Spectroscopy of ^{196}Hg

S. Das[1], S. Chatterjee[1], S. Samanta[1], R. Raut[1],* S. S. Ghugre[1], A. K. Sinha[2], S. Ali[3], P. Ray[3], A. Goswami[3], S. Nandi[4], R. Banik[4], S. Bhattacharya[4], S. Bhattacharyya[4], G. Mukherjee[4], S. Rajbanshi[5], S. Das Gupta[6], and H. Pai[3]

[1] *UGC-DAE CSR, Sector III, LB-8, Bidhan Nagar, Kolkata - 700098, INDIA*
[2] *UGC-DAE CSR, Indore 452017, INDIA*
[3] *Saha Institute of Nuclear Physics, Kolkata-700064, India*
[4] *Variable Energy Cyclotron Centre, 1/AF, Bidhan Nagar, Kolkata-700064, India*
[5] *Presidency University, 86, 1, College St, Kolkata, West Bengal 700073 and*
[6] *Victoria Institution(College), Kolkata-700009, India*

Introduction

The Hg isotopes with two protons less than the Z=82 magic number, lie in the transitional region between the strongly deformed prolate rare-earth and the spherical Pb nuclei. The ground state(g.s) band of the even-A isotopes have a 2^+ state at E_x 420 keV de-exciting with an enhanced E2 transition. The state has been interpreted in the framework of particle-vibration coupling scheme with configuration $(\pi s^{-1}_{1/2} d^{-1}_{3/2})$ [1]. The 4^+, 6^+, 8^+ states of the g.s sequence are approximately equidistant [2] followed by an isomeric 10^+ state of $T_{1/2}$ 7-25 ns. The 4^+ and the 6^+ states are interpreted as phonon multiplet states while the 8^+ and 10^+ states to be belonging to $(\pi h_{11/2})^{-2}$ configuration. The even-A Hg isotopes also exhibit a negative parity band, consisting of 5^-, 7^-, 9^- ... states, that de-excite to the g.s. band and has been established to be of collective origin based on a neutron in $i_{13/2}$ and one in the $p_{3/2}$, $p_{1/2}$ or $f_{5/2}$ orbitals. The level structure of the odd-A Hg isotopes exhibit an interesting overlap with the neighbouring even-A core. The present work reports a spectroscopic investigation on ^{196}Hg [Z = 80, N = 116]. The nucleus was previously studied by several groups [1, 3–6] wherefrom the aforementioned structural features, such as bands and isomers, were identified. The current study was primarily aimed at identifying the non-yrast structure therein.

*Electronic address: rraut@alpha.iuc.res.in

Experiment and Data Analysis

The nucleus of interest ^{196}Hg was populated using ^{194}Pt(α,2n)^{196}Hg reaction at E_{lab} = 32 MeV. The α-beam was obtained from the K-130 room temperature cyclotron facility at the VECC,Kolkata. The target was 13.6 mg/cm^2 thick foil of ^{194}Pt (enriched to $\sim$ 97%). The γ-rays from the de-exciting nuclei were detected using the INGA setup at VECC, then comprising of 7 Compton suppressed Clover detectors placed at 90° (4), 125° (2) and 40° (1) . The pulse processing and data acquisition system was based on Pixie-16 250-MHz, 12-bit digitizer modules from XIA LLC, USA running on a firmware and trigger logic conceptualized by UGC-DAE CSR, Kolkata center [7]. In-beam list-mode data were acquired under the trigger condition of at least two Compton suppressed Clovers firing in coincidence. Acquired data was sorted using IUCPIX package and also developed by UGC-DAE CSR, Kolkata [7] and being analyzed by using standard RADWARE package [8].

Results and Discussions

A part of the raw projection spectrum in Fig. 1 which is constructed from the coincidence data acquired in the current experiment. The ^{196}Hg nucleus was populated copiously in the current experiment along with lesser yield of $^{197,198}Hg$ isotopes. More than 30 new γ-ray transitions have been identified (Fig.1) and presently being placed in the level scheme. The asymmetric angle dependent matrices have been constructed and used for determinaination of multipolarities and electro-

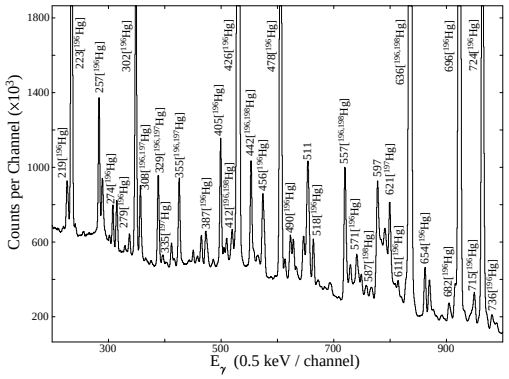

FIG. 1: Full projection spectrum showing the population of different nuclei during reaction

magnetic characters of the observed γ-rays from angular correlations and linear polarization measurements respectively.

Summary and Outlook

Nucleus has been populated upto an excitation energy E_x 4.3 MeV and spin $\sim 18\hbar$. The existing level structure in this domain has been confirmed. New γ-ray transitions have been identified and efforts are underway to place these in the excitation scheme. Data analysis is also in progress for multipolarity and electromagnetic assignments of the transition that will faciliate identification and/or confirmation of the spin-parity of the associated levels.

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