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# Mapping shape co-existence in the rare-earth, N<98 regions.

The shape coexistence effect in the rare earth region has been extensively studied in nuclei such as lead (Pb), mercury (Hg), platinum (Pt), and osmium (Os). In these nuclei, the excited 0+ bands appear at low energy and serve as intruder bands in the shape coexistence model. This phenomenon has also been observed in the lower mass region around Z ≈ 64 and N ≈ 90. However, there remains an unobserved gap in shape coexistence for nuclei within the range of 70 < Z < 78.
Therefore, this research is devoted to extending the conversion-electron studies into the yet-to-be-measured Hf isotopes, and the N<98 region. In particular, 164Hf has been chosen, as relatively little is known about this nucleus from electron capture (EC)-decay where the 0+ states could be measured. There are two measurements this research proposes to study the excited states of 164Hf using the iThemba LAB's facilities. The excited low spins, non-yrast, states of 164Hf are populated through the EC-decay of 164Ta (formed using the 141Pr(28Si,5n) reaction) using the Tape-Station facility. In the other measurements, the higher spins, yrast, states of 164Hf are populated directly through the in-beam (20Ne+148Sm) reaction at the AFRODITE facility. The two measurements complement each other. CERN ROOT code was successfully developed to analyze the data. A new "gamma" band and several transitions have tentatively been observed and added to the level structure of 164Hf. The preliminary results of the angular distribution ratios and polarization to measure the spins and parities are in agreement with previously known states and give confidence for the newly observed state. The half-lives of previously and newly observed gamma-ray transitions are measured and agree with previously measured ones.

## Notes

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