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Insight on shape coexistence in ^{100}Zr through lifetime measurements at GRIFFIN

The sudden onset of deformation in $A \approx 100$ nuclei at $N = 60$ has been described as a ground-state shape transition that has raised a lot of interest over the years from an experimental and theoretical point of view. This transition is most pronounced in the Zr and Sr isotopic chains where the low-energy excited-state structure shows significant signs of deformation developing at $N = 60$, as opposed to the spherical-like structure observed at $N \leq 58$.

At present, the two most promising theoretical interpretations of this phenomenon are given by the Monte Carlo Shell Model (MCSM) and the Interacting Boson Model with Configuration Mixing (IBM-CM). The MCSM calculations interpret the structure of ^{100}Zr within a multiple-shape-coexistence scenario with several distinct deformed shapes predicted for the lowest 0^+ states, with rotational bands built on top of them. In contrast, the IBM-CM calculations predict a weakly-deformed ''intruder" ground-state configuration in ^{100}Zr, with corresponding β and γ bands, and a low-lying spherical ''normal" configuration.

In order to test these theoretical models an experiment was performed at Canada's national particle accelerator centre TRIUMF to investigate the structure of ^{100}Zr following the β decay of ^{100}Y by utilizing the γ-ray spectrometer GRIFFIN (Gamma Ray Infrastructure For Fundamental Investigations of Nuclei). The 15 hyperpure Ge clover detectors of GRIFFIN were coupled with seven lanthanum bromide detectors for fast-timing lifetime measurements using the Generalized Centroid Difference method.

The lifetimes of several key excited states in ^{100}Zr, extracted for the first time in this study, will be compared to the MCSM and IBM-CM theoretical predictions. Evidence supporting the shape-coexistence scenario in ^{100}Zr will be presented, together with the notable structural similarities between ^{100}Zr and ^{98}Sr.

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