

# LONG-TERM OPTICAL BEHAVIOR OF BL LAC OBJECTS

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**Abstract.** On the basis of results of optical photometry and polarimetry of OJ287 and Mrk421 since 1981, we find two states of activities for both objects. In OJ287, a color-magnitude relation which is consistent with the standard jet-shock model is seen after the outburst in 1983, while before 1982 the optical colors were almost constant. In Mrk421, the colors became redder in 1985-87, and the change of the preferred direction of polarization was associated on smaller time scale in 1987.

We have been making optical polarimetry and photometry of bright BL Lac object OJ287 and Mrk421 with the multichannel polarimeter on the 91cm telescope since late in 1980, and the results were already given (Kikuchi 1992). In OJ287, we find a relation that the spectrum steepens as the brightness decreases after the outburst in 1983. This is explained by a standard jet-shock model (Marscher and Gear 1985). On much smaller time scale, this trend is more distinct, and we consider that the relation predicted by the jet-shock model has been observed in a course of evolution of a single flare.

However, photometric results in 1970s (Kikuchi et al. 1976, Hagen-Thorn 1980) and also in 1980-82 show that the colors in the optical region are almost constant and independent from the brightness. These two branches on the color-magnitude diagram are crossing around  $B-V=0.45$ . This leads that a basic, in other words, a less variable component, which is related probably with the emission from a jet, has become less dominant since 1983. It should be noted that in the outburst in 1972, much larger energy than in 1983 has emitted. If the constant color branch suggests that acceleration processes are well developed in a jet, it is likely that a large scaled outburst will occur only when the colors becomes blue, i.e.  $B-V$  is around 0.4.

On the other hand, Mrk421 became redder rather drastically in 1985-87 followed by a change of the preferred direction of polarization by about 40 deg in 1987. It will be useful in future to watch carefully the variations of polarized light, since rather sudden increases of polarized flux followed by slow decreases were observed at the starts of flares in 1982, 87 and 92.

## References

- Kikuchi, S.: 1992, in *Variability of Blazars*, ed. E.Valtaoja and M.Valtonen , p.289  
Kikuchi, S., Mikami, Y., Konno, M., and Inoue, M.: 1976, *Publications of the ASJ* **28**, 117  
Hagen-Thorn, V. A.: 1980, *Astrophysics and Space Science* **73**, 267  
Marsher, A. P., and Gear, W. K.: 1985, *Astrophysical Journal* **298**, 114