Onset of high-K isomers and shape evolution in neutron-rich A≈150 nuclei

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The neutron-rich A～150 region contains a wide variety of shape phenomena, including shape coexistence and possible static octupole and hexadecapole deformations. By the systematic studies of neutron-rich A～150 nuclei, onset of shape transition from near spherical to prolate deformation was found in Nd and heavier isotopes at N=90 or 92[1]. Beyond these neutron numbers, nucleus shows a strong quadrupole deformation and the high-K isomers were found [2]. The results indicate increasing quarupole collectivities with neutron numbers, but such studies were so far limited to N ≤ 96 due to the experimental difficulties.

In addition to the quadrupole collectivities, the region near Ba isotopes is a unique testing ground for the octupole collectivities. The nuclei near Z=56 and N=88 are expected to have large octupole collectivities associated with the interaction between orbits with ΔJ=ΔL=3. Observation of enhanced E1 transition rates is one of the indications of such octupole correlation. Experimental studies of Ba isotopes were limited up to ^{148}Ba nucleus [3] and further studies in neutron-rich side will have significant importance to understand the octuple collectivites.

In order to examine quadrupole and octupole collectivites in this region, we have performed isomer and β-γ spectroscopy experiments in the neutron-rich A=150～160 Nd, Ce, Ba nuclei. These studies become possible for the first time using the world's highest intensity RI beams available at RIBF with the high-efficient gamma spectrometer, EURICA[4]. These neutron-rich nuclei were produced using in-flight fission of a 345 MeV/u ^{238}U beam. Fission fragments were separated and transported by the BigRIPS and ZeroDegree spectrometer. Nuclei of interest were identified by measuring the time-of-flight and magnetic rigidity in the second stage of BigRIPS and by measuring the energy loss using the ion chamber at the final focal plane, F11. The secondary beam was implanted into an active stopper, WAS3Abi[5] to perform β-γ spectroscopy. A Cu passive stopper was also used for the isomer spectroscopy.

In the isomer studies, a previously reported K-isomer in ^{156}Nd[2] was confirmed and new high-K isomers in $^{158, 160}$Nd were found. By the systematic studies of ground state rotational band in Nd isotopes through isomer decay, development of quadrupole collectivites was investigated. In the β-γ studies of Cs isotopes, γ rays decaying from the excited levels in ^{150}Ba were newly identified.

The latest experimental studies of neutron-rich Nd and Ba isotopes will be presented.

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