

Fast variability of the optical polarization in blazars

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Abstract. Blazars are relativistic jet dominated active galactic nuclei, whose emission in the optical region is mostly synchrotron in nature and therefore – polarized. We monitored several objects on intra-night time scales in order to study the changes in their linear polarization parameters in different colors. Our first results suggest the presence of rapid changes in both – polarization degree and the electric vector orientation even within a few hours. The intra-night polarization variability in many of these blazars is studied for the first time at such an extent. Our study can have significant impact on the detailed modeling of the relativistic jet emission mechanisms.

Observations

All observations were performed with the 60 cm telescope of Belogradchik Observatory, Bulgaria. The telescope is equipped with a standard UBVRI filter set and a recently constructed polarimeter. The linear polarization parameters (polarization degree and angle) can be reconstructed by measuring the relative magnitudes of the object of interest at three positions of a polarizing filter (every 60 degrees).

Results

The blazars we primarily studied are well known for their fast intra-night flux variability (e.g. Bachev et al., 2023; Bachev et al., 2016; Raiteri et al., 2021, etc.). With this work we demonstrate that their polarization parameters can also change significantly on intra-night time scales. This result is somewhat surprising: not only is the optical flux erratically variable on short time scales but also is the polarization of the emission. Here we show some recent results for three objects: BL Lacertae, S4 0954+65 and S5 0716+714. For some of these objects intra-night *polarization* changes are demonstrated for the first time.

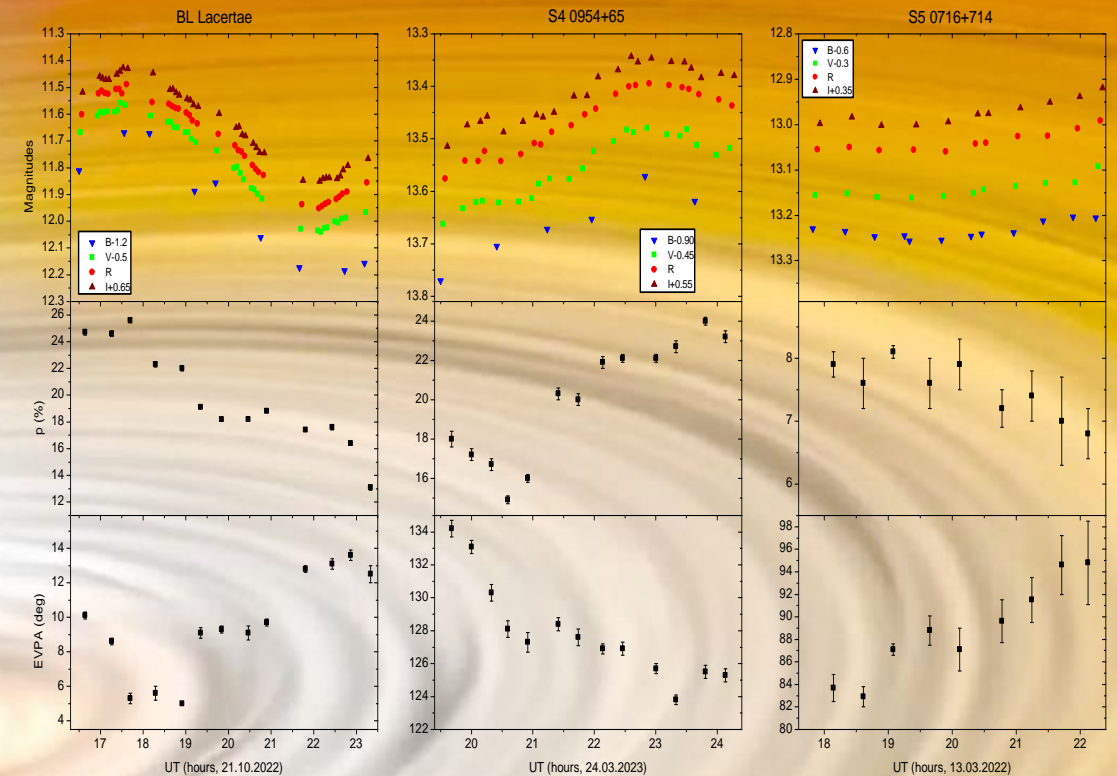
Conclusion

Our best guess would be that rapidly changing *Doppler* factors of several emitting regions, some of which occasionally happen to be on a close alignment with the line of sight, while travelling along a curved jet can be the primary candidate to reproduce the observed picture. Further intra-night variability studies of blazars, especially including polarimetry are highly encouraged and might be essential to better understand blazar variability.

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References

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Fast intra-night variability in three blazars – BL Lacertae (left), S4 0954+65 (middle) and S5 0716+714 (right). The upper panels show the flux variability in 4 colors (BVRI). The bottom two panels show the R-band polarization degree and electric vector polarization angle. One sees rapid (but mostly independent) changes in both – flux and polarization.