Swift Observation of GRB 120729A

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1 Introduction

BAT triggered (Trigger 529095) on GRB 120729A at 10:56:14 UT (Ukwatta et al., 2012). Swift slewed immediately to the burst. This was a $48.53\,\sigma$ rate-trigger on a burst with $T_{90} = 71.5 \pm 17.5$ sec. The XRT began observing the field at 10:57:22.2 UT, 68.1 seconds after the BAT trigger. XRT found a fading, uncatalogued X-ray source. The UVOT started settled observations at $\sim T + 77$ sec and detected an optical afterglow consistent with the XRT position. Our best position is the UVOT location at RA($J2000$) = 13.07433 deg (00h 52m 17.84s), Dec($J2000$) = +49.93974 deg (+49d 56′ 23.1″) with an uncertainty of 0.50 arcsec (90% confidence).

The spectroscopic redshift of the burst is ~ 0.80 (Tanvir & Ball, 2012). In addition, GRB 120729A was also detected by the Fermi GBM (Rau, 2012).

2 BAT Observation and Analysis

Using the data set from $T - 240$ to $T + 962$ sec, further analysis of BAT GRB 120729A has been performed by BAT team (Palmer et al., 2012). The BAT ground-calculated position is RA($J2000$) = 13.078 deg (00h 52m 18.8s), Dec($J2000$) = 49.936 deg (+49d 56′ 08.5″) ± 1.0 arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 76% (the bore sight angle was 19.1 deg).

The mask-weighted light curve (Fig. 1) shows a single FRED peak with a rise of ~ 20 secs and a fall of 100 seconds. There are no significant subsidiary peaks. T90 (15-350 keV) is 71.5 ± 17.5 sec (estimated error including systematics).

The time-averaged spectrum from $T - 3.08$ to $T + 101.94$ sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.62 ± 0.08. The fluence in the $15 - 150$ keV band is $2.4 \pm 0.1 \times 10^{-6}\,\mathrm{erg\,cm^{-2}}$. The 1-sec peak photon flux measured from $T - 0.03$ sec in the $15 - 150$ keV band is $2.9 \pm 0.2\mathrm{ph\,cm^{-2}}$ sec. All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at
`http://gcn.gsfc.nasa.gov/notices_s/529095/BA/`.

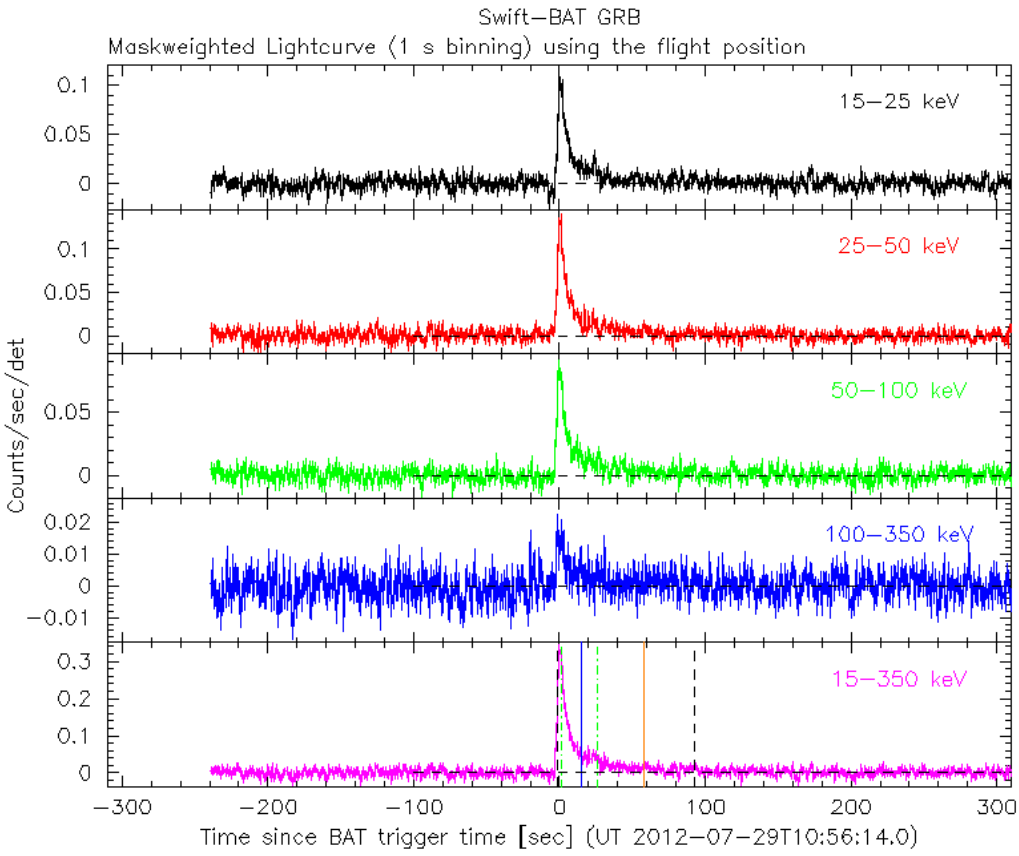

Figure 1: The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 10:56:14 UT.

3 XRT Observations and Analysis

XRT data were collected from $T + 74$ s to $\sim T + 200$ ks after the BAT trigger. The data comprise 170 s in Windowed Timing (WT) mode with the remainder in Photon Counting (PC) mode. The enhanced XRT position (Beardmore et al., 2012) for this burst is: RA, Dec = 13.07446, +49.93967 which is equivalent to:

RA (J2000): 00h 52m 17.87s
Dec (J2000): +49d 56' 22.8"

with an uncertainty of 1.8 arcsec (radius, 90% confidence).

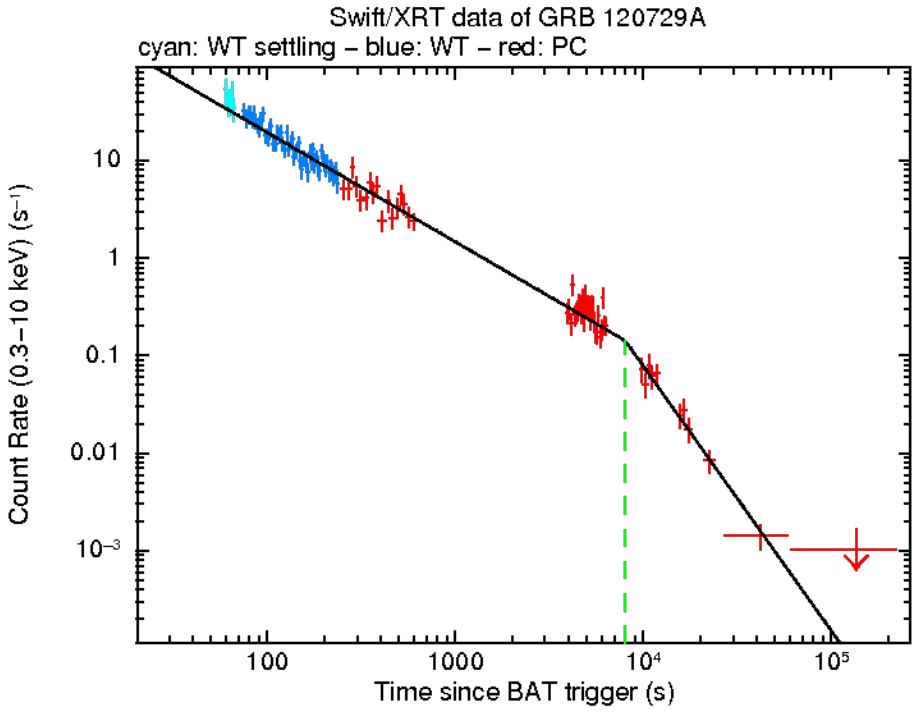

Figure 2: XRT Lightcurve. Count rate in the $0.3 - 10$ keV band is plotted with Window Timing (WT) mode data in blue, WT Settling data in light blue and Photon Counting (PC) mode data in red. The green dotted line highlights the break in the light curve at $T+8203$ seconds. The approximate conversion is 1 count/sec = $\sim 4.2 \times 10^{-11}$ ergs/cm^2/sec.

The X-ray light curve (Fig. 2) can be modelled with an initial power-law decay with an index of alpha=$1.115^{+0.023}_{-0.022}$, followed by a break at $T + 8203$ s to an alpha of 2.9 ± 0.4.

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of 1.56 ± 0.10. The best-fitting absorption column is $1.9 \pm 0.3 \times 10^{21}$cm^{-2}, in excess of the Galactic value of 1.4×10^{21} cm^{-2} (Kalberla et al., 2005). The PC mode spectrum has a photon index of $1.87^{+0.15}_{-0.14}$ and a best-fitting absorption column of $2.1^{+0.5}_{-0.4} \times 10^{21}$ cm^{-2}. The counts to observed (unabsorbed) $0.3 - 10$ keV flux conversion factor deduced from this spectrum is 4.2×10^{-11}(5.8×10^{-11}) erg cm^{-2}count^{-1}.

A summary of the PC-mode spectrum is thus:
Total column: $2.1^{+0.5}_{-0.4} \times 10^{21}\,\mathrm{cm}^{-2}$
Galactic foreground: $1.4 \times 10^{21}\mathrm{cm}^{-2}$
Excess significance: 2.5 sigma
Photon index: $1.87^{+0.15}_{-0.14}$

The results of the XRT-team automatic analysis are available at
`http://www.swift.ac.uk/xrt_products/00529095`.

4 UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 120729A, 77 seconds after the BAT trigger. A source consistent with the XRT position (Beardmore et al., GCN Circ. 13534) and the optical position reported by FTN (Virgili et al., 2012) is detected in the initial UVOT exposures.

The preliminary UVOT position is:

RA (J2000) = 00:52:17.83 = 13.07431 (deg.)
Dec (J2000) = +49:56:23.1 = 49.93974 (deg.)

with an estimated uncertainty of 0.50 arc sec. (radius, 90% confidence).

Preliminary detections and 3-sigma upper limits using the UVOT photometric system (Breeveld et al., 2011) for the early exposures are:

Filter	Tstart (s)	Tstop (s)	Exposure (s)	Magnitude
white	77	227	147	15.33 ± 0.02
v	620	640	20	15.92 ± 0.15
b	545	564	20	16.56 ± 0.12
u	289	539	246	15.78 ± 0.04
w1	4113	4313	197	18.49 ± 0.16
m2	3908	4108	197	18.91 ± 0.25
w2	595	615	20	17.57 ± 0.32

Table 1: Magnitudes and limits from UVOT observations

The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of E(B-V) = 0.16 in the direction of the burst (Schlegel et al., 1998).

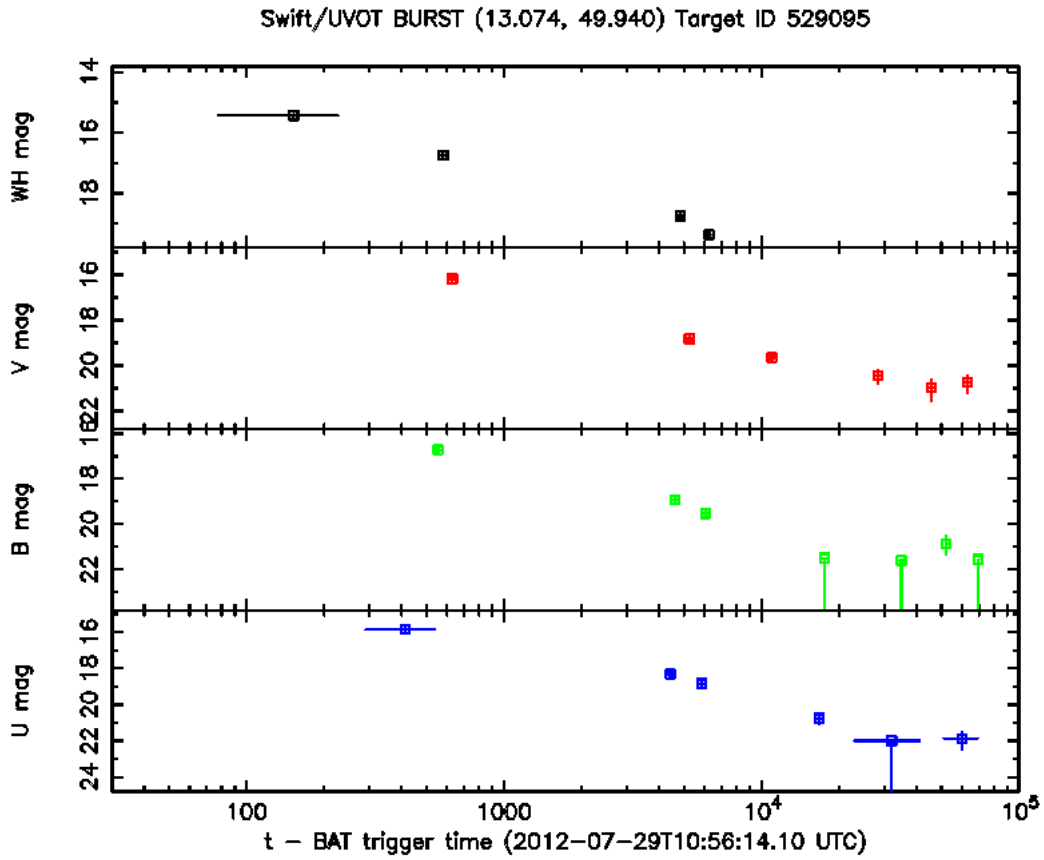

Figure 3: UVOT light curve in the white, b, u, and v filters.

References

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