E2 Rotational Invariants of 0_1^+ and 2_1^+ for ^{106}Cd: the Emergence of Collective Rotation

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The collective structure of ^{106}Cd is elucidated by multi-step Coulomb excitation of a 3.849 MeV/A beam of ^{106}Cd on a 1.1 mg/cm^2 ^{208}Pb target using GRETINA-CHICO2 at ATLAS which yielded 14 E2 matrix elements. The nucleus ^{106}Cd is a prime example of emergent collectivity that possesses a simple structure: it is free of complexity caused by shape coexistence and has a small but collectively active number of valence nucleons. This work follows in a long and currently active quest to answer the fundamental question of the origin of nuclear collectivity and deformation, notably in the cadmium isotopes. The results are discussed in terms of phenomenological models, the shell model, and Kumar-Cline sums of E2 matrix elements. The $\langle 0_2^+ \| E2 \| 2_1^+ \rangle$ matrix element is determined for the first time, providing a total, converged measure of the electric quadrupole strength, $\langle Q^2 \rangle$, of the first-excited 2_1^+ state relative to the 0_1^+ ground state. Strong evidence for triaxial shapes in weakly collective nuclei is indicated; collective vibrations are excluded.

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