Abstract Submitted
for the APR06 Meeting of
The American Physical Society

Relativistic magnetohydrodynamics with black hole excision: Application to short gamma-ray bursts YUK TUNG LIU, University of Illinois at Urbana-Champaign, MATTHEW DUEZ, Cornell University, STUART SHAPIRO, University of Illinois at Urbana-Champaign, MASARU SHIBATA, University of Tokyo, BRANSON STEPHENS, University of Illinois at Urbana-Champaign — A hypermassive neutron star (HMNS) is a possible transient formed after the merger of a neutron star binary. In our latest magnetohydrodynamic simulations in full general relativity, we find that a magnetized HMNS undergoes 'delayed' collapse to a rotating black hole (BH) as a result of angular momentum transport via magnetic braking and the magnetorotational instability. The outcome is a BH surrounded by a massive, hot torus with a collimated magnetic field. To follow the subsequent evolution of this system, we continue the evolution using a black hole excision technique. We find that the system quickly settles down to a quasi-stationary state. The torus is hot and accretes onto the BH quasi-steadily. This BH-torus system is a promising central engine for the short-duration gamma-ray bursts. This model predicts that a short gamma-ray burst formed in this scenario should accompany a burst of gravitational waves and neutrinos.

Yuk Tung Liu
University of Illinois at Urbana-Champaign

Date submitted: 12 Jan 2006 Electronic form version 1.4