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Evolution of High-spin Structure in Neutron-rich Au Isotopes near N=126 Shell Closure

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Neutron-rich nuclei around A ≈ 200, near the doubly magic 208Pb, are particularly intriguing due to their transitional nature. Both collective and intrinsic degrees of freedom likely play a critical role in determining their level structure. Furthermore, experimental studies of nuclei near closed shells provide an excellent opportunity to test shell model predictions based on effective nuclear interactions. While substantial structural information is available for Pt (Z=78) and Hg (Z=80) to Pb(Z=82) isotopes [1], this is not the case for the high-spin structure of neutron-rich A~200 for the odd Z case, e.g. Au (Z=79) isotopes. To investigate the evolution of collectivity below the N=126 shell closure, the high-spin structure of odd-even and odd-odd $^{195-202}$Au isotopes has been studied using prompt-delayed γ-ray spectroscopy.
The neutron-rich N~126 nuclei in the southwest region of ^{208}Pb were produced using multi-nucleon transfer reactions between ^{136}Xe beam (7 MeV/u) and ^{198}Pt target at GANIL. The Projectile-Like Fragments (PLFs) were fully identified by VAMOS++ spectrometer [2]. The corresponding Target-Like Fragments (TLFs) (N~126), were selected based on the isotopically identified PLFs and excitation energy of the fragments. The prompt γ rays of the fragments were measured by the state-of-the-art HPGe tracking array, AGATA [3]. Several new methods for characterizing of TLFs have been used. CATLIFE, a ToF spectrometer coupled with EXOGAM HPGe detector array, is utilized to measure the delayed γ rays of TLFs and obtain their mass number before the neutron evaporation [4]. For the analysis of the VAMOS++ data, a new calibration method, based on supervised learning techniques, for the kinetic energy was developed [5]. The new method improved the identification of ion charge state, especially at energies around the Bragg peak region.
In this contribution we will report on our recent results [6] where a dip like structure at N=119, a possible evidence for locally enhanced collectivity near the N=126 shell closure. This is shown from the evolution of the measured low-lying states above the isomers in Au isotopes. These levels in Au reflects the structure inherited from the corresponding states of the neighboring Hg core and is maintained consistently throughout the long isotopic chain.
Other experimental findings will also be presented. One is the disappearance of odd-j mirror band in the level scheme of odd-odd Au isotopes for N$\geq$117. New isomers in ^{199}Au and ^{201}Au have been identified with $T_{1/2}$ = 140(20) μs and 15.2(29) μs, respectively. The observed features are interpreted based on large-scale shell model calculations.

[1] NNDC —National Nuclear Data Center —https : / / www.nndc.bnl.gov.
[2] M. Rejmund et al. Nucl. Instrum. Methods. A646 (2011).
[3] S. Akkoyun et al. Nucl. Instrum. Methods. A668 (2012).
[4] Y. Son et al. Nucl. Instrum. Methods. B540 (2023).
[5] Y. Cho et al. Nucl. Instrum. Methods. B541 (2023)
[6] Y. Cho, Phd thesis Seoul National University (2025)

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