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Investing Quasi Fission Dynamics of ^{35} Cl + ^{181} Ta and ^{35} Cl + ^{205} Tl

Quasi-fission (QF) and fusion fission (FF) are two competing processes that affects formation probability of Super Heavy Element (SHE). To optimize the exploration of the SHE landscape, it is important to understand the competition between QF and FF. Several experiments are being carried out by us [1-2] to understand the dynamics of QF and FF, particularly to understand the role of entrance channel parameters. There are scarcity of reliable theoretical models too that efficiently predicts the amount of QF in a reaction. However, any new models [3] that are being developed, needs to be tested experimentally.

We have an ongoing research program [4-8] to systematically measure the fission fragment mass and energy distributions for several target projectile systems using large area MWPC at the Indian accelerator facilities [e.g; Kolkata Cyclotron, Mumbai and New Delhi Pelletron]. Non equilibration of mass and total kinetic energy are the signature of the presence of QF in a reactions.

In the conference we will report on our recent measurements of the fission fragment mass distributions in the ^{35}Cl + ^{181}Ta and ^{35}Cl + ^{205}Tl reactions with beam energies ranging from 167 to 180 MeV. For both the reactions, the mass distributions of fission fragments, analysed as a function of the canter-of-mass scattering angle θc.m., revealed distinct signatures of QF. A parabolic variation of the average total kinetic energy (TKE) with mass was observed, deviating from the liquid drop model and indicating an admixture of non-compound nuclear fission. For both reactions, the measured mass distributions were well reproduced using a three-Gaussian fitting approach, where one component corresponds to fusion-fission and the remaining two represent quasi-fission. The measured TKE distributions also show a deviation from a single Gaussian on the higher energy side. To decompose the experimental TKE distribution, two components are required: one corresponding to fusion-fission, with its peak value following the Viola systematics, and another corresponding to quasi-fission. The percentage of QF was consistently reproduced across both mass and TKE distributions. Thus, quasi-fission is observed in both the ^{35}Cl + ^{181}Ta and ^{35}Cl + ^{205}Tl reactions. To further elucidate the role of entrance-channel parameters in quasi-fission dynamics, a comparative analysis of these two reactions are being conducted and evaluated against theoretical model calculations to enhance our understanding of the underlying reaction mechanisms.

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