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Results on 235U(nth,f) isotopic fission yields using prompt and delayed gamma rays at the FIPPS spectrometer of the ILL

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Although nuclear fission has been known and studied for more than 80 years, it remains a very active field of research. A deeper understanding of the fission process can be achieved by investigating the prompt and delayed gamma-ray cascades emitted by fission fragments.

We report on the results of a measurement campaign performed with the FIPPS gamma-ray spectrometer at the ILL, using an active target consisting of 235U dissolved in a liquid scintillator. Prompt gamma rays were used to determine absolute, independent isotopic fission yields for a selected set of well-produced even-even nuclei from the 235U(nth,f) reaction, which were subsequently compared with the JEFF-3.3 evaluated data. This set includes the doubly magic nucleus 132Sn, for which we observe a pronounced deficit with respect to JEFF-3.3, in agreement with results obtained using a similar technique in the fast fission of 238U. Using the FIFRELIN fission fragment de-excitation code, we interpret this apparent anomaly as evidence that 132Sn is predominantly produced in its ground state, either at scission or after neutron evaporation.

Delayed gamma rays recorded in the same experiment were also analysed for a set of fission products to assess the potential of such experimental data for identifying discrepancies in nuclear databases in the context of the reactor antineutrino anomaly. No deviation is observed in the cumulative fission yield of 132Sn with respect to nuclear databases. However, an excess of about 40% is found for the 1118.7-keV transition in the beta decay of 90Kr, which may originate from an overestimated ground-state feeding of 90Rb in the evaluated data. This observation confirms a result previously reported using MTAS measurements.

Type of contribution

Regular Abstract

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