



Contribution ID: 26

Type: Poster

New structure features revealed in isomeric spectroscopy in the $Z \sim 82$, $N \sim 104$ region

Neutron-deficient nuclei around mid-shell at $N \sim 104$ in the lead region provide many examples of shape coexistence and shape isomers. In order to study shape coexistence in this region, prompt and delayed γ -ray spectroscopy of the ^{187}Pb , ^{183}Hg and ^{188}Bi isotopes produced in the reaction $^{50}\text{Cr} + ^{142}\text{Nd} \rightarrow ^{192}\text{Po}^*$ has been performed at the Argonne Gas-Filled Analyzer.

In ^{187}Pb , a new 5.15(15)- μs isomeric state at 308 keV above the spherical $3/2^-$ ground state was identified. A strongly-coupled band is observed on top of this isomer, which is nearly identical to the one built on the prolate $7/2^-$ [514] Nilsson state in the isotone ^{185}Hg . Based on this similarity and on the result of the potential-energy surface calculations, the new isomer in ^{187}Pb was proposed to be prolate with $J^\pi = 7/2^-$ and classified as a shape isomer. The retarded character of the 308-keV $(7/2^-) \rightarrow 3/2^-_{gs}$ transition with a deduced $B(E2) = 5.6(2) \times 10^{-4}$ W.u. can be well explained by the significant difference between the prolate parent and spherical daughter configurations, leading to the shape isomerism.

In ^{183}Hg , the decay of the nearly spherical $13/2^+$ isomeric state was first observed following the α decay of the $13/2^+$ isomer in ^{187}Pb . By the $\alpha - \gamma$ correlation measurement, the half-life of this isomer was measured to be $T_{1/2} = 290(30) \mu\text{s}$. This isomer was proposed to deexcite by retarded $M2$ transition, which can be explained by the notable shape change between the initial and the final states.

Recently, a strong shape staggering was found in the charge radii of $^{187,188,189}\text{Bi}$. To further characterize this phenomenon in ^{188}Bi , its in-beam and decay spectroscopy was studied in the same experiment. A new 0.25(5)- μs isomeric state decaying via a 243-keV transition to the (10^-) ^{188m}Bi was identified.

- [1] P. Möller et al., Phys. Rev. Lett. 103, 212501 (2009)
- [2] W. Q. Zhang et al., submitted to Physics Letters B.
- [3] A. Barzakh et al., Phys. Rev. Lett. 127, 192501 (2021).

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