

Swift Observation of the Short GRB 080121

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1 Introduction

BAT detected GRB 080121 at 21:29:55 UT (trigger 301491) (Cummings & Palmer, *GCN Circ.* 7209). This was a sub-threshold (6 sigma) peak in a 0.256 s image trigger on a weak short burst with $T_{90}=0.7\pm 0.2$ s. Swift did not automatically slew to the GRB location because the burst was below the on-board threshold. XRT and UVOT began follow-up observations at $T+2.3$ d, when the source location emerged from spacecraft Moon constraint.

Since no afterglow was detected by the two Swift narrow field instruments (Cucchiara & Schady, *GCN Circ.* 7217; Troja & Burrows, *GCN Circ.* 7224), our best position is the BAT location RA($J2000$)=137.235 deg (09h08m56s), Dec($J2000$)=+41.841 deg (+41d50'29'') with an error of 3 arcmin (90% confidence, including systematic errors).

2 BAT Observation and Analysis

Using the data set from $T-2$ to $T+8$ s, analysis of BAT GRB 080121 has been performed by the Swift team (Cummings & Palmer, *GCN Circ.* 7209). The BAT ground-calculated position is RA($J2000$) = 137.235 deg (09h08m56s), Dec($J2000$) = +41.841 deg (+41d50'29'') \pm 3 arcmin, (radius, systematic and statistical, 90% containment).

The masked-weighted light curves (Fig.1) shows a single peak at $T+0$ s. T_{90} (15–350 keV) is 0.7 ± 0.2 s (estimated error including systematics).

The time-averaged spectrum from $T-0.4$ to $T+0.4$ s is fitted by a simple power law model, though the best fit model is not well constrained because of the weakness of the burst. The fit gives a photon index of 2.6 ± 0.8 . For this model the total fluence in the 15–150 keV is $(3\pm 2)\times 10^{-8}$ ergs/cm². All the quoted errors are at the 90% confidence level.

3 XRT Observations and Analysis

Upon analysis of 21 ks of Photon Counting mode data, starting at $T+2.3$ d and ending at $T+5.1$ d, no X-ray afterglow candidate has been found within the BAT error circle. We estimate a 3-sigma upper limit on the mean count rate of $\sim 10^{-3}$ cts/s. which corresponds to an unabsorbed flux of 3.7×10^{-14} ergs/cm²/s (over 0.3–10 keV), assuming a Crab-like spectrum and a Galactic absorption of 1.23×10^{20} cm⁻² (Kalberla *et al.*, 2005).

4 UVOT Observation and Analysis

The UVOT began observing the field of GRB 080121 (Cummings & Palmer, *GCN Circ.* 7209) 2.3 d after the burst. No new source was detected within the BAT error circle in the co-added images in any filter down to 3-sigma magnitude. Upper limits are summarized in Table 1. These upper limits are not corrected for the expected Galactic extinction corresponding to a reddening of $E(B-V) = 0.02$ mag in the direction of the burst (Schlegel *et al.*, 1998).

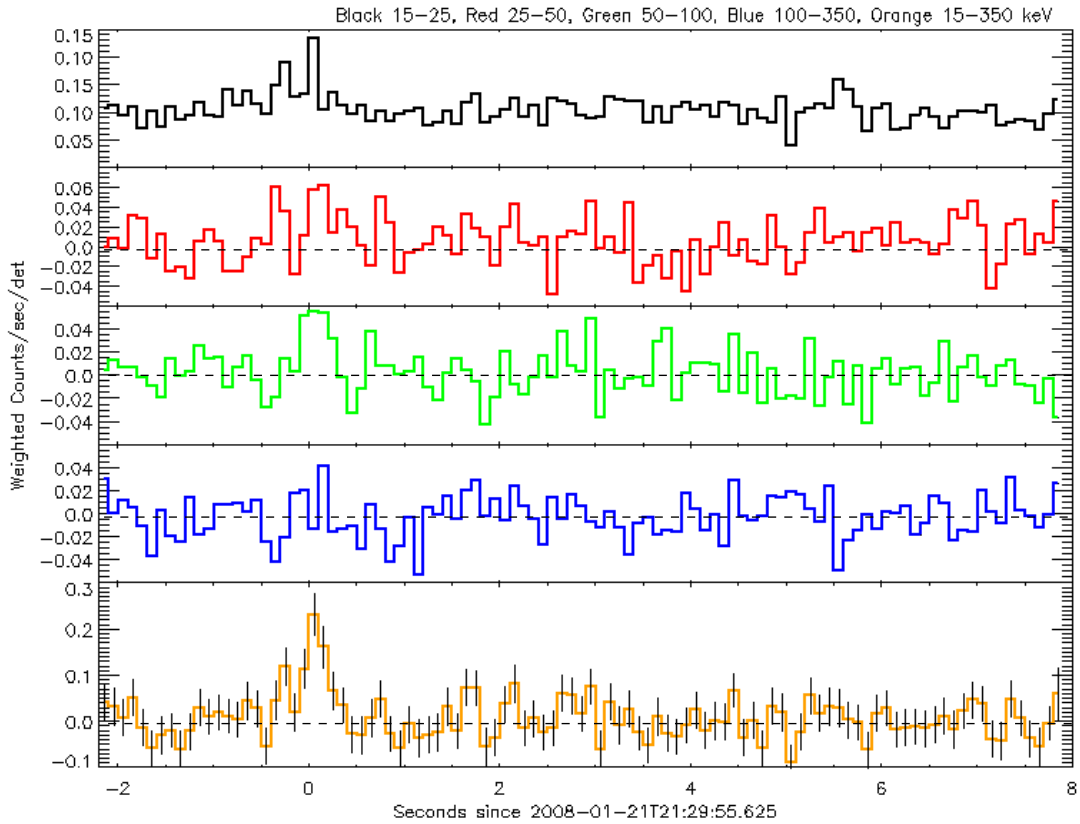


Figure 1: BAT light curve. The mask-weighted light curve (bin time is 0.1 s) in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and T_0 is 21:29:55 UT.

Filter	Start (ks)	Stop (ks)	Exposure (s)	3-Sigma UL (mag)
WHITE	196.4	224.1	2015	>22.25
V	195.7	223.8	2268	>20.73
UVM2	294.2	300.7	1491	>21.13

Table 1: Magnitude limits from UVOT observations. The start and end times of the exposures are given since the BAT trigger. No corrections have been made for the expected Galactic extinction.