International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

Dynamics of the collinear ternary fission decay

K.R. Vijayaraghavan[3], W. von Oertzen[1,2], M. Balasubramaniam[3], Yu.V. Pyatkov[4], D. V. Kamanin[4]

[1]*Freie Universitaet Berlin, Fachbereich Physik, Berlin, Germany*; [2]*Helmholtz-Zentrum Berlin, D14109 Berlin*
[3]*Department of Physics, Bharathiar University, Coimbatore - 641 046, India*
[4]*Joint Institute for Nuclear Research, 141980 Dubna, Moscow Region, Russia*

Contact email: *oertzen@helmholtz-berlin.de*

We have performed systematic work on the search for true ternary fission, with three fragments of comparable masses, e.g. in ^{252}Cf(sf,fff) and ^{235}U(n,fff). From numerous studies in the last decades (see Pyatkov et al.[1] and refs.) we have learnt, that for intermediate mass ternary fragments such decay will be collinear and special experimental techniques (missing mass), are needed to study these. The signature is obtained in binary TOF (based on gas detectors [1]) coincidences between two fragmrnts (θ_{rel} = 180°), with a dispersive medium in one of the detector arms and a support grid of the foils at the entrance of the ionisation chambers. With two fragments which are originally collinear, they are separated by a small angle, 2°, which allows the blocking of one of the lighter fragments leading to $missing\ mass$ events. The process was named "collinear cluster tri-partition", CCT. The relatively high yield of the CCT-effect (more than 10^{-3} per binary fission) in the channels like, ^{132}Sn + ^{50}Ca + ^{72}Ni, are explained. For the dynamics of the process we have calculated within the fragmentation valley the opening angle for fragments in the collinear decay, see Fig.1. For the process to be considered sequential, the kinetic energies [2] of the fragments are obtained. The third fragments have very low kinetic energies (below 20 MeV), but span a large phase space due to the favourable Q-values, which contains about 25 mass-combinations of nuclei with their excited states, and spins. This explains the large overall yield compared to previous work on $ternary\ fission$, where a light fragment in the decay is assumed to produce a triangle for the three vectors of the fragments in the detectors.

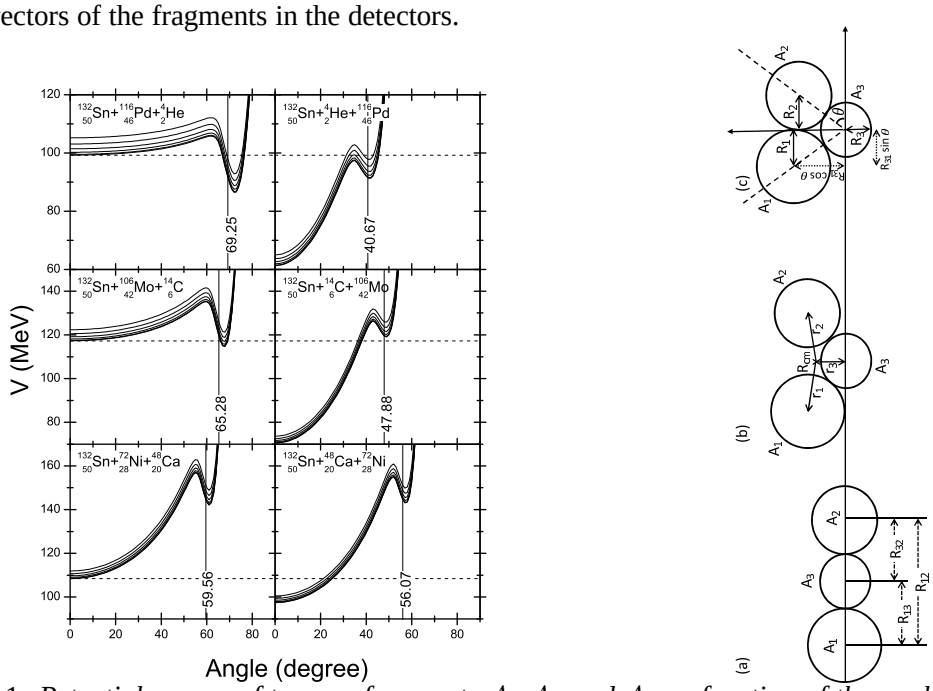

Figure 1: *Potential energy of ternary fragments A_1,A_2 and A_3 as function of the angles between them. Right: The relative angles of the three fragments in ternary (CCT) fission decay for ^{252}Cf (sf).*

[1] Y. V. Pyatkov, D.V. Kamanin, W. von Oertzen, et al. Eur. Phys. J. A 45, 29 (2010).
[2] K.R. Vijayaraghavan, W. von Oertzen, M. Balasubramaniam, Eur. Phys. J. A 48, 27 (2012).