Investigation of High Spin Level Structure of ^{186}Pt

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Introduction

From the low-lying spectroscopic properties (as shown in Fig. 1), it appears that ^{186}Pt is a transitional nucleus. In fact, the previous studies on the level structure of ^{186}Pt suggests that this nucleus is extremely γ soft and there are evidences for the presence of co-existing prolate, oblate and tri-axial band structures [1]. The shape-coexistence feature in Pt-isotopes has been of primary interest for many years. Extensive theoretical calculations have been carried out to understand the underlying feature. One debating issue persists: whether the intruder states play a major role in the shape evolution of Pt-isotopes or the same can be understood without invoking the intruder states. Recent results from the lifetime measurements of the states belonging to the yrast band in ^{186}Pt is suggestive of the mixing of coexisting bands of different deformations at the low-spin regime [2]. The present work aims at the investigation of the level structure of ^{186}Pt at high spins by using conventional gamma-ray spectroscopic techniques with the emphasize to look for the possible evolution of shape at higher excitations.

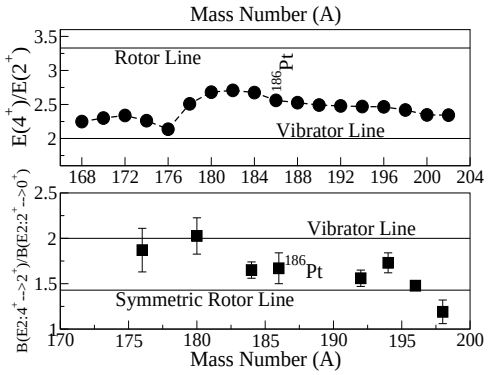

FIG. 1: Evolution of the low-lying spectroscopic properties along the isotopic chain of even-even Pt-isotopes. *Top pannel*: Variation of the ratio between the energies of the first 4^+ and 2^+ states as a function mass number (A). *Bottom panel*: Variation of the ratio of the reduced transitions probabilities as a function of mass number (A).

Experimental Details and Data Analysis

The high-spin states of ^{186}Pt was produced in the fusion-evaporation ^{174}Yb(^{16}O,4n) reaction. The ^{16}O beam at an energy of 85 MeV was delivered by the Pelletron-Linac facility, TIFR, Mumbai. With a backing of Al with thickness $\sim$ 750 μg/cm^2, the enriched ^{174}Yb isotope was accumulated on it by electrodeposition method. The target thickness was 1.14 mg/cm^2. The de-exciting γ-rays were detected using INGA (**I**ndian **N**ational **G**amma **A**rray). During the time of the experiment, the array was comprised of eighteen Compton suppressed high-resolution Clover detec-

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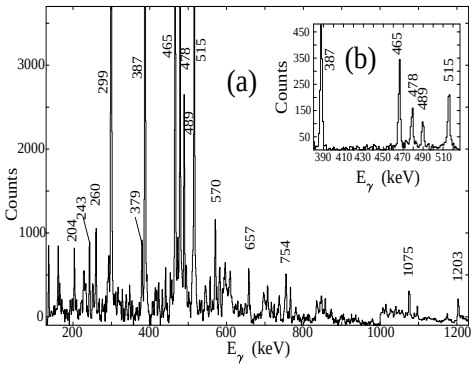

FIG. 2: (a): A representative $\gamma\gamma$ coincidence spectrum with the gate set on the 192($2^+ \rightarrow 0^+$)-keV ground state feeding transition of ^{186}Pt. The peaks labeled with their energies belong to ^{186}Pt. (b): Part of the $\gamma\gamma\gamma$ coincidence spectrum with the gates setting on the two transitions (192- and 299-keV) decaying from the lowest two levels of the ground state rotational band of ^{186}Pt.

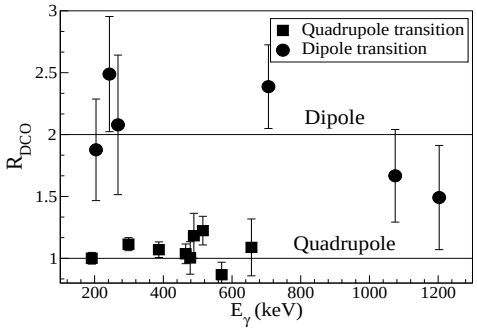

FIG. 3: DCO-ratio values, as deduced from the present set of data, for a few transitions in ^{186}Pt. The coincident gates were set on the known stretched quadrupole transitions in extracting the DCO-ratio values. Within this procedure, a pure quadrupole transition is expected to have DCO-ratio value 1; while a pure dipole transition would have DCO-ratio value 2. The horizontal lines have been drawn through these expected DCO-values to guide the eye.

tors. With respect to the beam direction, the detectors in the array were arranged as: four were at 90°, two were at 65°, three each at 40°, 115°, 140°, and 157°. The total count in the $\gamma\gamma$ projection spectrum is found to be $\sim 1.8 \times 10^7$. As the detailed off-line analysis is in progress, we are reporting here a few preliminary results. A representative $\gamma\gamma$ coincidence spectrum of ^{186}Pt is shown in Fig. 2(a). The quality of the triple-gamma coincidence data is highlighted in Fig. 2(b).

Attempts have been made to assign the spin of the populated levels using the standard DCO-method. For the extraction of DCO-ratios of the gamma rays of interest, an asymmetric $\gamma\gamma$ matrix has been made with detectors at 90° along the x-axis and the detectors at 157° along the y-axis. Within the given geometry of the array, this is found to be the most effective pair of angles to extract the DCO-ratio values. The measured DCO-ratios for a few transitions belonging to ^{186}Pt has been shown in Fig. 3. The nature of multipolarities of the transitions could clearly be resolved from the plot. The transitions with the deduced quadrupole multipolarity belong to the members of $E2$ rotational bands; whereas the transitions with dipole nature of multipolarity are mainly the interlinking transitions between the rotational bands. From the present stage of the on-going off-line analysis, it is indicative of the population of the states of ^{186}Pt up to $J \sim 22\hbar$ with $E_x \sim 6$ MeV.

Acknowledgments

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References

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