GRBs: Neutrino Driven Explosions

Neutrinos From the Disk Accelerate the Infalling Matter through

I) Neutrino Absorption and Scattering:

$$a_\nu \approx \frac{\kappa_t \, dr}{m_{shell}} \, \frac{L_\nu}{c} \approx \frac{1.5 \times 10^{-17} \, (kT_{\nu_e}/4 \text{ MeV})^2 \, L_\nu}{4 \pi r^2 \, c}$$

and II) Neutrino Annihilation:

$$a_{\nu\bar{\nu}} \approx \frac{\dot{e}(r) \, dr}{c} \, \frac{1}{m_{shell}} \approx \frac{\dot{e}(r)}{\pi c \, r^2 \, \rho}$$

The Neutrino Acceleration must Overcome the Gravitational Acceleration.

Solving for the Critical Explosion Density:

$$\rho_{crit} < (4 \, \dot{e}(r))/(4 \pi G \, M_{BH} \, c - 1.5 \times 10^{-17} \, (kT_{\nu_e}/4 \text{ MeV})^2 \, L_\nu)$$