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Broad Band Spectral Index TeV Blazars Detected by Fermi LAT

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Abstract. We collected the radio, K-band, optical, X-ray, and γ-ray data for 35 TeV blazars detected by Fermi LAT and studied the possible correlation between different broad band spectral indices ($\alpha_{r.o}$, $\alpha_{r.x}$, $\alpha_{ir.o}$, $\alpha_{ir.x}$, $\alpha_{o.\gamma}$, $\alpha_{x.\gamma}$) in all states (average/high/low). Based on our results, we suggested that the seed photons of the γ-ray drive from the synchrotron radiation themselves.

Key words. Blazars—general-radiation mechanisms—broad band spectral index.

1. Introduction

The continuum emission from blazars is thought to arise from a relativistic jet oriented close to the observer, the seed photons of blazers mainly come from the accretions disk and the broad line region clouds. Synchrotron photons may also contribute, and for TeV sources SSC models are indeed the favoured explanation (Xie *et al.* 1998; Cheng *et al.* 2000). Because large amplitude variations of the multi-band flux and spectral indices, simultaneous observations are required for researching correlation between various broad band spectral indices of blazars (Fan *et al.* 1998), and we seek to find the same kind of flux states (low/average/high), and we define the minimum flux in different bands as the low state for those objects in which flux variability has been observed. For the average and high states, we use the average and maximum observed fluxes in each band respectively, therefore, we collected a sample of 35 TeV blazars from the literature compiled by Xiong *et al.* (2013).

2. Correlation analysis of different broad band spectral index and discussion γ-ray emission from blazars

According to the definition of composite spectral indices (Ledden & O'Dell 1985) and the data compiled by Xiong *et al.* (2013), we calculated the broad band

Table 1. The broad band spectral index of full TeV blazars sample in average states.

X	Y	States	r	σ	N	P	Correlation	Plot-number
$\alpha_{r.o}$	$\alpha_{o.\gamma}$	average	−0.83	0.06	35	<0.0001	Strong	Fig. 1(a)
$\alpha_{ir.o}$	$\alpha_{o.\gamma}$	average	−0.89	0.04	32	<0.0001	Strong	Fig. 1(b)
$\alpha_{r.x}$	$\alpha_{x.\gamma}$	average	−0.88	0.08	33	<0.0001	Strong	Fig. 1(c)
$\alpha_{ir.x}$	$\alpha_{x.\gamma}$	average	−0.84	0.09	32	<0.0001	Strong	Fig. 1(d)

spectral indices $\alpha_{r.o}$, $\alpha_{r.x}$, $\alpha_{ir.o}$, $\alpha_{ir.x}$, $\alpha_{o.\gamma}$, $\alpha_{x.\gamma}$ and studied the possible correlations between different broad band spectral indices, our results are shown in Table 1 and Fig. 1(a–d).

1. For our sample, there are strong anticorrelations between $\alpha_{r.o}$ and $\alpha_{o.\gamma}$, between $\alpha_{ir.o}$ and $\alpha_{o.\gamma}$, between $\alpha_{r.x}$ and $\alpha_{x.\gamma}$, and between $\alpha_{ir.x}$ and $\alpha_{x.\gamma}$ in all the states (high/low/average).

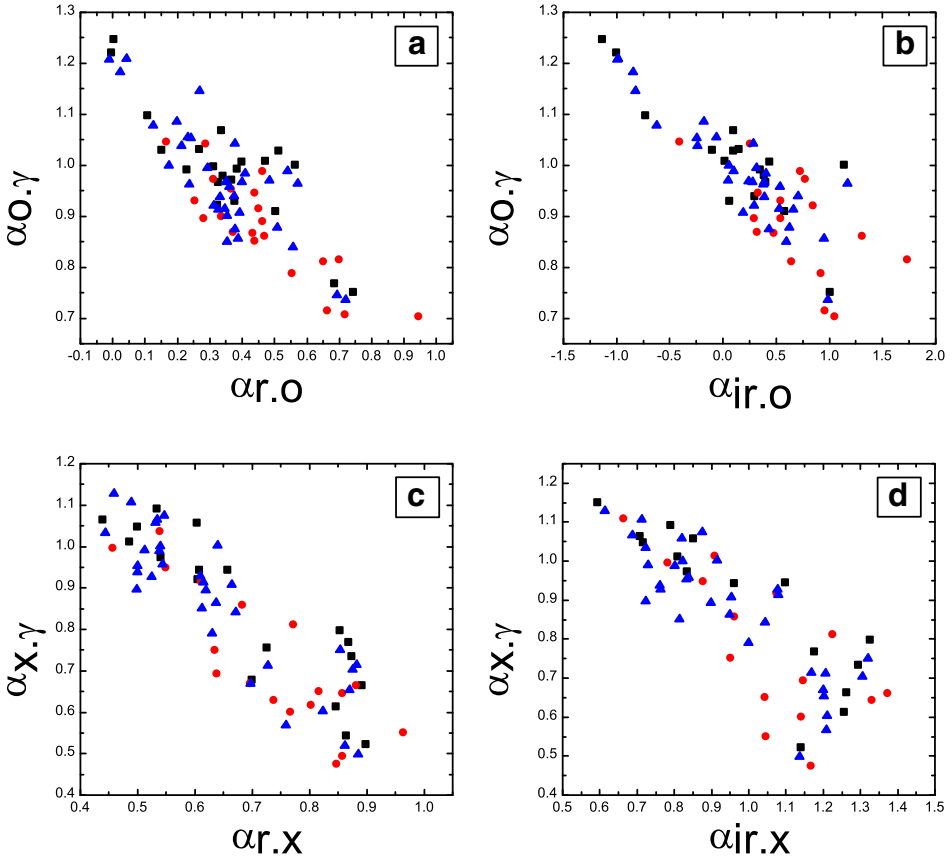

Figure 1(a–d). Correlation between different broad band spectral indices for our sample in all states (the black squares stand for high states; the red circles stand for low states; the blue triangles stand for average states).

2. For our sample, the γ-ray flux of blazars is proportional to the radio, optical, X-ray and K-band flux.
3. For our sample, the seed photon of high energy γ-ray emission come from the synchrotron radiation themselves and the inverse Compton scattering of circumnuclear dust is likely to be an important complimentary mechanism.

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