Spectroscopy of low lying states of N = 88 ^{150}Sm

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Introduction

The study of nuclear low lying states are of great importance for understanding the evolution of shell structure and collectivity, shape phase transitions as well as the shape co-existence[1-3]. The N = 88 ^{150}Sm nucleus is known to lie at the junction point of the shape transition observed for the nuclei in this mass region [4,5]. There exist a substantial number of experimental as well as theoretical studies focusing at the low lying structure of ^{150}Sm and its neighboring isotopes [6-8]. Most of the experimental studies, however, has been performed by using the (n,γ) reactions. Recent experimental study with neutron excitation has established the quasispherical phonon structure of the nucleus and a coexisting deformed 0^+ state[4]. The existence of octupole correlation has been observed in this nucleus following the measurement of lifetime and electromagnetic transition rates from (n.γ) reactions [7,8] as well as measurements with light ion induced fusion evaporation reaction [9]. The population of the low lying states of ^{150}Sm from the decay of ^{150}Nd is however very less explored and no γ–γ coincidence measurement exists till date following the decay spectroscopy of ^{150}Pm.

In the present work, the low lying structure of ^{150}Sm has been performed from decay of ^{150}Nd followed by the γ–γ coincidence study.

Experiment

The excited states of ^{150}Sm nucleus have been populated from the β-decay of ^{150}Pm ($\tau_{1/2}$ ~ 2.8hrs) produced by the reaction ^{150}Nd (p, nγ) ^{150}Pm using 8.0 MeV proton beam from K = 130 cyclotron at VECC. The 900 μg/cm^2 thick ^{150}Nd target (97% enriched) was electro-deposited on a 7.5 μm thick Al foil. The experimental set up consisted of four standalone Clover Ge detectors and two segmented planar Ge detectors as shown in Figure 1. The Clover Ge detectors were used for the detection of γ transitions and the planar Ge detectors were used to facilitate the detection of beta decay of the parent nucleus ^{150}Pm as well as the low energy γ transitions. Sixteen channel Mesytec amplifier (MSCF-16) was used for the pulse processing of both the clover and planar Ge detectors. For the measurement of γ–γ coincidence a MASTER logic of $M_\gamma \geq 2$ was established among the four Clover detectors. The detailed technique for the measurement of β-γ coincidence has been described in ref. [10]. The data conversion as well as acquisition was made by using VME standard Mesytec ADC (MADC32) and the Data Acquisition system LAMPS [11].

Figure 1: Experimental set up of the present work

Data Analysis and Results

The obtained data has been sorted using the LAMPS software to construct the RADWARE compatible γ–γ and β–γ matrices of different configurations. The prompt background subtracted γ–γ matrix has been studied in order to extract the coincidence information. Figure 2 - 4 show the gated spectra obtained from the preliminary analysis which displays some of the coincidence information among the decay γ transitions. From the present work several tentative transitions in the decay scheme of ^{150}Sm have been confirmed and some new transitions have been identified. The detailed analysis for the different γ–γ and β–γ coincidences are in progress.

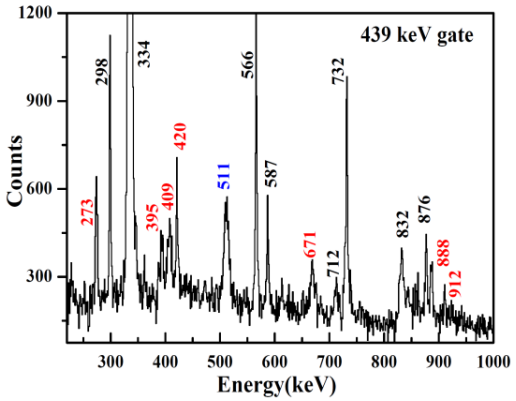

Figure 2: Gated spectrum of 439 keV. Peaks marked with red are the new transitions which have been confirmed to be present in ^{150}Sm.

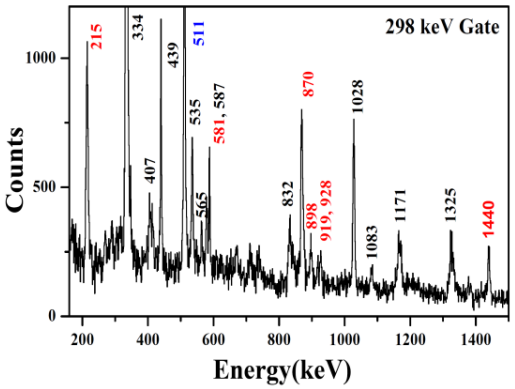

Figure 3: Gated spectrum of 298 keV. Peaks marked with red are the new transitions which have been confirmed to be present in ^{150}Sm.

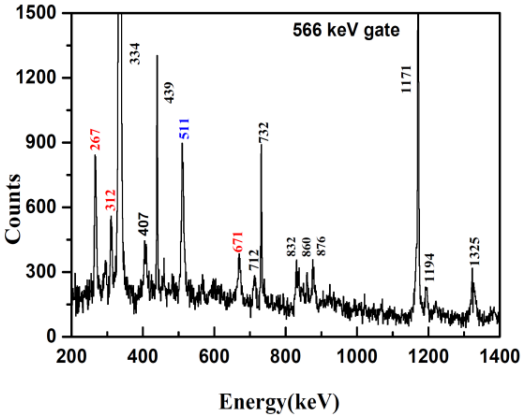

Figure 4: Gated spectrum of 566 keV. Peaks marked with red are the new transitions which have been confirmed to be present in ^{150}Sm.

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