Decay spectroscopy of neutron-rich Z ≈ 60 isotopes

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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. After the systematic studies of the excited levels of these isotopes, it was found that the nuclei beyond N = 90 or 92 in this region show characteristics of strong quadrupole deformation, such as low-energy 2^+ levels and the energy ratio of 4^+ to 2^+ levels of nearly 3.3. In addition, K isomers were systematically observed,[1] which indicates stable axial-symmetric deformation because K is a good quantum number in such nuclei and large ΔK transitions are strongly hindered.

In our studies of neutron-rich Nd isotopes through isomer spectroscopy using the EURICA spectrometer,[2] K isomers were systematically observed up to N = 100.[3] Gamma rays decaying from the isomer and those of ground-state rotational bands in low-lying levels were observed. The trend of decreasing $4^+ \rightarrow 2^+$ transition energy with increasing neutron number may indicate the development of quadrupole deformation in neutron-rich Nd isotopes.

Such development of deformation will reflect in the configuration of the ground state, and therefore, the spin and parity of neighboring odd and odd-odd nuclei will be useful for understanding the deformed structure. This can be investigated through β-γ spectroscopy.

In order to study the β decay of neutron-rich Pr isotopes, which are parent nuclei of the Nd isotope, β-γ spectroscopic measurement was performed at RIBF. The in-flight fission of ^{238}U at 345 MeV/u was employed to produce neutron-rich Pr isotopes and their neighbors. Nuclei of interest were selected and transported to the final focal plane, F11, using the BigRIPS fragment separator. These isotopes were stopped at the active stopper, WAS3ABi,[4] and β-γ spectroscopy of these isotopes was performed using the EURICA setup at F11.

Figure 1 shows a γ-ray energy spectrum after the β decay of ^{156}Pr. Gamma peaks at 67 and 155 keV are clearly identified in the spectrum, and they correspond to the previously reported $2^+ \rightarrow 0^+$ and $4^+ \rightarrow 2^+$ transitions of ^{156}Nd,[1] respectively. Based on the obtained results, we will assign the spin and parity of the parent nucleus, ^{156}Pr. In addition, γ transitions associated with the non-yrast levels of ^{156}Nd will be also investigated.

These data are currently being analyzed.

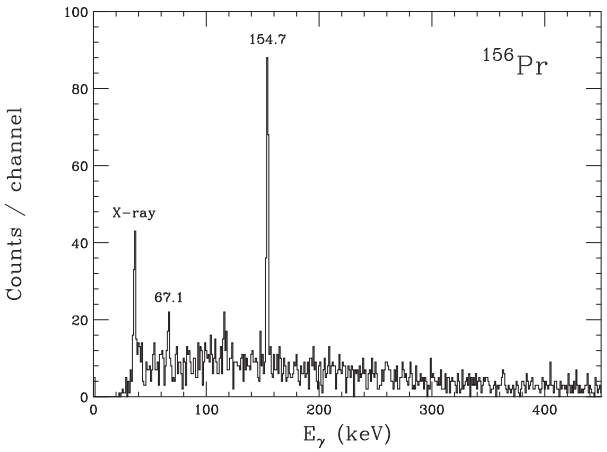

Fig. 1. Gamma-ray energy spectrum after β decay of ^{156}Pr.

References

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