GRB HOST GALAXIES: A FASCINATING RESEARCH FIELD

S. Klose¹

Abstract. Because of time constraints, there was no discussion on GRB host galaxies. Nevertheless, it is worth to extract the main points from the talks and posters presented during the conference.

1 Substantial activity in the field

The overwhelming majority of observational data concerns the hosts of long bursts (*e.g.*, Savaglio *et al.* 2009; see also the [www](http://www.grbhosts.org/) page of the GHostS project²), and meanwhile even redshift trends of host galaxy properties can be discussed (Savaglio, these proceedings). There is a lively discussion ongoing in the community whether or not long GRB hosts trace and quantify the evolution of the cosmic star-formation rate (SFR) and what the relations between mass, metallicity, and SFR tell us here (Graham *et al.*; Niino *et al.*; Savaglio *et al.*, these proceedings; Mannucci *et al.* 2011). More and more spectroscopic data of GRB hosts are published, either based on afterglow follow-up observations (*e.g.*, Christensen *et al.* 2011) or based on host galaxy studies. At least in the latter case it is obvious that this mainly remains a job for 8-m class optical telescopes. Observations with VLT/X-Shooter are particularly fascinating here (Vergani *et al.*, these proceedings; Vergani *et al.* 2011).

Increasing interest develops towards a study of those hosts that harbor dark bursts, and the MIR/FIR/submm band is particularly intriguing here (Palazzi *et al.*, these proceedings). This holds in particular after it has been discovered that a substantial population of dark bursts might be hosted by extremely red, globally dust-enshrouded objects (Rossi *et al.* 2012), and that the hosts of the dustiest GRBs point to a population of luminous, massive, and chemically evolved galaxies (Krühler *et al.* 2011), which are very different from the majority of GRB hosts. Obviously, there is a lot to investigate here.

On the far site, the hosts of high-*z* events remain fascinating (Basa *et al.* 2012), in particular since basically all of them remain undetected even for HST

¹ Thüringer Landessternwarte Tautenburg, 07778 Tautenburg, Germany

²<http://www.grbhosts.org/>

(Tanvir *et al.*, these proceedings; Tanvir *et al.* 2012). It seems we have to await here the next generation of ground and space-based optical telescopes in order to learn more about these galaxies (or these galaxy building blocks). Given that GRBs are the potential messengers of the first stars in the universe, chances are not small that these hosts will be among the first targets for these future telescopes.

On the near site, we might divide between the hosts of near-by GRB-SNe and the hosts of short bursts. The host of SN 1998bw still represents the nearest GRB host galaxy; it promises the best achievable data quality with respect to angular resolution. Substantial work has already been done here (*e.g.*, Christensen *et al.* 2008; Fynbo *et al.* 2000; Michałowski *et al.* 2009), and also in the case of other $z < 0.1$ GRBs the observational data can be of remarkable scientific quality (*e.g.*, Thöne *et al.* 2008). On the contrary, after some early enthusiasm in the years 2005/06 (*e.g.*, Fox *et al.* 2005; Gehrels *et al.* 2005), the following years have not given us so many nearby short burst host galaxies (the most remarkable exception is GRB 080905A at $z = 0.122$; Rowlinson *et al.* 2010). Most of these hosts are at cosmological distance (*e.g.*, Berger 2009). Hopefully, more high-resolution data will be obtained with HST soon.

2 Looking forward

The GRB field is rapidly developing and host galaxies are becoming an important observational target.

A better understanding of the nature of the long and short burst progenitors requires a deeper look into their birth places, deep in angular resolution in particular. For long bursts this mainly concerns the metallicity issue and the decision between the single and the binary star scenario. For this task, the host of SN 1998bw remains the best target in our days. More such near-by events are needed, but given the GRB redshift distribution, we might have to wait for another ten years, or so, to get this picture right. For short bursts, distance is the main challenge, too. Some open questions are: What are the characteristic ages of the short burst progenitors, are they representing a young or an old stellar population? Well possible that just a single nearby event in the coming years will bring us a big step forward in our understanding of the progenitor properties.

Following the very successful TOUGH survey with the ESO/VLT (Jakobsson *et al.*, these proceedings) also large amounts of Keck data become public now (Perley *et al.*, these proceedings), while HST remains the work horse for unprecedented deep and high-resolution host galaxy data (Fruchter *et al.*, these proceedings). ALMA and the *Herschel* satellite, following *Spitzer*, have opened the window into the MIR/FIR/submm regime (Sokolov *et al.*, these proceedings). Together with VLA, ATCA, WSRT, and GMRT this offers the possibility of a detailed characterization of the SED of host galaxies from radio to UV wavelengths, with the goal to derive the SFR and other galaxy parameters (*e.g.*, Hunt *et al.* 2011; Michałowski *et al.* 2012; Svensson *et al.* 2012). We can expect a fascinating progress on GRB host galaxy studies in the coming years.

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