}Cd .

In the present contribution, we show that the empirical data in $^{110-116}\text{Cd}$ is consistent with a vibrational interpretation for the majority of low-lying normal states, weakly coupled with a single deformed band of intruder states. The observed deviations from this paradigm are properly treated by an Hamiltonian with U(5) PDS, applied now to a series of isotopes. This work was done in collaboration with J.E. García-Ramos (Huelva) and P. Van Isacker (GANIL).

References

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