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Nuclear Masses, Neutron Capture, and the r-process[1] A. COUTURE, Los Alamos National Laboratory, R. F. CASTEN, Yale Univ. and Michigan State Univ/FRIB, R. B. CAKIRLI, Istanbul University — Individual neutron capture cross sections play an important role in the final isotopic abundances from a wide range of r-process scenarios. Unfortunately, the isotopes which show the greatest impact are far from stability and not within experimental reach for direct measurements in the coming years. We have discovered a previously unrecognized correlation between the neutron capture cross-section and the two-neutron separation energy. While initial studies required independent correlations for regions of different nuclear structure, recent work has shown a simple way to treat multiple regions in a consistent way, drastically improving its predictive reach. Because two-neutron separation energies can be measured with achievable rare beam intensities, the quality and quantity of S_{2n} data is far more extensive than what is available for neutron capture, allowing experimentally based extrapolations. In addition to providing extended predictions, this may offer hints into where traditional reaction theories have missed underlying physics that is needed to more accurately model the capture reaction process.

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