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Tracing r-process nucleosynthesis in neutron star mergers with long-lived remnants: results from M1 neutrino transport simulations

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Binary neutron star (BNS) mergers eject neutron-rich matter, providing ideal conditions for the nucleosynthesis of heavy elements via the r-process. The radioactive decay of these elements powers a quasi-thermal electromagnetic transient known as kilonova (KN). Despite significant progress since the detection of GW170817, many open questions about KNe remain, such as the interpretation of the spectral features observed in AT2017gfo. On the one hand, accurate predictions of r-process yields are crucial for modeling and interpreting KN signals. On the other hand, precise modeling of microphysics in BNS merger simulations is essential to determine the properties of the merger ejecta, which provide the starting point for nucleosynthesis calculations. In my talk, I will present the results of the nucleosynthesis from BNS merger ejecta, computed for the first time using tracer particles from numerical relativity simulations performed with the M1 neutrino transport scheme. These simulations predict long-lived remnants and account for three distinct ejecta channels: dynamical ejecta, neutrino-driven wind, and spiral wave wind.

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