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**Lanthanide Database of Abundances Formed in Neutron Star Mergers**[1] PRANAV NALAMWAR, JAIDEEP SINGH, LUKE ROBERTS, Facility for Rare Isotope Beams — Kilonovae are optical transients associated with neutron star mergers (NSMs) and are powered by the radioactive decay of heavy elements created by the rapid neutron capture process(r-process). It is important to note that the blue and red emission components from the kilonovae, along with their timescales, are greatly dependent on the distribution of the lanthanides and their various charge states in the merger material. To analyze these mergers and their abundances, we study the event through an Atomic Physics lens. Numerous kilonovae modeling groups employ unique atomic structure codes, often resulting in diverging results. To assist in benchmarking these models and codes, we study how varying atomic data inputs, such as atomic energy level information, affect the total abundance of these unique elements, which in turn affects opacity and light curves. Utilizing elemental abundances calculated by Skynet, a nuclear reaction network code, we uncover how distinct isotopes evolve over time due to variables such as temperature and electron fraction. We then use these calculated elemental abundances, the Saha Equation, and NIST ionization data to predict the ionization state populations of lanthanides on timescales similar to the expected time of the kilonova peak as well as ranking certain ionization state abundances weighted by probable Ye values. We will report on our most recent results, and how a multi-element merger material should evolve over time. This work is supported by Michigan State University and the Joint Institute of Nuclear Astrophysics.

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