Gamma-ray burst afterglows: Dust extinction properties from low to the high redshift Universe

Tayyaba Zafar

European Southern Observatory (ESO), Garching, Germany

Long duration Gamma-ray bursts (GRBs) are powerful spectacles since the Big Bang. The long duration GRBs are associated with the death of massive stars, have simple intrinsic power-law spectrum, and their cosmological occurrence stretches out to the epoch of reionization, a time when the first galaxies and stars were forming. These advantages make GRBs potentially unique and effective probes to study dust extinction in the Universe over broad range of redshifts. The knowledge of the dust properties in GRB host galaxies is very useful to understand the interstellar medium of high redshift galaxies and the cosmic star-formation history. Using an X-ray and optical spectroscopic sample of GRB afterglows, we construct the spectral energy distributions to determine the dust extinction in the GRB local environment. It is found that usually the featureless Small Magellanic Cloud type extinction law could explain these data. However, the rare Milky Way type 2175Å extinction feature is also seen in five GRB cases, with a large diversity of extinction curve shapes. This suggests that GRBs occur in diverse environments from young, low-mass, blue galaxies to the evolved, massive, red galaxies. Moreover, presence of various extinction laws hints the nature of the dust (grain population, sizes and composition), varying from silicates to carbonaceous grains. The results indicate a decrease in dust content in star-forming environments at high redshifts.