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The Role of Magnetic Field Geometry in the Evolution of Neutron Star Merger Accretion Disks

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Neutron star mergers are unique multi-messenger laboratories of accretion, ejection, and r-process nucleosynthesis. Theoretically, however, our current understanding of such events is limited, especially of magnetic effects, such as the role the post-merger magnetic field geometry has on the evolution of merger remnant accretion disks. Through the use of 3D general relativistic magneto-hydrodynamic simulations, we investigate such effects while fully capturing mass accretion, ejection, and the production of relativistic jets, over time intervals exceeding several seconds. I will show that not only does an initially poloidal post-merger magnetic field geometry generate relativistic jets, but the more natural, purely toroidal post-merger geometry generates striped jets of alternating magnetic polarity, a result seen for the first time. Our simulated jet energies, durations, and opening angles for all magnetic configurations span the range of sGRB observations. Concurrent with jet formation, sub-relativistic winds, launched from the radially expanding accretion disk, provide efficient collimation of the relativistic jets and an observational window into the observed kilonova. In comparison to GW 170817/GRB 170817A, I will demonstrate that the blue kilonova component, although initially obscured by the red component, expands faster, outrunning the red component and becoming visible to off-axis observers.

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