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ABSTRACT

On neutron capture and primary gamma-ray emissions at thermal energies

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Neutron capture is a possible outcome of a nuclear reaction between a neutron and a target nucleus. The associated probabilities are key components related to the nucleosynthesis. At thermal energies, this reaction often involves the formation of a compound nucleus in an excited state, composed by the target and the neutron. The structure of this residual nucleus drives the nuclear deexcitation process of emitted gamma rays. Here, we highlight the importance of the first step in this chain since the capture cross-section can be understood as a sum of the partial cross-section of individual primary gamma-ray emissions. These emissions are important for a precise modeling of the capture reaction as well as the subsequent gamma-ray cascade. When experimental values are not available, the primaries are given by theoretical predictions that rely on statistical assumptions difficult to be justified. We have analyzed the ability to model primary emissions with standard theoretical model parameterizations in comparison to experimental data for light and heavy isotopes, where we expect a high-level density to favor some of the statistical assumptions. One of our goals is to improve the accuracy of simulated gamma-ray cascade.

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