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Nuclear inputs and their impact on the r-process[1]

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The study of the rapid neutron capture or "r process" of nucleosynthesis offers the opportunity to glean insight into where the heavy elements (those above iron) on the periodic table are created in nature. Astrophysical sites, namely, supernovae and compact object mergers, e.g. two neutron stars, have long been touted as possible candidates. However, simulations of these environments require the input of thousands of pieces of nuclear data for which no experimental information is available. These unknown nuclear inputs may greatly impact the nucleosynthesis, leading to large uncertainties in the resultant abundances. It is therefore imperative to identify the most important nuclear inputs which leverage the final patterns. We report on recent studies that probe the variation in key nuclear quantities like masses, neutron capture rates, half-lives, branching ratios and fission. We show how these quantities influence the nucleosynthesis and discuss possible insights that can be gathered by current and future observations. We conclude that a targeted reduction of nuclear physics uncertainties either by new measurements or by improved nuclear models will allow for more robust r-process predictions.

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