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Fission studies at at NFS with SCONE

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Fission modeling is still the subject of much work. The objective is to understand the structure and dynamic effects involved in this reaction. From the point of view of fission applications, the objective is to provide precise data on the fission fragments yields and kinetic energies, but also on the emission of neutrons and γ-rays. The work being carried out in numerous laboratories ultimately aims to enable the provision of such data based on theories or phenomenological models. In this presentation I will describe the new results obtained with the large SCONE detector (Solid COunter for NEutrons), based on plastic scintillator bars. The detector design includes a significant amount of Gd, in order to carry out neutron counting with an efficiency of about 70 percent for fission neutrons. In addition, by design, SCONE is also a good γ-ray calorimeter, and in particular the granularity allows to determine the average γ-ray multiplicities. I will present the experimental results of the fast neutron induced fission of uranium 238 campaign performed at the GANIL/NFS facility, for neutron energies ranging from 1 MeV to 30 MeV. The complete distributions of fission neutron multiplicities, the average total radiated γ-ray en ergy, and the average γ-ray multiplicity in the fast neutron induced fission of uranium 238 will be discussed. Furthermore, measuring the different observables continuously as a function of neutron energy makes it possible to study the effects of multi-chances which confer structures into those observables. For the first time the second chance fission probability on uranium 238 was mea- sured experimentally. In a ddition, the re-analysis of old data on uranium 235 and plutonium 239 allowed us to obtain the aforementioned probability also for these two isotopes. These measure- ments open a way to take into account the effects of multi-chance in fission, that overcomplicate the description of the neutron induced fission process. Unfolding these effects will simplify the achievement of more precise models.

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