I. 2. Study of High-Spin Structure in ^{151}Er

Fukuchi T.[1], Gono Y.[2], Odahara A.[1], Shinozuka T.[3], Suzuki T.[3], Ukai M.[3], Koike T.[4], Shirotori K.[4], and Ma Y.[4]

[1]Department of Physics, Osaka University
[2]RIKEN
[3]Cyclotron and Radioisotope Center, Tohoku University
[4]Department of Physics, Tohoku University

High-spin isomers were reported in N = 83 isotones systematically[1)], namely ^{143}Nd, ^{144}Pm, ^{145}Sm, ^{146}Eu, ^{147}Gd, ^{148}Tb, ^{149}Dy, ^{150}Ho and ^{151}Er. Their lifetimes range from 10 ns to a few μ sec. The excitation energies of those isomers are close each other ranging between 8.5 and 9.0MeV except for ^{151}Er. Configuration of the high-spin isomers are deduced experimentally and theoretically[2)] to be $[\nu(f_{7/2}h_{9/2}i_{13/2})\ \pi(h_{11/2}^{2})]_{49/2+}$ for odd nuclei and $[\nu(f_{7/2}h_{9/2}i_{13/2})\ \pi(d_{5/2}^{-1}h_{11/2}^{2})]_{27+}$ for odd-odd nuclei. In a high-spin region of these nuclei, the angular momenta of individual valence particles align to the symmetry axis so that the overlaps of nucleon wave functions become to be maximum. Then the shape changes from near spherical to oblate. According to the Deformed Independent Particle Model (DIPM) calculations[2)], the shapes suddenly change at high-spin isomeric states. This sudden shape change causes the high-spin isomer. Therefore, these isomers could be described as high-spin shape isomers. As to ^{151}Er nucleus, $J^{\pi} = 67^{-}$ isomer at 10.6MeV was reported by C. Foin *et al.*[3,4)]. It is important to investigate the high-spin isomer in ^{151}Er, since the spin-parity and the excitation energy of the high-spin isomer in this nuclei are largely different to those of other isotones.

An experiment for ^{151}Er was performed at Cyclotron and Radioisotope Center (CYRIC), Tohoku University. Excitation states in ^{151}Er were populated using the reaction ^{116}Sn(^{40}Ar,5n)^{151}Er. The ^{116}Sn target of 1.4 mg/cm^2 was enriched to 90% and a target foil was backed by 11mg/cm^2 lead to stop the reaction products. This target was bombarded by ^{40}Ar beam of 197MeV with intensity of around 2pnA provided by the cyclotron. A germanium ball, Hyperball-2, which consist of 12 single and 4 clover type detectors was

used for prompt and delayed γ-γ-γ coincidence measurements. The total detection efficiency was about 3.2% for 1.3-MeV γ-ray in the singles mode. A total of 4.5×10^8 above 3-fold coincidence events were recorded in event by event mode.

An example of the γ-ray spectrum obtained by gating on the 1100-keV transition which belongs to ^{151}Er is shown in Fig.1. The coincidence relations between transitions are determined by this kind of spectrum. In order to determine the spin-parity of the high-spin isomer in ^{151}Er, analyses of γ-ray angular correlations and γ-ray linear polarization are also performing. The detailed analyses are now in progress.

References

1) Gono Y., et al., Eur. Phys. J. **A 13** (2002) 5 and references therein.
2) Dossing T., et al., Phys. Scr. **24** (1981) 258.
3) Foin C., et al., Eur. Phys. J. **A 8** (2000) 451.
4) Andre A., et al., Z. Phys. **A 337** (1990) 349.

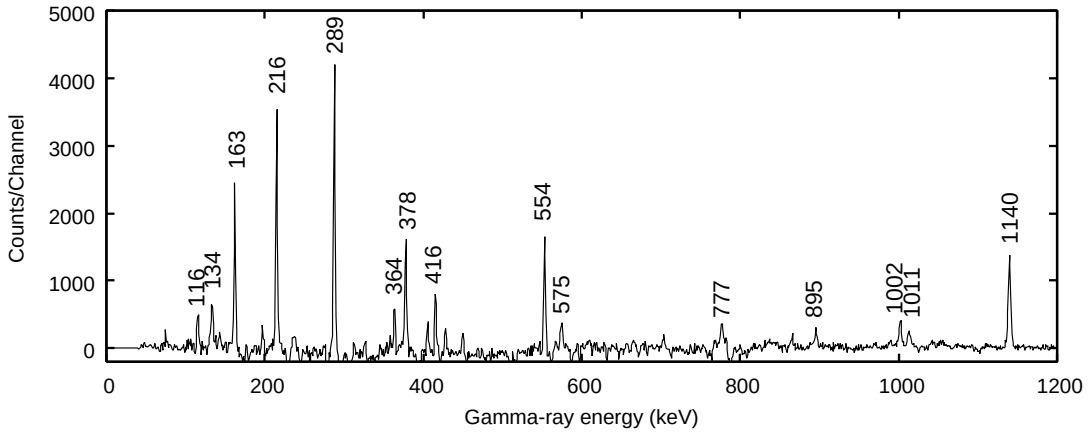

Figure 1. Gamma-ray spectrum obtained by gating on the 1100-keV γ-ray in ^{151}Er. Transitions in ^{151}Er are labeled in energy.