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The nuclear physics of r-process observables

Over five years ago the groundbreaking gravitational wave event GW170817 provided the first direct proof that neutron star mergers produce heavy elements via rapid neutron capture (r-process) nucleosynthesis. Still, the extent of the element synthesis in this environment and the role of neutron star mergers in contributing to the galactic tally of r-process elements have yet to be clarified. Interpreting clues from r-process observables such as light curves, abundance patterns, and isotopic ratios currently suffers from large uncertainties due in part to the unknown nuclear physics of the unstable species which participate in the r-process. Here we discuss quantifications of these uncertainties and what we can learn from observables despite them. We will also consider the prospects for reducing nuclear uncertainties via advances in nuclear theory and experiments at AMS and radioactive beam facilities.

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