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OPTICAL R-BAND PHOTOMETRY OF TeV BL Lac OBJECTS: 1ES1959 + 650 AND 1ES2344 + 514

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We present the results of R-band observations of two TeV BL Lacertae objects 1ES1959 + 650 and 1ES2344 + 514. To study the long-term variability (LTV) intraday variability (IDV) and intrahour variability (IHV) we observed these objects for 72 and 39 nights respectively. The LTV of 1ES1959 + 650 has a magnitude of 0.4, while it is below 0.1 in the case of 1ES2344 + 514. The IDV and IHV of both objects have magnitudes less than 0.01. The higher activity of 1ES1959 + 650 in comparison with that of 1ES2344 + 514 may be attributed to its higher radio luminosity. A new faint eclipsing binary star with an amplitude of magnitude 0.36 and period of 0.26 days was also identified.

Keywords: Active galaxies; BL Lacertae; Quasars; 1ES1959+650 and 1ES2344 + 514

1 OBSERVATIONS, FRAME REDUCTION AND RESULTS

The selection of spectral or energy band in the construction of complete samples constitutes one of the main biases and source of confusion in understanding blazar phenomenology, which has often led to useful but somehow unphysical classifications (Wolter and Celotti, 2001). Bright X-ray surveys such as the Einstein medium sensitivity survey (EMSS) and the slew survey (SS) provide clues for discovering new BL Lacertae objects.

Target BL Lacertae objects were selected using the catalogue of BL Lac objects detected in EMSS + SS (Perlman et al., 1996). Observations have been made using a ST-6 charge-coupled device (CCD) camera attached to the Newtonian focus of a 70 cm meniscus telescope (Kurtanidze and Nikolashvili, 2002). All long-term variability (LTV) observations are performed in the BVRI bands using exposure times of 120–180 s. The number of observation nights and frames obtained to study the LTV and intraday variability (IDV) are given in Table I. Frames have been reduced using DAOPHOT II.

The light curves illustrating the LTVs of 1ES1959 + 650 and 1ES2344 + 514 are presented in Figures 1 and 2. Both objects under study show light variations with a magnitude

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TABLE I Target Objects.

Name	Number of nights	Observations	
		N_{LTVR}	N_{IDVR}
1ES1959 + 650	72	41	751.31
1ES2344 + 514	39	25	323.14

of 0.4 in the R band. The largest is observed for 1ES1959 + 650 and equals 0.4 (Kurtanidze and Nikolashvili, 1999). 1ES2344 + 514 shows an obvious LTV trend over the observing period, but at a very low level, which is below 0.1 (see also Fan et al. (2001)). Consequently, the IDV might be very weak and may only be detected in exceptional cases of high photometric accuracy. Data plotted in Figure 1 (JD 1700-2200) and Figure 2 (JD 1400-2200) are the mean of 20–40 observations obtained during the night, when both

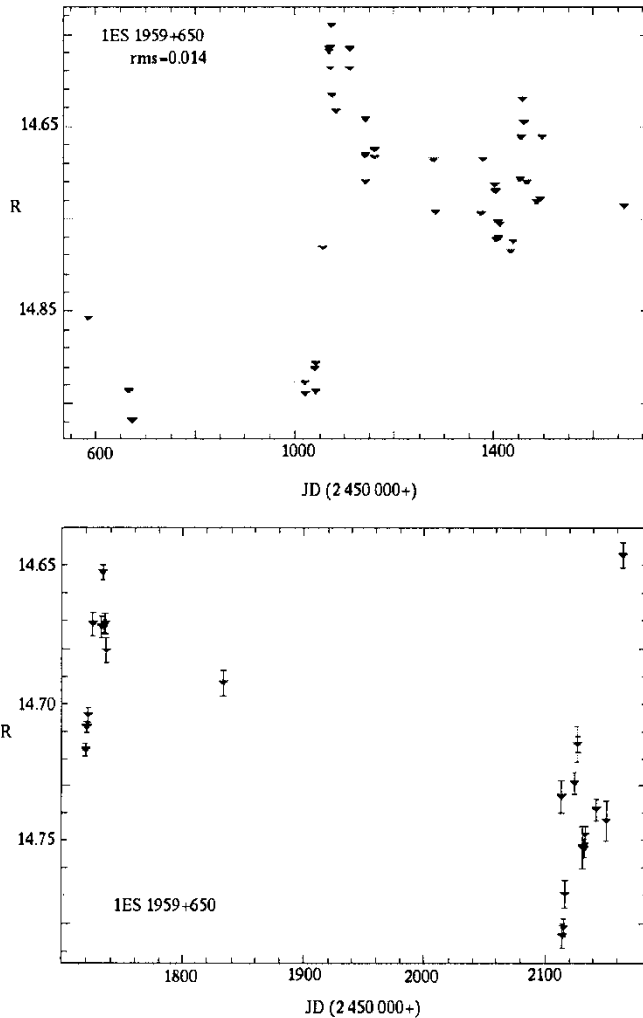


FIGURE 1 The LTV light curves of 1ES1959 + 650 (06.1997–10.2001).

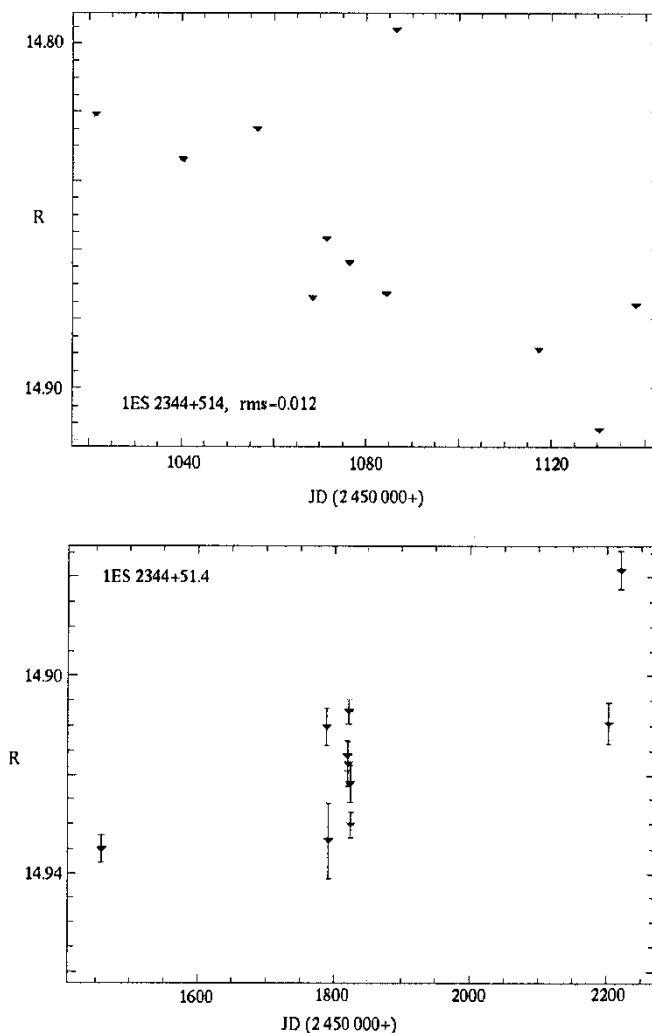


FIGURE 2 The LTV light curves of 1ES2344 + 514 (08.1998–11.2001).

BL Lac objects were constant with a magnitude of 0.01. It seems that X-ray selected blazars exhibited weak optical LTV (Raiteri et al., 1998; Villata et al., 2000). The higher level activity of 1ES1959 + 650 in comparison with that of 1ES2344 + 514 may probably be attributed to its higher radio luminosity.

A new faint eclipsing binary star with an amplitude of magnitude 0.36 and period of 0.26 days was identified (Kurtanidze and Nikolashvili, 1999) in the field of 1ES1959 + 650 (comparison star 5 (Villata et al., 1999)).

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