NEW RESULTS IN THE MODELING OF FISSION

AND RADIATIVE NEUTRON CAPTURE WITH FIFRELIN

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Abstract:

The nuclear de-excitation process (through neutron, gamma and electron emission) simulated by the Monte Carlo code FIFRELIN [1] has been improved recently and compared with results from fission and radiative neutron capture experiments. Several examples will be presented during this conference.

Firstly, the initial goal of the code is to predict fission observables and associated correlations. That way a dedicated fission experiment has been performed at JRC Geel involving a fission chamber and several neutron and gamma scintillators (VESPA). FIFRELIN code has been used to calculate the relevant observables and especially the average neutron and gamma multiplicities as a function of fission fragment mass and kinetic energy [2]. Up to now it was very difficult to obtain a reasonable agreement for both neutron and gamma multiplicities within the same code using a unique set of model parameters. New calculations performed with HFB microscopic combinatorial level densities are in good agreement with measured neutron/gamma multiplicities as a function of mass or total kinetic energy.

Secondly, the code is used to estimate, among others, the gamma and electron cascades resulting from a neutron capture reaction. In a context of electron antineutrino spectrum emitted in a research reactor, the simulation of the STEREO compact detector was recently improved by applying the FIFRELIN ^{155,157}Gd(n_{th},γ) cascades [3]. As the detection efficiency has to be controlled to the %-level, a precise description of gamma cascades in Gd is necessary. The nuclear level scheme constructed from the RIPL-3 database and extended to initial capturing state at neutron separation energy has been updated with dedicated latest data from the EGAF database. Finally, a calculation of the angular distribution of gamma rays has been included in the code, with a perfect reproduction of all angular correlations [4].

In addition, FIFRELIN has been coupled with the depletion code PHITS-DCHAIN to estimate delayed fission components and first results will be briefly presented [5].

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