W65a The Cocoon Breakout and Emission in Binary Neutron Star Mergers

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In binary neutron star mergers, short gamma-ray bursts' jets are launched and propagate across the dynamical ejecta. Using 2D numerical simulations, we study the jet cocoon; the byproduct of the jet propagation across the dynamical ejecta. We follow the cocoon at later times after the jet breakout. Our results show that, the fraction of the cocoon that breaks out of the ejecta (in terms of mass and energy) is not substantial, with most of the cocoon being trapped inside the dynamical ejecta even at later times. This is in contrast with the cocoon of collapsar jets. In addition, we present an analytical model for the cocoon breakout. Our model is reasonably consistent with numerical simulations at predicting the properties of the cocoon after the breakout. Finally, we apply our analytic model to estimate the cocoon?s cooling emission, as an electromagnetic counterpart to gravitational waves from neutron star mergers, as well as other observational features.