Investigation of octupole correlations of neutron-rich $Z \sim 56$ isotopes through β-γ spectroscopy

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A recent study on the existence of static octupole deformation in Ra isotopes[1)] attracted much attention. The interaction between orbits with $\Delta J = \Delta L = 3$ is responsible for octupole correlations and thus the nuclei with orbits having the properties near the Fermi surface are expected to have large octupole correlations. This corresponds to Z or $N \sim 34$, 56, 88, and 134, and neutron-rich Ba isotopes ($Z = 56$, $N \sim 88$) are also expected to have large octupole correlations. The Ba isotopes have been studied and octupole bands with enhanced E1 transition rates have been discovered[2)]. However, the previous study revealed that the E1 rates do not peak at $N = 88$, $^{148}Ba_{92}$ has large E1 rates comparable to as much as those of $^{144}Ba_{88}$, while $^{146}Ba_{90}$ has much smaller rates. Calculations of octupole correlation have large uncertainty and differ from each other. For example, ref[3)] predicts some β_3 values in $^{150}Ba_{94}$ while ref[4)] argues that the β_3 of ^{150}Ba is almost zero. Experimental investigations of neutron-rich isotopes in which no excited state is known, such as ^{150}Ba, are important to understand the strange systematics of the E1 rates of the Ba isotopes.

We performed β-γ spectroscopy on neutron-rich $Z \sim 56$ isotopes at RIBF. The neutron-rich isotopes were produced using in-flight fission of a 345MeV/nucleon ^{238}U beam. Fission fragments were identified by measuring the time-of-flight and magnetic rigidity in the second stage of BigRIPS and by measuring the energy loss by using the ion chamber at the final focal plane, F11. The secondary beam was implanted into an active stopper WAS3ABi[5)], which consists of five layers of double-sided-silicon-strip detectors. The γ rays from the implanted nuclei were detected using EURICA[6)], which is an array of 12-cluster Ge detectors in which each cluster consists of 7 crystals.

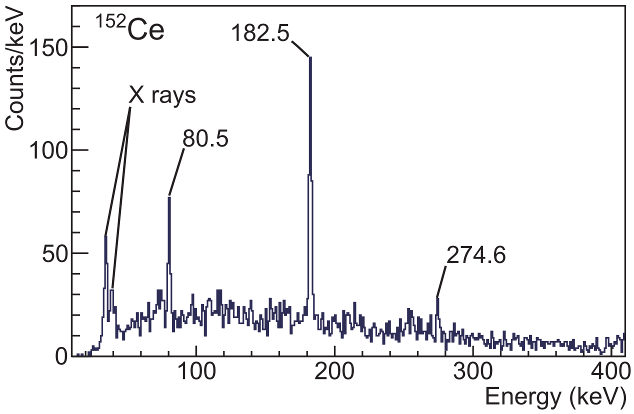

Fig. 1. Preliminary γ-ray energy spectra of the β decay from ^{152}La to ^{152}Ce. The time window is 100 ms from the ion implantation. The low-energy peaks around 34 and 39 keV are K_α and K_β X rays of Ce atoms, respectively, after the emission of conversion electrons.

Figure 1 shows the γ-ray energy and timing spectra of β-decay events after the implantation of ^{152}La. Three known γ rays were confirmed at 80.5, 182.5, and 274.6 keV; these had been reported as E2 decays from the 2^+, 4^+, and 6^+ states of the ground-state band of ^{152}Ce, respectively, by the spontaneous fission of ^{252}Cf in ref[7)]. From this result for ^{152}Ce, the feasibility of the measurement and analysis has been confirmed. Analysis of Ba isotopes is in progress, and the results may help us understand the octupole correlations of nuclei.

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