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Neutron-capture reaction rates for astrophysical applications

The rapid neutron capture process (r-process) is responsible for the synthesis of approximately half of the abundance of the heavy elements. The recent LIGO and Virgo gravitational-wave detection of a direct signal from two colliding neutron stars, combined with the wealth of follow-up measurements across the electromagnetic spectrum, demonstrated that an r-process had occurred during the collision. However, despite knowing at least one location for the r-process, many open questions remain. The uncertainties in the nuclear physics inputs present a large barrier to accurately model the r-process abundances in large-scale nucleosynthesis calculations. Masses, β-decay half-lives, β-delayed neutron emission probabilities and neutron-capture reaction rates are the main nuclear properties needed in r-process calculations. Of this set of nuclear input, the neutron-capture rates are the most uncertain and difficult to measure with theoretical predictions ranging over orders of magnitude far from stability. In this talk the indirect determination of neutron-capture cross sections using the "γ-Oslo" technique to provide information on level densities and g-ray strength functions will be discussed. The level density and strength function are critical inputs for constraining the neutron-capture rates, especially in very neutron-rich regions important in "cold" r-process scenarios.

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