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Using a realistic equation of state in neutron star post-merger simulations.

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Neutron-star mergers provide unique environments for mass accretion, ejection, and r-process nucleosynthesis. Theoretically, however, simulating such systems are challenging, especially within the assumed equation of state (EOS) of the post-merger material. Although the ideal gas EOS, commonly used in simulations of post-merger systems, is a good approximation, a realistic EOS can account for electron-positron plasma degeneracy effects, thus, affecting the neutron abundances. This can change the composition of the disk, therefore, affecting the observed radiative signatures (e.g. kilonova). Here, I will present results of long-duration 3D general relativistic magnetohydrodynamic (GRMHD) simulations of post-merger systems with the use of a realistic Helmholtz EOS, evolved up to several seconds after the merger. In this, we treat ions as an ideal gas and electrons and positrons as a non-interacting Fermi gas, while including blackbody radiation with an assumption of the local thermodynamic equilibrium. The Helmholtz EOS, together with alpha-particle recombination, may contribute the to the unbinding of the disk material, thereby increasing the amount, and velocity, of ejected material. Moreover, I will compare these results to simulations where an ideal gas EOS was implemented, highlighting the differences within our results (e.g. mass accretion and ejection rate, jet power).

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