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Probing Dynamics of Fusion-Fission Process in Heavy to Very Heavy Nuclei

Studies in heavy-ion induced fusion-fission process has established itself as one of the major branches of low and medium energy nuclear structure and reaction physics. A plethora of dynamical processes manifest through the fusion-fission of two atomic nuclei over a wide range of projectile energy. The process of fission followed by fusion of two heavy nuclei or survival of the Compound Nucleus (CN) against fission and formation of Evaporation Residues (ER) are deeply connected with various factors like, nuclear Shell Structure, Target-Projectile mass asymmetry, projectile energy, Angular Momentum distribution in the CN etc. Other than studying the dynamical effect associated with fusion and subsequent fission (or survival against fission) of heavy CN, there is also the long-standing desire to understand formation of very heavy or Super Heavy Elements (SHE). In this talk we plan to review the present status of heavy-ion induced fusion-fission processes at energies above the Coulomb Barrier. We would like to touch upon aspects of fission followed by complete and incomplete fusion and processes like fast and quasi-fission. We will be primarily drawing from our measurements carried out at Inter University Accelerator Centre, New Delhi using the Hybrid Recoil mass Analyser (HYRA) coupled with the TIFR 4π Sum-Spin spectrometer [1]. We will provide a brief introduction to the subject of heavy-ion induced fusion followed by fission process and its wider ramifications in low and medium energy nuclear physics. We will summarise what we have learnt so far and what are the unresolved mysteries. Example to support the current understanding of the subject will be primarily from our very recent measurements of angular momentum gated Evaporation Residues from the heavy 186Pt and very heavy 240Cf nuclei. Detailed analysis using Statistical Model analysis and Dynamical approach will also be presented. We will also discuss the role of nuclear viscosity in the survival of the CN against fission.
[1] Phys Rev C 88 024312 (2013), Phys Rev C 88 034606 (2013), Nucl. Phys. A 890, 62 (2012), Jour. Phys. G 41 (2014), EPJ Web of Sc.(2011,2013), Phys. Rev. C 95 (2017), Phys. Rev. C 96 (2017), Phys. Rev. C 99 (2019), Phys Rev C. 101,(2020), Phys. Rev C 2024 (In Press)

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