

## Swift Observations of GRB 090926B

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### 1 Introduction

At 21:55:48 UT on 2009-09-26, the Swift Burst Alert Telescope (BAT) triggered and located GRB 090926B (trigger=370791). Swift slewed immediately to the burst. XRT and UVOT started observing about 90s after the trigger (Grupe et al. *GCN Circ.* 9935). Because GRB 090926B was at a very hot location in the sky which was rapidly heating up the XRT, it was decided to drop this burst after the first three orbits.

The best *Swift* position of this burst is the astrometrically corrected XRT position given in Grupe et al. (*GCN Circ.* 9940) with RA-2000 = 03h 05m 14.01s, and Dec-2000 =  $-39^{\circ} 00' 21.5''$  with an uncertainty of  $1.7''$ .

A VLT spectroscopic redshift for this burst of  $z=1.24$  was reported by Fynbo et al. (*GCN Circ.* 9947).

### 2 BAT Observation and Analysis

At 21:55:48 UT on 2009-09-26, the Swift Burst Alert Telescope (BAT) triggered and located GRB 090926B (trigger=370791). Swift slewed immediately to the burst. The BAT ground-calculated position is RA, Dec = 46.310, -38.997 deg which is

$$\text{RA(J2000)} = 03\text{h } 05\text{m } 14.3\text{s}$$

$$\text{Dec(J2000)} = -38^{\circ} 59' 50.9''$$

with an uncertainty of 1.0 arcmin, (radius, sys+stat, 90% containment). The partial coding was 26% (Baumgartner et al. *GCN Circ.* 9939).

The mask-weighted light curve shows a sharp rise at T-20 s, then a complex peak reaching a maximum at T-1 s, followed by an approximately exponential decay. T90 (15-350 keV) is  $109.7 \pm 11.3$  s (estimated error including systematics).

The time-averaged spectrum from T-21.6 to T+133.2 s is best fit by a power law with an exponential cutoff. This fit gives a photon index  $0.52 \pm 0.24$ , and  $E_{\text{peak}}$  of  $78.3 \pm 7.0$  keV ( $\chi^2 = 57.75$  for 56 d.o.f.). For this model the total fluence in the 15-150 keV band is  $(7.3 \pm 0.2) \times 10^{-6}$  ergs  $\text{cm}^{-2}$  and the 1s peak flux measured from T-1.31 s in the 15-150 keV band is  $3.2 \pm 0.3$  photons  $\text{s}^{-1} \text{cm}^{-2}$ . A fit to a simple power law gives a photon index of  $1.54 \pm 0.00$  ( $\chi^2 = 125.34$  for 57 d.o.f.). 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/370791/BA/](http://gcn.gsfc.nasa.gov/notices_s/370791/BA/)

### 3 XRT Observations and Analysis

The XRT began observing the field of GRB 090926B at 21:57:16.8 UT, 88.3 seconds after the BAT trigger (Grupe et al. *GCN Circ.* 9935).

Using 1692 s of XRT Photon Counting mode data and 1 UVOT images, we find an astrometrically corrected X-ray position (using the XRT-UVOT alignment and matching UVOT field sources to the USNO-B1 catalogue): RA, Dec = 46.30840, -39.00600 which is equivalent to:

RA (J2000): 03h 05m 14.01s

Dec (J2000): -39° 00' 21.5''

with an uncertainty of 1.7'' (radius, 90% confidence, Grupe et al. *GCN Circ.* 9940). This position is 32.7'' from the BAT ground-calculated position given in Baumgartner et al. (*GCN Circ.* 9939).

A spectrum formed from the 307s Windowed Timing (WT) mode data can be fitted with an absorbed power-law with a photon spectral index  $\Gamma = 1.84 \pm 0.07$  with an absorption column of  $(1.70 \pm 0.22) \times 10^{21} \text{ cm}^{-2}$  which is in excess of the Galactic value of  $1.91 \times 10^{20} \text{ cm}^{-2}$  (Kalberla et al. 2005). The 2ks Photon Counting mode spectrum results is a slightly flatter X-ray spectrum with  $\Gamma = 1.58_{-0.20}^{+0.22}$ . The absorption column density, however, is consistent with the WT result. Based on the excess absorption, according to Grupe et al. (2007, AJ, 133, 2216), the redshift of this burst was predicted to be less than 4.0, which was later confirmed by the VLT measurement of  $z=1.24$  reported by Fynbo et al. (*GCN Circ.* 9947).

The 0.3 – 10 keV light curve given below (Fig.2) can be modelled with a broken power-law decay with an index of  $\alpha = 2.00 \pm 0.05$ , followed by a break at  $T+712_{-160}^{+190}$  s to an  $\alpha = 1.23_{-0.17}^{+0.07}$ .

### 4 UVOT analysis

The Swift/UVOT began settled observations of the field of GRB 090926B 98s after the BAT trigger (Grupe et al., *GCN Circ.* 9935). No source was detected at the position reported by VLT (Malesani et al., *GCN Circ.* 9944) and the enhanced Swift XRT position (Grupe et al., *GCN Circ.* 9940).

The 3-sigma upper limits for the finding charts (FC) and summed images are listed in Table 1.

Filter	$T_{\text{Start}}$	$T_{\text{stop}}$	Exposure	Mag
white(FC)	98	248	147	> 21.02
white	591	2053	303	> 21.21
v	641	2103	175	> 19.19
b	567	5976	226	> 20.32
u(FC)	310	560	246	> 20.30
u	715	5900	333	> 20.22
uvw1	691	5695	333	> 20.25
uvm2	5290	5490	197	> 19.77
uvw2	616	1389	58	> 19.09

Table 1: Magnitudes from UVOT observations of GRB 090926B. The quoted upper limits have not been corrected for the expected Galactic extinction along the line of sight of  $E_{\text{B-V}} = 0.02$  mag. All photometry is on the UVOT photometric system described in Poole et al. (2008, MNRAS, 383, 627).

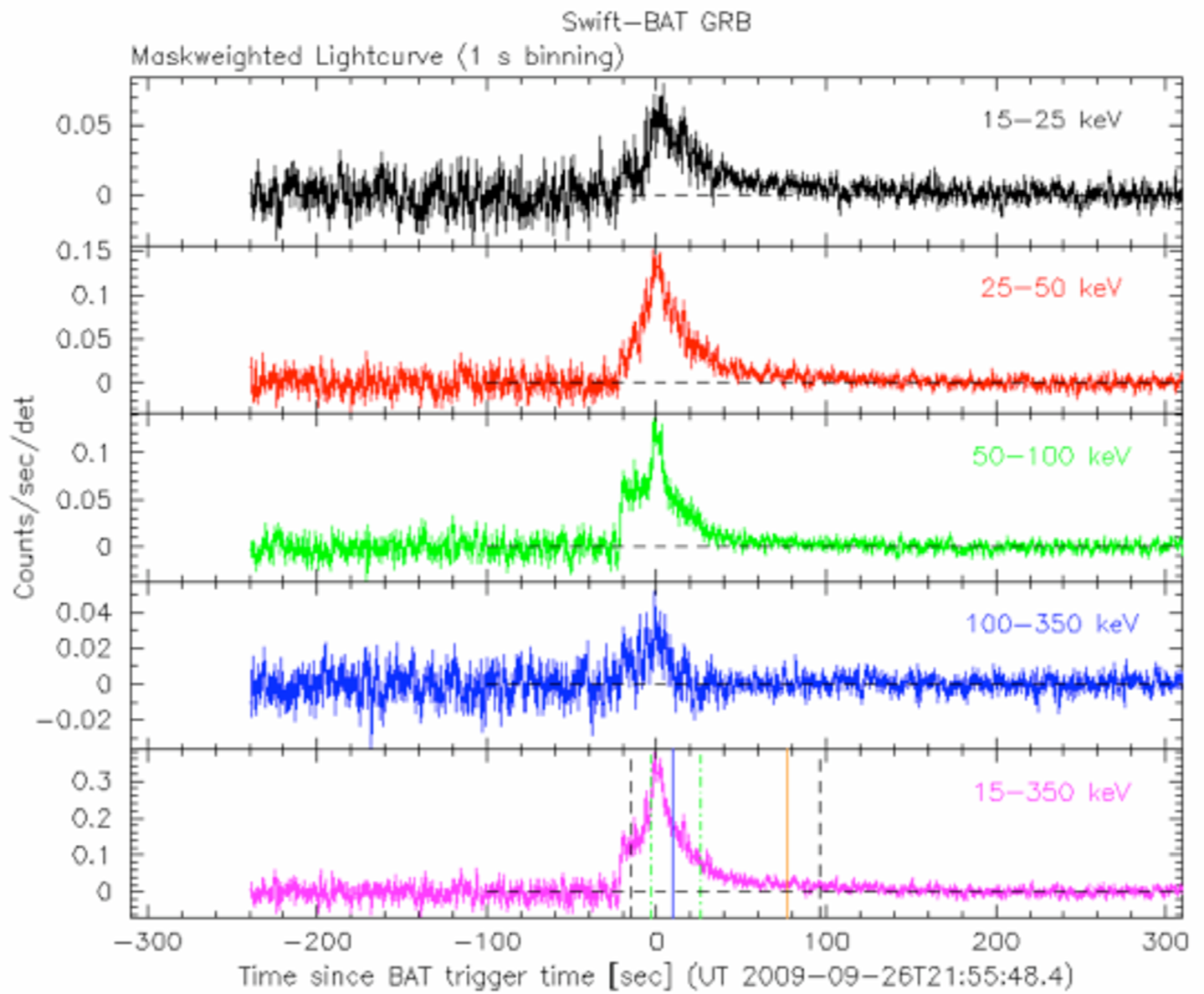


Figure 1: BAT Light curve of GRB 090926B.

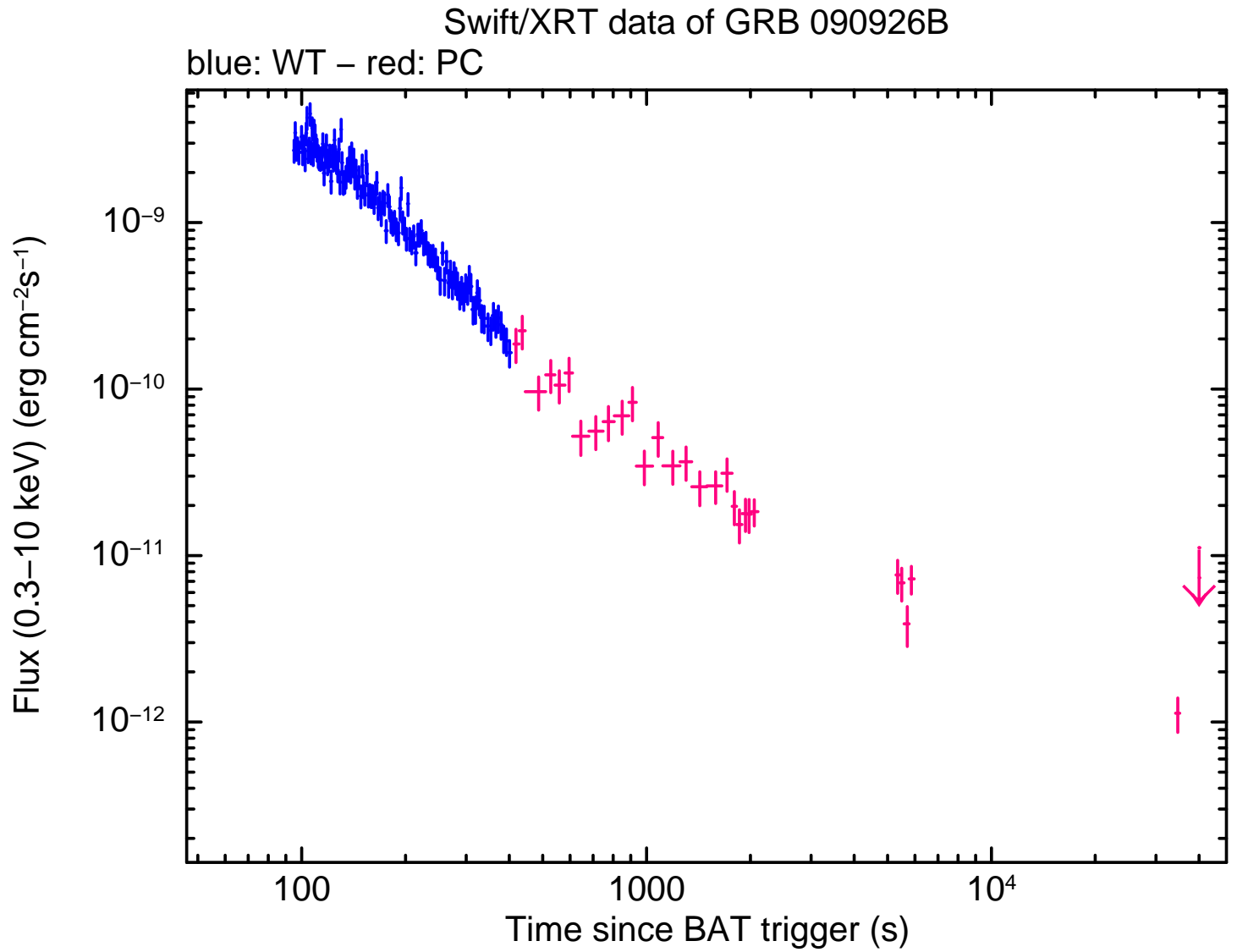


Figure 2: XRT flux light curve of GRB 090926B in the 0.3-10 keV band. The approximate conversion is  $1 \text{ count s}^{-1} = \sim 4.9 \times 10^{-11} \text{ ergs s}^{-1}\text{cm}^{-2}$  for an observed flux assuming a standard X-ray afterglow spectrum.