

Absorption spectroscopy of GRB 160410A: The first complete study of the ISM of a short GRB.

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Abstract

Short gamma-ray bursts (sGRBs) are produced on the coalescence of two compact objects such as two neutron stars. These cataclysmic events release a large amount of energy in gravitational waves during the coalescence event to a single compact object. We present the results of the study of GRB 160410A that, at $z = 1.7177$, is one of the farthest SGRBs ever detected. The GRB afterglow emission was first detected by Swift/BAT and observed with the X-shooter spectrograph at VLT starting just ~ 8 minutes after the GRB. This is one of the best spectra ever obtained on the GRB afterglow emission of a sGRB. It allow us to perform for the first time a chemical study of the circumburst medium of a sGRB. The spectrum shows low-ionization features common to long GRBs (lGRB), however, high-ionization features are missing. We detect the broad absorption line corresponding to Lyman-alpha feature with a measured value for the column density compatible with a Damped Lyman-alpha Absorption (DLA) region. We find no evidence for dust depletion. The measured metallicity, $[\text{Fe}/\text{H}] = -2.5 \pm 0.2$, is low as compared to lGRB-DLA systems. Late observations with OSIRIS/GTC failed to detect an underlying galaxy at the GRB location down to $r > 27$ mag. The GRB ligh-curve is better described by a double-broken power-law and a spectral energy distribution consistent with no extinction. GRB 160410A is in contrast with our findings for GRB 201221D, a softer sGRB that shows only Fe II and Mg II features at $z = 1.045$ with line strength consistent with the mean value measured for lGRB environments. The host galaxy is a well detected massive galaxy with low star formation rate.

My poster is available at <https://doi.org/10.5281/zenodo.7048964>