

Lifetime measurement in ^{103}Pd

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Introduction

The level structure of $A \sim 100$ nuclei reveals fascinating phenomena even at low and moderate spin regimes such as vibrations and rotations built upon prolate deformed shape [1–3]. The lifetime measurement of nuclear level is necessary aspect of nuclear structure study. The Doppler shift attenuation method (DSAM) has been used to determine the short (sub picosecond) lifetimes of the excited nuclear states [4]. The measured Doppler shift depends directly on the angle between the γ ray detector and recoil direction and on the recoil velocity of the nucleus at the moment of γ emission. Present study is to find the lifetimes of the moderate spin states of ^{103}Pd by DSAM.

Experimental details

The excited states of ^{103}Pd were populated in $^{94}\text{Zr}(^{13}\text{C}, 4n)$ reaction at bombarding energy of 55 MeV, using the beam from pelletron at Inter University Accelerator Centre (IUAC), New Delhi. A 1 mg/cm² thin target of ^{94}Zr with 10 mg/cm² gold backing was used. Coincidence γ rays were detected using

Indian National Gamma array (INGA) consisting of 18 Compton suppressed clover detectors at IUAC [4]. Eight Compton suppressed clover detectors were mounted in backward rings at an angle of 148° and 123°, four detectors were mounted in the forward rings at 32° and 57° and remaining 6 were mounted at 90° in the middle ring. Two and higher fold γ - γ coincidence events were recorded in the list mode by CANDLE [5].

Result and discussion

Lifetimes of the states of negative parity band of ^{103}Pd [3] were reported earlier. The LINESHAPE code [6] is used in present study for extracting lifetimes of the excited nuclear states from Doppler shifted lineshapes. Five angle dependent matrices, corresponding to five different angles, were created with gain of 0.5 keV/channel. Coincidence spectrum with γ transitions of interest were created by projecting on relevant axis from respective matrices. The gating transitions chosen were below the transitions of interest for lineshape analysis of yrast band. The forward and backward Doppler shifted lineshapes were observed for 970 ($\frac{23}{2}^- \rightarrow \frac{27}{2}^-$) and 1094 keV ($\frac{27}{2}^- \rightarrow \frac{31}{2}^-$) transitions of ^{103}Pd . The lineshapes of transitions were obtained by putting gate on the 476.7 keV transition and

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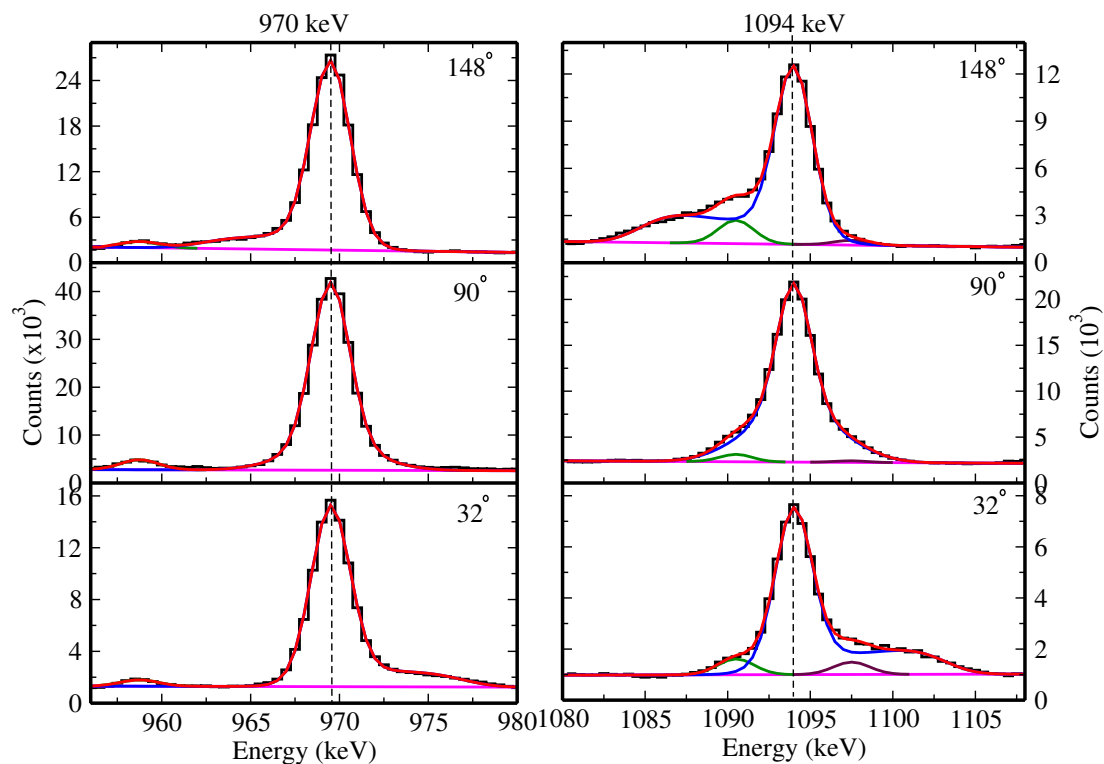


FIG. 1: Representative spectra and fitted lineshapes for the 970 and 1094 keV γ rays in the negative parity quadrupole band of ^{103}Pd .

are shown in FIG.1. The side feeding into each level of the band was considered as a cascade of five transitions having a fixed moment of inertia comparable to that of the in-band sequences. The transition quadrupole moment, transition quadrupole moment of side feeding and side feeding intensities have been used as input parameters for the lineshape analysis. The extraction of lifetime of other states from the data is under progress and will be presented.

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