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ER cross-section and ER gated spin distribution measurements in the mass region A~190

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Evaporation Residue (ER) cross-sections and ER gated γ-ray fold distributions were measured for the ^{32}S + ^{154}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}Pt* compound nucleus was popultaed 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 ~ 0.5 - 1 pnA was bombarded on ^{154}Sm target of thickness 118μgm/cm^2 with carbon capping and backing of 25μgm/cm^2 and 10μgm/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:
\begin{equation}
P(k) = \sum_{M_{\gamma=0}}^{\infty}R(k,M_{\gamma}) P(M_{\gamma})
\end{equation}
where R(k, M_γ) 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_γ) is the probability of multiplicity distribution. Experimental fold data is used to extract multiplicity as well as spin distribution of ^{186}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_γ,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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