

Structural ambiguities in ^{114}Cd

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The stable even-even Cd nuclei are usually considered to be good examples of spherical vibrators close to the U(5) dynamical symmetry [1,2]. $^{114}_{48}\text{Cd}_{66}$ is expected to show maximum collectivity among the Cd isotopes with a strong proton 2p-4h intruder structure. We have studied ^{114}Cd with the (n,n' γ) reaction at the University of Kentucky Van de Graaff Laboratory through excitation function and angular distribution measurements of the γ rays. Lifetimes of the levels have been measured by the Doppler-shift attenuation method. A multiphonon structure in ^{114}Cd [3] has been proposed considering the experimental data, theoretical predictions, and systematic behavior of the collective states in $^{108-120}\text{Cd}$.

Here, we report disturbing discrepancies observed while assigning the multiphonon states in ^{114}Cd . Systematics of 3-phonon levels over Cd isotopes[2,4-7] support the 0_4^+ state at 1859 keV as the member of the 3-phonon multiplet. Surprisingly, no strong E2 transition have been observed from the 0_4^+ state to the 2-phonon states questioning the validity of its 3-phonon origin. The 3_1^+ level at 1865 keV has been assigned as the member of quartet of 3-phonon states, while the 3_2^+ state at 2205 keV could not be explained in the multiphonon scenario. The lifetime of the 3_2^+ state is measured for the first time as $\tau = 910_{-150}^{+210}$ fs. Considerable E2 branching have been observed from this state to the 3-phonon states, but the 4-phonon octet should not exhibit 3^+ member[8]. Theoretical calculations suggest this state as an intruder excitation. A strong E0 transition from this state [9] to the 3_1^+ state indicates a very different configuration from the 3_1^+ 3-phonon state. However, the absence of another 2^+ state in the 1700-1900 keV region, expected for this intruder configuration and presence of a strong E2 transition from the 3_2^+ state to the 2_4^+ state raises a question regarding the 3-phonon origin of the 2_4^+ state and hence the validity of the multiphonon description of ^{114}Cd . A strong M1 transition from the 3_2^+ state to the 2-phonon states, as well as to the intruder states, makes the scenario more ambiguous.

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