

# Gamma-ray burst groups observed by BATSE, BeppoSAX and Swift

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## Abstract

Short and long bursts were identified by the BATSE team in the early 90's. A decade ago there were some suggestions about the intermediate duration type of bursts. We are going to summarize recent analyses of the duration distributions of the BeppoSAX and Swift data. Our conclusion is all the three satellites (CGRO, Swift, BeppoSax) can see the third type of the GRBs. The properties of the group members are very similar in the different data sets.

## 1 Introduction

Series of papers studied the classification of the Gamma-ray burst (GRB). They mainly agreed among these mysterious phenomena not just short (hard) and long bursts exist but also a third type of GRBs. In this paper we are going to summarize these analyses mainly done by the authors.

The discovery of the third type of GRBs goes back as early as 1998 [Mukherjee et al. (1998), Horváth (1998)]. After that many research groups studied the BATSE bursts' sample and concluded the third group of the GRBs statistically exists [Hakkila et al. (2000), Balastegui et al. (2001), Rajaniemi & Mähönen (2002), Horváth (2002), Hakkila et al. (2003), Borgonovo (2004), Horváth et al. (2006), Chattopadhyay et al. (2007)]. Later several studies were published analysing different data sets. We are going to summarize some results according to the CGRO, Swift and Beppo-Sax satellites.

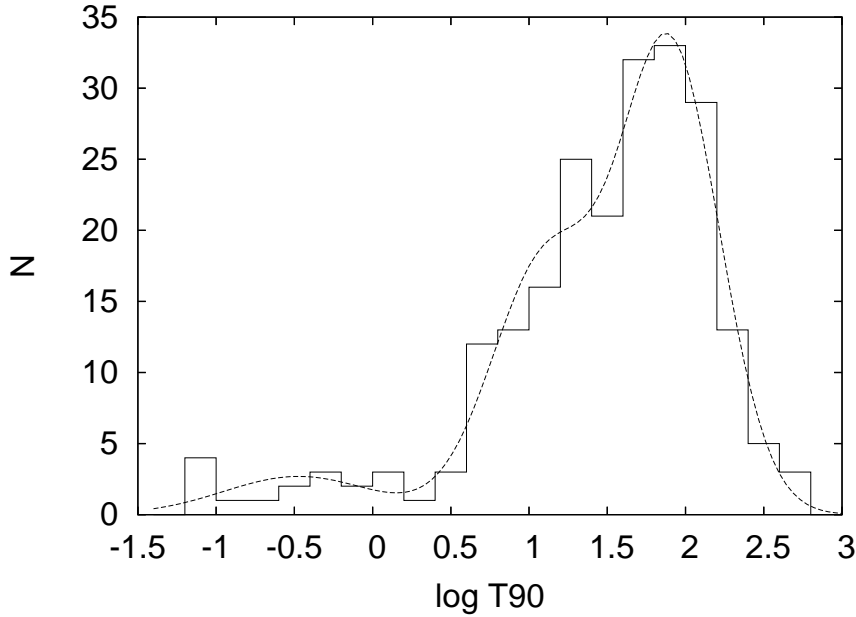


Figure 1: The duration distribution of the Swift bursts and a three Gaussian fit.

## 2 The BATSE sample

The Compton Gamma-Ray Observatory (CGRO) finished its mission in 2000 and the final BATSE catalog was published. The duration distribution of this sample can be well fitted with three Gaussian. The significance that the third component is needed is 99.5% [Horváth (2002)]. Several papers confirmed similar or even better significance [Balastegui et al. (2001), Rajaniemi & Mähönen (2002), Hakkila et al. (2003), Horváth et al. (2006), Chattopadhyay et al. (2007)].

## 3 The Swift sample

The First Bat BAT Catalog [Sakamoto et al. (2008)] was published in 2008. In the catalog there are 237 GRBs, of which 222 have duration information. The duration distribution of this sample can be seen in Figure 1. Also a three Gaussian fit is plotted in the figure. The significance of the third component is 99.4 % (see [Horváth et al. (2008)]).

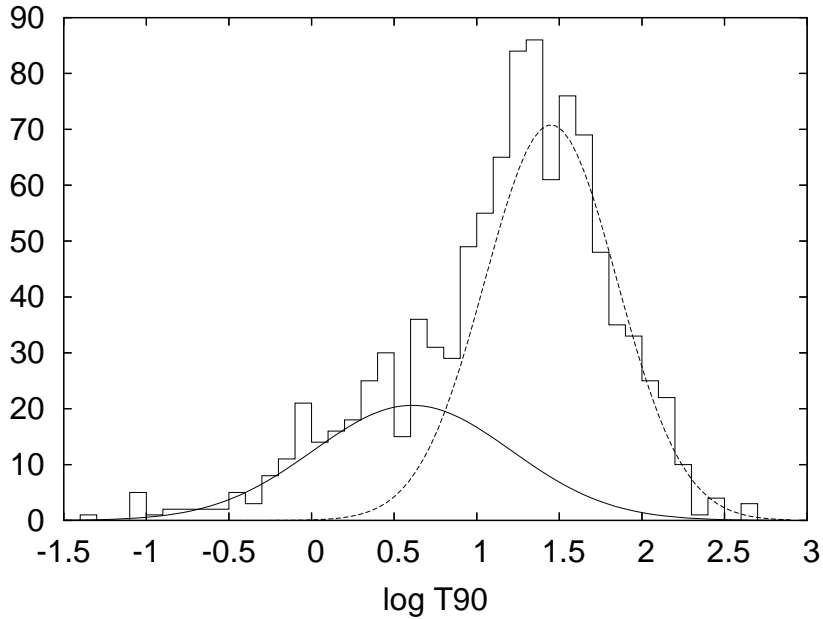


Figure 2: The duration distribution of the Beppo-Sax GRBs.

## 4 The Beppo-Sax sample

In the BeppoSAX catalog [Frontera et al. (2009)] there are 1082 GRBs, of which 1003 have duration information (see Figure 2. for the distribution). For the analysis of this distribution we used the Maximum Likelihood (ML) method. The ML method was not able to identify all the three subgroups in the BeppoSax data at a high significance level. However the third group in our analysis was the shortest in duration. Therefore analyzing the duration distribution observed by BeppoSax GRBM one can find the long and the intermediate duration population [Horváth (2009)]. The short population can be seen only with low significance level.

## 5 Acknowledgements

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