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Examining lanthanide production in merger accretion disk winds: nuclear masses and the rare-earth peak NICOLE VASSH, REBECCA SURMAN, University of Notre Dame, MATTHEW MUMPOWER, Los Alamos National Laboratory, GAIL MCLAUGHLIN, North Carolina State University, FIRE COLLABORATION — The observations of the GW170817 electromagnetic counterpart suggested lanthanides were produced in this neutron star merger event. Lanthanide production in heavy element nucleosynthesis is subject to large uncertainties from nuclear physics and astrophysics unknowns. Specifically, the rare-earth abundance peak, a feature of enhanced lanthanide production at A$\sim$164 seen in the solar r-process residuals, is not robustly produced in r-process calculations. The proposed dynamical mechanism of peak formation requires the presence of a nuclear physics feature in the rare-earth region which may be within reach of experiments performed at, for example, the CPT at CARIBU and the upcoming FRIB. To take full advantage of such measurements, we employ Markov Chain Monte Carlo to "reverse engineer" the nuclear masses capable of producing a peak compatible with the observed solar r-process abundances and compare directly with experimental mass data. Here I will present our latest results and demonstrate how the method may be used to the learn which astrophysical conditions are consistent with both observational and experimental data. The question of where nature primarily produces the heavy elements can only be answered through such collaborative efforts between experiment, theory, and observation.

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