KLASİK VE TEKRARLAYAN NOVALARİN X-İSİNİ EVRİMLESMELERİNDE SON YİLLARDAKİ YENİLİKLER

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ÖZET

XMM-Newton ve Chandra (Swift/XRT ve RXTE dahil) X-isini uydulariyla son yillarda yapilan Nova gozlemleri novalarin patlama sonrasi nasil evrimlestigi konusunda bilgilerimizi oldukca ilerletti. Nova kabuklarinin çözünülebilecegini ve calisilabilecegini gorduk. Cesitli X-isini cizgilerinden novanin X-isini spektroskoposini calistik ve yuksek yogunluklu bolgelrini inceledik. Isi ve Emisyon Olcegi varyasyonlarini tespit ettik. Boylece novalarin sert X-isini yaymalarinin cesitli sebeplerini gozlemis olduk. Beyaz cuceleri cok yuksek IsIda X-isini yayarken yakaladik. Isik egrilerinde cesitli varyasyonlar gorduk. Bunlardan baska, yeni patlamis novalarin bir-iki sene icinde X-isinlarinda madde aktarimi yaptigini bulduk. Butun bu yenilikler konusmada gozden gecirilecektir.

Gama-ışını Patlamaları: GROND gözlemleri

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Abstract

Gamma-ray Bursts (GRBs) are unique events that can reach us from very large distances and thus carry information about the early Universe, the star-formation rate history, and the first galaxies. Here we present the results of afterglow observations of GRB 070802 and host galaxy observations of GRB 070729 both obtained with GROND (Gamma-ray Burst Optical/Near-infrared Detector), which is a 7-band simultaneous imaging detector mounted on 2.2m MPI/ESO telescope in Chile.

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Keywords: *gamma-ray bursts, galaxies*

Özet

Gama-ışını Patlamaları çok yüksek mesafelerden dünyaya ulaşabilen ve bu sayede evrenin ilk zamanları, yıldız oluşum hızının geçmişi, evrendeki ilk gökadalar gibi konulara ışık tutabilecek bilgiler taşıyan olaylardır. Bu bildiride Şili'deki 2.2 metrelik MPI/ESO teleskobunda takılı bulunan ve 7 ayrı bantta birden aynı anda gözlem yapabilen bir dedektor olan GROND (Gamma-ray Burst Optical Near-infrared Detector) ile yapılan GRB 070802'in ardışıma ve GRB 070729'un evsahibi gökada gözlemlerini ve onların sonuçlarını aktaracağız.

Anahtar kelimeler: *gama-ışını patlamaları, gökadalar*

1. Introduction

Gamma-ray bursts (GRBs) are the most energetic cosmological explosions in the Universe, emitting energies on the order of 10^{52} erg in a very short time interval ranging from milliseconds to minutes. The prompt emission is released in gamma-rays from a few keV in some cases up to GeV range, with a peak energy around a few hundred keV. In most cases, the prompt emission is observed to be followed by a long lasting afterglow emission in lower energies from X-rays to radio.

A new need for multiband imaging arose with the observation of a large number of gamma-ray burst (GRB) afterglows with the Swift satellite (Gehrels et al. 2004). With its much more sensitive instruments, it detects GRBs over a very wide redshift range. Because intermediate to high-resolution spectroscopy to measure the physical conditions of the burst environment (e.g., Vreeswijk et al. 2007) is constrained to the first few hours after a GRB explosion, a rapid determination of the redshift became important. This is best done with multiband photometry (until integral field units have grown to several arcminute fields of view) and deriving a photometric redshift based on the Lyα break (Lamb & Reichart 2000).

Gamma-**R**ay burst **O**ptical and **N**ear-infrared **D**etector (GROND) is composed of 7 detectors each associated with a different wavelength band allowing observations in 7 bands simultaneously (Greiner et al. 2008). Four of these detectors are optical CCDs of type E2V 42-40, covering ~ 400 – 1000 nm distributed as g',r',i',z' bands. The other three are HAWAII infrared detectors equipped with J, H and K filters covering ~ 1100 – 2350 nm. Therefore it covers the Lyman-limit or the Lyα absorption features, which are necessary for photometric redshift determination, for a redshift range of z ~ 3 – 13.

2. Automated Observations with GROND

The main aim of GROND is to conduct automated GRB follow-up observations and determine the photometric redshift of gamma-ray bursts automatically as fast as possible.

Automated observations and data analysis are handled by the GROND Pipeline (GP) system which is specially designed and written for GROND (Yoldaş & Küpcü Yoldaş in prep.) .It is based on an asynchronous framework to provide speed and degree of freedom necessary to apply different analysis strategies.

The GP decides whether to follow-up an event based on GCN information, after receiving the GRB alerts (as GCN notices) via socket connection. The visibility is calculated for every event, and the events marked for followup are scheduled. The GP dynamically schedules observations throughout the night, which allows followup of multiple targets as well as targets lined up during the daytime.

The GP controls the following aspects of an observation: starting, dynamically selecting the observation blocks to be executed (unless the sequence is fixed by the user), and stopping. Observations are initiated by the GP using a modified version of the ESO Rapid Response Mode (RRM) software.

Data analysis is also done on the fly by the sub-processes of GP. Currently all acquired data are reduced, astrometrically corrected, and analysed using psf photometry (using Pyraf/IRAF libraries), and the afterglow is identified automatically. The implementation of the photometric redshift determination is work in progress. The GP also provides a web interface for user interaction and reporting.

3. GROND Gamma-ray Burst Observations Overview

GROND has been mounted on ESO/MPI 2.2m telescope at La Silla/Chile since the end of April 2007. 136 GRBs have been seen since then, 98 of which were visible from La Silla.

GROND observed 47 out of 98 automatically. 35 of these GRBs could not be observed due to i) bad weather conditions at La Silla (14/98), ii) no override right during visitor or ESO technical time (11/98), iii) 12/98 bursts happened during the GROND intervention for technical updates to the instrument. The rest of the GRBs were not observed due to, i.e. technical problems, delayed distribution of the burst information, or intentionally skipped due to large positional uncertenties or in favor of other GRBs.

3.1 GRB 070729

GRB 070729 was detected by SWIFT BAT on 27 July 2007 at 00:25:53 UT (Sato et al. 2007). It is a short burst with a T90 of 0.9s. The X-ray afterglow is detected during the ground analysis of SWIFT XRT data (Guidorzi et al. 2007). A single extended object was found in the XRT error-circle and reported as the possible host galaxy (Berger & Kaplan 2007; Berger & Murphy 2007). No other afterglow detections were reported. Later on, Swift team published a refined XRT position[1]. This refined position is ~9 arcseconds away from and hence, does not overlap with the previous XRT position.

GRB 070729 was scheduled by the GROND Pipeline system to be observed for ~5 hours starting at 06:25 UT, the time when the GRB started to be visible at La Silla. GROND observations started automatically at 06:35 UT and continued until sunrise.

Figure 1 shows the combined r',i',z' band GROND image of the field of GRB 070729. The extended object reported by Berger & Murphy (2007) (object A in Fig. 1) is detected in all GROND bands except g', however it is not covered by the refined XRT error circle. There is another extended object at RA = 03:45:15.7 Decl. = -39:19:19.9 just ouside the refined XRT error circle (object B in Fig. 1), detected in all GROND bands.

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[1] http://www.swift.ac.uk/xrt_positions/00286373/image.php

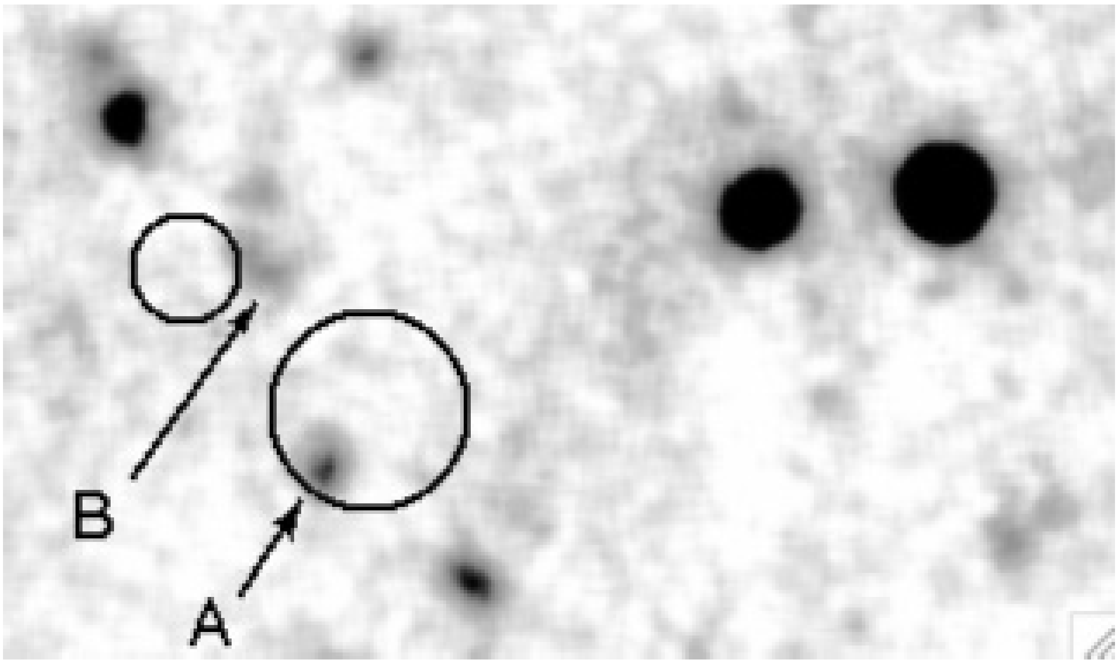

Figure 1: *The combined, smoothed r',i',z' image of the field of GRB 070729 (Küpcü Yoldaş et al. 2008). The larger circle marks the old XRT error circle (Guidorzi et al. 2007)and the smaller circle marks the refined XRT error circle*[1]*. The two neighbouring extended objects are marked as A and B. North is up, East is to the left.*

We analysed the spectral energy distributions (SEDs) of both object A and B, using Bruzual & Charlot (1993) models embedded to HyperZ for 7 different galaxy types including spirals, elliptical, irregular and starburst. We set the redshift, galaxy type and the reddening law as free parameters.

Object A is best fit by a 3.5 Gyr old elliptical galaxy at a redshift of $z = 1.24$ with an $A_v = 0.6$ mag using an LMC- or MW-like reddening law with a χ^2 of 1.18 and 0.84, respectively. For the Calzetti reddening, the best fit is a 2.6 Gyr old eliptical galaxy at $z = 1.32$ and $A_v = 1.0$ mag ($\chi^2 = 0.86$).

The preliminary analysis of object B indicates that it is a young, high-redshift galaxy best fit with starburst galaxy models.

Both objects are faint (with r'-band brightness > 23 mag) in agreement with those of the short burst host galaxies studied by Berger et al. (2007). Based on the results of the current analysis, we cannot exclude any of the two objects from being the host galaxy of GRB 070729.

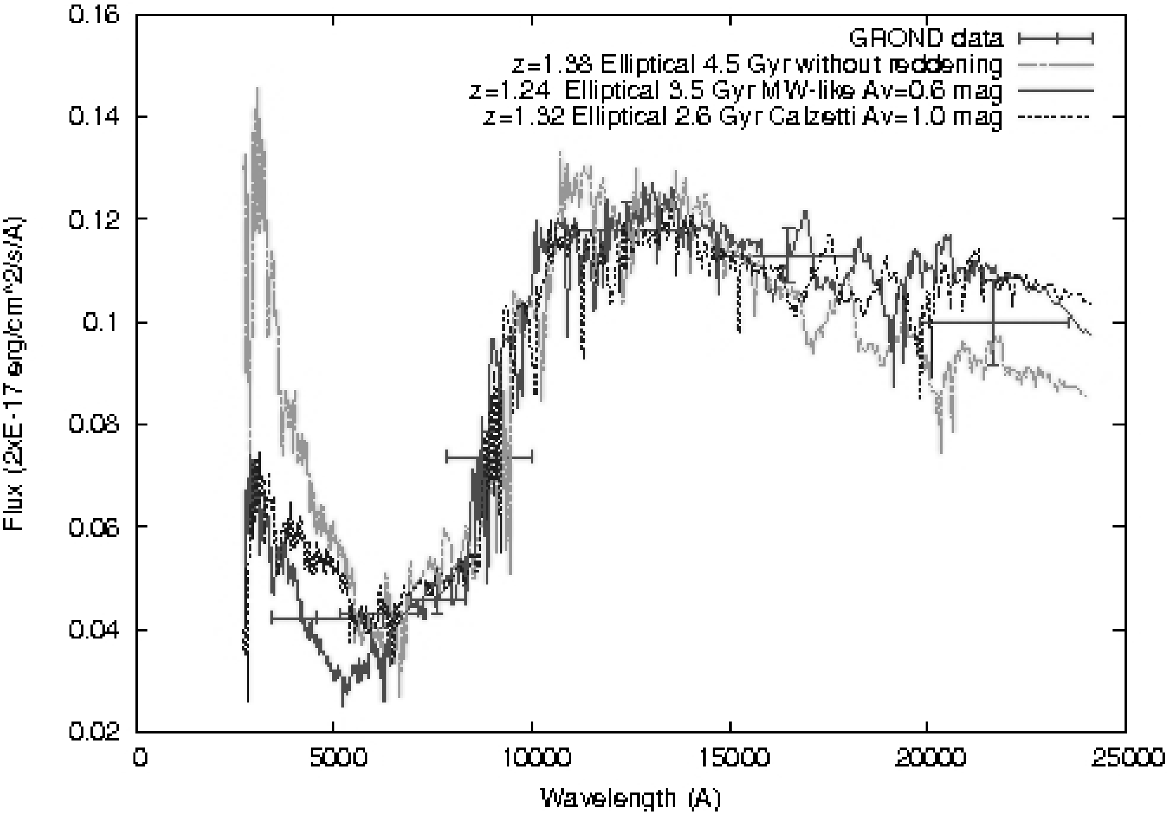

Figure 2: *The optical and near-infrared SED of object A (see text) from Küpcü Yoldaş et al. (2008). The g'-band data point is the upper limit. The best fitting models are old elliptical galaxies at z~1, with moderate extinction.*

3.2 GRB 070802

GRB 070802 was detected by SWIFT BAT on August 2nd 2007 at 07:07:25 UT, as a long burst with T90 ~ 16s (Barthelmy et al 2007).Ground analysis of the Swift XRT data detected the X-ray afterglow 102 arcsec away from the BAT position.

GROND Pipeline initiated observations immediately starting 9 minutes after the burst, leading to the discovery of the afterglow after the first 4 minute observation (Greiner et al. 2007). The spectroscopic redshift of the burst is found to be z=2.45 by Prochaska et al. (2007).
The afterglow observations of GRB 070802 revealed a complex light-curve behavior which can be fit by two broken power-laws (see Fig. 2). The behavior is the same for z',J,H,K bands indicating that it is not

caused by a change in the density of the ambient medium. The most probable explanation is a reverse shock followed by a forward shock (i.e. Nakar & Piran 2004), where the light-curve is best modeled by double broken power-laws.

The optical and near-infrared spectral energy distribution was also studied by combining the data obtained between 2007-08-02 07:31 UT and 2007-08-02 08:08 UT (see Fig. 3). The best fit models are with MW or LMC like extinction curves which explains the drop-out at the i'-band coincident with 2200 A rest-frame absorption feature of LMC and MW-like reddening laws. This is the most significant detection so far for the 2200 A feature in a GRB.

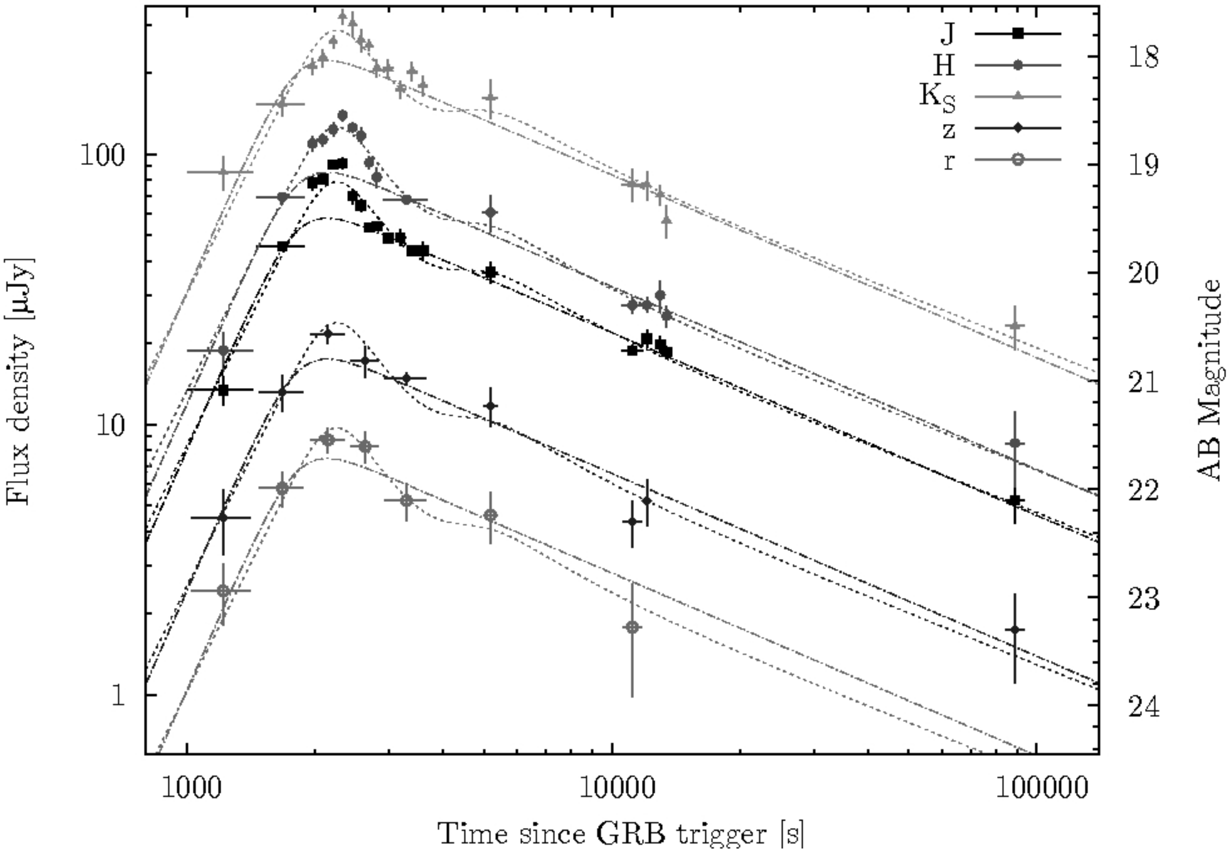

Figure 3: *The optical and infrared light-curve of the afterglow of GRB 070802 (Krühler, Küpcü Yoldaş et al. 2008). The afterglow shows a rise in early times continued with a power-law decay until about 27 hours after the burst. The gap in observations between ~4000 – 10000 seconds after the burst was caused by the misprinted XRT coordinates distributed in (Barthelmy et al. 2007).*

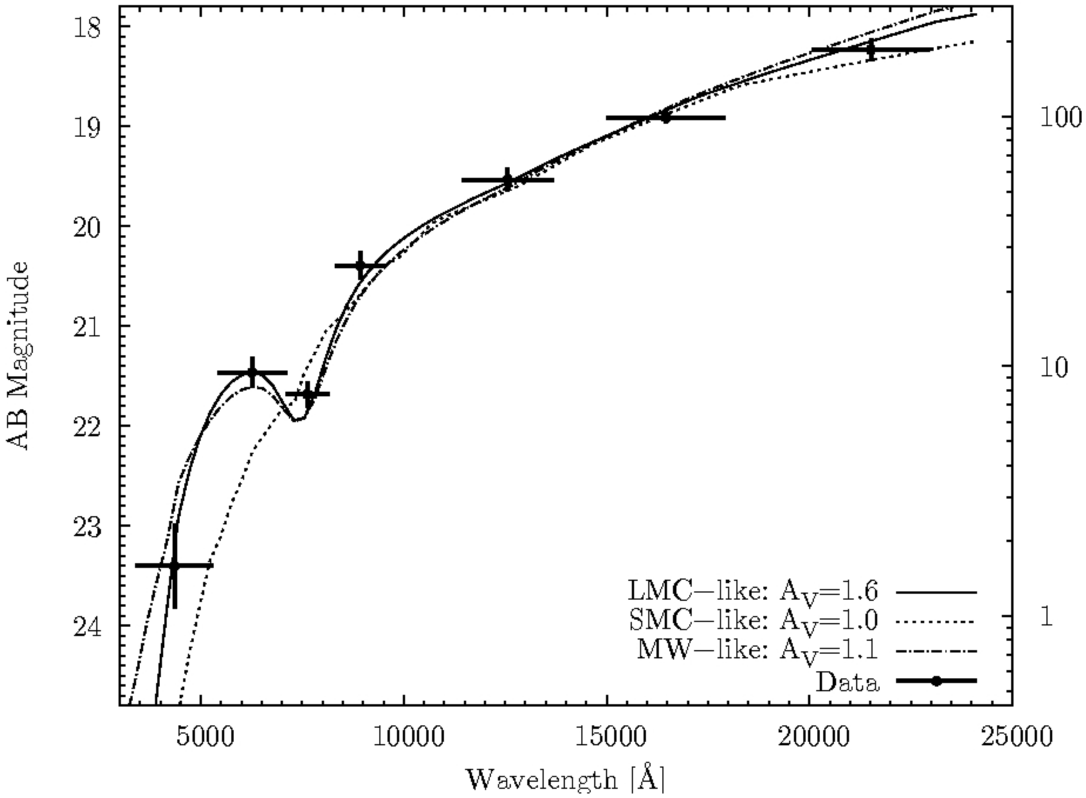

Figure 4: *The optical and near- infrared SED of the afterglow of GRB 070802, during the rise seen in the light-curve (Krühler, Küpcü Yoldaş et al. 2008). The best fit models are I) power-law with an index of -1.5 assuming an LMC-like reddening law with Av = 1.6 mag, ii) power-law with an index of -1.3 assuming a MW-like reddening law with Av = 1.1 mag. This is one of few GRBs which show substantial intrinsic host extinction. The drop-out at the i-band coincides with 2175 A rest-frame absorption feature of LMC and MW-like reddening laws.*

4.0 Summary and Conclusions

GROND observations of GRB 070729 revealed a faint host galaxy candidate with a relatively high-redshift compared to the other short GRB hosts, and yet an early-type galaxy similar to the first discovered short GRB hosts.

On the afterglow side, GRB 070802 was the first burst for GROND occurring during nighttime and revealed significant amount of dust and an MW-like absorption feature in its host galaxy for the first time.

The cases of GRB 070729 and GRB 070802 demonstrates the importance and advantage of simultaneous multi-wavelength obsevrations of GRB afterglows and host galaxies. GROND consolidates rapid response and deep simultaneous multi-wavelength observation capability and offers a unique and more poweful alternative to robotic telecopes and large telescopes with single filter instruments.

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