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Cosmology and the subclasses of the gamma-ray bursts

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Abstract. Several statistical studies - done also by the authors of this contribution - show that there are three subclasses of gamma-ray bursts. They can be called as short, intermediate and long ones, because they can be separated with respect to their durations. The short and intermediate bursts are distributed anisotropically on the sky. This behavior is highly remarkable, and can have a cardinal impact on the cosmology. The subject of this contribution is a survey of this topic.

Keywords. gamma rays: bursts, stars: Wolf-Rayet, supernovae: general, cosmology: early universe

1. Subgroups of the gamma-ray bursts: Impact on the cosmology

The authors have shown that there are three subgroups of gamma-ray bursts (GRBs). They were confirmed in the datasets of different satellites: Compton (BATSE) - Horváth (1998), Mukherjee *et al.* (1998) Horváth (2002), Hakkila *et al.* (2003), Horváth *et al.* (2006); Swift - Horváth *et al.* (2008), Huja *et al.* (2009); Horváth *et al.* (2010), Veres *et al.* (2010); RHESSI - Řípa *et al.* (2009); BeppoSAX - Horváth (2009). GRBs can be separated with respect to their durations (short, intermediate and long subgroups). In this contribution we briefly discuss the cosmological implications of this separation. The short and long GRBs are physically different phenomena (Balázs *et al.* 2003).

The physics of the intermediate GRBs is unclear. The angular sky distribution of the subgroups are also different for the GRBs in the BATSE database: The short and intermediate GRBs are distributed anisotropically, but no such behavior was confirmed for the long ones (Balázs *et al.* 1998, Balázs *et al.* 1999, Mészáros *et al.* 2000, Vavrek *et al.* 2008). The long GRBs can be at extremely high redshifts (up to $z \simeq 20$) (Mészáros & Mészáros 1996, Horváth *et al.* 1996, Mészáros *et al.* 2006); the short and intermediate GRBs should be at moderate redshifts (see Figure 1) - i.e. up to $z \simeq 1 - 3$.

But even at these redshifts, together with the fact that they are distributed anisotropically, the short and intermediate GRBs can have a cardinal impact on the cosmology, because the cosmological principle requires any class of objects at redshift $z > 0.1$ to be distributed homogeneously and isotropically (Mészáros *et al.* 2009a, Mészáros *et al.* 2009b).

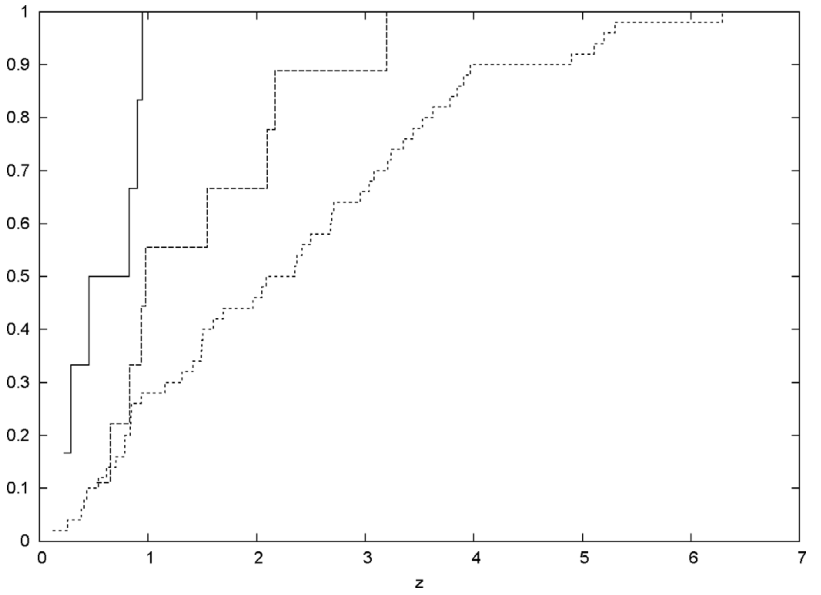

Figure 1. The redshift distribution of the three subgroups of GRBs with known redshifts and detected by the Swift satellite; z means redshift, and on the vertical axis any step gives a GRB similarly to the KS statistical test; for more details see Horváth *et al.* (2010).

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