

Optical Monitoring of 3C 66A in 1994–2008

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Abstract. 3C 66A is one of the most interesting blazar. Our monitoring was carried out with a 1.56-m telescope of the Shanghai Astronomical Observatory (SHAO) from 13 December 1994 to 9 November 2008. Some peaks and gradual brightening of the source up to three times were observed.

Key words. AGN: blazar—BL Lac: individual—3C 66A.

1. Introduction

The blazar 3C 66A (0219+418) is classified as a low-frequency peaked BL Lac object. A weak Mg 11 emission line has been detected by Miller *et al.* (1978). This led to the determination of its redshift at $z = 0.444$, which was confirmed by Lanzetta *et al.* (1993). However, Bramel *et al.* (2005) pointed out that these redshift determinations are usually still quite uncertain. This source has displayed infrared, optical, ultraviolet, and X-ray variability on different time scales (e.g., Ghosh & Soundararajaperumal 1995; DeDiego *et al.* 1997). It was also the target of an extensive multiwavelength Whole Earth Blazar Telescope monitoring campaign from 2003–2004 and from 2007–2008.

2. Observations and data reduction

The observations presented here were obtained with a 1.56-m telescope at SHAO from 13 December 1994 to 9 November 2008. Typical integration times were 120 s for filters I and R, and 240 s for filter V, depending on sky conditions and the brightness of 3C 66A. The comparison stars are from Fiorucci & Tosti (1996). The instrumentation and data reduction is the same as in Tao *et al.* (2008).

Our R band data (Fig. 1) show that 3C 66A was found in a very active state from 1995–1996 and it reached a peak from JD 2452938 to JD 2452948. The peak brightness is 13.53 mag. in R band on 24 December 1995. Then the brightness of 3C 66A dropped rapidly in 1997 and was in a low state from 1997–2002. In 2003 and 2004, 3C 66A underwent a gradual brightening again reaching a series of maximum, 13.60 mag. on 2 November 2003, 13.61 mag. on 4 October 2004 and 13.62 mag. on 15 October 2004. In this period, Bottcher *et al.* (2005) found a peak at 13.4 mag. on

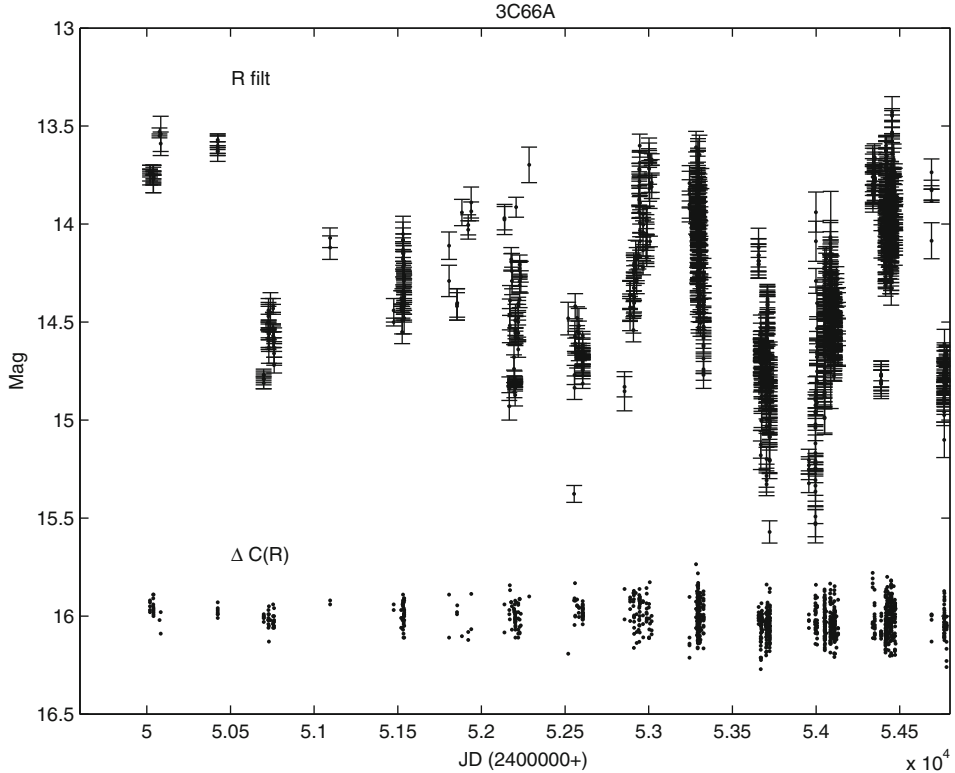


Figure 1. R-band light curve of 3C 66A (top) with relative differences between comparison stars (bottom).

18 February 2004, and Gu *et al.* (1996) found another peak at $R = 13.4$ on 13 January 2004. The last brightening happened in 2007. From JD 2454415 to JD 2454475, the light curves showed a double peak and two maximas were found at 13.60 mag. on 13 November 2007 and 13.43 mag. on 19 December 2007. Our intensive monitoring of blazars found three periods in a very active state, those were in 1995–1996, 2003–2004 and 2007. The other two data bands, V and I, have similar variation trend.

It is also interesting to find the intra-night variations of 3C 66A. A typical case happened on 13 Dec. 2007, $\Delta R \sim 0.2$ and $\Delta t \sim 3$ h. The intra-night variation can give an upper limit to the mass of the central black hole if the time scale indicates the innermost stable orbit period.

It is a common phenomenon that the short-term variability is overlapped on the long-term variation (Fan *et al.* 1998, 2002, 2007; Romero 2000; Bottcher *et al.* 2002). Blazars are interesting objects to observe for extended periods of time (from months to even few years) which can give long term flux variation behaviour.

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