Gamma−Ray−Bursts Hosts: Digging out Low−Mass High−z Star−Forming Galaxies

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Hours Requested: 2.2

Abstract:
We propose IRAC and MIPS observations (4.5, 8 and 24 micron) of 6 gamma−ray burst (GRB) host galaxies at redshift 0.2<=z<=0.5. GRB hosts are generally low−luminosity metal poor galaxies. It is not clear whether they are also star−bursting, because measured star formation rates (SFRs) are very uncertain and because their total stellar mass has been poorly investigated. Using these and other existing Spitzer data (a total of 19 hosts at 0.0<z<1.1) we will obtain a robust estimate of the stellar mass and SFR for the sample, and establish whether GRB hosts are the equivalent at high redshift of local starburst galaxies. Small galaxies at z<1.1 are recognized as having a key role in the last 8 Gyrs of the history of the universe. This is also know as the 'downsizing' scenario. GRB hosts are unique probes to push to the limit our investigation of the downsizing scenario. The program can be execute with 2.2 hours of Spitzer time.

1 Scientific Justification

1.1 Summary

We seek to robustly estimate the total stellar masses and star formation rates of a sample of gamma-ray burst host galaxies. It is now established that GRB host galaxies are generally faint starforming systems. Several lines of argument suggest that in the second half of the life of the universe small galaxies were more active than big ones. This scenario for galaxy formation is called *downsizing*. GRB hosts can very effectively be used to further investigate this issue, because even if they are faint, their position as well as their redshift are measured very accurately from the afterglow. These are two major advantages from which existing deep surveys cannot benefit. Thus GRBs allow us to select the least massive, smallest galaxies at high redshift.

For this program we have selected 6 GRB hosts at $0.2 \leq z \leq 0.5$ with existing optical photometry. MIPS and IRAC observations will complement existing data and allow us to:

- Determine the stellar mass of the host galaxies
- Measure their star formation rate
- Estimate the dust extinction from the comparison with optical-UV SFR indicators
- Study the stellar population from the overall SED

Our 6 hosts will be merged with a larger sample observed with Spitzer. The final sample will contain 19 objects, i.e. 27% of all GRBs with measured redshifts.

We waive all proprietary rights and will make our data public through the GRB Hosts Studies (GHostS[1]) web site. GHostS is the largest public archive dedicated to the investigation of GRB hosts, recently initiated by our group.

1.2 The GRB Host Galaxies in the Downsizing Scenario

We have recently shown that small galaxies ($M_* < 10^{10}$ $M_\odot$) have been the most active objects for the last 8 Gyr (Glazebrook et al. 2004; Juneau et al. 2005; Savaglio et al. 2005). This supports the downsizing scenario for galaxy formation (Cowie et al. 1996), according to which large systems formed abundantly in the past, whereas small galaxies have been dominating the scenes in recent times. These findings shook the standard picture of galaxy formation, which foresees big galaxies having a dominant role only in the recent history of the universe (Blumenthal et al. 1984). The importance of reaching more extreme limits through the observation of small faint systems is now becoming clear.

Unfortunately, the difficulties in acquiring spectra (necessary to determine the redshift) of very weak objects are limiting our investigation capabilities. In this scenario, the galaxies associated with GRBs are the best possible targets. A few studies have shown that GRB hosts are generally low-luminosity systems, indicating low masses (Chary et al., 2002; Le Floc'h et al. 2003). The advantage of going after GRB hosts is that the redshift and the position can be accurately measured from the optical afterglow, facilitating observational follow-ups. Moreover, GRB hosts often show very strong emission lines, and from these

[1]GHostS URL: http://www.pha.jhu.edu/∼savaglio/ghosts