Spectral classification and variation of Fermi GRBs

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Overview

The Fermi GBM catalog contains general physical quantities of the observed objects and also fitted parameters (peak energy, spectral indices, intensity) from four spectral models (Band, smoothly broken power law, Comptonized, power law) for the peak flux and the fluence. We studied the nature of the errors of the peak flux, the fluence and duration parameters. We have found linear correlation between the logarithm of the measured quantities and their error bars. We interpret our results as an indication that the peak flux, fluence and duration follow a Poisson distribution.

Data & Mathematical summary

The FERMIGBRST catalog contains the parameters of more than 2000 Fermi GBM GRBs which were calculated from their light curves and spectral fitting. Linear discriminant analysis (LDA) finds k − 1 canonical coordinates (k being the number of classes) that best separate the categories. These functions are uncorrelated and defined, in effect, an optimal k − 1 space through the p-dimensional cloud of data separates (the projections in that space of) the k groups best. We used the LDA with Jackknifed Prediction from *'MASS'* package in R. Finally, we analyzed the errors of the parameters.

Results

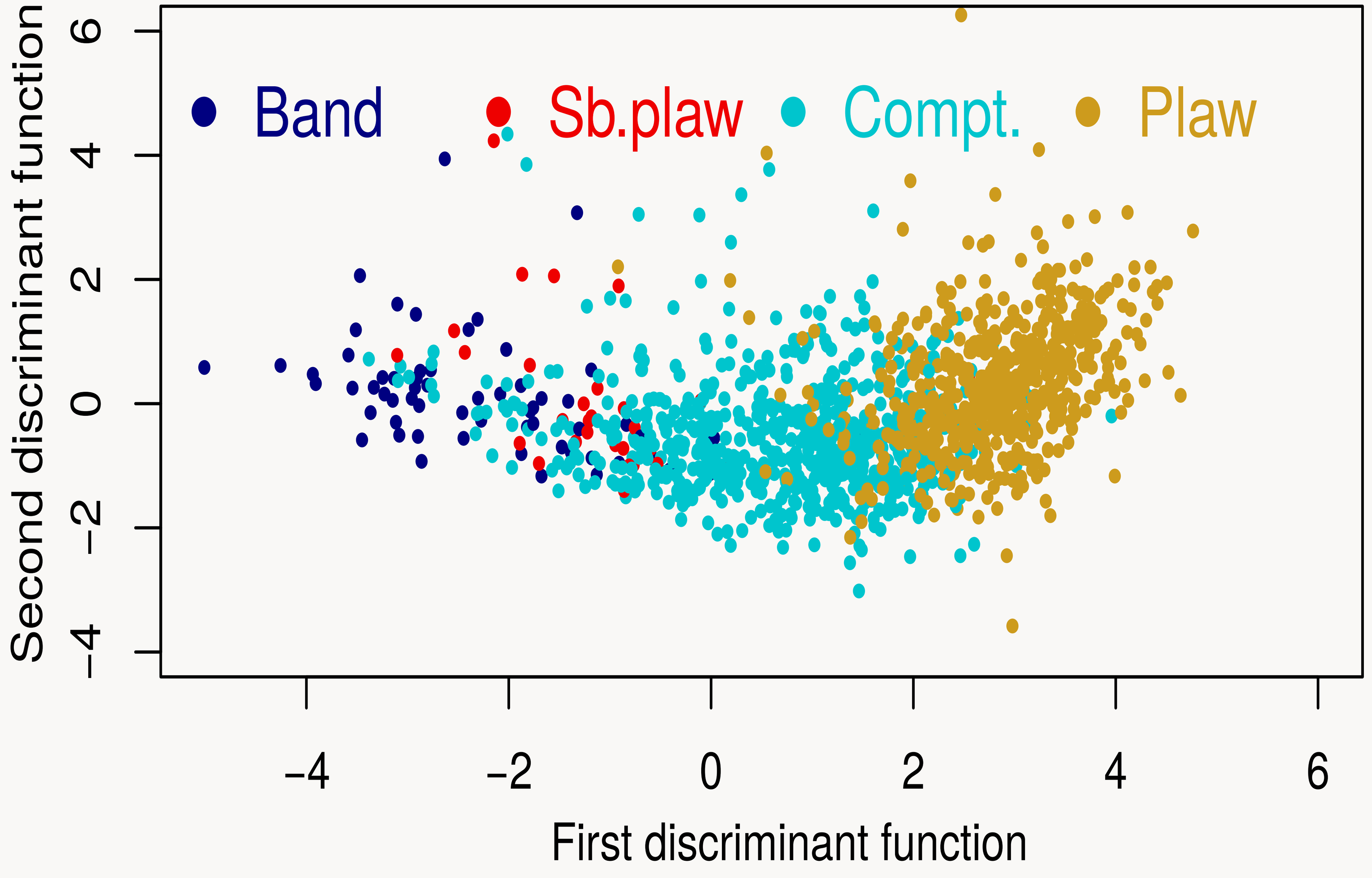
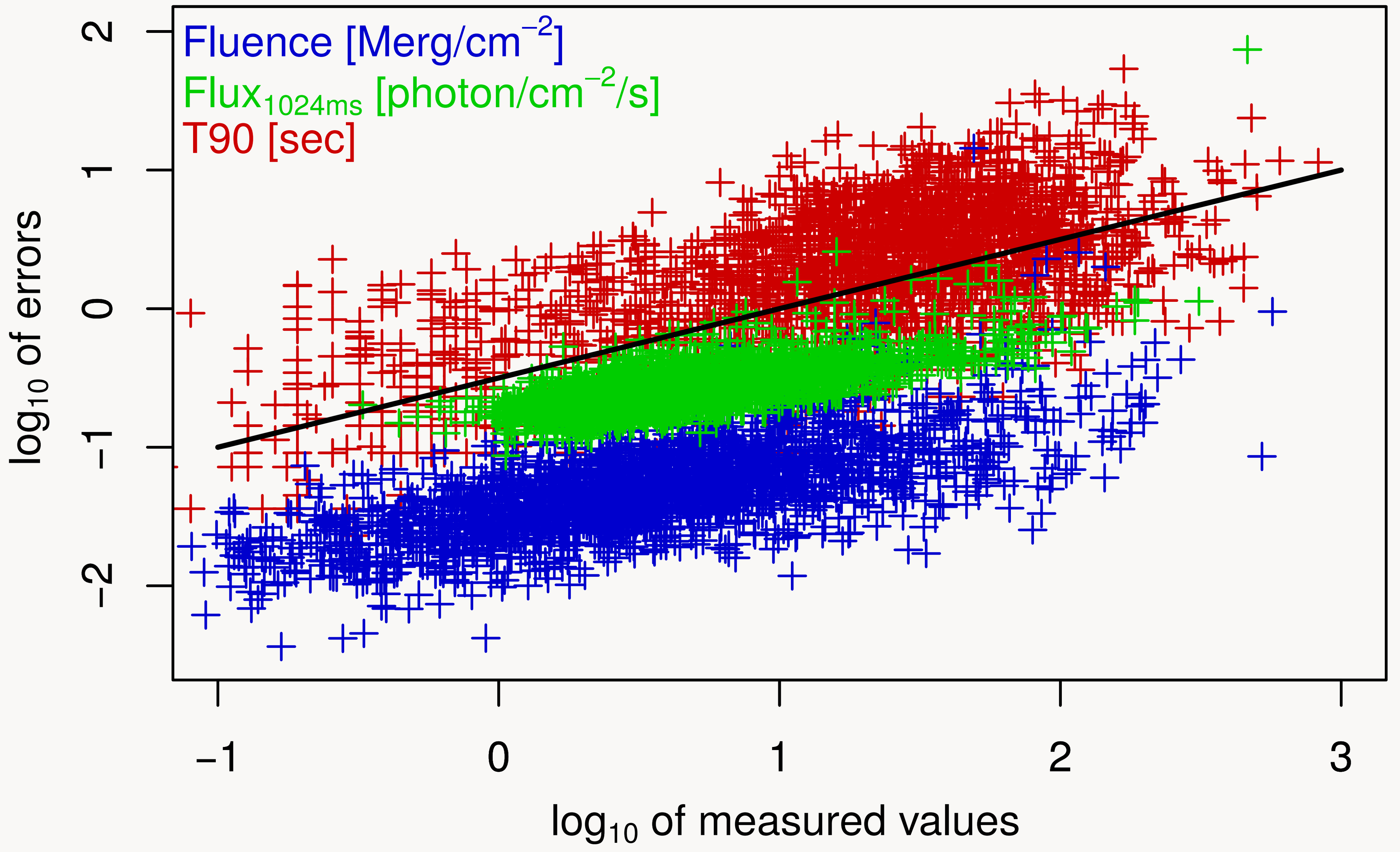


Fig. 1. Using the 'good sample' published by Gruber et al. (2014) the peak flux spectra could be discriminated well based on flux. Our results show that even if the fluence spectra is made by using significantly more photons the discrimination for between the peak flux spectra is better.

Fig. 2. We examined the errors of the main physical parameters and found strong correlation − 0.68 ± 0.037 − between the errors and the measured values on logarithmic scale. The significant slope is ≈ 2 : 1 which can be explained as a result of natural Poissonic noise.



Summary

We found that there is a linear correlation between the Fermi GBM parameters and those errors. We interpreted these results as a Poisson distribution. We showed that these physical parameters (fluxes, fluences and durations) could discriminate between the spectral classes.

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Bibliography

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