Signature splitting in $\pi d_{5/2}$ band of ^{183}Ir

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Introduction

The mass A≈180 region exhibits many nuclear phenomena like band crossing, K-isomerism, shape co-existence, signature splitting, etc. The odd proton ^{183}Ir nucleus have been widely studied in past for backbending phenomenon [1]. But, there is no discussion on the signature splitting. The signature splitting elucidates the energy staggering of two signature partner bands, one is energetically favored while another is unfavored. The favored and unfavored sequences are defined as

$$\alpha_f = \frac{1}{2}(-1)^{j-1/2},\ \alpha_{uf} = \frac{1}{2}(-1)^{j+1/2} \quad (1)$$

where, j is the odd particle angular momentum. These sequences are connected by $\Delta I = 1$ transitions with primarily M1 character. However, sequences itself build over the $\Delta I = 2$, E2 transitions.

The present work is carried out to study the high spin states of ^{183}Ir and the signature splitting observed in $\pi d_{5/2}$ band.

Experimental details

The high spin states in ^{183}Ir are populated via fusion evaporation reaction by bombarding the ^{18}O projectile on ^{169}Tm target at E_{beam}= 94 MeV provided by 15 MV Pelletron accelerator at IUAC, New Delhi. The self-supporting target of the thickness of 6.5 mg/cm^2 was used. The discrete γ-rays were detected using Indian National Gamma array (INGA) consisting of 16 Compton suppressed clover detectors at different angles θ, *i.e.* $32°, 57°, 90°, 123°$ and $148°$ at IUAC. Low energy γ-rays were measured by two Low energy photon spectrometer (LEPS) at angles $61°$ and $119°$.

The list-mode data were acquired using in-house developed CANDLE software in two-fold coincidence mode. The off-line sorting of list-mode data was done using CANDLE and INGASORT. Coincidence matrices were created to identify various bands in the ^{183}Ir. The coincidence time window for these matrices was set around 400 ns. RADWARE was also used to analyze the different gated spectra.

Data analysis and Results

In order to establish a positive parity $\pi d_{5/2}$ band in ^{183}Ir gates were put on the symmetric matrix. The above band was already reported in earlier work [2]. The transitions belonging to the band are clearly observed in 307 keV gate (as shown in Fig. 1) in our data. Further analysis is in progress to look for new transitions in this and other bands reported in reference [2, 3].

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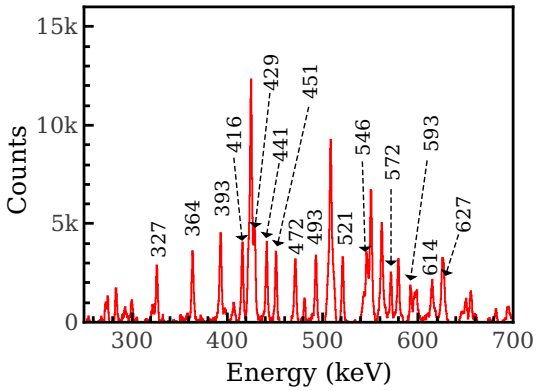

FIG. 1: The 307 keV coincidence γ-ray spectra of ^{183}Ir.

The partial level scheme (as shown in Fig. 2) clearly indicates the presence of signature partner interconnected by M1 transitions. The signature splitting in the band is calculated using formula [4]

$$\Delta E = [E(I) - E(I-1)] - [E(I+1) - E(I) + E(I-1) - E(I-2)]/2. \quad (2)$$

At low spin (below $\frac{19}{2}$), there is no splitting. However, the signature splitting observed after $\frac{19}{2}$ and enhances as spin increases. The extent of splitting is proportional to the coriolis interaction, which is more at high angular momentum. The signature splitting is presented in Fig 3 as a function of angular momentum.

Further analysis to understand the structure of the bands is in progress and will be presented in the symposium.

Acknowledgement

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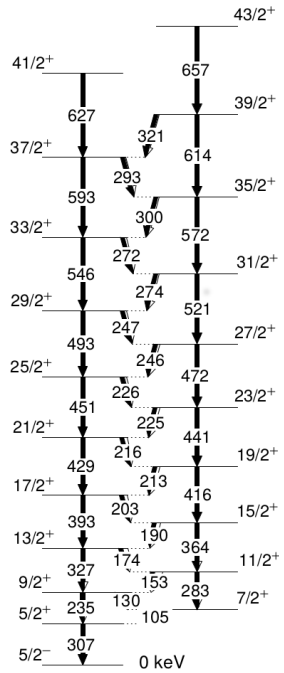

FIG. 2: Partial level scheme of ^{183}Ir.

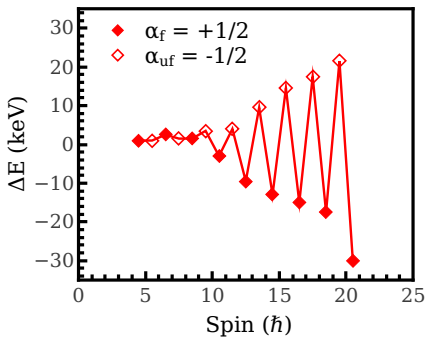

FIG. 3: Signature splitting in $\pi d_{5/2}$ band of ^{183}Ir.

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