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GRB 070125 and the environments of spectral-line poor afterglow absorbers

A. De Cia, R. L. C. Starling, K. Wiersema, A. J. van der Horst, P. M. Vreeswijk, G. Björnsson, A. de Ugarte Postigo, P. Jakobsson, A. J. Levan, E. Rol, S. Schulze, N. R. Tanvir

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GRB 070125 is among the most energetic bursts detected and the most extensively observed so far. Nevertheless, unresolved issues are still open in the literature on the physics of the afterglow and on the GRB environment. In particular, GRB 070125 was claimed to have exploded in a galactic halo environment, based on the uniqueness of the optical spectrum and the non-detection of an underlying host galaxy. In this work we collect all publicly available data and address these issues by modelling the NIR-to-X-ray spectral energy distribution (SED) and studying the high signal-to-noise VLT/FORS afterglow spectrum in comparison with a larger sample of GRB absorbers. The SED reveals a synchrotron cooling break in the UV, low equivalent hydrogen column density and little reddening caused by a LMC- or SMC-type extinction curve. From the weak MgII absorption at z=1.5477 in the spectrum, we derived logN(MgII)=12.96+0.13-0.18 and upper limits on the ionic column density of several metals. These suggest that the GRB absorber is most likely an LLS with a 0.03Z\odot<Z<1.3Z\odot metallicity. The comparison with other GRB absorbers places GRB070125 at the low end of the absorption line equivalent width distribution, confirming that weak spectral features and spectral-line poor absorbers are not so uncommon in afterglow spectra. Moreover, we show that the effect of photo-ionization on the gas surrounding the GRB, combined with a low N(HI) along a short segment of the line of sight within the host galaxy, can explain the lack of spectral features in GRB070125. Finally, the non-detection of an underlying galaxy is consistent with a faint GRB host galaxy, well within the GRB host brightness distribution. Thus, the possibility that GRB070125 is simply located in the outskirts of a gas-rich, massive star-forming region inside its small and faint host galaxy seems more likely than a gas-poor, halo environment origin.

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