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Core Dominance Parameter for γ-Ray Loud Blazars

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Abstract. In this paper, we compiled 572 blazars that have known core dominance parameter (log R), out of which 121 blazars are γ-ray loud blazars. We compared log R between 121 blazars and the rest with non γ-ray detections, and found that γ-ray loud blazars showed a different distribution, and their average value of log R is greater than that for non γ-ray blazars. Our analysis suggests that the γ-ray emissions are strongly beamed.

Key words. γ-rays: blazar: core dominance parameter.

1. Introduction

Blazars are a special subgroup of active galactic nuclei (AGNs). They are also the most active galaxies in the Universe, and show some extreme properties: Radio loud, rapid variability, superluminal motion, non-thermal continuum spectrum, high polarization, strong emisson line or non-emission line (see Fan 2005). We can also regard the γ-ray emissions as one of the properties for blazars from γ-ray detections (Abdo *et al*. 2009, 2010; Ackermann *et al*. 2011). Blazars can be divided into two subclasses: BL Lacertae objects (BLs) and Flat Spectrum Radio Quasars (FSRQs). All the characteristics suggest that the γ-ray emissions in blazars are strongly beamed. Core dominance parameter, to some extent, is an indicator of a beaming effect. In this paper, we used the core dominance parameter to investigate the beaming effect in the γ-ray emissions.

2. Sample and results

The new γ-ray detector has detected more than 1000 blazars (see Abdo *et al*. 2010; Ackermann *et al*. 2011). It has provided a good chance for us to study the nature of γ-ray blazars. We compiled 572 blazars that have log R from our previous paper (Fan *et al*. 2011), out of which 121 blazars have γ-ray detections and 451 blazars have non γ-ray detections. We used their log R to investigate their beaming effect in γ-ray loud blazars. We compared the log R between γ-ray and the non γ-ray blazars. We found that the average value of $\langle \log R \rangle = 0.95 \pm 0.85$ for γ-ray blazars, and $\langle \log R \rangle = 0.02 \pm 0.93$ for non γ-ray blazars. Their histograms are shown in Fig. 1(a) and their cumulative distribution is shown in Fig. 1(b). A Kolmogorov–Smirnov test

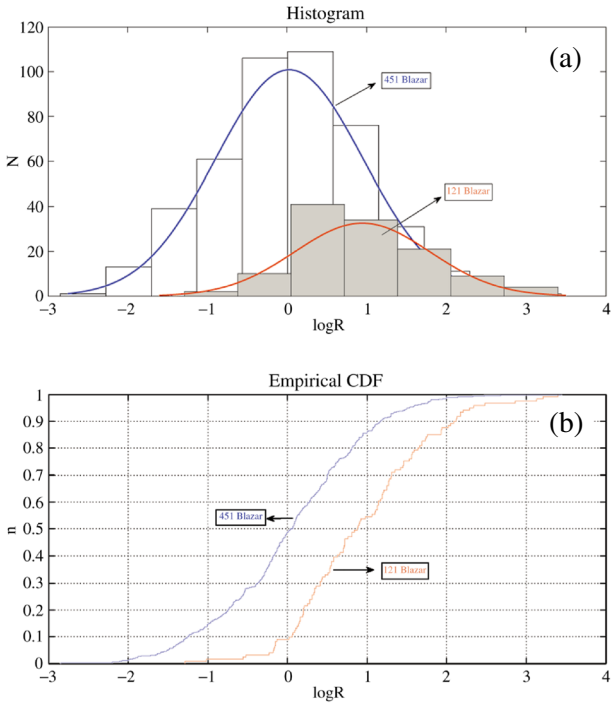

Figure 1. Histogram of core-dominance parameter (**a**), and cumulative distribution (**b**).

suggests that the probability for the two distributions to come from the same parent distribution is $P = 7.6 \times 10^{-15}$.

3. Discussion and conclusion

From the analysis, we found that log R is different between γ-ray blazars and non γ-ray blazars. The γ-ray blazars show greater log R than the non γ-ray blazars. It is known that the core dominance parameter, to some extent, is an indicator of the beaming effect, greater log R shows stronger beaming effect. In this sense, γ-ray blazars show stronger beaming effect than the non γ-ray blazars.

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