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SPECTRAL MICROVARIABILITY IN QUASARS

A. Ramírez,[1] D. Dultzin,[1] and J. A. de Diego[1]

Optical microvariability (OM, small amplitude variations in time scales from minutes to hours) in radio-quiet quasars (RQQ) may be as frequent as in radio-loud quasars (RLQ) (de Diego et al. 1998; Ramírez et al. 2007). However, observations cannot still establish the origin of OM.

We develop a method to discern where OM originates (Ramírez 2007): the accretion disk (i.e., thermal instabilities) or the relativistic jet (i.e., non-thermal processes) (e.g., Wiita 2006; Webb & Malkan 2000). Such discernment could impose relevant restrictions to energy emission models of active galactic nuclei. In this work, 23 RQQ and 23 RLQ were observed with four telescopes located in Mexico and Spain, using BVR filters. Details of selection criteria, observation strategy, and data reduction are described in de Diego et al. (1998). Our method works comparing models with observations. The observed fluxes are fitted by combinations of both thermal (black body) and non-thermal (power law) emission models. Different combination allows fit the data; however, spectral variations can discern between thermal and non-thermal variations (Figure 1). Spectral variability is analyzed taking differences between flux at t_0 (flux measured at the beginning of each observing night for each object) and flux at later time t, and normalizing with respect to initial flux, i.e.,

$$\varpi_\nu = \frac{f_{\nu t} - f_{\nu t_0}}{f_{\nu t_0}} \, . \qquad (1)$$

Some advantages from this expression are: data transformation to standard photometric system and interstellar extinction corrections are avoided. Plotting data in ϖ_V and ϖ_R versus ϖ_B plane (Figure 1), and comparing with disk and jet changes, allows the diagnose of the origin of OM events. Figure 1 shows an example (the case of a RLQ: PKS 1510-089).

11 OM events were detected in 5 RQQ and 3 RLQ. 3 variations correspond to thermal origin, 5 events correspond to non-thermal, and 3 cannot be classified neatly. Our main results are: OM can originate as frequently in the disk as in the jet; in each OM event, our method can distinguish between them. Thermal OM was detected in RLQs, as well as non-thermal OM in RQQs. These results indicate that RLQs and RQQs samples belong to the same parent population. In other words, our results agree with a framework where both RQQs and RLQs may have the same kind of energy source, or at least they are very similar.

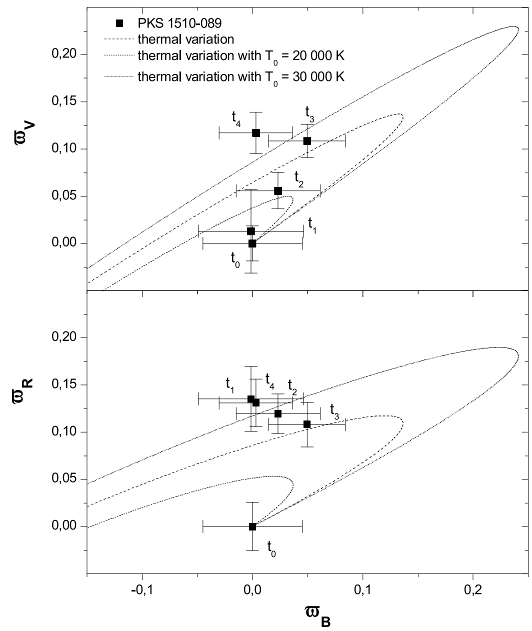

Fig. 1. Changes in thermal component. First, a unique component (a power law) has been fitted to the PKS 1510-089 data. This single component cannot reproduce the variation; then, a second (thermal) component is added. With this second fit, we found a possible explanation to the microvariability event. Figure shows thermal variation for three cases: back bodies with initial temperatures of 26 000 K (dashed line), 20 000 K (dotted line) and 30 000 k (continuous line).

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[1]Instituto de Astronomía, Universidad Nacional Autónoma de México (aramirez@astroscu.unam.mx).