

Title:

The Late Peaking Afterglow of GRB 100418A

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Abstract:

GRB 100418A is a long Gamma-Ray Burst at redshift  $z=0.6235$  discovered with the Swift Gamma-Ray Burst Explorer with unusual optical and X-ray light curves. After an initial short-lived, rapid decline in X-rays, the optical and X-ray light curves observed with Swift are approximately flat or rising slightly out to at least  $\sim 7$  ks after the trigger, peak at  $\sim 50$  ks, and then follow an approximately power-law decay.

Such a long optical plateau and late peaking is rarely seen in GRB afterglows. Observations with REM during a gap in the Swift coverage indicate a bright optical flare at  $\sim 25$  ks. The long plateau phase of the afterglow is interpreted using either a model with continuous injection of energy into the forward shock of the burst or a model in which the jet of the burst is viewed off-axis. In both models the isotropic kinetic energy in the late afterglow after the plateau phase is  $>100$  times the  $10^{51}$  erg of the prompt isotropic gamma-ray energy release. The energy injection model is favored because the off-axis jet model would require the intrinsic  $\theta_{90}$  for the GRB jet viewed on-axis to be very short,  $\sim 10$  ms, and the intrinsic isotropic gamma-ray energy release and the true jet energy to be much higher than the typical values of known short GRBs. The non-detection of a jet break up to  $\sim 2$  Ms indicates a jet half-opening angle of at least 14 degrees, and a relatively high collimation-corrected jet energy of at least  $10^{52}$  erg.