The high energy spectrum of 3C 273

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Introduction

The high energy spectrum of the bright quasar 3C 273 is usually understood in terms of inverse-Compton emission in a relativistic leptonic jet. This model predicts variability patterns and delays that could be tested with simultaneous observations from the radio to the GeV range.

The instruments IBIS, SPI, JEM-X on board INTEGRAL, PCA on board RXTE, and LAT on board Fermi have enough sensitivity to follow the spectral variability of 3C 273 from the keV to the GeV.

The aim of this work is to use contemporaneous X-ray to γ-ray observations obtained with INTEGRAL and Fermi to study the origin of the non-thermal spectral components.

Methods

We perform crosscorrelations between the lightcurves obtained with Fermi-LAT, RXTE-PCA and in the radio (37 GHz) with the Metsähovi Radio Telescope. The lightcurves are shown in Fig. 1

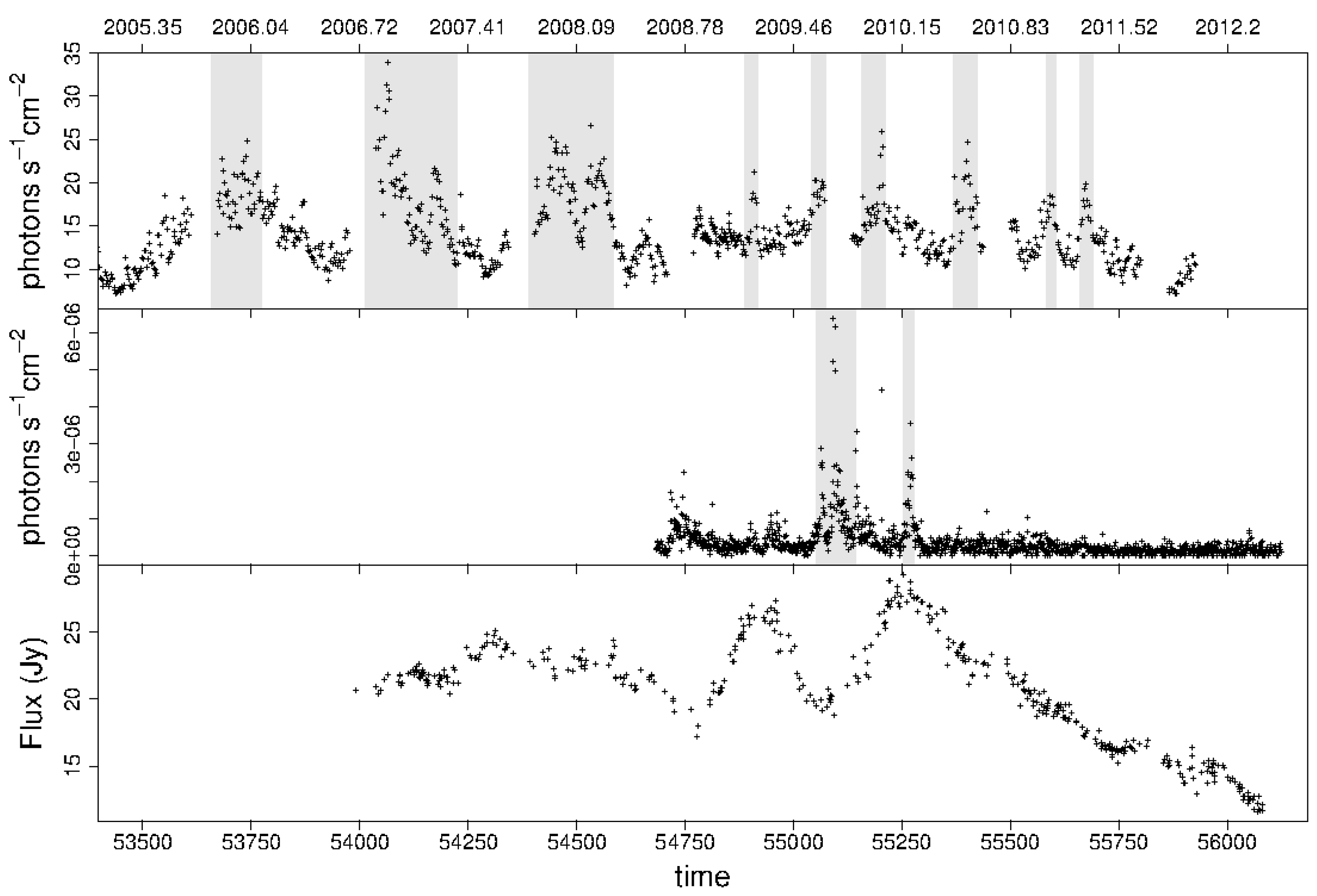

Fig. 1: Top: RXTE-PCA lc (0.2 - 75 keV). Middle: Fermi-LAT lc (0.1 - 100 GeV). Bottom: radio lc at 37 GHz.

Grey area in Fig. 1 show the flaring times in X-rays (*PCA flaring time*, top panel) and γ rays (*LAT flaring time*, middle panel). The quasi-simultaneous broad band spectra built at each flaring epoch are shown in Fig. 2, togheter with the CGRO dataset (data from [1]).

Results

A positive correlation is found only between γ rays and radio, indicating a **delay of radio emission** of ~ +120 days. This is expected from a blazar-like emission originated by a relativistic jet. X-rays are not correlated with γ rays or radio, suggesting that they have a different origin.

Broad band spectra are fitted with a **two-component model**: a cutoff powerlaw to model the X-ray band, and a log-parabola to model the γ ray band. This model gives the best fit result while a single component model (cutoff powerlaw only or log-parabola only) is not able to adequately fit the whole spectrum. The two-component model is shown in Fig. 2.

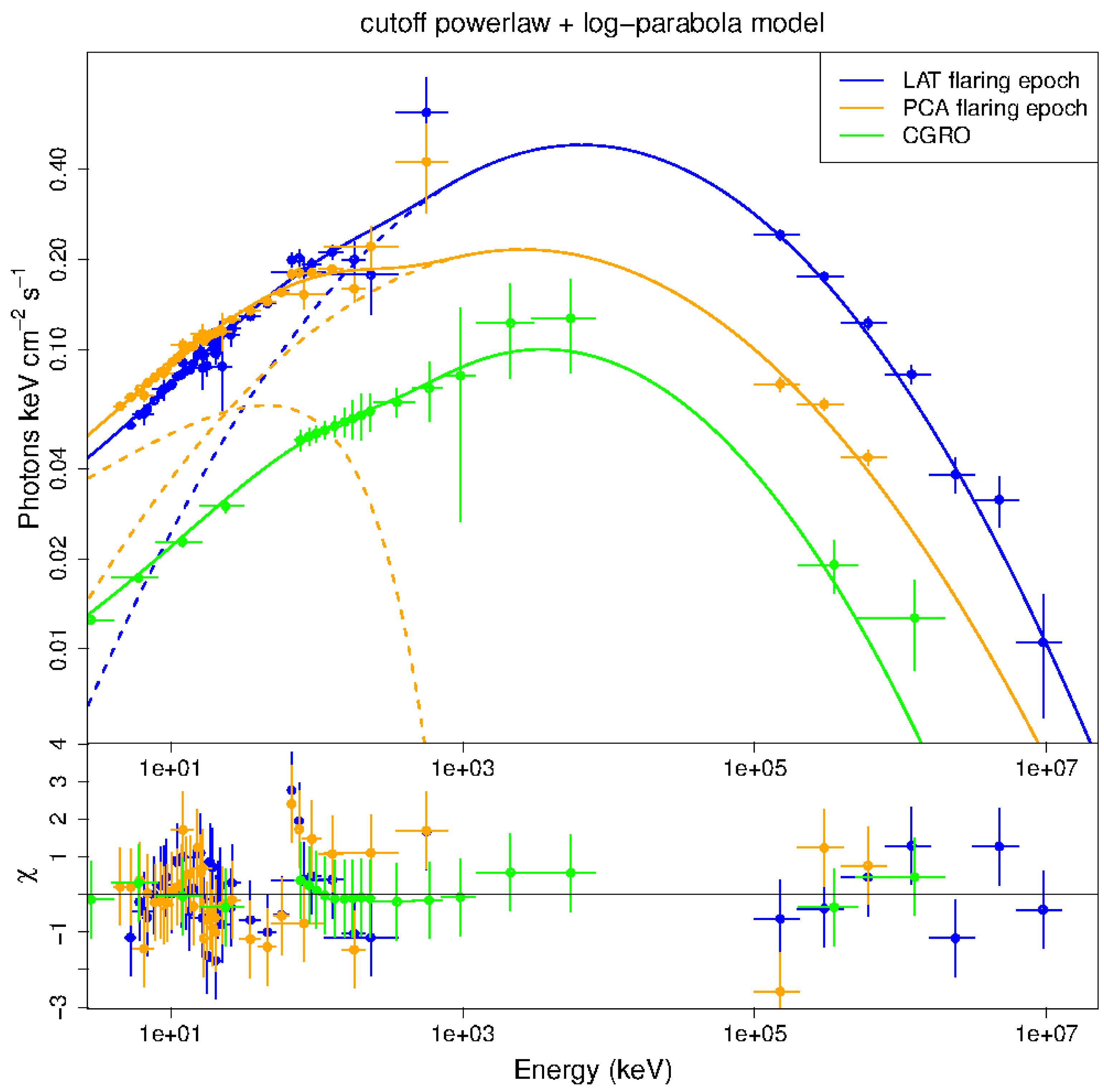

Fig. 2: Spectra at different epochs fitted with the two-component model.

Both temporal and spectral analysis suggest a two-component model to explain the complete high energy spectrum. X-ray emission is likely dominated by a Seyfert-like component while the γ-ray emission is dominated by a blazar-like component produced by the relativistic jet, as suggested by the correlation with radio data. Changes of the electron Lorentz factor are found to be the most likely source of the observed variability.

Conclusions

It is still an open question if MeV blazars like 3C 273 are a class of AGNs separated from GeV and TeV blazars, their emissions being driven by different acceleration mechanisms of the electrons inside the jet.

As there are no experiments sensitive enough in the MeV, it is difficult to study in detail the spectral properties of the γ-ray emission of 3C 273. Nevertheless, the shape of the γ-ray spectrum of 3C 273 is very similar to the shape of the GeV peaked blazar detected by Fermi, which are usually fitted with the log-parabola model, suggesting that the electron distribution looks universal in very different conditions.

Future missions devoted to the MeV energy domain like ASTROGAM will have the capability to investigate the matter.

References

[1] G.G. Lichti et al., 1995, A&A 298, 711

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