Mass asymmetric fission in ^{40}Ca+^{142}Nd reaction

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An important observable in nuclear fission is the distribution of fragment masses, which provides crucial information about the reaction mechanism. Mass-asymmetric fission in spontaneous and low energy fission of actinide nuclei could be explained by the effect of shells in the fragments near scission, with increased binding energy near magic numbers. However, the observation of mass asymmetric fission from β-delayed measurements [1] in neutron deficient Hg isotopes could not be explained with fragment shell properties which would favour symmetric splitting into two ^{90}Zr nuclei. This suggests the important role of shell structure other than those of fragments here.

Fission fragment mass ratio distributions have been measured at ANU for the ^{40}Ca+^{142}Nd reaction populating the compound nucleus ^{182}Hg at different excitation energies (E*). Mass asymmetric fission has been observed in this reaction at E*=33.6 MeV, for the first time. Mass ratio (M$_R$) distribution observed in this study is compared with that reported for ^{180}Hg [2] in FIG. 1. Superficially, our observation seems to support the persistence of shell effects up to E*=33.6 MeV. However, the result may also be explained assuming 25% contribution from third chance fission of ^{180}Hg. The observation of mass-asymmetric fission following heavy ion fusion opens up a new avenue for exploring this new mode of fission in neutron deficient Hg region.

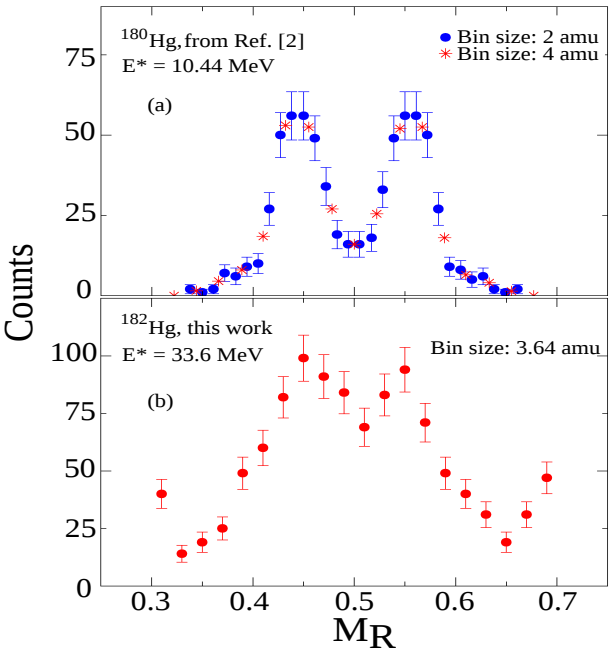

FIG. 1: The M$_R$ distribution measured in this study compared with that of ^{180}Hg reported in Ref. [2] .

[1] A. N. Andreyev, M Huyse and P. Van Duppen, Rev. Mod. Phys. 85, 1541 (2013).
[2] J. Elseviers et al., Phys. Rev C 88, 044321 (2013)