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Long Term 3D-MHD Simulations of Neutron Star Merger Accretion Tori with Realistic Microphysics[1] STEVEN FAHLMAN, RODRIGO FERNANDEZ, University of Alberta — We examine the long-term evolution of accretion tori around the black hole remnants of compact object mergers involving at least one neutron star, to better understand the role of secular outflows in the creation of kilonovae and the synthesis of r-process elements. We modify the FLASH code to evolve magnetohydrodynamics in non-uniform 3D spherical coordinates, enabling efficient evolution of magnetic fields over large simulation domains. Gravity is implemented as a pseudo-Newtonian potential. We include neutrino evolution via an improved lightbulb/leakage scheme and take into account nuclear recombination of α-particles in the equation of state. With this new framework, we evolve post-merger systems of tori around black holes and examine the outflows. We find results broadly consistent with general relativistic simulations. Magnetically driven outflows unbind a significant fraction of torus mass over a few seconds, with velocities $\sim 0.1c$ and average electron fractions favouring lanthanide-rich ejecta. Ejected torus mass is negatively correlated with system compactness. The fraction of mass with $Y_e > 0.25$ is insufficient to explain the blue kilonova of GW170817 based on current kilonovae models.

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Steven Fahlman
University of Alberta

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