

Parity assignment of a dipole band in ^{139}Pm

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Introduction

Several dipole bands based on three quasi-particle configurations were reported in $A \sim 140$ mass region. In odd-neutron ^{139}Nd ($Z=60$) and ^{137}Sm ($Z=62$) nuclei, a positive parity dipole band, based on $\pi h_{11/2} \otimes \pi g_{7/2} \otimes \nu h_{11/2}$ 3-qp configuration was reported at relatively lower excitation energy (~ 2 MeV), as compared to negative parity dipole bands. The observation of such bands are very rare in this mass region. A similar band was observed in odd-proton ^{139}Pm ($Z = 61$), the parity of the band was not confirmed. Present work confirmed the parity of this band on the basis of linear polarization measurement. The work extends the systematic of the rare band from odd-neutron to odd-proton nuclei and provide additional information on the band structure.

Experimental Details and Data Analysis

Excited states of ^{139}Pm have been populated using $^{127}\text{I}(^{16}\text{O}, 4n)^{139}\text{Pm}$ fusion evaporation reaction at energy $E_{beam} = 82$ MeV beam accelerated from 15 UD pelletron accel-

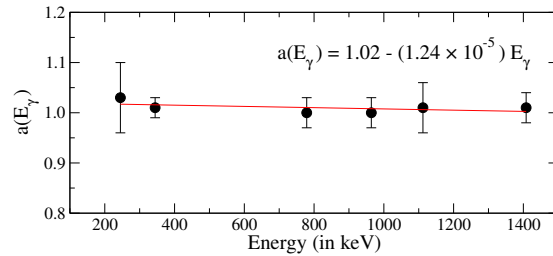


FIG. 1: Asymmetry correction factor of clover Ge-detectors, placed at 90° with respect to reaction plane, as a function of energy of γ -transitions.

erator facility [1] at the Inter University Accelerator Centre (IUAC), New Delhi. The experimental data has been acquired in two and higher fold coincident events, using 18 Compton suppressed clover detectors of INGA array [2]. Linear polarization asymmetry measurement has been done using clover Ge-detectors, serving as Compton polarimeter, placed at 90° with respect to beam direction. The linear polarization asymmetry [3] can be expressed as:

$$\Delta_{asym} = \frac{a(E_\gamma)N_\perp - N_\parallel}{a(E_\gamma)N_\perp + N_\parallel}$$

Where, $a(E_\gamma)$ is the asymmetry correction factor. For the present experimental set-up, the $a(E_\gamma) = 1.02 - 1.24 \times 10^{-5} \times E_\gamma$, is determined using a standard radioactive ^{152}Eu

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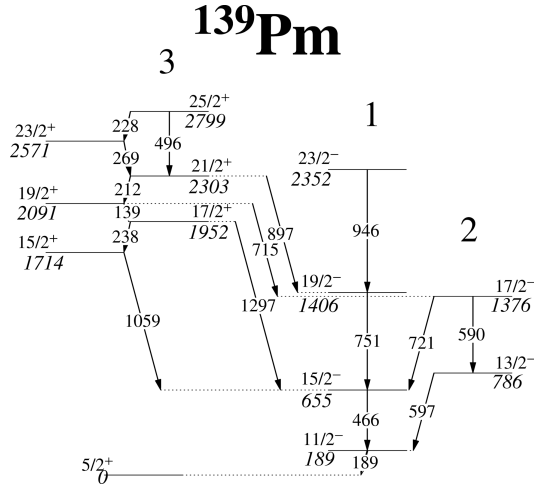


FIG. 2: Partial level scheme of ^{139}Pm

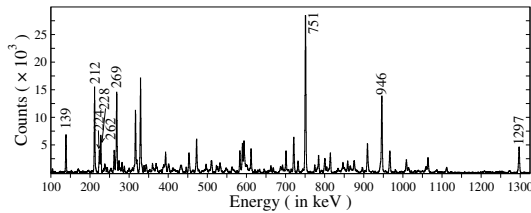


FIG. 3: Coincidence energy gated spectrum of 466 keV γ -transition, showing the transitions belonging to ^{139}Pm . Only transitions of interest are marked in the spectrum.

source (Fig. 1). The details of analysis procedure of polarization asymmetry has been discussed in ref. [4], The positive (negative) value of Δ_{asym} confirms the electric (magnetic) nature of the γ -transitions. The off-line data analysis has been carried out using INGA-SORT [5].

Experimental Results

A cascade of four $\Delta I = 1$ transitions was previously reported at 1714 keV excitation energy, at spin $15/2 \hbar$, with tentative parity [6]. This band was decaying to $I^\pi = 15/2^-$ at 655 keV state, through 1297.3 keV γ -transition. The coincidence energy gate of 466 keV (Fig. 3), re-confirms the placement of transitions of the band (Fig. 2). The present polarization

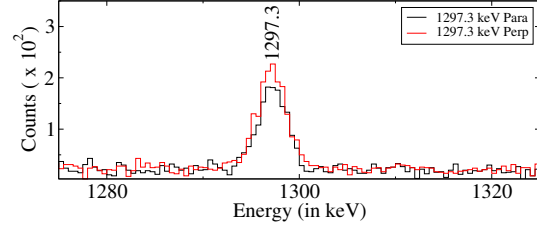


FIG. 4: Parallel and perpendicular components of Compton scattered events in the clover Ge-detectors placed at 90° with respect to reaction plane. The spectrum is obtained from 466 keV coincidence energy gate.

asymmetry (Δ_{asym}) result confirms the electric nature of the 1297.3 keV transition, as it's value is found to be 0.11 ± 0.04 (positive). This confirms the positive parity of the $\Delta I = 1$ band with band-head $I^\pi = 15/2^+$ at 1714 keV state. The spins of the level are also reconfirmed on the basis of R_{DCO} -results. Further analysis of the data is underway and results will be presented during the symposium.

Acknowledgments

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