

Swift Observation of SuperAGILE GRB 070724B

P. Romano, C. Guidorzi (Univ Bicocca&INAF-OAB), A. Moretti (INAF-OAB), M.M. Chester (PSU), S.D. Barthelmy (GSFC), D.N. Burrows (PSU), P. Roming (PSU), N. Gehrels (GSFC) for the Swift Team

1 Revisions

- Updated XRT light curve using data out to $T + 6.5 \times 10^5$ s.

2 Introduction

The long (55s), soft GRB 070724B, triggered SuperAGILE, still in verification phase, at 2007-07-24 23:25:09 UT (Feroci et al., GCN Circ. 6668). The SuperAGILE burst position was reconstructed as RA, DEC (J2000) = 17.629 deg, 57.673 deg, which is: RA(J2000) = 01^h 10^m 31.0^s, Dec(J2000) = +57° 40' 23" with an uncertainty of 20' (radius). This uncertainty is almost entirely systematic and it is due to the very preliminary absolute position calibration, carried out by the SuperAGILE team on only 3 X-ray sources. At this preliminary stage the absolute positioning was obtained by the ground calibrations, preliminarily checked with these sources. The light curve showed a multi-peak structure. The AGILE Gamma Ray Imager (GRID) data show no significant emission at energy above 50 MeV. The AGILE Mini-Calorimeter (ASM in 0.35–3 MeV no directional information), also shows no statistically significant count rate increase in correspondence of GRB 070724B (Chen et al., GCN Circ. 6670).

GRB 070724B triggered Konus-Wind at $T_0=84307.346$ s UT (23:25:07.346) (Golenetskii et al, GCN Circ. 6671). The light curve shows the main multi-peaked pulse with a total duration of ~ 50 s followed by a weak pulse at $T - T_0 \sim 102$ s with a duration of ~ 10 s. The burst had a fluence of $1.80_{-0.25}^{+0.04} \times 10^{-5}$ erg cm⁻², and a 64-ms peak flux measured from $T_0 + 29.744$ s of $2.17_{-0.45}^{+0.34} \times 10^{-6}$ erg cm⁻² s⁻¹ (20–500 keV). The time-integrated spectrum of the burst (from T_0 to $T_0 + 49.408$ s) can be fitted (20–500 keV) by a power law with exponential cutoff model: $dN/dE \propto E^{-\alpha} e^{(-E(2-\alpha)/E_p)}$ with $\alpha = 1.15 \pm 0.13$ and $E_p = 82 \pm 5$ keV ($\chi^2 = 40/42$ d.o.f.).

GRB 070724B triggered the Suzaku WAM at 23:25:09 UT (= T_0 , Endo et al., GCN Circ. 6672). The observed light curve with 1/64 sec time resolution shows a multi-peaked structure with $T_{90} \sim 41$ s. The fluence in 100-1000 keV was $1.04_{-0.07}^{+0.08} \times 10^{-5}$ erg cm⁻². The 1-s peak flux measured from $T_0 + 39$ s to $T_0 + 40$ s was 3.33 ± 0.40 photons cm⁻² s⁻¹ in the same energy range. Preliminary result shows that the time-averaged spectrum from $T_0 - 2$ s to $T_0 + 43$ s is well fitted by a single power-law with a steep photon index of 2.8 ± 0.2 .

Swift/BAT was not observing the field of GRB 070724B at the time of the trigger. At $T + 19.1$ hours Swift executed a target of opportunity (ToO) observation of GRB 070724B, hence no BAT observations were made. Here we report on the detection of a fading XRT source within the SuperAGILE error circle and UVOT upper limits on this candidate.

The Burst Advocate for this burst is P. Romano (patrizia.romano@brera.inaf.it). 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 ToOWeb site for information: <http://www.swift.psu.edu/too.html>).

3 BAT Observation and Analysis

No BAT observations were made for this GRB, since Swift slewed in the context of a ToO at T+19h.

4 XRT Observations and Analysis

XRT observed GRB 070724B starting on 2007-07-25 18:32:39 UT, at $T + 19.1$ hours (Romano et al., GCN Circ. 6669). Using the whole set of XRT data (16.5 ks in Photon Counting mode, between $T+19.1$ hours and $T+7.5$ days), the refined XRT position of the most likely candidate is RA(J2000)= 17.48477 deg, Dec(J2000)= +57.67620 deg, RA(J2000)= 01^h 09^m 56.34^s, Dec(J2000)= +57^d 40' 34.3'', with an uncertainty of 3.9 arcsec (radius, 90% containment; Romano et al., GCN Circ. 6703). This is 0.4 arcsec from the X-ray position given in Romano et al. (GCN Circ. 6675) and 4.6 arcmin from the initial SuperAGILE position (Feroci et al., GCN Circ. 6668).

The light curve exhibits a fading behaviour, with a power-law slope of $1.19_{-0.19}^{+0.23}$ (90% confidence level).

The spectrum (150 photons) can be fit using Cash statistics with an absorbed power law with a photon index of 2.6 ± 0.5 and a column density of $(9 \pm 3) \times 10^{21} \text{ cm}^{-2}$ in excess of the Galactic value ($3.1 \times 10^{21} \text{ cm}^{-2}$; Kalberla et al. 2005). The absorbed (unabsorbed) 0.3–10.0 keV flux for the spectrum is 1.2×10^{-12} (4.4×10^{-12}) ergs $\text{cm}^{-2} \text{ s}^{-1}$, at mean time of $T + 1.54\text{d}$.

5 UVOT Observation and Analysis

The Swift/UVOT observed the field of GRB 070724B beginning on 2007-07-27 00:02:11 UT, 48.6 hours after the burst trigger time (Chester & Romano, GCN Circ. 6677). No new source is detected in any of the UVOT observations inside the refined Swift/XRT error circle for the candidate. The 3-sigma upper limits for detecting a source inside the XRT error circle in the co-added frames are reported in Table 1. The reported upper limits are uncorrected for the estimated Galactic reddening of $E(B - V) = 0.51$ mag towards the direction of the burst (Schlegel et al. 1998).

Filter	T_start (s)	T_stop (s)	Exp (s)	3-sigma UL mag
White	179270	197091	1776	21.3
V	175022	196602	2023	19.8

Table 1: Magnitude limits from UVOT observations.

References

- Chen, A., et al. 2007, GCN Circ. 6670
 Chester, M.M., Romano, P. 2007, GCN Circ. 6677
 Endo, A., et al. 2007, GCN Circ. 6672
 Feroci, M., et al. 2007, GCN Circ., 6669
 Golenetskii, S., et al. 2007 GCN Circ. 6671
 Kalberla, P.M.W., et al. 2005, A&A, 440, 775
 Romano, P., et al. 2007a, GCN Circ. 6669
 Romano, P., et al. 2007b, GCN Circ. 6675
 Romano, P., et al. 2007c, GCN Circ. 6703
 Schlegel, D.J., Finkbeiner, D.P., & Davis, M. 1998, ApJ, 500, 525

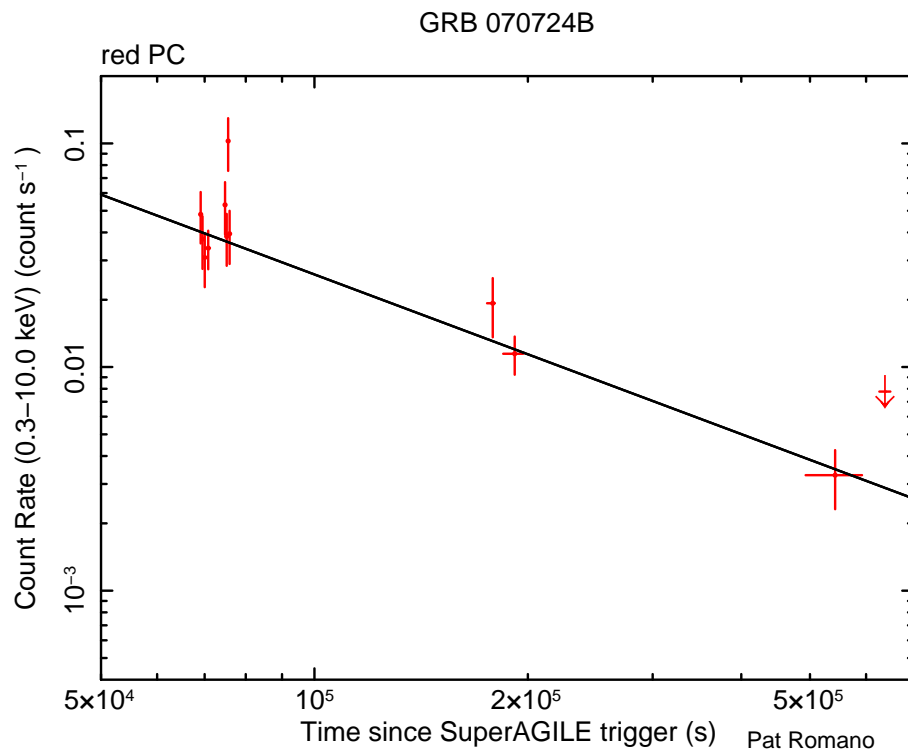


Figure 1: XRT Lightcurve. Counts s⁻¹ in the 0.3–10 keV band: Photon Counting mode (red). The approximate conversion factor to observed flux in the 0.3–10 keV energy range is 1 count s⁻¹ $\sim 9.7 \times 10^{-11}$ erg cm⁻² s⁻¹.