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First Evidence of Axial Shape Asymmetry and Shape Coexistence in 74Zn: Suggestion for a Northern Extension of the N=40 Island of Inversion

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Results from recent experiments studying nuclei in the ^{78}Ni region suggest that the $N = 50$ shell closure persists, in agreement with state-of-the-art shell-model calculations. However, how collectivity manifests and evolves in this region of the Segrè chart is still an open question, particularly concerning phenomena such as vibrational modes, axial shape asymmetry (triaxiality) and shape coexistence. This is especially true in the Zn isotopic chain in the neutron-rich region, in which even definitive spin assignments are unavailable except for the very low-lying states.
In this talk, I will present the results of a recent experiment performed at the TRIUMF laboratory (Vancouver, Canada) using the GRIFFIN γ-ray spectrometer. The excited states of ^{74}Zn were investigated via γ-ray spectroscopy following ^{74}Cu β-decay. By exploiting γ-γ angular correlation analysis, the 2_2^+, 3_1^+, 0_2^+ and 2_3^+ states in ^{74}Zn were firmly identified. The γ-ray branching and $E2/M1$ mixing ratios for transitions de-exciting the 2_2^+, 3_1^+ and 2_3^+ states were measured, allowing for the extraction of relative $B(E2)$ values. In particular, the $2_3^+ \rightarrow 0_2^+$ and $2_3^+ \rightarrow 4_1^+$ transitions were observed for the first time. The levels observed were organized into rotational-like bands and the results were compared with large-scale shell-model calculations from which the shapes of individual states were determined. Enhanced triaxiality is suggested to characterize ^{74}Zn in its ground state. Furthermore, an excited $K = 0$ band with a different shape is identified. A shore of the $N = 40$ island of inversion appears to manifest above $Z = 28$, previously thought as its northern limit in the nuclide chart.

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