

## Polarization measurement of $^{127}\text{I}$

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### Introduction

The odd-mass iodine ( $Z=53$ ) nuclei are the representative of the characteristic features of the transitional nuclei as they exist between the region of spherical ( $Z=50$ ) and the well deformed ( $Z=57$ ) nuclei. Systematically,  $^{117-125}\text{I}$  nuclei, show the existence of  $\Delta I=2$  bands based on  $5/2^+$ ,  $7/2^+$ , and  $11/2^-$  states arising from  $d_{5/2}$ ,  $g_{7/2}$ , and  $h_{11/2}$  proton configurations, respectively [1-7]. A  $\Delta I=1$  band based on a  $g_{9/2}$  proton hole state below the  $Z=50$  shell, characterized by M1 cascade and E2 crossover transitions, is also systematically observed in these nuclei.

Systematic of iodine nuclei was further extended by B. Ding et al. [8], by caring out the in-beam  $\gamma$ -ray spectroscopy of  $^{127}\text{I}$  nucleus. The level scheme of this nucleus was extended up to spin  $35/2 \hbar$  and several new levels were reported, however, author could not establish the spins and parities of many new states unambiguously. Therefore, further investigation has been carried out for the proper understanding of the level structure of this nucleus.

### Experimental Details

In the present study, the excited states of  $^{127}\text{I}$  nucleus were populated via reaction  $^{124}\text{Sn} (^7\text{Li}, 4n) ^{127}\text{I}$  at 33 MeV using the  $^7\text{Li}$  beam from 15UD Pelletron accelerator facility at the Inter University Accelerator Centre (IUAC), New Delhi. The experiment

was done using fifteen Compton suppressed clover detectors of the Indian National Gamma Array (INGA) facility. The  $^{124}\text{Sn}$  enriched (94.7%) target of  $1.5\text{mg}/\text{cm}^2$  thickness with Au backing was used in this experiment. In present study, DCO ratio and polarization correlation measurements were carried out in order to confirm the spins and parities of many excited states in  $^{127}\text{I}$ .

### Results

The DCO ratio was determined by the following relation in order to determine the multi-polarities of  $\gamma$ - transitions:

$$R_{\text{DCO}} = \frac{I_{\gamma}(\text{measured extreme, gated central})}{I_{\gamma}(\text{measured central, gated extreme})}$$

The polarization asymmetry parameter

$$P = \frac{aN_{\perp} - N_{\parallel}}{aN_{\perp} + N_{\parallel}}$$

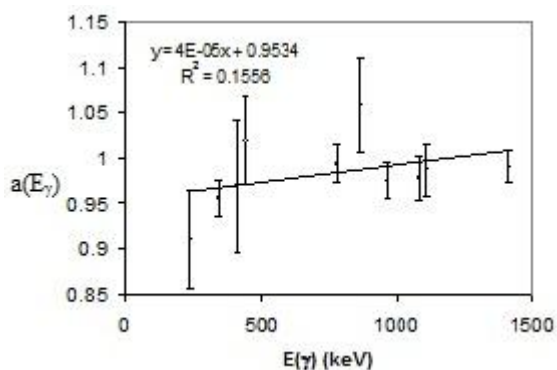
was determined for several  $\gamma$ -rays taking the advantage of the clover detectors. The value of the correction parameter 'a' was determined by using the radioactive source ( $^{152}\text{Eu}$ ) and express it as a function of  $E\gamma$ . The

$$a(E\gamma) = \frac{N_{\parallel}}{N_{\perp}}, \text{ for individual } \gamma\text{-energies, were}$$

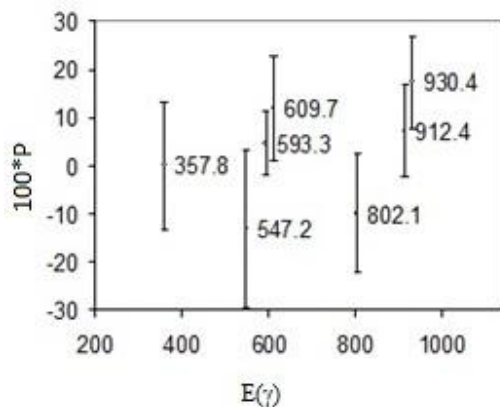
determined using  $N_{\parallel}$  and  $N_{\perp}$ , the intensities of the scattered photons parallel and perpendicular to the direction of the reaction plane respectively [9]. The plot of  $E\gamma$  vs  $a(E\gamma)$ , as shown in the figure 1, was fitted to a straight line which gives of value of  $a(E\gamma)$

close to unity. The results of the asymmetry parameter are shown in figure 2.

The results from the present DCO ratio and polarization correlation measurements together will be useful in the unambiguous assignment of the spins and parities of many states in  $^{127}\text{I}$  nucleus. Further data analysis is in progress and details will be presented during the symposium.



**Figure 1:** Plot of  $E(\gamma)$  vs  $a(E_\gamma)$  for  $\gamma$ -rays of  $^{152}\text{Eu}$  source fitted with a straight line function.



**Figure 2:** The values of polarization asymmetry parameter, for various  $\gamma$ -rays of  $^{127}\text{I}$  nucleus are shown.

## References

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