# In-Beam r-Ray Spectroscopy of 107In

## I. 5 In-Beam γ-Ray Spectroscopy of $^{107}$In

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A γ-ray spectroscopic study of $^{107}$In with the $^{106}$Cd (α,p2nγ)$^{107}$In reaction is in progress. Recently, Andersson et al.[1] have investigated high-spin yrast states in $^{107}$In using the $^{92}$Mo($^{19}$F,2p2nγ)$^{107}$In reaction. However, unambiguous spin and parity assignments have not been made in this study for the 1854.1-keV and higher-lying states. The aims of the present experiment are to make definite spin and parity assignments for these states on one hand, and on the other to study non-yrast states arising from the hole-core coupling. Measurements of γ-ray excitation functions, proton-γ coincidences and γ-ray angular distributions have been performed so far.

A target was prepared by depositing $CdCO_3$ enriched to 90.8 % in $^{106}$Cd onto a 6 μm Mylar backing, and was bombarded with α-particles from the CYRIC cyclotron. A 90 cm$^3$ Ge(HP) detector was used for detection of high energy γ-rays, and a 5 cm$^3$ planar Ge detector for detection of low energy γ-rays. The former has a resolution of 2.1 keV at 1332 keV γ-ray energy, and the latter a resolution of 0.57 keV at 122 keV. In the p-γ coincidence measurement, a surface-barrier Si detector of 2000 μm thickness was used for proton detection. In order to reduce the background due to $\beta^+$ particles, a permanent magnet was set in front of the Si detector.

Excitation curves of γ-rays of the (α,p2nγ) reaction are similar in shape to those of γ-rays of the (α,3nγ) reaction, and it is difficult in the present experiment to discriminate between γ-rays from $^{107}$In and those from $^{107}$Sn on the basis of excitation curves. On the other hand, γ-rays of the (α,pnγ), (α,2pnγ), (α,αnγ) and (α,α2nγ) reactions cannot be excluded in the present p-γ coincidence measurement at an α-particle energy of 45 MeV. Therefore, only when γ-rays fulfilled both of the two conditions, i.e. i) to be seen in the p-γ coincidence spectrum and ii) to exhibit excitation functions of (α,p2nγ) or (α,3nγ) type, we identified them as γ-rays originating from $^{107}$In.

All the γ-rays assigned in the present study to $^{107}$In, except for several weak ones, have been reported in ref. 1. We have, however, obtained an interesting result about the angular distribution for the 150.3 keV γ-transition. It has been reported in ref. 1 that the 150.4 keV γ-transition shows an angular distribution typical for ΔI=2 transitions. On the contrary, the angular distribution suggesting ΔI=1 transition has been observed in the present experiment for the 150.3 keV γ-transition. The angular distribution coefficients $A_2$ and $A_4$ obtained in the two studies are given in table 1. It is probable that the discrepancy comes from the difference in resolution between the γ-ray detectors used in the two studies; a resolution of 0.57 keV at 122 keV γ-ray energy in the present study and 2.3 keV at 1332 keV in the earlier study. Figure 1 shows γ-ray

spectra observed in the present experiment, and we can see two lines lying closely to the 150.3 keV line. The triplet might not be resolved in ref. 1. The excitation function of the 151.1 keV γ-ray suggests that it originates from $^{108}$In or $^{108}$Sn.

Reference

1) Andersson, E., Herges, P., Klapdor, H. V. and Wischnewski, I. N., Phys. Rev. C24 (1981) 917.

Table 1. The angular distribution coefficients for the 150 keV γ-transition

| | $A_2$ | $A_4$ |
|---|---|---|
| Present | -0.22±0.01 | -0.07±0.01 |
| Previous[a)] | +0.41±0.03 | -0.16±0.03 |

a) Ref. 1.

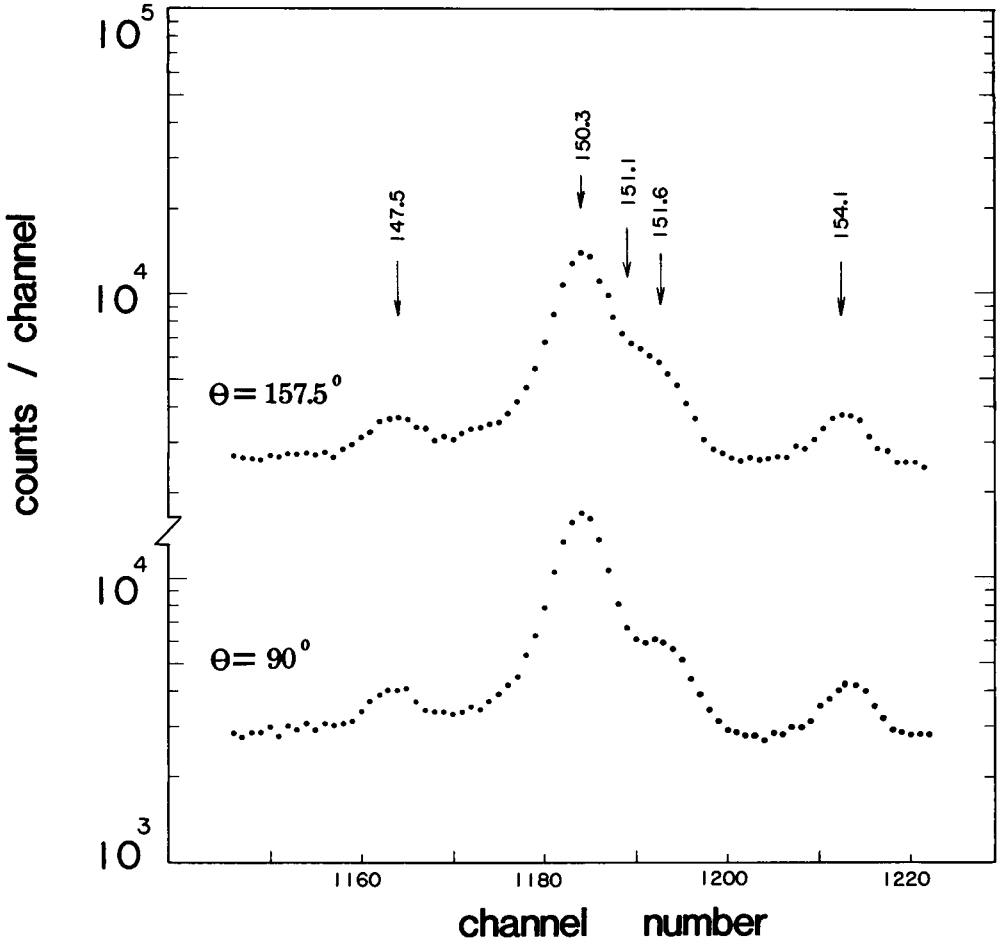


Fig. 1. Partial γ-ray spectra observed at angles of 90.0° and 157.5° with a 5 $cm^3$ planar Ge detector.