

Characterization of the optical polarimetric variability in a sample of blazars†

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Abstract. Brightness variations across the entire electromagnetic spectrum, occurring at several time scales, are known properties of blazars. The variability of the continuum emission may be related to the formation and propagation of shock waves in the relativistic jet. In this case we may expect variations also in the degree of polarization and its position angle. In order to effectively constrain such models, we begun in 2003 a program to monitor the optical polarimetry of a sample of blazars, of which we present here the first results.

1. Introduction

We are carrying out an observational program to study the incidence of polarization variability among the different classes of blazars on time scales of days to months. The sample includes sources classified as Radio selected BL Lacs (RBL), X-ray selected BL Lacs (XBL) and Flat Spectrum Radio Quasars (FSRQ). Additionally, for some objects we are investigating the variability on short time scales (few hours) and the existence of a wavelength dependence in the polarization, which might indicate which structural component is responsible by the observed activity. Here we show the first results of this program.

The observations have been carried out since the beginning of 2003, with the B&C 60 cm telescope at the Laboratório Nacional de Astrofísica (Brazópolis, Brazil, MCT/CNPq), using IAGPOL, the IAG/USP CCD imaging polarimeter (Magalhães et al. 1996). The data reduction was made with the PCCDPACK, a set of tasks for IRAF ambient developed by the IAG/USP polarimetry group (Pereyra 2000, for example).

2. Observational results

We present below a few comments about the main properties observed until this moment for some sources of our sample.

PKS 2005-489 - Few observations of the optical polarization in this source are available in the literature. Our data showed the existence of variations in time scales of days to months, but no activity was detected in time scales of hours.

PKS 2155-304 - Variability in time scales of hours to months was observed in this XBL source.

PKS 0537-441 - In this RBL source we register the largest variation in the degree of polarization of the monitoring program until now; the degree of polarization changed of $\sim 5\%$ to $\sim 20\%$ in almost two months.

PKS 1514-241 - This RBL shows significant uncorrelated variations in P and θ . P varies between ~ 0.5 and 6% and θ between ~ 11 and 137° , with the occurrence of large amplitude fluctuations in time scales of several days.

† Based on observations made at Laboratório Nacional de Astrofísica (MCT/CNPq)

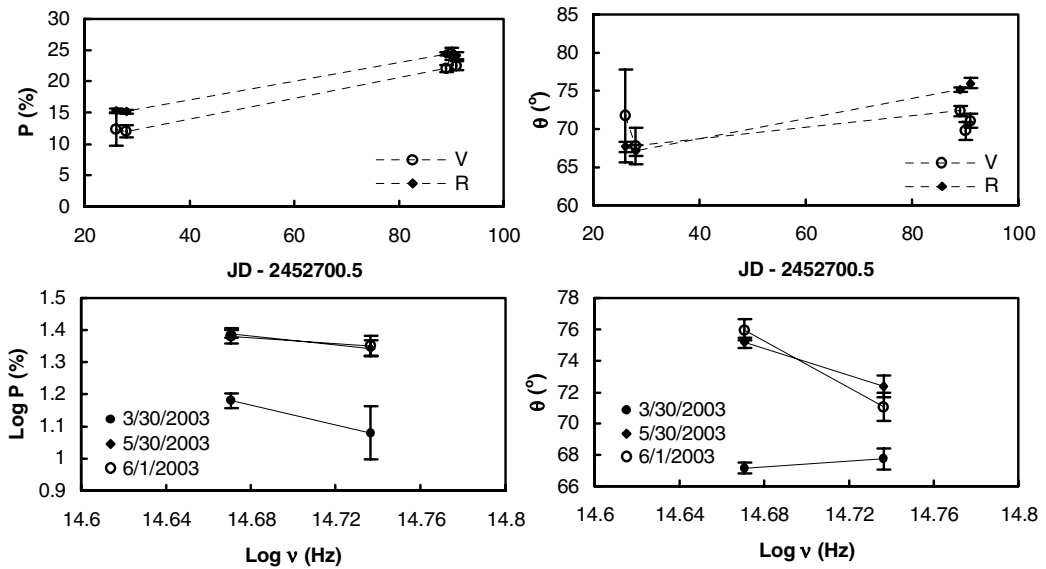


Figure 1. Top: degree and polarization angle of 3C 279. Bottom: spectral dependence observed in the polarization parameters.

3C 279 - The variation of the polarization parameters observed for this FSRQ are shown in Figure 1. Additionally, we present the spectral dependence of P and θ , that is given by (Smith & Sitko 1991).

$$P_\nu = \frac{d \log P}{d \log \nu}; \quad \theta_\nu = \frac{d \theta}{d \log \nu}$$

3. Final remarks

Until now, all the studied sources presented variations in P and θ in time scales of months and only PKS 2155-304 showed variability in time scales of hours in the polarization degree. For those sources in which the spectral dependence of the polarization parameters was studied, $P_\nu < 0$, which indicates that the spectral dependence is not due to the host galaxy light dilution (Takalo et al. 1992, for example). These observations are part of an effort to continuously monitor AGNs, mainly blazars, at different wavelengths (radio, optical, NIR) and covering several time scales of variability.

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References

Magalhães, A. M., Rodriguez, C. V., Margoniner, V. E., & Pereyra, A. 1996, ASP Conf. Ser., 97, 118
 Pereyra, A. 2000, PhD Thesis, IAG-USP
 Smith, P. S., & Sitko, M. L. 1991, ApJ, 383, 580
 Takalo, L. O., Sillanpaa, A., Nilsson, K., Kidger, M., de Diego, J. A., & Piirola, V. 1992, A&AS, 94, 37