

DOUBLE PEAKED OUTBURSTS OF THE BLAZAR OJ 287 IN 1994 – 1996

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ABSTRACT

VRI bands CCD photometric observations of the BL Lac object OJ 287 have been carried out during the period from October, 1994 to May, 1996. OJ 287 underwent two major outbursts during our observations. The first peak (V 14.0 mag.) occurred in the first half of November, 1994 and faded out to 16.5 mag within 150 days. The second peak (14.0 mag.) was observed in late December, 1995. The latter peak continued at nearly the same brightness until May, 1996. Such a long lasting outburst has never been reported for OJ 287. Color indices ($V - R$ and $V - I$) remained nearly constant during the outbursts.

Key Words : BL Lac objects – CCD Photometry – OJ287

I. INTRODUCTION

The BL Lac object OJ 287 has attracted attentions of many astronomers working in the field of active galactic nuclei (AGN) and it has been the subject of intensive observational studies in all wavelength regions for more than two decades. The long term photometric behaviour of OJ 287 is of special interest because it is the only one object which is known to exhibit periodic outbursts with an interval of about 11.6 years (Sillanpää et al. 1988, Takalo 1994).

We have initiated CCD photometric monitoring observations of OJ 287 at Osaka Kyoiku University on October 13, 1994. Since our observatory is located near at longitude E 135° , we have an advantage that we can observe during the daytime in the western hemisphere (Europe and America). Our geographical location may be important when an analysis of the variability of the object on a time scale of a day or shorter is attempted.

II. OBSERVATIONS

CCD photometric observations were carried out using a 50-cm reflector at Osaka Kyoiku University (locating at longitude E $135^\circ 39' 6.''6$ and at latitude N $34^\circ 32' 52.''7$). The telescope has an $F/12$ Cassegrain focus. A liquid-nitrogen cooled CCD camera is attached at the focus. The camera uses an EEV 88200 chip and Johnson V and Cousins R and I interference filters can be inserted before its shutter.

The data reduction was performed in a standard way using the IRAF software package running on a UNIX workstation. All of the object images were de-biased and then flat fielded using normalized dome flat images.

Measurements of magnitudes of the target were performed relatively to the nearby standard stars, which are taken from Smith (1985), using the aperture photometry routine in IRAF (APPHOT).

III. RESULTS AND SUMMARY

Results of our photometric observations of OJ 287 are shown in Fig. 1 (V band light curve) and Fig. 2 (color curves). Our data shows that OJ 287 was brightest on November 12 when it reached a peak at $V = 14.03$ mag. Sillanpää et al. (1996) noted the 1994 peak of OJ 287 was on November 10, nearly coincident with our result. According to Takalo (1994), the historically highest brightness was reached in 1972 ($V = 12.2$). The peak observed in 1984 was slightly fainter ($V = 12.6$). The 1994 high state was more than one magnitude fainter than the two preceding ones observed in 1972 and 1984.

After the peak observed in November, 1994, OJ 287 faded gradually until $V = 16.5$ within about 150 days. We found several flares (flickerings) with amplitudes of around 0.5 mag during the declining phase.

In the winter of 1995, Kidger (1995) announced that OJ 287 was again in a high state. Our observations in 1995 began on November 17 and confirmed the reported high state. We continued our monitoring observation until the end of May, 1996. OJ 287 was brightest on December 22 (V 14.01 mag). The date was 1.1 years after the first peak. This time separation between the two peaks is nearly coincident with previous ones (1.2 years observed in 1972 – 1973 and 1983 – 1984, Sillanpää et al. 1996).

OJ 287 faded out to about V 15 mag in January and February, 1996. Then, to our surprise, it had brightened again and remained in the high state (brighter than V 14.5 mag) for more than three months until the end of May, 1996.

We confirmed two major outbursts OJ 287 during the period (1994 – 1996) and found several interesting features as summarized below.

1. We observed two outbursts of OJ 287 in 1994 and 1995 which showed a double peaked structure. The observations support the proposed 11.6 years period.

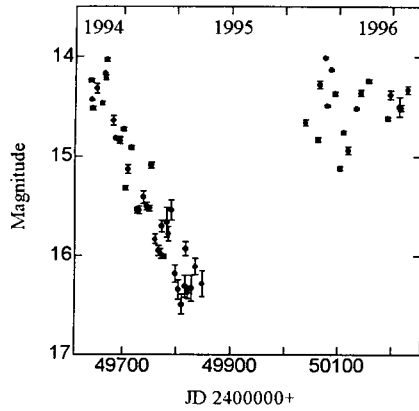


Fig. 1.— V band light curve of OJ 287

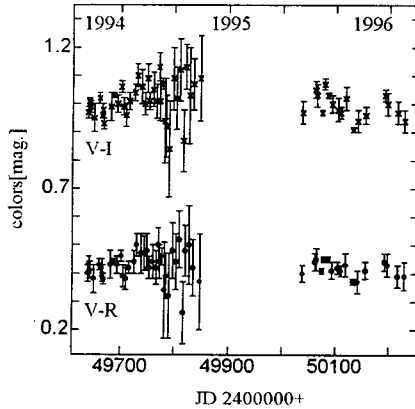


Fig. 2.— $V - I$ and $V - R$ color curves

2. The 1994 outburst was fainter by more than 1 mag. than the two previous ones observed in 1972 and 1984.
3. The second peak observed in 1995 - 1996 was peculiar because it attained the peak as bright as the first peak and showed a very broad plateau in the light curve.
4. Color indices ($V - R$ and $V - I$) remained nearly constant during the outbursts.

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