W45a The Post-Breakout Cocoon in Binary Neutron Star Mergers

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We present 2D numerical simulations of jet propagation in the dynamical ejecta of Binary Neutron Star (BNS) mergers, similar to GW170817. We follow the jet dynamics for a relatively long period of $\sim 10s$ from its launch. We focus on the properties of the cocoon, from its breakout until the system becomes fully ballistic. One interesting finding is that in BNS mergers, a significant fraction of the cocoon (in terms of mass and energy) is trapped inside the dynamical ejecta. This is due to the fact that the surrounding medium is expanding at substantial velocity ($\sim 0.2 - 0.3c$). This is in contrast with the case of collapsars where the medium (stellar envelope of a massive star) is static, and most of the cocoon is able to breakout. We estimate the mass, energy and velocity of the cocoon that breaks out of the medium, both analytically and numerically. Finally, we estimate the cocoon's electromagnetic counterparts using a one-zone model.