

The optical identification of events with poorly defined locations: the case of the *Fermi* GBM GRB 140801A

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Accepted 2015 September 22. Received 2015 September 16; in original form 2015 June 2

ABSTRACT

We report the early discovery of the optical afterglow of gamma-ray burst (GRB) 140801A in the 137 deg² 3- σ error-box of the *Fermi* Gamma-ray Burst Monitor (GBM). MASTER is the only observatory that automatically reacts to *all Fermi* alerts. GRB 140801A is one of the few GRBs whose optical counterpart was discovered solely from its GBM localization. The optical afterglow of GRB 140801A was found by MASTER Global Robotic Net 53 s after receiving the alert, making it the fastest optical detection of a GRB from a GBM error-box. Spectroscopy obtained with the 10.4-m Gran Telescopio Canarias and the 6-m Big Telescope Alt-azimuth of the Special Astrophysical Observatory of the Russian Academy of Sciences reveals a redshift of $z = 1.32$. We performed optical and near-infrared photometry of GRB 140801A using different telescopes with apertures ranging from 0.4 to 10.4 m. GRB 140801A is a typical burst in many ways. The rest-frame bolometric isotropic energy release and peak energy of the burst are $E_{\text{iso}} = 5.54_{-0.24}^{+0.26} \times 10^{52}$ erg and $E_{\text{p, rest}} \simeq 280$ keV, respectively, which is consistent with the Amati relation. The absence of a jet break in the optical light curve provides a lower limit on the half-opening angle of the jet $\theta = 6^\circ.1$. The observed E_{peak} is consistent with the limit derived from the Ghirlanda relation. The joint *Fermi* GBM and *Konus-Wind* analysis show that GRB 140801A could belong to the class of intermediate duration. The rapid detection of the optical counterpart of GRB 140801A is especially important regarding the upcoming experiments with large coordinate error-box areas.

Key words: acceleration of particles – black hole physics – magnetic field – gamma-ray: general – X-ray: general.

1 INTRODUCTION

A new generation of experiments that will open new observational windows for the study of the Universe is beginning to come online, or will do so in the following years. They will detect gravitational

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