Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3473** Type: **Invited Speaker / Conférencier(ère) invité(e)**

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

Wednesday, 8 June 2022 10:45 (30 minutes)

Understanding nuclear structure near ^{78}Ni is crucial to infer how chemical elements originate in the Universe. State-of-the-art shell model calculations agree with observations from recent experiments regarding the persistence of the N=50 shell closure in neutron-rich nuclei. 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, triaxiality and shape coexistence. This is especially true in the Zn isotopic chain in the neutron-rich region beyond the valley of stability, 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 gamma-ray spectrometer. The excited states of ^{74}Zn were investigated via gamma-ray spectroscopy following ^{74}Cu beta decay. By exploiting gamma-gamma angular correlation analysis, the 2_2^+, 3_1^+, 0_2^+ and 2_3^+ states in ^{74}Zn were firmly established. The gamma-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 compared with large-scale shell-model calculations from which the shapes of individual states were determined. Enhanced axial shape asymmetry (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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Session Classification: W1-4 Nuclear Structure (DNP) | Structure nucléaire (DPN)

Track Classification: Technical Sessions / Sessions techniques: Nuclear Physics / Physique nucléaire (DNP-DPN)