

## Swift Observations of GRB 061110A

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### 1. INTRODUCTION

At 11:47:21 UT, the Swift Burst Alert Telescope (BAT) triggered and located GRB 061110A (trigger=238108) (Falcone, et al., GCN Circ. 5795). Swift slewed immediately to the burst, and the pointed instruments began taking data. The BAT light curve shows multiple peaks with a T90 duration of about 41 sec. The spectral lag is 2.75 sec (+0.55,-0.48 sec) between the 15-25 to 50-100 keV bands. This is among the longest 3-4% compared to BATSE spectral lags. Currently, our best position for this burst is derived from XRT data to be RA,Dec(J2000) = 22 25 09.9, -02 15 30.7, with an uncertainty of 3.7 arcsec (90% containment).

The follow-up of this GRB is ongoing, but it should be noted that it is near the same position as GRB 061110B so observing time will be split between these two bursts. The host of this GRB has a tentative redshift measurement of  $z=0.757$ , from VLT observations (Thoene, et al., GCN Circ. 5812).

### 2) BAT OBSERVATION AND ANALYSIS

Using the data set from T-240 to T+726 sec from recent telemetry downlinks, we report further analysis of BAT GRB 061110A (Cummings, et al., GCN Circ. 5802). The BAT ground-calculated position is RA,Dec = 336.284, -2.252 deg {22h 25m 8.1s, -2d 15' 6.0"} (J2000) +/- 1.1 arcmin, (radius, sys+stat, 90% containment). The partial coding was 100%. The off-axis angle was 6.3 degrees.

The mask-weighted lightcurve is shown in Figure 1. There is a FRED-like peak starting at ~T-15 sec, peaking at ~T+5 sec, and extending out to ~T+80 sec. T90 (15-350 keV) is 41 +/- 2 sec (estimated error including systematics). The spectral lag is 2.75 sec (+0.55,-0.48 sec) between the 15-25 to 50-100 keV bands.

The time-averaged spectrum from T-8.8 to T+38.5 is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.67 +/- 0.12. The fluence in the 15-150 keV band is 1.1 +/- 0.1 x 10<sup>-6</sup> erg/cm<sup>2</sup>. The 1-sec peak photon flux measured from T+9.74 sec in the 15-150 keV band is 0.5 +/- 0.1 ph/cm<sup>2</sup>/sec. All the quoted errors are at the 90% confidence level.

### 3. XRT OBSERVATION AND ANALYSIS

We have analyzed the first 3 orbits of XRT data for GRB 061110A (Vetere, et al., GCN Circ. 5806). A 560s photon counting (PC) mode image provides a refined XRT position:

RA(J2000) = 22 25 09.9  
Dec(J2000) = -02 15 30.7

with an uncertainty of 3.7 arcsec (90% containment). This position is 2.2 arcsec away from the initial XRT position (Falcone, et al., GCN Circ. 5795), 1.66 arcsec away from the optical afterglow detection by Chen et al. (GCN Circ. 5797) and 1.5 arcsec away from its later confirmation by Zhai et al. (GCN Circ. 5798).

The X-ray light curve is shown in Figure 2. It shows a rapid decay with a slope of  $\alpha=2.36\pm 0.22$  throughout most of the 1st orbit (slope derived using PC data from approximately T+300 s to T+2000 s). The data beyond T+5000 seconds shows flattening. A power-law fit to the spectrum, using the windowed timing (WT) mode data, gives a photon index of 3.1 +/- 0.2 and a column density of (1.6 +/- 0.2)e21 cm<sup>-2</sup>. We note that the galactic hydrogen column density in the direction of the burst is 4.94e20 cm<sup>-2</sup>. The 0.2-

10.0 keV observed mean flux during WT observation is  $1.1 \cdot 10^{-9}$  ergs  $\text{cm}^{-2}$   $\text{s}^{-1}$ , which corresponds to an unabsorbed flux of  $3.4 \cdot 10^{-9}$  ergs  $\text{cm}^{-2}$   $\text{s}^{-1}$ .

#### 4. UVOT OBSERVATION AND ANALYSIS

The Swift/UVOT began observing the field of GRB 061028 at 11:48:32 on 2006-11-10, 71s after the BAT trigger (Schady et al., GCN Circ 5813). No new source was detected within the XRT error circle (Vetere, et al., GCN Circ. 5806) or at the afterglow position reported by Zhai et al. (GCN Circ. 5798) in coadded images in any filter down to the following 3-sigma magnitude upper limits:

Filter	T_mid (s)	Exp. (s)	3-sigma UL
V	3952	2579	20.42
B	4016	442	20.55
U	3888	452	20.28
UVW1	3792	452	19.72
UVM2	6192	1273	20.55
UVW2	4128	452	20.31

T\_mid is the mid time of the coadded exposure with respect to the BAT trigger. These upper limits are not corrected for Galactic extinction  $E(B-V) = 0.09$ .

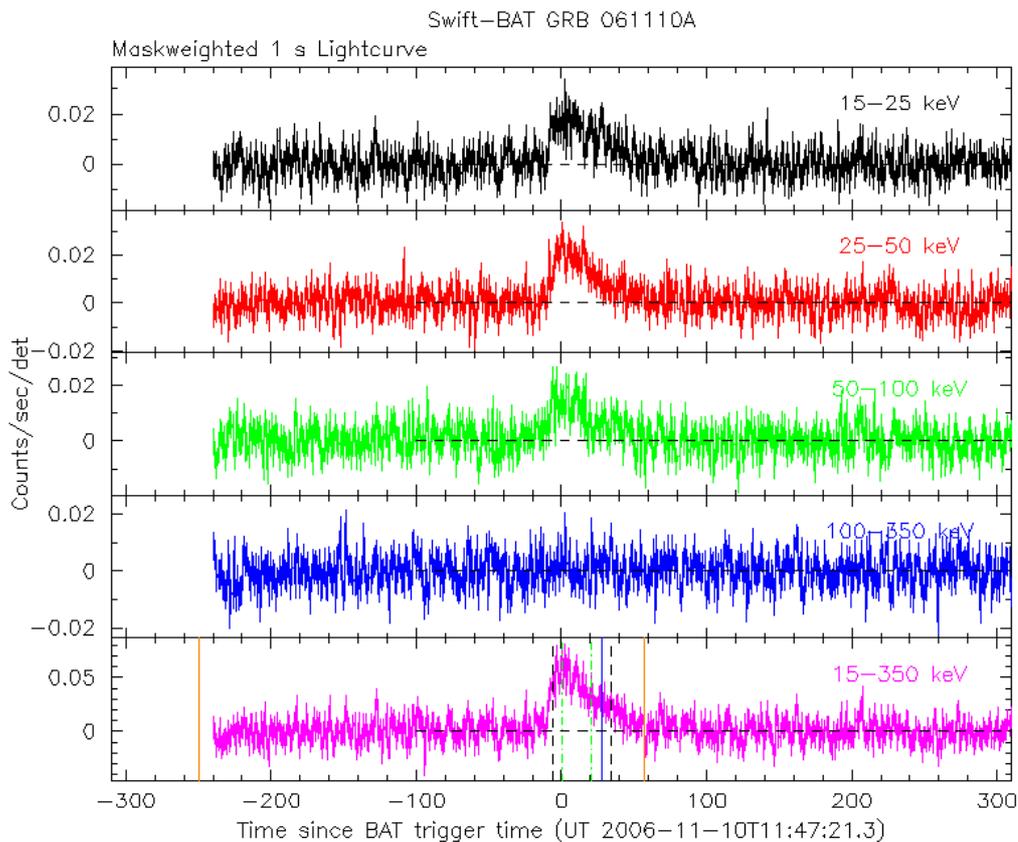


Fig. 1: BAT Lightcurve. The light curve in the 4 individual plus total energy bands.

