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THE BLUE COLORS OF GAMMA-RAY BURST HOST GALAXIES

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There is now an increasing number of evidence supporting the idea that the cosmic Gamma-ray Bursts (GRBs) originate from the collapse of massive stars in distant star-forming galaxies. Because GRBs are likely detectable up to very high redshift, and because the gamma-rays are not attenuated by intervening columns of gas and dust, these phenomena thus offer a unique perspective to probe the star formation in the early Universe independently of the biases associated with dust extinction.

In a first step of a long-term study to characterize the physical properties of the starbursts pinpointed by GRBs, we report here on the R–K colors of GRB host galaxies. Such colors, in principle, should provide indications about the fraction of star formation occuring in blue galaxies as opposed to that taking place in highly reddened sources. In Figure 1 we compare the R–K colors of GRB hosts with those of field galaxies from the HDF (Fernandez-Soto et al. 1999). The K magnitudes of GRB hosts were partly derived from our near-infrared (NIR) observations at the VLT, whereas the remaining data points and the R magnitudes were gathered from the literature. Using the optical and NIR local templates of Coleman et al. (1980) and Mannucci et al. (2001), we have also overplotted the colors that would exhibit such templates if they were shifted to higher z assuming no evolution. One can clearly see that GRB hosts display rather blue colors, typical of the population of blue faint sources at high z. Moreover they appear significantly bluer than the local irregular galaxies, which reveals an even stronger contribution of the UV-continuum from star-forming regions.

On one hand, this result seems to be consistent with the blue colors characteristic of the active star-forming HII regions that dominate the optical emission of starburst galaxies at high redshift. One the other hand, several authors have recently argued that a significant fraction of the star formation history may have occured in reddened sources enshrouded in dusty environments, such as those found among the Extremely Red Objects (EROs, R–K ≥ 5). Thanks to their dust-penetrating power, GRBs should be capable to trace such a hidden star-forming activity. So far, indeed, GRBs have enabled the discovery of two submillimeter dusty galaxies, yet with blue optical counterparts, but surprisingly no reddened object has been observed among the GRB hosts (see Figure 1). A plausible explanation may simply originate from the very small number of sources in the current sample of GRB host galaxies. Nonetheless, if this tendancy were to be confirmed with a larger number of sources, key results could be deduced and – unless a careful revision of the GRB starburst selection and the possible effects of metallicity in the burst environments is to be done – severe constraints relative to the contribution of reddened starbursts at high z may indeed be obtained.

The advent of future instruments dedicated to GRBs and their afterglows will provide better statistics to investigate further this issue.

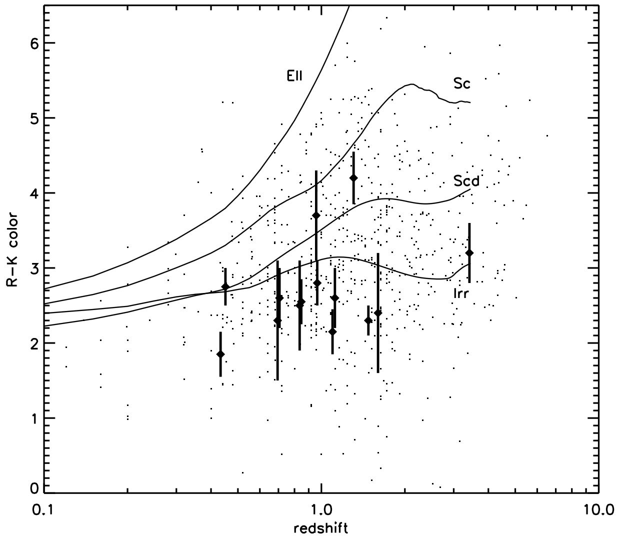

Fig. 1. The R–K colors of GRB host galaxies (filled diamonds), compared with those of field sources from the HDF (dots). Solid lines represent the expected colors of local templates shifted to higher z.

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