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Plans to constrain the reactor-relevant ^{135}Xe(n,γ) reaction through the beta-Oslo method while benchmarking against surrogate and inverse-Oslo methods at the same time.

The nuclear reactor community has identified measurements of the abnormally-large (n, γ) reaction cross section of the unstable fission fragment and reactor poison, ^{135}Xe, to be of the highest priority due to its large uncertainty at non-thermal energies. This uncertainty is apparent in data evaluations such as ENDF, JEFF, and JENDL, in which not only the evaluations differ from each other by an order of magnitude above thermal energies, but two of the evaluations famously demonstrate a striking discontinuity of more than two orders of magnitude at 19 keV. This discontinuity is known to produce confusing and contradicting predictions in neutronics codes, particularly in attempts to model the next generation (Gen4) of reactors which operate in higher energy regimes than traditional thermal reactors. Furthermore, reactions on a long-lived isomer of ^{135m}Xe is almost ignored in evaluations and absent from experimental measurements.

We, in collaboration with colleagues in the nuclear data community, have selected to constrain this important cross section using three indirect techniques that have not previously been benchmarked against each other: the beta-Oslo method, the surrogate method, and the indirect-Oslo method. The Shape method, while previously benchmarked against Oslo methods, will also be employed for comparison. I will discuss our plans primarily for the beta-Oslo measurement at the CARIBU facility, through the direct decay of a 50/50 split of isomer and ground state of ^{136}I into excited states of ^{136}Xe, and also solely from the ground state of ^{136}I created from ^{136}Te decay. Comparison of cross sections determined from each population method will help probe the spin-selective limitations of the beta-Oslo method and indicate if spin matching of the beta-decay to that of the constrained cross section improves the technique, leading to better predictions of (n, γ) reactions on the similar-spin ground and isomeric states of ^{135}Xe. Each will be analyzed independently and benchmarked against separate surrogate and inverse-Oslo experiments, which will use inverse-kinematic beams and charged-particle exit channels.

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