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The study of gamma emission in the fission process

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Prompt fission gamma spectra (PFGS) have been recently measured for the $^{238}\text{U}(n,f)$ and $^{239}\text{Pu}(n,f)$ reactions using fast neutrons produced by the LICORNE directional neutron source. The setup consisted of ionization chambers containing the actinides samples and LaBr₃ scintillators to measure the coincident prompt fission gamma rays. Prompt fission gamma rays were discriminated from prompt fission neutrons using the time-of-flight (TOF) technique. The total energies, multiplicities and average energies of gamma-rays per fission were extracted from the PFGS. In addition, information on the dependence of PFGS characteristics as a function of excitation energy was obtained.

These experiments provide important nuclear data for reactor physics, as an input for gamma heating calculations, since the gamma heating effect can be under-estimated by up to ~30% with present nuclear data. Furthermore the new PFGS information will be useful from a fundamental physics point of view, where results can be compared with many competing theoretical predictions to refine models of fission process. Observables like multiplicities, mean energies and total energy can shed light on the energy sharing between fragments and the angular generation mechanism in fission process. It will also lead to a better understanding of the competition between neutron and gamma emission.

Auteur principal: M. QI, Liqiang (IPN NESTER)

Orateur: M. QI, Liqiang (IPN NESTER)

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