SAIP Contribution ID: 490

Isotropic energy and luminosity correlations with spectral peak energy for five long Gamma-Ray Bursts

Response to the Referee comments received on 20 November 2017:

We are grateful to the Referee for a comprehensive review of our manuscript that helped us to improve the paper. We append our responses immediately following the comments. Sentences and grammatical errors that need to be corrected are mentioned here as well (printed in blue italics).

General comments from referee:

This paper presents the results of spectral fitting of 5 GRBs detected by Fermi in 2015 and compared to the Amati and Yonetoku relations. The methods and results are described relatively clearly and seem to be valid. The paper will, therefore, merit publication in these proceedings. However, the text seems to be written rather hastily, with a number of incomplete sentences (e.g., no conjugated verb in the main sentence). Particularly disturbing in this sense is the last "sentence" in Section 4.1 - but there are many more grammatical errors that need to be corrected. Apart from that, I only have one minor comment referring to Table 1, where I find the column title "Prob. > 90 %" confusing. I suggest something like "# of HE photons".

1. *Particularly disturbing in this sense is the last "sentence" in Section 4.1 - but there are many more grammatical errors that need to be corrected.*

   We agree with the reviewer and in response to this comment, we have removed the last sentence "In Figure 3, the A2008 data (GRB150727A) with smaller E_{iso} and E^{i}_{peak} is seems an outlier of the correlation." because we didn't plot the confidence level to say that GRB 150727A is an outlier. In section 4.1, we have also rearranged the sentences and revised the entire paragraph.

2. *Apart from that, I only have one minor comment referring to Table 1, where I find the column title "Prob. > 90 %" confusing. I suggest something like "# of HE photons".*

   2.1 Section 2, In Table 1, column five title "Prob. > 90 %"

   Yes, the suggested correction has been made. The title now reads:
   # of HE photons

   2.2 Section 2, In Table 1, column five, the title labeled by superscript ''l'' that defined as caption under the Table "Photons with probability >90 % above 100 MeV"

   We rewrote the caption as:
   [l]The number of High Energy (HE) photons with probability >90%

Changes through out the whole paper

1. *Abstract, line 2*
   "triggered by" -> which triggered

Section 1 (paragraph 1)

Lines: 1-2

2. *"Gamma-ray bursts, mostly emitting radiation in the gamma-ray waveband which lasts for few seconds, and may be tailed by the X-ray, optical or radio emission which last for a few days."*

Changed:
Gamma-ray bursts mostly emit radiation in the gamma rays which last for up to hundreds of seconds. Gamma radiation is tailed by the X-ray, optical and radio emission which last for a few days.

Lines: 4 -11

3. *"For long GRBs (duration > 2 s), observational correlations among the rest frame intrinsic spectral peak energy Ei,peak, the peak isotropic luminosity Liso and the isotropic radiated energy in the prompt emission phase have been anticipated. Ei,peak correlates with the isotropic luminosity Liso (so called Yonetoku relation) [3] and with the isotropic radiated energy first stated by Amati et al. [4]. One of the key properties of the prompt emission of GRBs that is still poorly understood concerns the spectral-energy correlations found when considering the time-integrated spectra of bursts of known redshift."*

We rephrased the appropriate sentences as follow:
For the long GRBs (duration of bursts >2 s), observational correlations exist among the spectral peak energy Ei,peak of the prompt emission and its isotropic peak luminosity Liso (so-called Yonetoku relation) [3]) and isotropic radiated energy which was discovered by Amati [4]. The key properties of GRB prompt emission obtained from the time-integrated spectra of bursts with known redshift are still poorly understood.

Lines: 14 - 17

4. *"The strong motivation to investigate the correlations of GRB phenomenology can be used to make GRBs into standard candles of cosmology, alongside the commonly used standard candle, the supernovae Type Ia for the purpose of constraining the cosmological parameters and to understand the GRB physics of the prompt emission."*

We have reworded the sentences as follow:
The investigation of GRB phenomenology with spectral energy correlations have relevant implications, both for the theoretical understanding of the prompt emission and for using GRBs as standard candles in cosmological studies.

Section 1 (paragraph 2)

Lines: 4-5

5. *"which is a two smoothly broken power law with a break energy"*

Changed:
which is a two smoothly jointed power laws cutting at a breaking energy

Lines: 5 and 6

6. *"breaking"*

We removed the 'ing'

break

Lines: 6 -11

7. *"Further, since the prompt emission spectra of the Fermi-GBM GRBs covers large energy range, their spectra can be fitted well even using a power law with exponential high-energy cut-off (Comptonized) and SBPL model. Using the parameters employed in the best fit spectral model, we have calculated the observables and hence the Amati and Yonetoku relation are implemented to test the correlation of GRBs observables."*

The sentences are reworded follow:
For the photon emission that covers large energy range, their spectra can be modelled by using a power law with exponential high-energy cut-off (Comptonized) or SBPL photon model. Using the parameters obtained from the best fit photon model, we have computed the $E^{i}_{,peak}$, E_{iso} and L_{iso} to study the Amati relation ($E^{i}_{,peak}$ - E_{iso}) and Yonetoku relation ($E^{i}_{,peak}$ - L_{iso}).

Line: 13

8. *"come"*

We changed the word to:
coming

Section 2

Lines: 2 - 9

9. *"Among these (GRB150403A & GRB150314A) are detected by both LAT and GBM while the other three sources (GRB150727A, GRB151027A & GRB150301B) are detected only by GBM as shown in Table 1. The highest- energy photons (E_{max}) in the LAT-detected GRBs with known redshift range between 0.1 GeV to more than 30 GeV. The highest-energy photons of the GRB150314A is ~0.62 GeV (with 97.8 % photon probability) and GRB150403A is ~5.4 GeV (with 99.6 % photon probability) belongs to the event which is observed at ~81 s and ~632 s after the GBM trigger, respectively."*

The sentences are reworded follow:
Among these bursts, GRB 150403A & GRB 150314A are simultaneously detected by both LAT and GBM while the other three sources GRB150727A, GRB 151027A & GRB 150301B are triggered only by GBM as shown in Table 1. To analysis the LAT-detected GRBs with known redshift, we have selected the high energy data between 0.1 GeV and 30 GeV. The highest-energy (E_{max}) photon of the GRB 150314A is ~0.62 GeV photon (with 97.8 % probability of being associated with GRB) and for the GRB 150403A, it is 5.4 GeV (with 99.6% probability) which are observed at ~81 s and ~632 s after the GBM trigger, respectively.

Section 2, subsection 2.1

Line: 7

10. *"~39 MeV"*

Typing mistake and we corrected:
~10 MeV

Line: 8

11. *"Overflow"*

We changed to:
overflowing

Section 3

Line: 3

12. *"(version 8.1)"*

We removed

Line: 3

13. *"~39 MeV"*

Typing mistake and we corrected:
~10 MeV

Line: 8

14. *"Table 2 and 3 shows"*

We reworded as:
Tables 2 and 3 show

Line: 9

15. *"Column"*

Changed:
columns

Line: 12

16. We changed *"Column"* -> columns

Line: 14

17. We changed *"Figure"* -> Figures

Line: 16

18. We changed *"band"* -> Band

Line: 17

19. We changed *"tables"* -> Tables

Section 4

Subsection 4.1

Lines: 1-12

20. *"We have rearranged the sentences and revised the entire paragraph but the last sentence "In Figure 3, the A2008 data (GRB150727A) with smaller E_{iso} and E^{i}peak is seems an outliers of the correlation." is removed because we didn't plot the confidence level to say that GRB 150727A is an outlier."*

Subsection 4.2

Lines: 2-3

21. *"The correlation defining L_{iso} as the luminosity emitted at the peak of the light curve."*

We have reworded the appropriate sentences as follow:
In the correlation analysis, we computed the L_{iso} emitted at the 1-second peak of the light curve from 1 keV to 10 MeV band.

Lines: 3-5

22. *"In Figure 4, we show the peak luminosities, as a function of intrinsic peak energy in the rest frame of each GRB. We combined our Fermi-2015 GRBs data with the 8 BATSE Y2004 [3] results in the same plane."*

We have reworded the appropriate sentences as follow:
In Figure 4, we have shown the plots of the peak luminosity as a function of intrinsic peak energy for both the data of *Fermi*-2015 GRBs and its combination with 8 GRBs in Yonetoku et al. 2004 (Y2004) [3].

Lines: 5

23. *"This is another key result of the present work."*

We prefer to remove the sentence.

Lines: 6

24. We changed "*upper limit*" -> upper limits

Line: 7

25. We changed *"has been"* -> have been

Line: 15

26. We removed a word *"low"* from the sentence.

Section 5

Line: 1

27. We removed the term *"GBM"*

Line: 1

28. *"the light curve"*

We changed to:
time-integrated spectra

Line: 2

29. *"~39 MeV"*

Typing error and we corrected follow:
~10 MeV

Line: 5

30. *"on"*-> in

Line: 9

31. *"joined"*-> joint

Line: 15

32. *"observables data"*-> observable

Line: 18

33. *": we have 13 GRBs in total"*

We prefer to reword the phrase as:
(i.e., 13 GRBs)