

ER cross-section and ER gated spin distribution measurements in the mass region $A \sim 190$

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Evaporation Residue (ER) cross-sections and ER gated γ -ray fold distributions were measured for the $^{32}\text{S} + ^{154}\text{Sm}$ nuclear reaction above the Coulomb barrier at six different beam energies from 148 to 191 MeV. γ -ray multiplicity and spin distributions were extracted from ER-gated fold distributions. The measured ER cross-sections are compared with the results of both the Statistical model calculations and the dynamic model calculations. Statistical model calculations have been performed to generate a range of parameter space for both the barrier height and Kramers' viscosity parameter over which ER cross-section data can be reproduced. The calculations performed by the dinuclear system model reproduce the data considering both complete and incomplete fusion processes. Comparison of the ER cross-sections measured in previous work using very different target-projectile combinations with much less mass asymmetry than the present measurement clearly demonstrates the effect of the entrance channel on ER production cross-section.

In the present case, $^{186}\text{Pt}^*$ compound nucleus was populated to measure the ER cross-sections. These measurements were carried out using Hybrid Recoil Mass Analyser (HYRA) in gas mode coupled with TIFR 4π spin-spectrometer. ^{32}S pulsed beam from 15 UD Pelletron + LINAC accelerator facility at IUAC (Inter-University Accelerator Facility), New Delhi with an average current of $\sim 0.5 - 1$ pA was bombarded on ^{154}Sm target of thickness $118 \mu\text{g}/\text{cm}^2$ with carbon capping and backing of $25 \mu\text{g}/\text{cm}^2$ and $10 \mu\text{g}/\text{cm}^2$ respectively.

Raw fold distributions were ER-gated to remove statistical and non-rotating γ rays contributions. Realistic simulations of TIFR 4π spectrometer, consisting of 32 NaI(Tl) detectors were carried out using Geant4, and fold distribution for different multiplicities were generated i.e. for a given gamma multiplicity M , distribution in fold k . Fold distribution $P(k)$ probability can be given by:

$$P(k) = \sum_{M_{\gamma}=0}^{\infty} R(k, M_{\gamma}) P(M_{\gamma})$$

where $R(k, M_{\gamma})$ is the response function, in other words, it is the probability of firing k detectors out of N detectors for M uncorrelated γ rays and $P(M_{\gamma})$ is the probability of multiplicity distribution. Experimental fold data is used to extract multiplicity as well as spin distribution of $^{186}\text{Pt}^*$. Response function was generated using Geant4 simulations using the exact geometry of the spin-spectrometer. We have convoluted experimental fold data with $R(M_{\gamma}, k)$ to get the multiplicity distribution (with error bars). Theoretical calculations along with experimental results will be presented in the school.

Presentation type

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