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Fission Yields for reactor applications: Development of a new program at CEA-Cadarache

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Fission yields play a crucial role in improving our understanding of the fission process and are essential for numerous reactor physics applications, such as decay heat calculations and the determination of delayed neutron multiplicities. In this context, the research group at CEA-Cadarache is actively involved in fission yield studies, with a focus on three complementary aspects.

Fission yield measurements using the Lohengrin recoil mass spectrometer
Taking advantage of the high performance of the Lohengrin recoil mass spectrometer and a close collaboration between CEA-Cadarache, the Laboratory of Subatomic Physics and Cosmology (LPSC, Grenoble, France), and the Institut Laue-Langevin (ILL, Grenoble, France), a new experimental procedure has been developed. This procedure aims (i) to improve the accuracy of experimental fission yield data and (ii) to provide the corresponding experimental fission yield correlation matrices.
In addition, a new time-of-flight device coupled to the Lohengrin spectrometer has been developed and characterized in order to specifically investigate the symmetric and highly asymmetric mass regions. The first results obtained with this new setup demonstrate very promising performance.

Evaluation of fission yields in the thermal energy region
A new methodology for fission yield evaluation has been developed at CEA-Cadarache and applied to thermal-neutron-induced fission reactions on the following target nuclei: ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu. These evaluations, which have been included into the recent JEFF-4.0 nuclear data library, provide consistent independent and cumulative fission yields. For each fission product, the evaluated yield and its associated uncertainty are provided, together with the correlation matrices between fission product yields.

From pre-neutron to post neutron fission yields to deduce various fission observables
The evaluated post-neutron mass yields Y(A) are related to the pre-neutron mass yields Y(A*) through the probability P(*□|*A*) that a fission fragment of mass A*emits □ prompt neutrons and becomes a fission product of mass A. Using the generalized □□-method and assuming that this probability follows a Gaussian distribution, we deduce the average number of prompt neutrons as a function of fragment mass* <□ *(A)*>, commonly referred to as the saw-tooth curve. The Monte Carlo code FIFRELIN was then employed to calculate the main post-fission observables relevant for reactor applications.

Type of contribution

Invited Speaker

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