Study of Fission Fragment angular distributions for ^{9}Be + ^{232}Th

S. Appannababu[1], R. G. Thomas[2], B. V. John[2], A. Saxena[2], D. C. Biswas[2], B. K. Nayak[2], Y. K. Gupta[2], L. S. Danu[2], P. K. Rath[1] and R. K. Choudhury[2]
[1]*Department of Physics, The M. S. University of Baroda, Vadodara - 390002, INDIA and*
[2]*Nuclear Physics Division, Bhabha Atomic Research Centre, Mumbai - 400085, INDIA*

Introduction

The study of fusion-fission dynamics through heavy ion induced fission fragment angular distributions is a topic of great interest due to the observation of entrance channel effects on fragment anisotropies [1]. In the past various entrance channel properties of the interacting nuclei such as target deformation, ground state spins of target/projectile and entrance mass asymmetry have been identified to affect the fission fragment anisotropies[1]. Recently there is a lot of interest in the study of fusion-fission dynamics with stable weakly bound nuclei due to the observation of fusion enhancement/suppression around the Coulomb barrier, and to understand the effect of breakup channel on reaction mechanism[3]. The small threshold energy for breakup of ^{9}Be into ^{8}Be + ^{1}n (1.67 MeV) and/or into ^{5}He + ^{4}He (2.55 MeV), makes it a suitable candidate to study the reactions induced by these projectiles. With above motivation, we have carried out fission fragment angular distribution measurements for the system ^{9}Be + ^{232}Th around the coulomb barrier to study the effect of break up on fusion-fission dynamics.

Experimental Details

The Experiment was performed at 14 UD BARC-TIFR Pelletron facility at Mumbai. ^{9}Be beam was bombarded on ^{232}Th target of thickness 1.9 mg/cm^2 at energies around the Coulomb barrier. Two silicon surface barrier detectors of thickness 15 μg/cm^2 were placed on a rotatable arm inside the scattering chamber to detect the fission fragments with a collimator of 5mm diameter at a distance of 13.5 cm from the target. These two detectors were rotated to detect the fission yields from 180° to 170° in laboratory frame. Data at overlapping angles were taken in the telescope detectors for normalization of the solid angles. One Si surface barrier detector of thickness 300 mm with a collimator of 1mm was placed at 25° to the beam direction, and at a distance of 42 cm from the target for normalization of fission yields and getting the absolute differential cross sections.

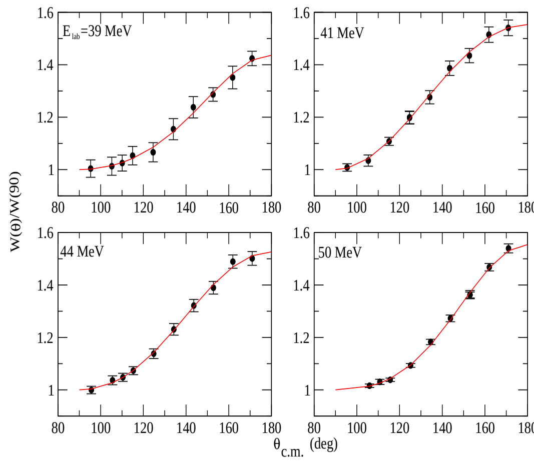

FIG. 1: Fission fragment angular distributions at different energies along with the Legendre polynomial fits for the reaction ^{9}Be+^{232}Th.

Results and Discussion

The measured fission fragment angular distributions were transformed from laboratory to center of mass frame using viola systematic for symmetric fission[4]. The elastic events in the monitor detectors were used for normalization by assuming that all of this from Rutherford scattering. The fission

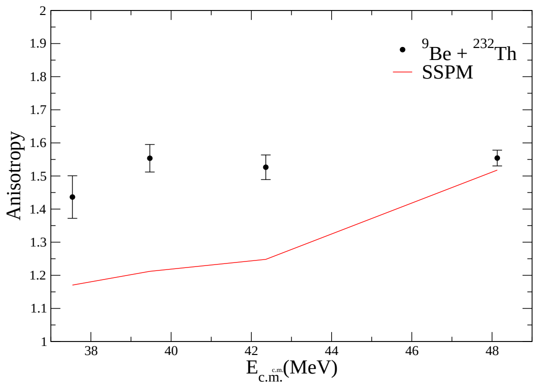

FIG. 2: Fission anisotropies as a function of $E_{c.m.}$ for the reaction ^{9}Be+^{232}Th.

fragment angular distributions are fitted to Legendre polynomials up to second order to extract the anisotropies. The angular distributions along with Legendre polynomial fitting at different energies as a function of $\theta_{c.m.}$ were shown in the Fig.1. The anisotropy values for the system as a function of $E_{c.m.}$ along with the predictions of Statistical Saddle Point Model(SSPM) is is shown in the Fig.2. At the highest energy the experimental anisotropy value is consistent with the prediction of SSPM but near the Coulomb barrier energies the experimental anisotropy values are much higher than the SSPM values. There is one more measurement of fission fragment anisotropies for the present system at 50 MeV and 53 MeV bombarding energies, where the fragment anisotropies have been reported to be consistent with SSPM [5]. Pre-equilibrium fission model calculations are being carried out to quantitatively understand the present experimental results and the details of the analysis will be presented.

Acknowledgments

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