GRB980329 - an interesting 'grito burst

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1 Introduction

GRB980329 (BATSE trigger 6665) is one of the most interesting objects in our Milagrito sample of 54 GRB. This is the burst that I usually use to illustrate how interesting Milagro observations can be. Prompt emission was detected by BATSE and the EGRET TASC detector. X-ray, radio and optical/ir afterglows were measured for this object. Despite the identification of a host galaxy the redshift of this burst is unknown. Originally the redshift of this burst was estimated to be 5 based on the assumption that the redness of the optical transient was due to absorption of the blue end of the spectrum by the lyman break. An optical spectrum of the host galaxy was taken with Keck no lines could be identified (hence the lack of redshift). However the optical spectrum was rather blue and contained no evidence of Lyman alpha absorption, this indicates that the original estimate of z$\sim$5 was incorrect, and that the redshift of this burst was likely to be less than 4. The spectral index of the host galaxy favors z$<$ 3. If this burst is to fit in the grb standard candle relation proposed by Frail et al (ApJ 2001) and Kumar et al (??) then its redshift must be less than one. It seems that as time goes on this burst gets more and more interesting to us.

2 Milagrito Observations

This burst had T90 of 18.6 seconds and was at a zenith angle of 24.7 degrees. In a 1.6 degree bin placed at the position of the gamma-ray burst we saw 17 signal events and 10.84 background events. This corresponds to a 99% upper limit of 19.5 events. To convert the Milagrito upper limits to fluxes, we threw four sets of simulations. These were all thrown from 200 GeV to 20 TeV with and -2.0 differential photon spectrum. We found that all GRB observed in Milagrito fell into one of 4 groups: (a) 0.9 meters of water and 30 cm of water on the cover, (b) 0.9 meters of water, dry cover, (c) 1.5 meters of water, dry cover and (d) 2 meters of water, dry cover. We threw MC to describe each of the 4 scenarios. GRB980329 fell into category (d), the integrated effective area from 200 GeV to 20 TeV at a zenith angle of 24 degrees was 568.8 m^2, thus our flux upper limit was 3.43e-6 ph/cm^2 between 200 GeV and 20 TeV. Converting this to an integral flux limit above 4 TeV (we chose approx. the median energy so that we are less sensitive to changes in the assumed spectrum) we find that the limit becomes 1.7e-7 ph/cm^2. In figure 1 I show the BATSE and EGRET tasc spectra with our upper limit, plotted as E^2dN/dE. Also on this plot, I indicate the 3 sigma milagro sensitivity.

Why am I sending out this memo now, when the analysis was done a few years ago? Well, I think that the nufnu plot of the combined BATSE (Preece - private communication), EGRET (Catelli and Dingus) and Milagrito results for this burst look cool. Even though the extrapolation of the EGRET spectrum is consistent with our observation, this still

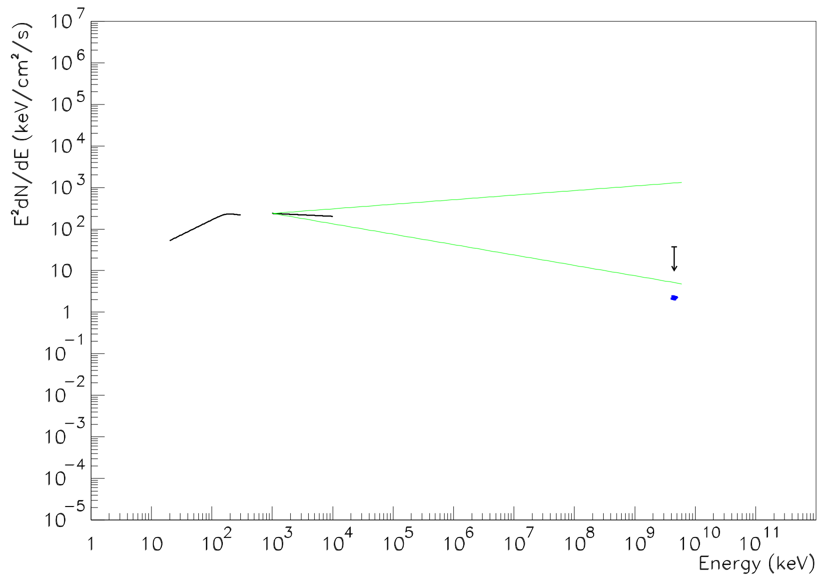

Figure 1: Spectral energy distribution for the prompt emission from GRB980329. This shows the Milagrito 99% upper limit, and below it, the Milagro 3 sigma sensitivity.

shows that there was not a second more powerful high energy component such as is implied by our result on 970417. This burst (and the other grito bursts with counterparts) are particularly well studied by the community. I think that it makes Milagro look very good and makes Milagrito look competitive. So I wanted to distribute this plot with some explanation of where it came from, in case anyone else is interested in using it to illustrate our sensitivity.