Swift Observation of XRF 080515

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1 Introduction

BAT triggered on XRF 080515 at 06:01:13 UT (Trigger 311658) (Holland, *et al.*, GCN Circ. 7721). This was a long burst with $T_{90} = 21 \pm 5$ s. *Swift* did not slew to this burst immediately due to a Sun constraint. The prompt spectrum suggests that this burst is an X-ray flash. XRT and UVOT began follow-up observations at approximately $T + 1.5$ days. Our best position is the XRT location, RA, Dec (J2000.0) = $3\overset{\circ}{.}16343$, $+32\overset{\circ}{.}57894$, which corresponds to

RA(J2000.0) = $05^{\rm h}37^{\rm m}19\overset{\rm s}{.}14$
Dec(J2000.0) = $+05^\circ05'05\overset{''}{.}4$

with an uncertainty of $3\overset{''}{.}8$ (radius, 90% containment).

The Burst Advocate for this burst is Stephen Holland (`Stephen.T.Holland@nasa.gov`). Please contact the Burst Advocate by e-mail if you require additional information regarding *Swift* follow-up observations of this burst. In extremely urgent cases, after trying the Burst Advocate, you can contact the *Swift* PI by phone (see the *Swift* ToO Web site for information: `http://www.swift.psu.edu/too.html`).

2 BAT Observations and Analysis

Using the data set from $T - 237$ to $T + 962$ s we report our analysis of GRB 080515 (trigger 311658) (Holland, *et al.*, GCN Circ. 7721). The BAT ground-calculated position is RA, Dec (J2000.0) = $3\overset{\circ}{.}166$, $+32\overset{\circ}{.}564$, which corresponds to

RA(J2000.0) = $00^{\rm h}12^{\rm m}39\overset{\rm s}{.}8$
Dec(J2000.0) = $+32^\circ33'50''$

with an uncertainty of $1\overset{'}{.}6$, (radius, systematic+statistical, 90% containment). The partial coding was 8%.

The mask-weighted light curves (Fig. 1) shows a single peak at approximately $T - 5$ s, peaking at approximtely $T + 2$ s, and ending at approximately $T + 25$ s. T_{90} (15–350 keV) $= 21 \pm 5$ s (estimated error including systematics).

The time-averaged spectrum from $T - 2.6$ to $T + 24.0$ s is best fit by a power law with an exponential cut off. This fit gives a photon index of of $\Gamma = 0.94 \pm 1.21$, and $E_{\rm peak} = 25.0 \pm 15.6$ keV. For this model the total fluence in the 15–150 keV band is $(2.0 \pm 0.3) \times 10^{-6}$ erg cm^{-2} and the 1-s peak flux measured from $T + 1.37$ s in the 15–150 keV band is 3.9 ± 0.7 ph cm^{-2} s^{-1}. A fit to a simple power law gives a photon index of $\Gamma = 2.44 \pm 0.19$. All the quoted errors are at the 90% confidence level.

The fluence ratio in a simple power-law fit between the 25–50 keV band and the 50–100 keV band is 1.35. This is larger than 1.32, which can be achieved with a Band function of $\alpha = -1.0$, $\beta = -2.5$, and $E_{\rm peak} = 30$ keV. Therefore, preliminary analysis shows that the $E_{\rm peak}$ of XRF 080515 is very likely $\lesssim 30$ keV, so this burst can be classified as an X-ray flash (e.g., Sakamoto *et al.*, ApJ, in press, arXiv:0801.4319).

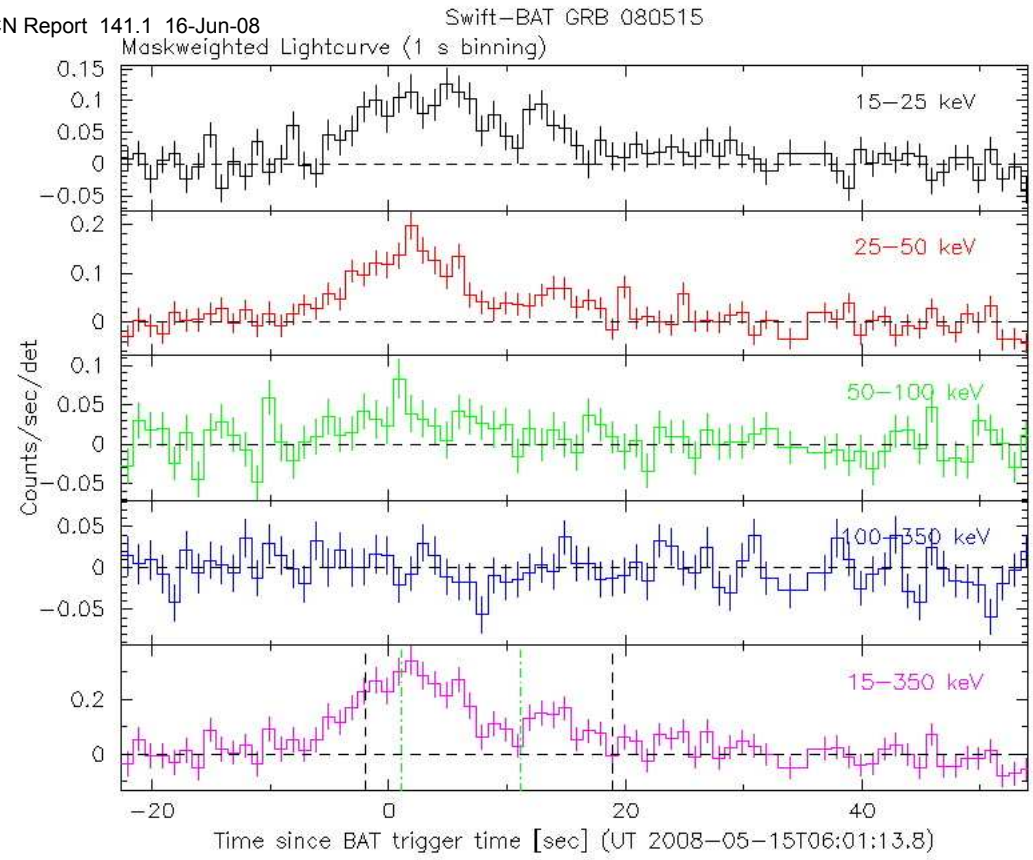

Figure 1: BAT light curves. The mask-weighted 1 s light curves in the four individual plus total energy bands. The units are count s^{-1} illuminated-detector^{-1} and T_0 is 06:01:13.8 UT.

3 XRT Observations and Analysis

The *Swift*/XRT began observing XRF 080515 approximately 1.5 days after the initial detection, when the burst was no longer Sun-constrained. A fading X-ray source was identified in the BAT error circle at RA, Dec (J2000.0) = $3^{\circ}.16343$, $+32^{\circ}.57894$, which corresponds to

RA(J2000.0) = $00^{\rm h}12^{\rm m}39^{\rm s}.22$
Dec(J2000.0) = $+32^{\circ}34'44''.2$

with an uncertainty of $3''.8$ (radius, 90% containment).

The light curve shows a power-law slope of $\alpha = -1.0^{+0.7}_{-0.5}$ (see Figure 2).

The spectrum of the source can be fit with a power law with $\Gamma = 1.95 \pm 0.34$ absorbed by the Galactic column of $N_{\rm H} = 4.65 \times 10^{20}$ cm^{-2}. This spectrum, averaged over 1.5–6.6 days after the burst, has an observed (unabsorbed) flux of 2.28×10^{-13} (2.59×10^{-13}) erg cm^{-2} s^{-1}, which is a count rate to flux conversion of 1 count s^{-1} = 5.2×10^{-11} erg cm^{-2} s^{-1}.

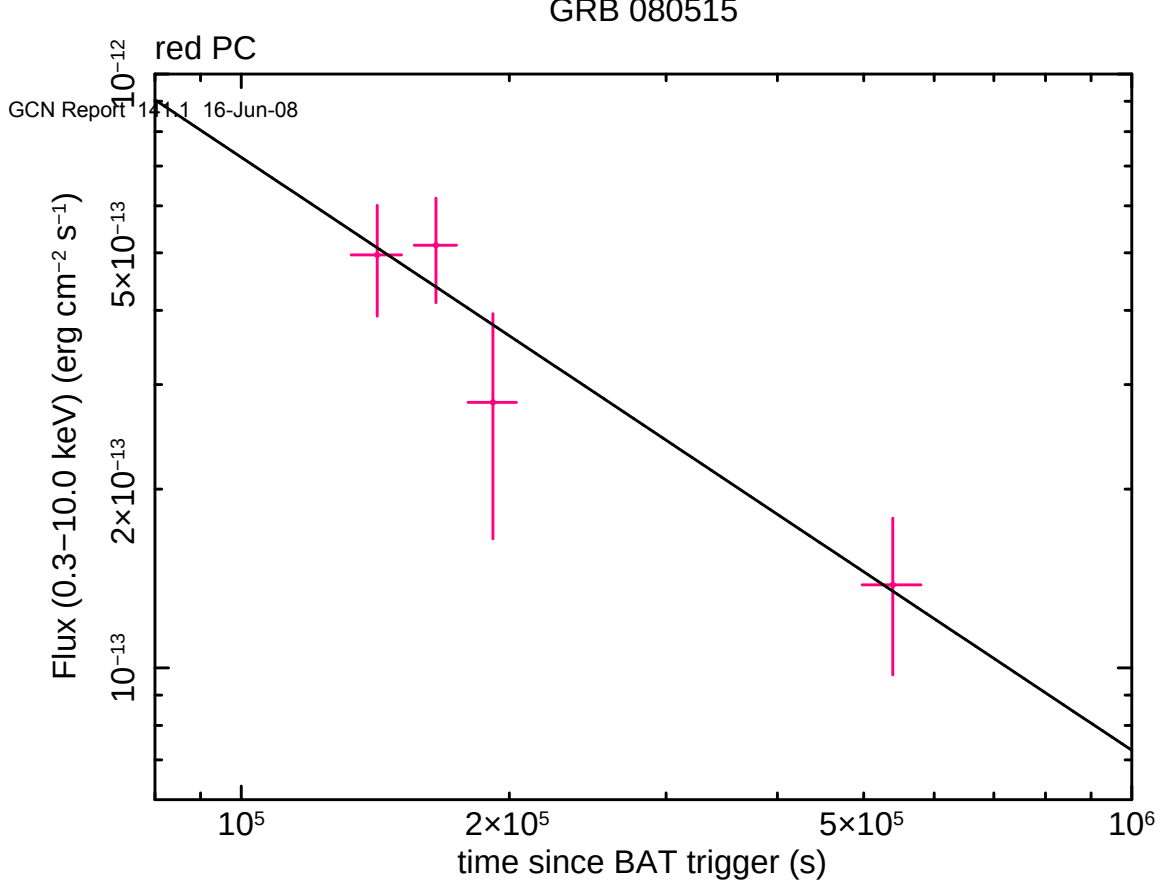

Figure 2: XRT light curve in erg cm^{-2} s^{-1} in the 0.3–10 keV band: Photon Counting mode (red).

4 UVOT Observation and Analysis

The field of XRF 080515 was observed by *Swift*/UVOT with the v filter for 6262 s between approximately 1.5 and 2.4 days after the BAT trigger. The XRT error circle is located in the scattered light halo of the $B = 11.4$ mag star TYC 2264-1051-1, so it is not possible to constrain the presence of an afterglow in the UVOT data.