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Nuclear data sensitivities and the rapid neutron capture process[1]

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Simulations of the rapid neutron capture or r process of nucleosynthesis require the input of thousands of pieces of nuclear data for which no experimental information is available. These uncertain nuclear quantities are coupled, for instance, nuclear masses effect r-process abundances by entering into calculations of Q-values, neutron capture rates, photo-dissociation rates, β-decay rates and the probability to emit neutrons. We report on our recent studies of nuclear data sensitivities in the r process. These studies take into account the propagation of uncertainties to properly identify individual nuclei that influence r-process abundances over a range of nuclear models and astrophysical conditions. We additionally explore the impact of uncertainties in nuclear data on the r process by performing global Monte Carlo simulations. We conclude that the reduction of nuclear data uncertainties either by new measurements or by improved nuclear models will allow for more robust r-process predictions.

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