Swift Observations of GRB 090823

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1 Introduction

At 16:11:12 on 2009-08-23, GRB 090823 triggered the Suzaku WAM (Cummings et al. *GCN Circ.* 9835). The IPN was notified, and the burst was also observed by KONUS-Wind, Agile-MCAL, and (during a slew maneuver) Swift-BAT. A source was found in ground analysis of BAT event data, which is routinely collected during many pre-planned slews, and the source location was confirmed by IPN triangulation.

Swift started observing the field of GRB 090823 about 30 hours after the trigger and found an X-ray source at RA-2000 = 08h 34m 42.42s, and Dec-2000 = $+60^\circ$ $39^{'}$ $06.1^{''}$ which is the best position of this burst. *Swift* observed the field of GRB 090823 two more times and confirmed that the X-ray source is indeed the afterglow. No optical counterpart has been reported for this burst.

2 BAT Observation and Analysis

The *Swift* BAT saw GRB 090823 during a slew maneuver and did not trigger on it. Therefore spectral data are available only from the small amount of event data serendipitously recorded beginning during the tail of the event. For the time interval $T_{\rm peak}$ + 9 s to $T_{\rm peak}$ + 19 s containing 1% of the BAT fluence, the photon index of a simple powerlaw fit to the BAT data is 2.27±0.21. The fluence during this interval was (1.0 +- 0.3)$\times 10^{-7}$ ergs cm^{-2}. Figure 1 displays the BAT light curve from the 1.6s rates.

A more complete spectral coverage is given by Golenetskii et al. (*GCN Circ.* 9836) based on Konus-Wind data.

3 XRT Observations and Analysis

The XRT began observing the field of GRB 090823 beginning on 2009-08-24 at 22:17, 30 hours after the Suzaku WAM trigger for a total of 4.7 ks (Grupe et al. *GCN Circ.* 9840).

XRT found an uncatalogued X-ray source within the 4' BAT error circle given by Cummings and Copete et al. (GCN circs. 9838 and 9839, respectively) at RA-2000,Dec-2000=128.67676, +60.65169 which corresponds to

RA-2000 = 08h 34m 42.42s

Dec-2000 = $+60^\circ$ $39^{'}$ $06.1^{''}$

with an uncertainty of $5.5^{''}$ (radius, 90% confidence).

During the 4.7 ks observation on 2009-08-24 the X-ray source had a count rate of (5.7±1.1)$\times 10^{-3}$ counts s^{-1} in the XRT which converts to an observed flux in the 0.3-10 keV band of (2.7±0.5)$\times 10^{-13}$

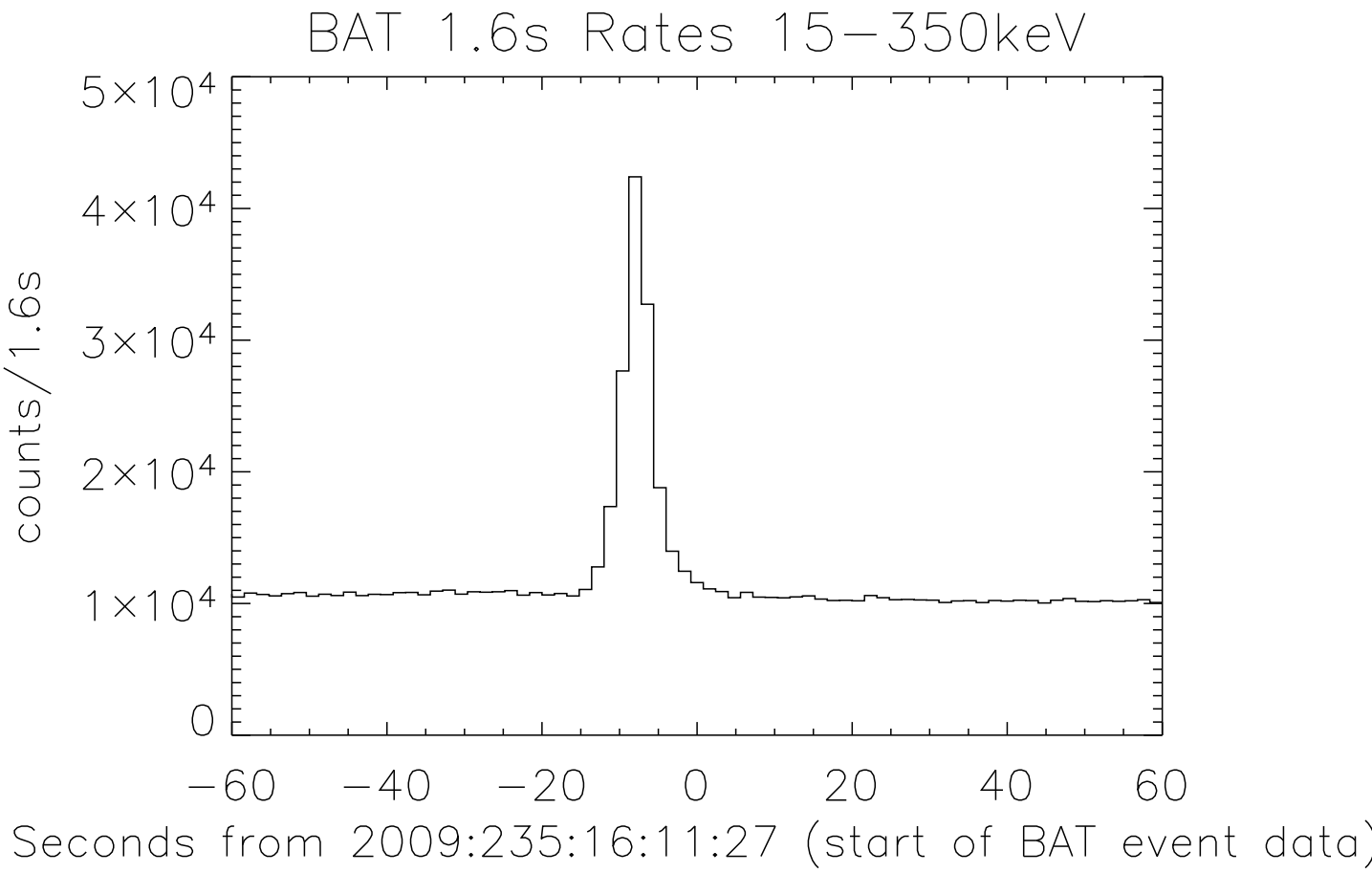

Figure 1: BAT Light curve of GRB 090823.

ergs s^{-1} cm^{-2} assuming a typical GRB afterglow spectrum. *Swift* observed the field of GRB090823 twice again for 9.5 ks on 2009-08-27 and 7.5 ks on 2009-09-05 (Grupe *GCN Circ.* 9902). During the 2009-08-27 observation the X-ray source was clearly detected again at a level of $(2.3\pm0.6)\times10^{-3}$ counts s^{-1} (about 1.1×10^{-13} ergs s^{-1} cm^{-2}). During the 2009-09-05 observation, however, the X-ray source was definitely gone and we can only derive a 3σ upper limit at a level of 1.9×10^{-3} counts s^{-1} (9.4×10^{-14} ergs s^{-1} cm^{-2}, confirming that the X-ray source is the X-ray afterglow of GRB 090823. The $0.3-10$ keV light curve is given below (Fig.2).

4 UVOT analysis

The Swift/UVOT began settled observations of the field of GRB 090823 30 hours after the trigger. No optical afterglow consistent with the XRT position is detected in the initial UVOT exposures (Grupe

et al. *GCN Circ.* 9840). Preliminary 3σ upper limits using the UVOT photometric system (Poole et al. 2008, MNRAS, 383, 627) for the initial exposures are listed in Table 1. The values quoted are not corrected for the Galactic extinction due to the reddening of E(B-V) = 0.06 in the direction of the burst (Schlegel et al. 1998).

Filter	$T_{\rm Start}$	$T_{\rm stop}$	Exposure	Mag
white	109194	115699	1464	>21.8
v	110009	116640	1680	>20.1
u	108380	114954	1597	>20.7

Table 1: Magnitudes from UVOT observations of GRB 090823

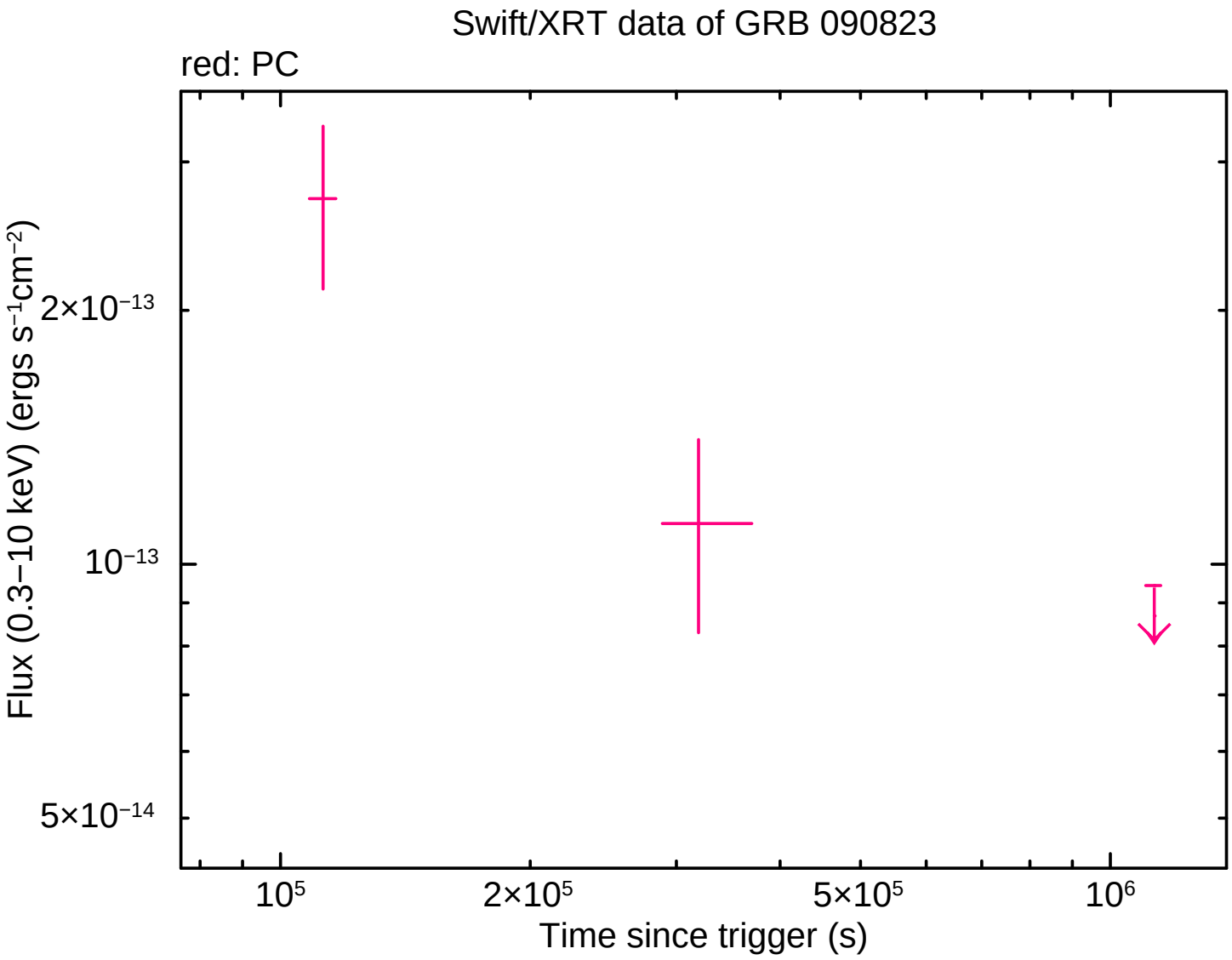

Figure 2: XRT flux light curve of GRB 090823 in the 0.3-10 keV band. The approximate conversion is 1 count $s^{-1} = \sim 5 \times 10^{-11}$ $ergs\ s^{-1}cm^{-2}$ for an observed flux assuming a standard X-ray afterglow spectrum.