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Prompt Fission Neutrons in Coincidence with Well-Defined Fission Fragments: A Dedicated Experiment

It is generally accepted that prompt fission neutrons (PFN) have two components with unknown relative intensities: neutrons dynamically released at scission (SN) and neutrons evaporated from fully accelerated fragments (EVN). There is no indication which of these two components is the dominant one since the gross features of PFN can be reproduced by both models [1, 2, 3]. To remove the ambiguity, instead of looking at averaged properties, one has to study PFN observables correlated with fragment properties.
It has been pointed out [2] that, for a fixed fragment-mass division, the kinetic energy spectrum and the angular distributions with respect to the fission axis of EVN and of SN are different: the first are smooth while the second present oscillations. In the case of angular distribution, the oscillations are due to the proximity of the fragments at the moment of emission. The calculated spectrum is not smooth since it consists of a finite weighted sum (only 35 non-negligible terms) of individual contributions with different mean values and widths.
To confirm or infirm experimentally the existence of fine structures in the angular and energy distributions of PFN is of outmost importance. It unveils the origin of the neutron emission during fission which is the best known and most discussed feature of nuclear fission.
[1] N.Carjan, M. Rizea, Phys. Lett. B 747, 178 (2015).

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