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## Study of multi-quasiparticle band in $^{125}\text{I}$

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### Introduction

The nuclei near the shell closure at  $Z=50$  with mass number  $A \sim 120-130$  exhibit significant variation in shape and deformation. The iodine ( $Z=53$ ) nuclei, lying in between spherical Sn ( $Z=50$ ) and deformed Cs ( $Z=58$ ), portray a rich variety of structural features in this transitional region. In the light odd-mass iodine nuclei ( $A < 121$ ) rotational structure corresponding to the proton  $h_{11/2}$  band was reported [1]. In contrast, the nuclei having mass number above 121 exhibit vibrational structure correlated to neutron  $h_{11/2}$  band [2].

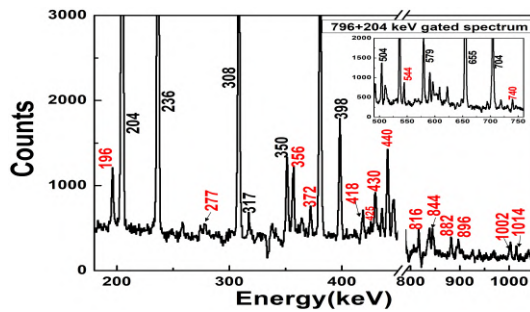


FIG. 1: Added gates corresponding to the decay of Band-4 of Ref. [4].

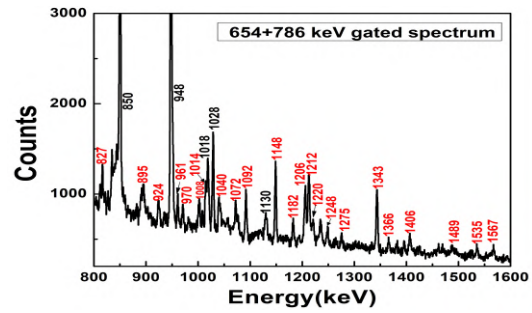


FIG. 2: Added gates corresponding to the decay of Band-4 of Ref. [3].

The existence of triaxial shape has been observed in several nuclei in this region as understood from observation of signature splitting,  $\gamma$  vibration, wobbling motion, chirality, etc.

The competition and combination of prolate and oblate shape was proposed with different multi-quasiparticle rotational bands in  $^{125}\text{I}$  [3, 4]. Different multi-quasiparticle configurations in comparatively higher angular momentum states were reported in light and heavy ion studies. In a study, Chakraborty et al. [5] proposed  $\gamma$ -vibrational and chiral configuration in  $^{125}\text{I}$  based on available experimental data. Therefore,  $^{125}\text{I}$  is an interesting candidate to explore the different distinctive structural phenomena. In the present work,  $^{125}\text{I}$  has been investigated with  $\alpha$ -induced fu-

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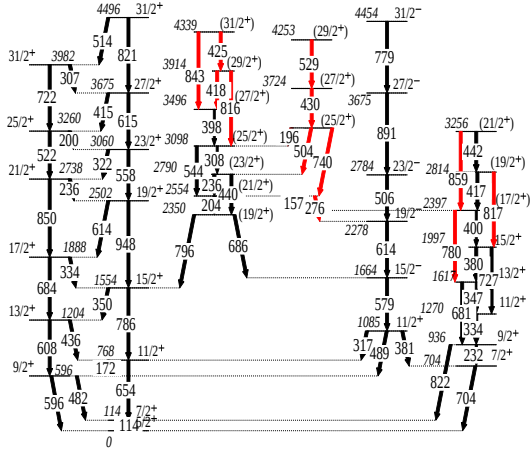


FIG. 3: Proposed level scheme of  $^{125}\text{I}$  from the present analysis.

sion evaporation reaction data.

### Experimental Details

$^{125}\text{I}$  was populated through the  $^{123}\text{Sb}(\alpha, 2n\gamma)$  reaction at  $E_{\text{lab}} = 30$  MeV using the K-130 cyclotron at VECC, Kolkata. The emitted gamma rays were detected by a multi-detector array (INGA) of six Compton-suppressed clover detectors (4 at  $90^\circ$  and 2 at  $55^\circ$ ) and one LEPS detector. Coincidence data were collected by using a digital data acquisition system.

### Results and Discussion

The experimental data were sorted into symmetric and asymmetric  $\gamma$ - $\gamma$  matrices to build up the level scheme. The data were analyzed using the program INGASORT [6] and RADWARE [7]. From our analysis, the

earlier reported level scheme constructed with light ion data [4] has been confirmed.

We have observed a significant number of new  $\gamma$  transitions in  $^{125}\text{I}$  in addition to our preliminary study [8]. Figures 1 and 2 show schematic representations of some newly observed gamma transitions in  $^{125}\text{I}$ . The  $\gamma$  transitions have been placed in the level scheme (Fig. 3) based on coincidence relationships and relative intensities. Our primary motivation in this work is to study the multi-quasiparticle configuration in  $^{125}\text{I}$ , and further study to confirm this is in progress. Directional correlation of oriented nuclei (DCO) and polarization measurement has been carried out using angle-dependent asymmetric matrices for a few excited states of this nucleus. Based on the calculated results, we have tentatively assigned the spin-parity of some levels.

### References

- [1] C.-B. Moon, J. Korean Phys. Soc. **45**, 859 (2004).
- [2] C.-B. Moon and J. U. Kwon, J. Korean Phys. Soc. **32**, 666 (1998).
- [3] P. Singh et al., Phys. Rev. C **82**, 034301 (2010).
- [4] H. Sharma et al., Phys. Rev. C **59**, 2446 (1999).
- [5] S. Chakraborty et al., J. Phys. G: Nucl. Part. Phys. **47**, 095104 (2020).
- [6] R. K. Bhowmik et al., Proc. DAE-BRNS Symp. Nucl. Phys. (India) B **44**, 422 (2001).
- [7] D. C. Radford, Nucl. Instrum. Methods A **361**, 297 (1995).
- [8] S. S. Alam et al., Proc. DAE-BRNS Symp. Nucl. Phys. (India) **63**, 256 (2018).



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