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Exotic decays and octupole collectivity of neutron-deficient Ba region

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The neutron-deficient isotope ^{112}Ba is possibly the heaviest N=Z nucleus, providing a unique opportunity to explore exotic nuclear phenomena. Two particularly interesting aspects in this region are exotic decay modes and octupole deformation.

Super-allowed alpha decay is a type of alpha decay where the emission of an alpha particle is significantly enhanced due to strong proton-neutron interactions, as the valence nucleons occupy identical orbitals on the doubly magic ^{100}Sn core. The alpha-decay chain ^{108}Xe $\longrightarrow$ ^{104}Te $\longrightarrow$ ^{100}Sn was experimentally observed [1], but only an upper limit for the half-life of ^{104}Te was reported. From this, the authors concluded that at least one of ^{104}Te or ^{108}Xe must have an alpha preformation factor greater than 5, indicating the existence of super-allowed alpha decay. This decay chain was remeasured at RIBF as RIBF-168, and the results are yet to be published. It remains an open question whether the ^{112}Ba $\longrightarrow$ ^{108}Xe decay also exhibits a large preformation factor.

Cluster radioactivity has long been a subject of theoretical interest, though experimental evidence, such as ^{12}C emission, remains elusive. Theoretical predictions for the half-life of ^{12}C decay from the ^{112}Ba region vary significantly [2,3], primarily due to uncertainties in model Q-values and other parameters. Some calculations predict half-lives shorter than the experimental lower limit of ^{12}C decay from ^{114}Ba [4], suggesting that current models are not yet reliable. Experimental measurements of Q-values, particle decay energies, and half-lives in this region are crucial for constraining and validating theoretical models predicting such exotic cluster decays.

Moreover, the region around ^{112}Ba (Z=N=56) is particularly interesting due to its predicted octupole collectivity. Nuclei where N or Z = 34, 56, 88, and 134 are considered octupole magic, owing to strong octupole correlations among orbitals at the Fermi surface. Experimental evidence from neutron-rich Ba isotopes at N=88 strongly supports this octupole collectivity, with observed low-energy 3^- states and large B(E3) values. Recent theoretical studies, employing self-consistent mean-field calculations with the Gogny-D1M functional and Interacting Boson Model (IBM) calculations [7], predict that octupole deformation also appears in lighter isotopes, notably ^{112}Ba and ^{114}Ba, where 3^- states are expected to lie below 1 MeV. The same study predicts 3^- states slightly above 1 MeV in ^{110}Xe and ^{112}Xe. Direct experimental confirmation of these states via gamma-ray spectroscopy would be crucial for verifying these theoretical models.

Possible measurements at RIBF of this region will be discussed.

[1] K. Auranen et al., Phys. Rev. Lett. 121 182501 (2018)
[2] Yonghao Gao et al., Sci. Rep. 10, 9119 (2010)
[3] Joshua T. Majekodunmi et al., Phys. Rev. C 105, 044617 (2022)
[4] C. Mazzocchi et al., Phys. Lett. B 532, 29-36 (2002)
[5] B. Bucher et al., Phys. Rev. Lett. 116, 112503 (2016)
[6] B. Bucher et al., Phys. Rev. Lett. 118, 152504 (2017)
[7] K. Nomura et al., Phys. Rev. C 104, 054320 (2021)

Primary author(s) : YOKOYAMA, Rin

Presenter(s) : YOKOYAMA, Rin

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