First observation of high excited states in ^{126}I

Bhushan Kanagalekar[1], Pragya Das[1,*] Bhushan Bhujang[1], Vivek Parkar[2], R. Palit[2], S. Muralithar[3], R. P. Singh[3], and R. K. Bhowmik[3]

[1]*Physics Department, Indian Institute of Technology-Bombay, Powai, Mumbai - 400076, INDIA*
[2]*Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai - 400005, INDIA*
[3]*Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi - 110067, INDIA*
**email: pragya@phy.iitb.ac.in*

The phenomena of chirality and decoupling were our main motivation towards studying the odd-odd nucleus ^{126}I. So far, in the literature the nucleus ^{126}I was produced using the reaction ^{126}Te(p, n)^{126}I and very low lying states have been reported [1]. Here we present the identification of the gamma transitions belonging to ^{126}I and the population of its high spin states with very good cross-section.

We performed two experiments to identify the gamma transitions belonging to ^{126}I. First was the excitation function measurement by populating ^{126}I *via* two different reactions ^{124}Sn(^{6}Li, 4n)^{126}I and ^{124}Sn(^{7}Li, 5n)^{126}I. Gamma rays were detected in one HPGe clover detector and the lithium beam was delivered by the Pelletron accelerator at Tata Institute of Fundamental Research (TIFR), Mumbai. Fig. 1 gives the relative intensity of the gamma transitions belonging to all the important reaction channels in the reaction of ^{6}Li + ^{124}Sn. According to the PACE calculation, in this beam energy range the 4n reaction channel should have very good cross-section. We therefore concluded that all the intense gamma transitions which did not belong to any of the neighbouring nuclei should belong to ^{126}I. Some of these gamma lines were 105 keV, 122 keV, 324 keV, 734 keV and 854 keV. In the second experiment, we tried to confirm the existence of these lines by populating ^{126}I through α-channel using the reaction ^{124}Sn(^{10}B, α4n)^{126}I. In this experiment γ-γ-α coincidence data were collected using the gamma detector array (GDA) in conjunction with the charge particle detectors at Inter University Accelerator Centre (IUAC), New Delhi. Fig. 2 (a), (b) show the total projected spectrum without and with α-gating, respectively. For example, considering the 324 keV gamma line, it was found that there was indeed an enhancement in its intensity with α-gating.

In a very recent experiment (July 2009), we populated the high spin states of ^{126}I using the reaction ^{124}Sn(^{7}Li, 5n)^{126}I at the beam energy of 50 MeV delivered by the Pelletron accelerator at IUAC. The experimental set-up, called INGA consisted of 15 HPGe clover detectors. A self-supporting target of thickness 2.7 mg/cm^2 was used. The triple gamma coincidence data were collected at the rate of 3 kHz. The data were initially calibrated and gain matched. From the E_γ *vs* E_γ matrix, the projected spectra for various energy gates were generated. Fig. 3 shows one example of projected spectrum with gate on 122 keV gamma line. All the gamma transitions, mentioned above as belonging to ^{126}I, were found to be very intense. Further data analysis is currently in progress, and the results will be presented.

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References

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Fig. 1

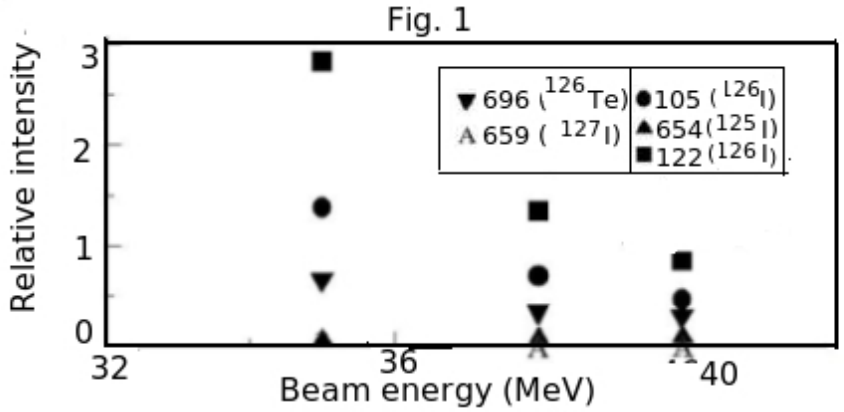

Fig. 2

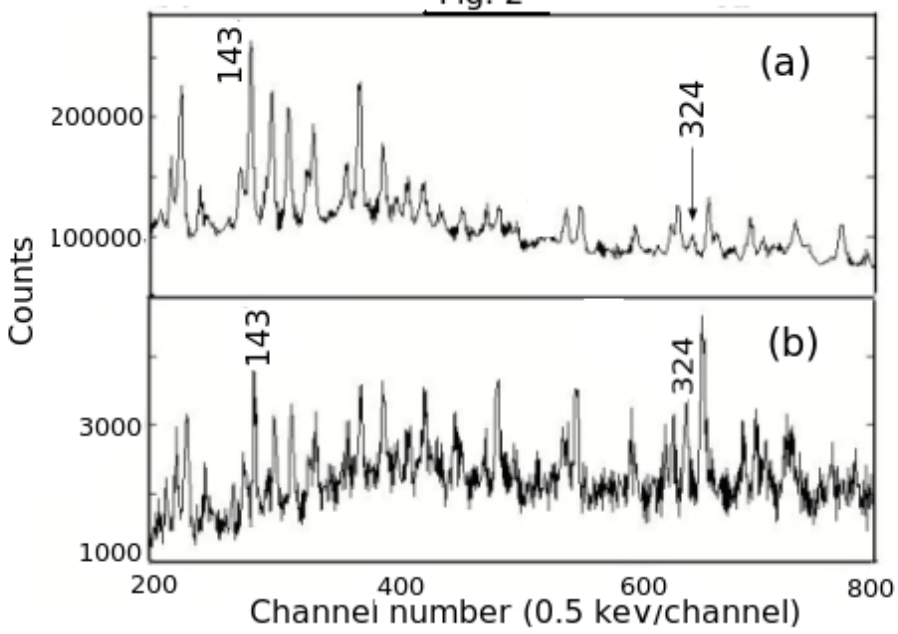

Fig. 3