GCN_Report_119.1 11-Mar-2008

Swift Observations of GRB 080229A

J. K. Cannizzo (NASA/UMBC), S. D. Barthelmy (GSFC), A. P. Beardmore (U Leicester),
J. R. Cummings (NASA/UMBC), P. A. Evans (U Leicester), O. Godet (U Leicester),
C. Gronwall (PSU), S. T. Holland (CRESST/USRA/GSFC), E. A. Hoversten (PSU),
S. Immler (CRESST/GSFC/UMD), J. A. Kennea (PSU), V. Mangano (INAF-IASFPA),
C. B. Markwardt (CRESST/GSFC/UMD), K. M. McLean (GSFC/UMD), J. Mao, (INAF-OAB),
A. Moretti (INAF-OAB), C. Guidorzi (Univ. Bicocca & INAF-OAB),
P. T. O'Brien (U Leicester), M. R. Goad (U Leicester), J. P. Osborne (U Leicester), C. Pagani (PSU),
K. L. Page (U Leicester), D. M. Palmer (LANL), E. Fenimore (LANL),
A. M. Parsons (GSFC), N. Gehrels (GSFC), T. Sakamoto (NASA/UMBC),
H. Krimm (GSFC/USRA), G. Sato (GSFC/ISAS), B. Sbarufatti (INAF-IASFPA),
M. Stamatikos (NASA/ORAU), J. Tueller (GSFC), R. L. C. Starling (U Leicester),
G. Stratta (ASDC), T. Ukwatta (GWU), V. Beckmann (ISDC, Versoix),
and E. Troja (U Leicester/INAF-IASFPa) report on behalf of the Swift Team:

1. INTRODUCTION

BAT triggered on a long burst, GRB 080229A, at 17:04:59 UT (trigger=304379) (Cannizzo, et al., *GCN Circ.* 7335, Markwardt, et al., *GCN Circ.* 7338, Beardmore, et al., *GCN Circ.* 7343, Mao, et al., *GCN Circ.* 7346). Swift slewed immediately to the burst. Our best position is from the XRT: RA,Dec = (228.21828, −14.70467), which is {15h 12m 52.39s −14d 42' 16.8"} (J2000) with an estimated uncertainty of 1.4 arcsec (90% error radius). No optical afterglow was detected by either UVOT of any ground based observatories down to deep limits (e.g., $r > 25.9$ at $T + 13.1$ hr by Gemini South; Berger, et al., *GCN Circ.* 7344). With a simultaneous detection, *INTEGRAL* SPI-ACS clearly observes a multi-peak structure.[1]

2. BAT OBSERVATION AND ANALYSIS

Using the data set from $T - 239$ to $T + 303$ sec, the BAT ground-calculated position is RA, Dec = 228.220, -14.697 deg, which is RA(J2000) = 15h 12m 52.7s Dec(J2000) = -14d 41' 50" with an uncertainty of 1.5 arcmin, (radius, sys+stat, 90% containment). The partial coding was 18%.

The mask-weighted light curve shows an initial small peak starting at $\sim T - 3$ sec, peaking at T_0, and ending at $\sim T + 12$ sec. Then there are two smaller peaks centered on T+18 and T+28 sec. Then comes two overlapping large peaks on $T + 35$ and $T + 39$ sec with the latter tailing out to $\sim T + 85$ sec. $T90$ (15 − 350 keV) is 64 ± 16 sec (estimated error including systematics).

The time-averaged spectrum from $T - 15.1$ to $T + 64.9$ sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is 1.91 ± 0.06. The fluence in the 15 − 150 keV band is $9.0 \pm 0.2 \times 10^{-6}$ erg cm^{-2}. The 1−sec peak photon flux measured from $T + 40.36$ sec in the 15 − 150 keV band is 5.7 ± 0.2 ph cm^{-2} s^{-1}. All the quoted errors are at the 90% confidence level.

3. XRT OBSERVATION AND ANALYSIS

The XRT light-curve shows a flare peaking few seconds after the beginning of the observation (103 ± 2 sec). The descending part of the flare can be fit by a power law with a slope of $\alpha_1 =$

[1] http://isdc.unige.ch/Soft/ibas/results/triggers/spiacs/2008-02/2008-02-29T17-04-59.00-00000-00000-0.png

4.45 ± 0.09 up to a break at $t_1 = 192.4 \pm 2.5$ sec, which is followed by a flat decay with a slope of $\alpha_2 = 0.18 \pm 0.01$. A second break is present at $t_2 = 2700 \pm 1000$ sec with $\alpha_3 = 0.8 \pm 0.5$.

The spectrum formed from all the WT data can be modeled with a power-law of photon index $\Gamma = 2.88 \pm 0.09$, with an absorbing column of $N_H = (3.1 \pm 0.2) \times 10^{21}$ cm^{-2} (in excess with respect to the Galactic value of 8.97×10^{20} cm^{-2}). The spectrum formed from the PC data can be modeled with a power-law of photon index $\Gamma = 1.99 \pm 0.07$, with an absorbing column of $N_H = (3.1 \pm 0.2) \times 10^{21}$ cm^{-2}, which is in agreement with the WT one.

4. UVOT OBSERVATION AND ANALYSIS

The UVOT observed the field of GRB 080229 starting 2008:02:29 at 17:06:22 UT with a 9.4 s setling image followed at 17:06:41 UT with a finding chart. No afterglow is detected at the position of the enhanced XRT position in the finding chart, nor in the three subsequent exposures.

The source is near a bright F0 star and its possible detection may be affected by it. Therefore a small aperture of 3" was used, while the background was determined for a region at equal distance to the nearby star.

The following $3-\sigma$ upper limits (in the UVOT photometric system, Breeveld et al., GCN Circ. 6614) were determined for the initial observations in the white and v filters at the XRT position (RA=15:12:52.53, DEC= -14:42:19.3, J2000):

Filter	Tstart(s)	Tstop(s)	Exp(s)	Mag (3-sigma UL)
wh	101	200	99.8	> 20.9
v	208	608	400.0	> 19.9
wh	856	956	99.8	> 20.9
v	962	1362	400.0	> 19.9

The observations with enough counts to allow for aspect correction of the image were co-added in order to provide an upper limit to the flux of a host-galaxy. The summed images have some pixels affected by the nearby source, but no indication of an extra source contribution was found in the summed images. The summed images span the first day. A source region size of 3" was chosen, which extends further away from the star and includes at the star-side end the refined XRT source region. It was considered, that the small 1.4" region for the source provided in the refined XRT position was too small to average out variations due to the PSF of the nearby star.

Filter	Exp(s)	Mag (3-sigma UL)
wh	666	> 21.8
v	1849	> 20.1
b	529	> 20.8
u	1320	> 21.0
uvw1	1328	> 21.1
uvm2	1079	> 21.1
uvw2	393	> 20.6

The values quoted above are not corrected for the expected Galactic extinction corresponding to a reddening of $E_{B-V} = 0.15$ mag in the direction of the burst (Schlegel et al. 1998).

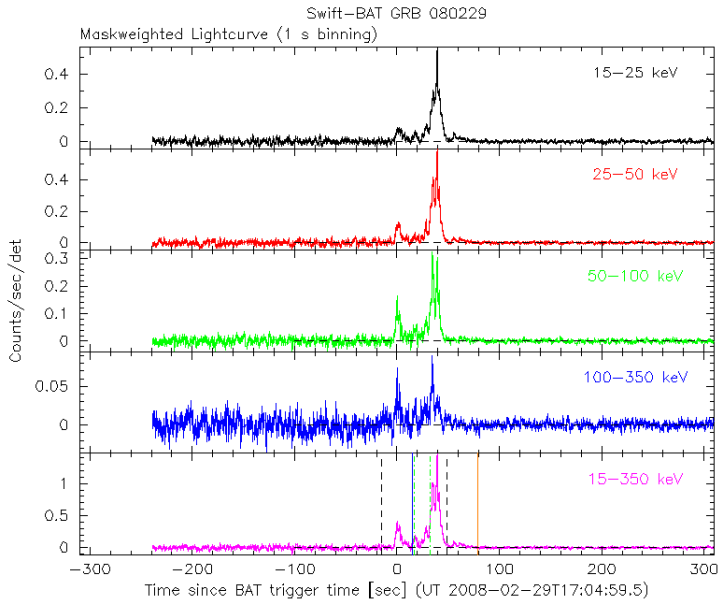

Figure 1: BAT Lightcurve. The light curve in the 4 individual plus total energy bands ($15-25$ keV, $25-50$, $50-100$, $100-150$, and $15-150$).

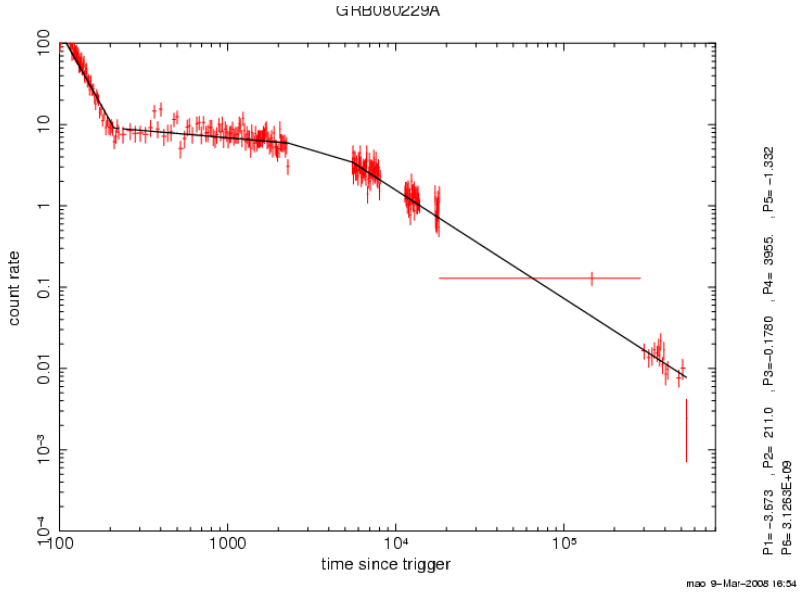

Figure 2: XRT Lightcurve. A broken powerlaw fit gives: $\alpha_1 = 4.45 \pm 0.09$, $t_{\mathrm{break},\ 1} = 192.4 \pm 2.5$s, $\alpha_2 = 0.18 \pm 0.01$, $t_{\mathrm{break},\ 2} = 2700 \pm 1000$s, $\alpha_3 = 0.8 \pm 0.5$.