

Picosecond Lifetime Measurement of Vibrational, Rotational and Shell-Model in ^{106}Cd

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The low-lying excited states of $A \sim 106-110$, even-even cadmium isotopes are textbook examples of nuclear quasi-vibrational excitations [1]. In addition, within the IBA-1, ^{110}Cd is one of the best examples of $U(5)$ symmetry [2]. However, previous experimental deduction of the $B(E2 : 2_1^+ \rightarrow 0_1^+)$ and $B(E2 : 4_1^+ \rightarrow 2_1^+)$ in ^{106}Cd does not appear to correct for contaminations from energy doublets and the deduced $B(E2)$ values unexpectedly deviate from $B(E2)$ ratios predicted from QRPA calculations [3, 4]. Also, the population of medium-spin excited states from fusion-evaporation reactions indicate that there are other collective structures built upon 2, 4 and 6 quasi-particle configurations above 2.9MeV [5, 6]. This presentation will give details of ‘Recoil Distance Doppler Shift’ experiments, undertaken at Yale University in August 2004 and Universität zu Köln in September 2005 to determine the underlying nature of these excitations in ^{106}Cd . These experiments were performed to populate various excited states in ^{106}Cd , by the $^{98}\text{Mo} + ^{12}\text{C}$ fusion-evaporation reaction. The techniques used for determining picosecond and sub-nanosecond lifetimes in ^{106}Cd and their corresponding $B(E2)$ values, using the Köln and New Yale Plunger Device and the ‘Differential Decay Curve Method’ [7] will be discussed along with specific methods for correcting contamination of doublets and accounting for low recoil velocities and finite target thicknesses [8]. Mean lifetimes and $B(E2)$ values deduced from these experiments will be presented along with relevant theoretical comparisons from Total Routhian Surface and QRPA calculations.

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