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Spectral Energy Distributions of SDSS Blazars

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Abstract. We compiled the radio, optical and X-ray data for SDSS sample, and presented broad band spectral index. The broad band energy distribution reveals that FSRQs and LBLs objects have similar spectral properties. However, HBLs have a separate distinct property. Even so, a unified scheme was also revealed from colour–colour diagram.

Key words. Galaxies: active—BL Lacertae objects: general—galaxies: fundamental parameters—quasars: general.

1. Introduction

Blazars are a subset of Active Galactic Nuclei (AGNs) and have strong emission at all wavelengths. Generally, they comprise BL Lacertae (BL Lacs) objects and Flat Spectrum Radio Quasars (FSRQs). In addition, BL Lacs objects can be divided into 'High energy peaked BL Lacs' (HBLs) and 'Low energy peaked BL Lacs' (LBLs). The relationship between BL Lacs objects and FSRQs can substantially promote our understanding about the fundamental nature of blazars and has been discussed by a number of authors (Fossati *et al*. 1998; Li *et al*. 2010; Xie *et al*. 2003). Fossati *et al*. (1998) suggested that three different kinds of blazars follow an almost continuous spectral sequence: from FSRQs through LBLs to HBLs. However, some authors found that HBLs do not follow the blazar sequence (Antón & Browne 2005; Li *et al*. 2010). In this paper, we will study the distributions of the radio–optical–X-ray Spectral Energy Distributions (SEDs) of SDSS blazars.

2. Sample of SDSS blazars

Sloan Digital Sky Survey (SDSS) is one of the most ambitious and influential surveys in the history of astronomy. Based on the sample of Plotkin *et al*. (2008) and Chen *et al*. (2009), we compiled a large sample of 686 blazars which have the broad-band spectral index $\alpha_{\rm ro}$, $\alpha_{\rm rx}$ and $\alpha_{\rm ox}$. They are the two-point spectral indices between 5 GHz and 5000 Å, 5 GHz and 1 KeV, and 5000 Å and 1 KeV, respectively.

3. Broad band spectral energy distribution of blazars

It is very significant to search the connection among different blazar subclasses. In the following, we will analyse the relationship between HBLs, LBLs and FSRQs. In Fig. 1, we have plotted α_{rx} vs. α_{ro} and α_{ox} vs. α_{ro} for the SDSS sample blazars. Figure 1 shows that there is a good correlation with the correlation coefficient $r = 0.75$ for α_{rx} vs. α_{ro} and $r = 0.69$ for α_{ox} vs. α_{ro}, which provides some more evidence for the unified scheme. However, one can note that the majority of FSRQs and LBLs mixed together, but HBLs occupy a separate distinct region, which suggests that the spectral properties of HBLs is different from that of FSRQs and LBLs. This suggests that there are also some different distributions from the blazar sequence. The different SEDs between HBLs, FSRQs and LBLs may be associated with the

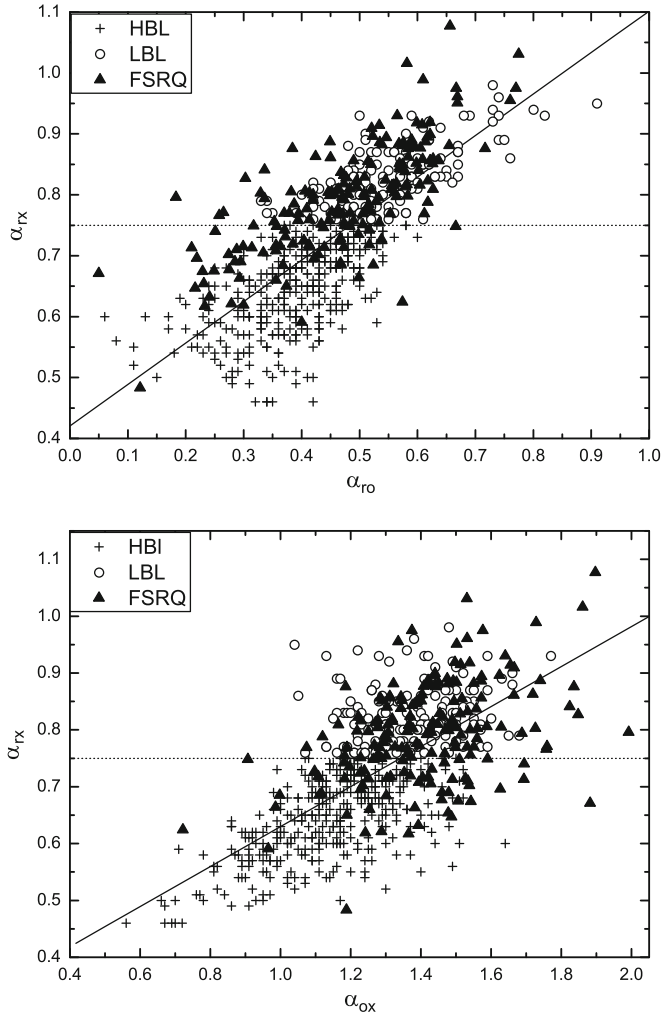

Figure 1. *Top*: The relationship between α_{ro} and α_{rx}. *Bottom*: The relationship between α_{ro} and α_{rx}.

different X-ray spectrum, the intrinsical difference environments around the blazars nucleus and the difference of the location of the emitting region.

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