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Multipolarity and Mixing ratio of γ-ray in ^{67}Ga

In the light odd-mass $^{65-69}$Ga isotopes ($Z = 31$), the excited states have several bands arising from the weak coupling of a quasi-particle occupying the $\pi f_{5/2}$, $\pi p_{3/2}$, and $\pi g_{9/2}$ orbitals [1]. In the present study, the excited states of ^{67}Ga were populated via ^{56,57}Fe(^{13}C, p2nγ/pnγ) fusion-evaporation reaction at 45 MeV beam energy. The ^{13}C beam was obtained from the 14 UD Pelletron accelerator at the Tata Institute of Fundamental Research (TIFR), Mumbai, India. The Indian National Gamma Array (INGA), equipped with 15 Compton-suppressed HPGe clover detectors (at the time of the experiment), was used to detect the de-excited γ-rays. The level scheme analysis was performed using the RADWARE package [2] and Cubix software [3].

In the present work, the low-lying γ-ray transitions were reinvestigated using two-fold and three-fold coincidences. The spin and parity of the levels were assigned based on the $R_{\rm DCO}$ and linear polarization asymmetry (Δ) values. In our measurements, the 342.5-, 416.6-, 554.4-, 712.4-, 824.0-, 888.4-, 958.0-, 1159.8-, 1202.0-, 1239.8-, 1317.9-, 1330.7-, and 1641.5 keV γ-ray transitions exhibit quadrupole character with $\Delta I = 2$ or $\Delta I = 0$. The 358.9-, 546.1-, 842.9-, 871.3-, 935.2-, and 1343.4 keV γ-ray transitions have been identified as dipole transitions. Based on polarization asymmetry (Δ) measurements, the 712.4-, 824.0-, 888.4-, 958.0-, 1159.8-, and 1202.0 keV γ-ray transitions are of $E2$ character, while the 871.3 keV γ-ray transition is of $E1$ character. The 554.4 keV γ-ray transition has a negative polarization asymmetry (Δ) value and exhibits $E1$ ($\Delta I = 0$) character. Other transitions, such as 358.9-, 546.1-, and 842.9 keV, have $M1/E2$ character.

The relative intensities of the measured γ-ray energies are also reported in our work. The multipolarity of the γ-rays agrees with a recently published paper; however, due to limited statistics, we did not observe the newly reported $E3$ transition [4]. To determine the mixing ratio of the γ-rays, further analysis is in progress, and more results will be presented during the conference.

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