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Mass ejection in neutron star mergers: connecting merger simulations to nucleosynthesis and kilonova observations[1]

FRANCOIS FOUCART, University of New Hampshire

Determining the properties of the mildly relativistic outflows produced during and after the merger of neutron star binaries is crucial to understand the role of neutron star mergers in the production of heavy elements, as well as to analyze multi-messenger observations of these systems. The mass and composition of these outflows determine how much matter is available for r-process nucleosynthesis, as well as the relative abundance of the various elements produced by the r-process. Additionally, the properties of these matter outflows are tightly linked to the observable characteristics of kilonovae, the optical/infrared signals powered by radioactive decays of the ashes of the r-process. A good understanding of merger outflows allows us to constrain the role of merger in nucleosynthesis, and improves our ability to gather information about the properties of the merging objects from kilonova observations. To model merger outflows, we currently rely on numerical simulations of neutron star mergers and of their post-merger remnants. In this talk, I will review what simulations have taught us so far about neutron star merger outflows, and discuss both their recent successes and the impact of their remaining limitations on our ability to reliably model neutron star merger outflows.

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