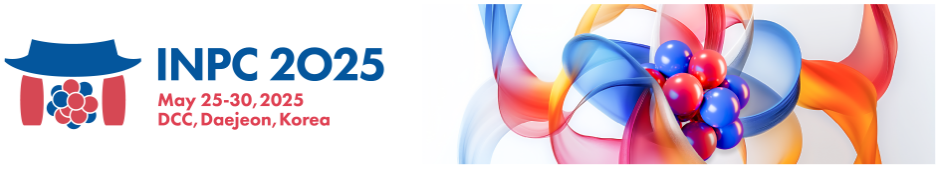

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Probing multiple shape coexistence in Cd isotopes using Coulomb excitation

Monday, 26 May 2025 16:30 (25 minutes)

Mid-shell Cd nuclei were traditionally considered to be the best examples of vibrational nuclei. Recent studies that combined detailed γ-ray spectroscopy with sophisticated beyond-mean-field calculations had suggested [1,2] that the low-lying 0^+ states in ^{110,112}Cd possessed prolate, triaxial, and oblate shapes with rotational-like bands built upon them. If confirmed, this would have major implications on structural interpretations of nuclei in the Z = 50 region, and perhaps beyond. Soon afterwards a similar picture was suggested for ^{106}Cd [3,4].

The low-energy Coulomb-excitation technique represents an ideal tool to study nuclear deformation. It enables a direct determination of electromagnetic transition matrix elements between low-lying excited states including spectroscopic quadrupole moments and signs. Those can be further analysed in terms of quadrupole invariants [5] yielding model-independent information on shape parameters of individual states. This requires, however, extensive sets of high-precision experimental data.

A multi-faceted experimental program to ascertain the deformation of low-energy states in ^{110}Cd has been initiated. We seek to firmly establish the shape of the $0^+_{1,2,3}$ states through the use of the rotation-invariant sum rules for $E2$ transitions. Coulomb-excitation measurements were performed using various reaction partners: ^{14}N and ^{32}S beams with EAGLE at HIL UW (Warsaw, Poland), ^{60}Ni beam with AGATA at LNL (Legnaro, Italy) and ^{110}Cd beam on a ^{208}Pb target with GRETINA at ANL (Argonne , USA). These measurements have been complemented by an experiment performed at TRIUMF-ISAC with the GRIFFIN spectrometer examining the decays of ^{110}Ag/^{110}In that will provide high-precision data on γ-ray branching ratios and transition mixing ratios. First results on quadrupole deformation parameters for the 0^+_1 and 0^+_2 states, demonstrating non-axial character of the ground state in ^{110}Cd, will be presented. These experimental findings will be discussed in the context of: (i) Symmetry-Conserving Configuration-Mixing approach [1,2] and, (ii) new calculations with the general quadrupole collective Bohr Hamiltonian model involving two variants of interactions: SLy4 and UNEDF0.

Future perspectives will be outlined, including a brief overview of Coulomb-excitation studies addressing shape coexistence in the Z ~ 40 –50 mass region within the experimental campaigns at HIL Warsaw and at LNL Legnaro.

References

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