Swift Observation of GRB 070529

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1 Revisions

This is the final report on *Swift* observations of the gamma-ray burst GRB 070529. The XRT light curve and best-fitting decay slopes have been updated

2 Introduction

BAT triggered on GRB 070529 at 12:48:28 UT (Trigger 280706) (Holland, *et al.*, *GCN Circ.* 6466). This was a long burst with $T_{90} = 109 \pm 3$ s. *Swift* slewed to this burst immediately and XRT began follow-up observations at $T + 131$ s, and UVOT at $T + 134$ s. Our best position is the UVOT location, RA($J2000$) = 283.7427 deg (18h54m58.24s), Dec($J2000$) = +20.6594deg (+20d39′34.0″) with an error of 0.5 arcsec (90% confidence).

Berger, *et al.*, *GCN Circ.* 6470 found an absorption redshift of $z = 2.4996$ for GRB 070529.

3 BAT Observation and Analysis

Using the data set from $T - 119$ to $T + 283$ s, further analysis of BAT GRB 070529 has been performed by the *Swift* team (Parsons, *et al.*, *GCN Circ.* 6468). The BAT ground-calculated position is RA($J2000$) = 283.725deg (18h54m54.0s), Dec($J2000$) = +20.648deg (+20d38′54″) ±1.9 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 16%.

The masked-weighted light curves (Fig.1) shows multiple overlapping peaks starting at T_0 and lasting to $T + 120$ s. There is a possible (≈ 4 sigma) 10 s peak at $\approx T - 55$ s. T_{90} (15–350 keV) is 109 ± 3 s (extimated error including systematics).

The time-averaged spectrum from $T - 1.2$ to $T + 120.9$ s is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.38 ± 0.16. The fluence in the 15–150 keV band is $2.6 \pm 0.2 \times 10^{-6}$ erg cm^{-2}. The 1-s peak photon flux measured from $T + 2.02$ s in the 15–150 keV band is 1.4 ± 0.4 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level.

4 XRT Observations and Analysis

Using the data from the first two orbits of XRT data of GRB 070529 (3.6 ks in Photon Counting mode), the refined XRT position, calculated from the second orbit data only to avoid pile up, is RA($J2000$) = 283.7425deg (18h54m58.2s), Dec($J2000$) = +20.6589 deg (+20d39′32″) ±3.8 arcsec (90% confidence, radius). This position is within 0.9 arcsec of the initial XRT position, and 2.3 arcsec from the optical afterglow candidate, reported by Holland, *et al.*, *GCN Circ.* 6466.

The 0.3–10 keV light curve (Fig.2) shows a power law decline with a slope of 0.73 ± 0.09, a break at $T + 2300 \pm 850$ s, and a slope of 1.30 ± 0.05 after that. Detailed light curves in both count rate and flux units are available in both graphical and ASCII formats at `http://www.swift.ac.uk/xrt_curves/`.

We extracted a spectrum of the PC data which can be fitted with an absorbed power law with a photon index of 2.2 ± 0.2 and a column density of $(3.5 \pm 0.8) \times 10^{21}$ cm^{-2}, slightly in excess with

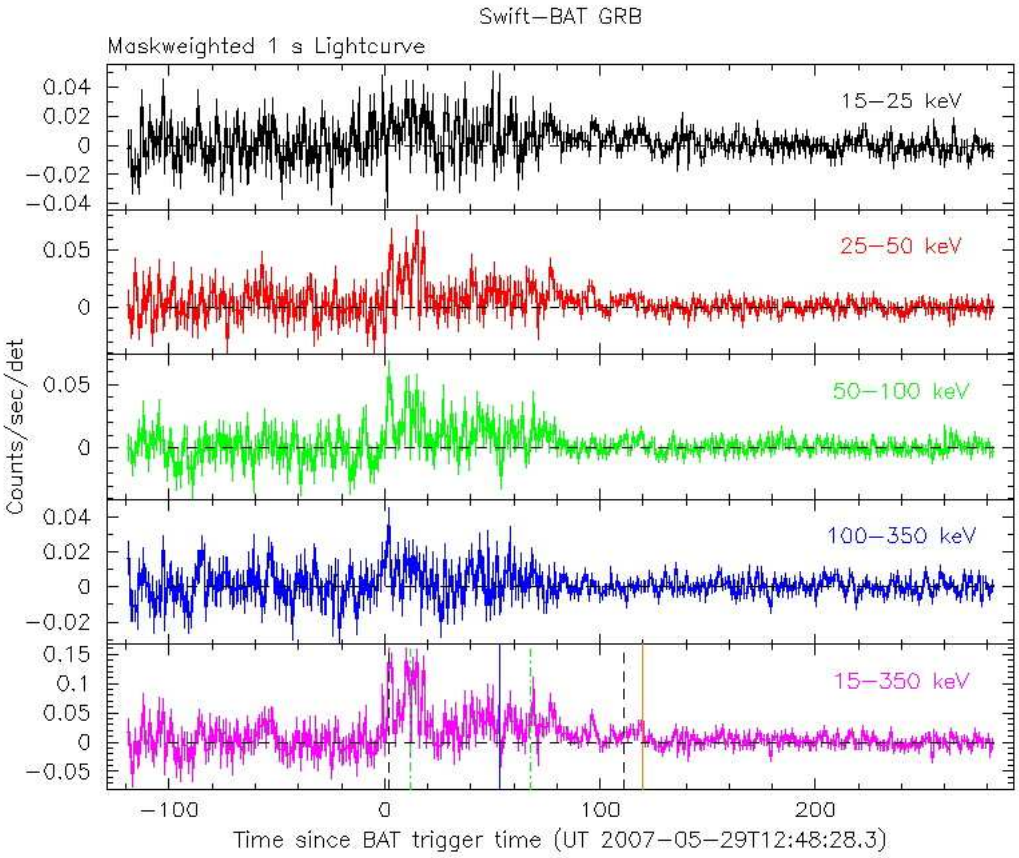

Figure 1: BAT light curve. The mask-weighted light curve in the 4 individual plus total energy bands. The units are count s^{-1} illuminated-detector−1 T_0 is 12:48:28 UT.

respect to the Galactic absorption column (1.9×10^{21} cm^{-2}; Dickey & Lockman, 1990).

The absorbed (unabsorbed) 0.3–10.0 keV average flux in the $T + 150$ s to $T + 7$ ks time interval is 1.6×10^{-11} (2.8×10^{-11}) erg cm^{-2} s^{-1}.

5 UVOT Observation and Analysis

The *Swift* Ultraviolet/Optical telescope (UVOT) began its initial V-band finding chart exposure of GRB 070529 (Holland, *et al.*, *GCN Circ.* 6466) 134 seconds after the trigger. The optical afterglow is clearly detected inside the refined XRT error circle (Mangano, *et al.*, *GCN Circ.* 6469). Successively, the optical source fades with a decay slope, based on the V-band data points, of about 1.8. Magnitudes and 3-sigma upper limits are summarized in Table 1. Errors are at 1 sigma level. No correction has been made for the considerable Galactic reddening toward the burst of $E_{B-V} = 0.3$ mag (Schlegel, *et al.*, 1998). No observation was performed in the White filter due to bright stars in the field.

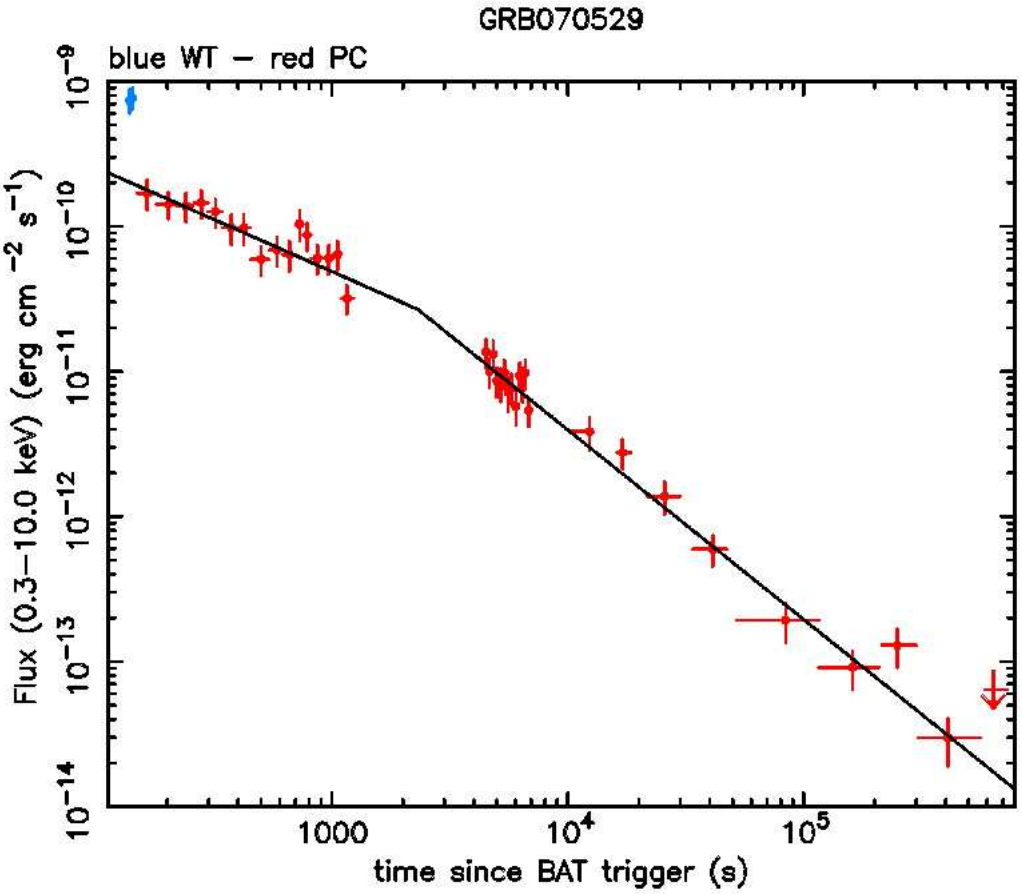

Figure 2: XRT flux lightcurve in erg cm^{-2} s^{-1} in the 0.3–10 keV band: Window Timing mode (blue) and Photon Counting mode (red).

Filter	Start	Stop	Exposure (s)	Mag
V	134	534	393	17.1 ± 0.1
V	652	1253	420	19.3 ± 0.4
V	40 339	47 072	2039	> 20.4
B	613	758	20	> 18.8
U	588	6277	439	> 20.1
UVW1	564	6072	459	> 20.5
UVM2	540	7038	592	> 20.8
UVW2	432	6687	432	> 21.0

Table 1: Magnitudes and 3-sigma upper limits from UVOT observations

References

1) Dickey, J. M., & Lockman, F. J., 1990, ARAA, 28, 215

2) Schlegel, D. J., Finkbeiner, D. P., & Davis, M., 1998, ApJ, 500, 525