

Swift Observations of GRB 090328A

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1. INTRODUCTION

At 09:36:46 UT, the Fermi Gamma-Ray Burst Monitor (GBM) triggered and located GRB 090328A (McEnery *et al.* GCN Circ. 9044). The burst was also detected and located with the Fermi Large Area Telescope (LAT) (McEnery *et al.* GCN Circ. 9044). Swift began a ToO observation (target ID 20103) of the LAT position at 01:26 UT March 29th, 2009. A bright afterglow was discovered in both the X-ray (Kennea GCN Circ. 9045) and optical bands (Oates GCN Circ. 9048). Cenko *et al.* (GCN Circ. 9053) determined a spectroscopic redshift of 0.736. The afterglow was also detected with the VLA at a frequency of 8.46 GHz (Frail *et al.* GCN Circ. 9060). UVOT data provide (Oates GCN Circ. 9048) the most accurate Swift position of RA (J2000) = 06h 02m 39.67s and Dec (J2000) = $-41^{\circ} 52' 54.5''$ with an estimated 90% confidence radius of 0.6". The VLA observations provide the most accurate position of RA (J2000) = 06h 02m 39.67s and Dec (J2000) = $-41^{\circ} 52' 53.8''$ with an estimated error of 0.25".

The burst was also detected with Konus-Wind (Golenetskii *et al.* GCN Circ. 9050) and INTEGRAL (Golenetskii *et al.* GCN Circ. 9049). The GBM time-integrated spectrum is best fit with a Band model with a peak energy of 653 ± 45 keV.

2. XRT OBSERVATIONS AND ANALYSIS

The XRT began observing GRB 090328A about 57 ks after the Fermi trigger. Using 1.3 ks of XRT Photon Counting (PC) mode data and 2 UVOT images, Kennea *et al.* (GCN Circ. 9046) found a UVOT-enhanced XRT position of RA (J2000) = 06h 02m 39.58s and Dec (J2000) = $-41^{\circ} 52' 57.5''$ with an uncertainty of 2.0 arc seconds (radius, 90% confidence).

The entire XRT light curve can be modeled with a power-law model with a decay index of $\alpha=1.63\pm 0.09$.

A spectrum formed from the PC mode data can be fitted with an absorbed power-law model with a photon spectral index of 1.85 (+0.21, -0.35). The best-fitting absorption column is $1.4 (+1.1, -1.0) \times 10^{21} \text{ cm}^{-2}$, in excess of the Galactic value of $5.0 \times 10^{20} \text{ cm}^{-2}$ (Kalberla *et al.* 2005). The counts to observed (unabsorbed) 0.3-10 keV flux conversion factor deduced from this spectrum is $5.7 \times 10^{-11} (7.7 \times 10^{-11}) \text{ erg cm}^{-2} \text{ count}^{-1}$.

3. UVOT OBSERVATIONS AND ANALYSIS

The Swift/UVOT began a ToO observation of the field of GRB 090328A 16 hours after the Fermi trigger. An optical afterglow was detected in the u and white filters at the position RA (J2000) = 06h 02m 39.67s and Dec (J2000) = $-41^{\circ} 52' 54.5''$ with an estimated uncertainty of 0.6 arc seconds (radius, 90% confidence). The magnitudes of the detections are given in Table 1 below. The photometry uses the UVOT photometric system described in Poole *et al.* (MNRAS 383, 627 (2008)).

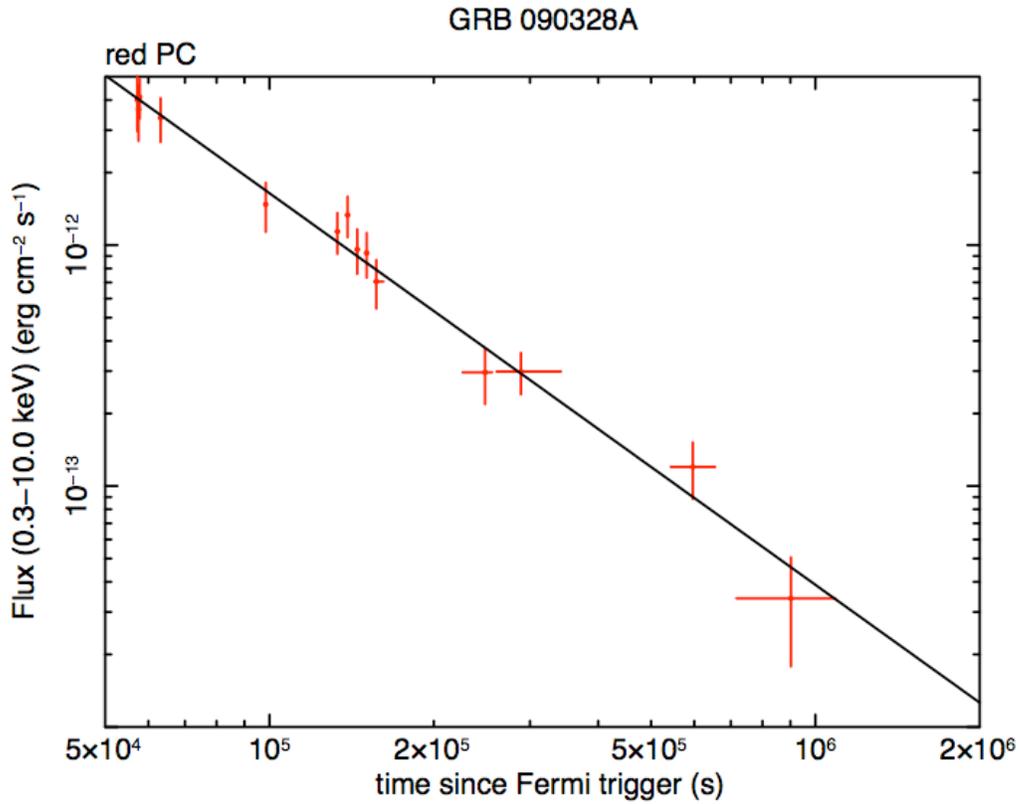


Figure 1: The XRT light curve plotted as a function of the time since the Fermi trigger. One count- s^{-1} is about $5.7 \times 10^{-11} \text{ erg-cm}^{-2}\text{-s}^{-1}$ (observed) in the 0.3-10 keV band.

Filter	T_{mid}	Exposure	Magnitude	Uncertainty
	(hours)	(seconds)		
u	16.0	793	19.04	0.13
white	16.1	173	19.56	0.14

Table 1: UVOT Observations. The mid-point times of the exposures are given in hours since the Fermi trigger. No corrections have been made for the expected extinction in the Milky Way corresponding to E_{B-V} of 0.06 (Schlegel *et al.* 1998).

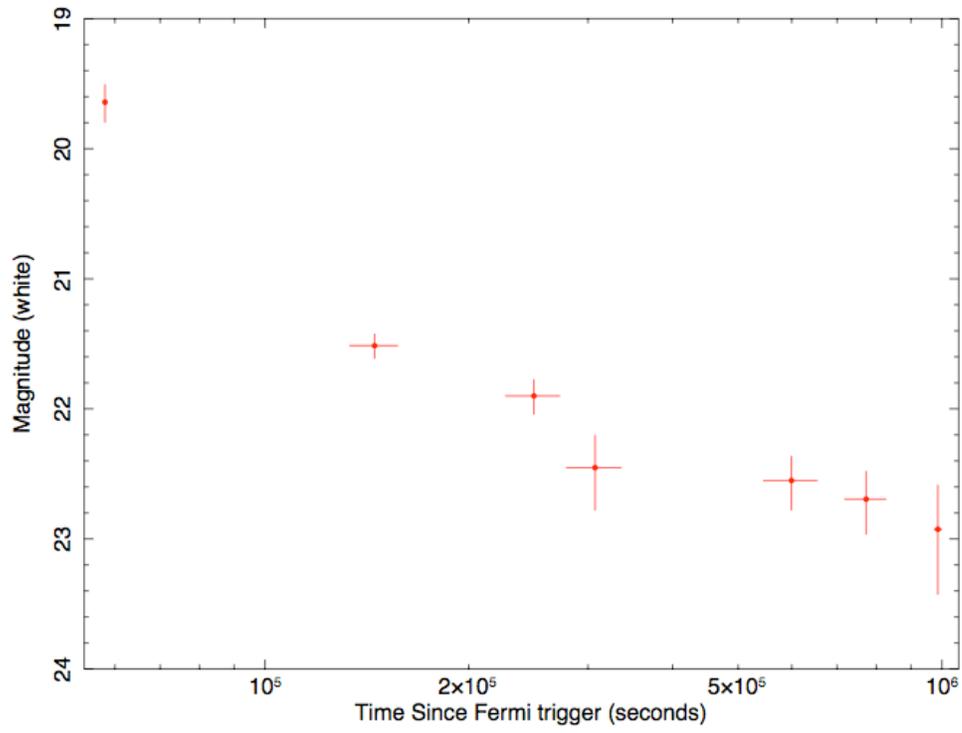


Figure 2: The light curve in the UVOT white filter.