Original investigation of dust in GRB Host galaxies

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The dust in Gamma-Ray Bursts Host (GRBH) galaxies plays an important role because it can strongly affect the shape of the optical and NIR afterglow spectrum and even causing no detection in case of high amount of extinction. On the good side, the shape of the extinction curve itself brings us some information about the dust composition and grain size. Though extinction curves are well studied in the local group because stars can still be resolved, it is not the case anymore at high redshift. The fact that the Gamma-Ray Burst (GRB) afterglow is well described by a synchrotron emission enables us to know accurately the intrinsic emitted spectrum shape. Then comparing the spectrum we observe with what was emitted gives us a direct access to the extinction curve at high redshift and thus to some dust properties of distant galaxies.

In this study we investigate an original method to get an insight of the dust distribution in the Host Galaxy by comparing the extinction curve along the GRB afterglow line of sight with the attenuation curve, which is an integration over all lines of sight of the Host Galaxy.

In order to rely on the shape of the extinction curve we have selected GRB afterglows from the literature having a rest-frame UV coverage. Attenuation curves are derived using the CIGALE SED fitting algorithm, which requires reasonably well sampled optical-to-NIR SED and the use of mid-IR/mm/radio observations when available.
Eventually 5 GRBs-GRBHs association (at $1.5 < z < 3$) passed our selection criteria. The Hosts in our sample are rather dusty and massive and the extinction curves are unusual for GRBs with the presence of a 2175 Å bump.

As a by-product of our study we found that a recent strong burst of star formation is required to obtain a good SED fit for 4 of our 5 GRB Hosts, so that they could be considered as starburst galaxies.

The attenuation curves are marginally consistent with the Calzetti law, however there is a great variety when comparing to the extinction curves. Previous works using transfer radiative code already investigated dust distributions capable of reproducing a steep extinction curve, with and without a bump, and a Calzetti-like attenuation curve. The next step of this study will then be the use of radiative transfer simulations to assess more accurately the dust distribution inside these galaxies, especially investigating the case where the extinction curve lie below the attenuation curve.