The Continuing Saga of the Cd isotopes; Multiple Shapes or Vibrational Structures?

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It was suggested recently that the even-even Cd isotopes with neutron numbers N=58–72 possess multiple shape coexistence involving deformed structures [1,2,3,4]. At the same time, a partial-dynamical symmetry approach has successfully reconciled the discrepancies of the experimental data on $B(E2)$ values with the multi-phonon vibrational interpretation [5] and argued that it cannot be abandoned [6,7]. In order to distinguish between the interpretations and test the multiple-shape-coexistence hypothesis, a series of Coulomb-excitation experiments with the aim of extracting the shapes through the use of the invariant quantities $\langle Q^2 \rangle$ and $\langle Q^3 \cos 3\delta \rangle$ was performed. Results from the first study performed at the Heavy Ion Laboratory using beams of ^{14}N and ^{32}S [8,9] led to the conclusion that the ^{110}Cd ground state has a triaxial shape [8,10] while the 0_2^+ state has a nearly identical β_2 deformation but its axiality parameter γ remains unknown. Further Coulomb-excitation measurements on ^{110}Cd have been conducted at Legnaro Nuclear Laboratory (LNL) and at Argonne National Laboratory with the aim to determine the shapes of the higher-lying 0^+ states. A campaign of measurements on ^{112}Cd has also been initiated using a ^{12}C beam at the Maier-Leibnitz Laboratory and a ^{60}Ni beam at LNL. In parallel, in order to improve the spectroscopy of the Cd isotopes, a series of β-decay experiments was conducted at the TRIUMF-ISAC radioactive beam facility to study ^{110,112,116,118}Cd. These measurements have resulted in greatly expanded level schemes and identified many additional weak low-energy γ-ray decay branches between highly-excited states. An overview of these studies and their impacts on addressing the conflicting interpretations of the Cd isotopes will be given.

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