Frontiers in Gamma Ray Spectroscopy FIG18

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Systematic study of fission fragment de-excitation depending on compound system and excitation energy

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Content :

Nuclear fission is a complex process, which – after almost 80 years since its discovery – is still not fully understood. One field of research is for instance studies of the de-excitation process of fission fragments, which in the early stages, i.e. within a few nanoseconds after scission, takes place through the successive emission of prompt neutrons and gamma rays. For nuclear applications, information about the prompt neutrons is crucial for calculating the reactivity in reactors, while precise knowledge about the prompt gamma rays is important for the assessment of the prompt heat released in the reactor core. Concerning the latter we have contributed in the past years with a number of precise measurements of prompt gamma-ray spectra from spontaneous as well as thermal and fast neutron-induced fission of various compound systems. From those we determined average characteristics like multiplicity, mean energy per photon and total gamma-ray energy released in fission.

The obtained results were investigated for their dependence of mass and atomic numbers of the fissioning system as well as the dissipated excitation energy. The purpose of this endeavor was to find a description that allows predicting prompt gamma-ray spectra characteristics for cases that cannot be studied experimentally.

In this talk we will give an overview on the latest measurements of prompt fission gamma ray spectra. We will also present first results from a recent angular correlation measurement between these gamma rays and fission fragments from the spontaneous fission of ^{252}Cf and infer what can be learned from the observed angular distributions. For instance, the relative contributions of dipole and quadrupole photons were deduced and compared to results of very recent calculations with the Monte Carlo Hauser-Feshbach code FIFRELIN, developed at CEA Cadarache.

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