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THE OBSERVATION OF SUPERHUMPS IN T LEONIS

T Leo, a SU UMa type dwarf nova experienced a superoutburst in March 30 ~ April 9, 1994. Figure 1 shows the long term light curve around the superoutburst, characterized by a sudden increase, subsequent gradual decrease and steep decline at the end of the superoutburst. The abscissa is day count from the first day of the superoutburst (March 30, 1994 0.00 UT). The big arrow indicates the epoch of our observation which was in the midst of the superoutburst. The six smaller arrows indicate upper limits.

We observed this star on April 4, 1994 using 576 × 384 pixels Thomson CCD camera (TH7882CDA) attached to the Cassegrain focus of 60 cm reflector at Ouda Station, Kyoto University (Ohtani et al., 1992). The mode of 2 × 2 on-chip summation, the V-band filter designed to reproduce the Johnson V-band, and exposure time between 55 and 70 seconds were chosen to get a better time resolution but with sufficiently high counts. The observation was done for four hours, covering almost three superhump periods within one night, therefore no one-day alias problem arises in the period analysis.

The reduction was done using the personal-computer-based aperture photometry package developed by one of the authors (T.K.). This package enables us to de-bias, apply flat fielding and estimate the instrumental magnitudes automatically. The aperture size was 8″ in radius and the sky level was determined from the pixels whose distance from the individual objects are between 16″ and 30″. Table 1 gives the coordinates and magnitudes of the comparison and check stars from Guide Star Catalog (GSC).

The short term light curve of differential magnitude between the object and comparison is shown in Figure 2. The constancy of comparison star was confirmed using nearby check stars. No systematic variation larger than its corresponding photon statistic error ($0\overset{m}{.}03$ for check star in a single frame) was found during the observation. The expected error for one measurement of the differential magnitude between the object and comparison is about $0\overset{m}{.}01$. One can clearly see the steep brightening and more gradual fading which are characteristics of superhumps.

The light curve was analyzed using PDM program within IRAF package (IRAF is distributed by National Optical Astronomy Observatories, U.S.A.). Figure 3 shows the Θ diagram, the abscissa is frequency per day. The lowest minimum point corresponds to 86.4 minutes period, the second lowest minimum corresponds to twice this period. For the estimation of error, another period analysis was made. We smoothed the curve and took the maxima, minima and the middle of rising and fading stages. From the distances between two adjacent points with the same phase we get the periods. The average of the periods was precisely the same with the PDM result, that is, 86.4 minutes, with the r.m.s. error of 0.4 minutes.

Table 1

	α_{2000}	δ_{2000}	m_v
Comparison	$11^h38^m16^s.71$	$+03°27'12''.4$	11.9
Check 1	$11^h38^m13^s.37$	$+03°27'31''.8$	13.1
Check 2	$11^h38^m30^s.56$	$+03°25'53''.7$	14.0

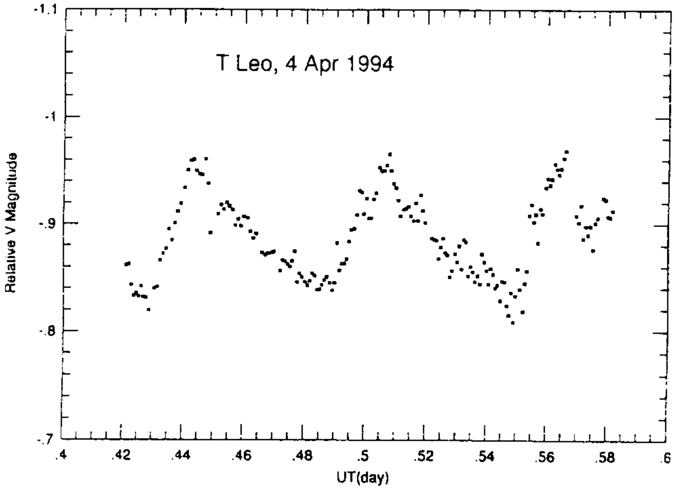

Figure 1

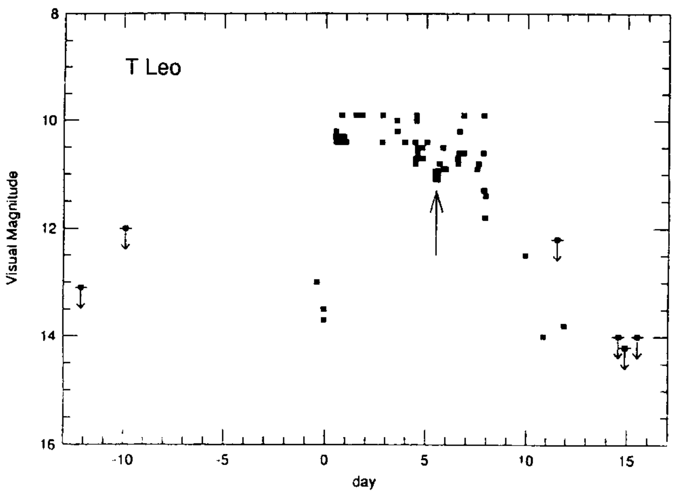

Figure 2

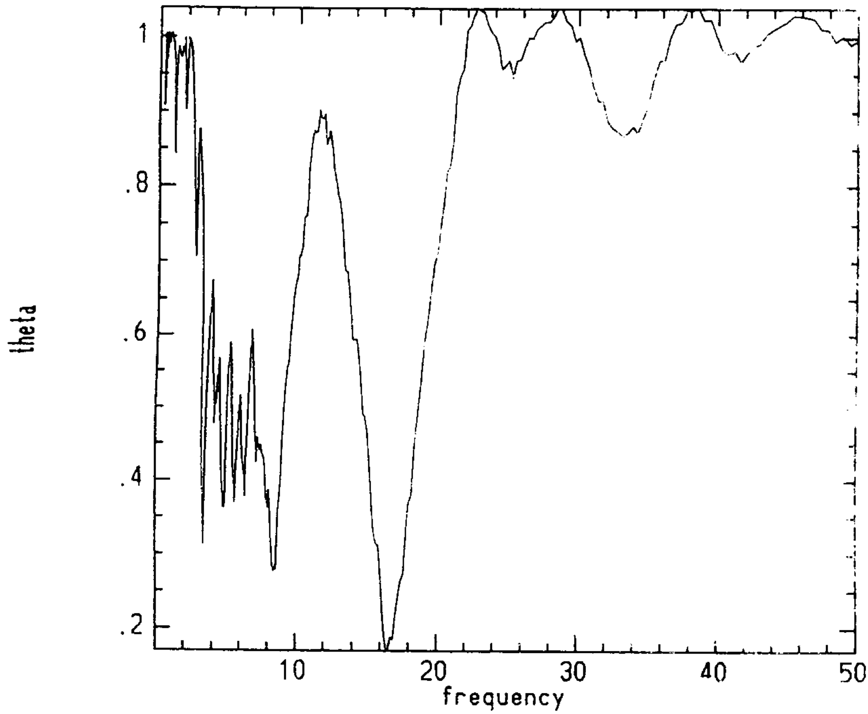

Figure 3

This observation gives us a chance to discriminate the true period between two published values. Kato and Fujino (1987) found the period of 92.3 minutes, whereas the observations by Lemm et al. (1993) gave 86.8 minutes. One of these is probably the true period and the other is its one-day alias. The difference is small but crucial in judging whether this star is normal or peculiar from the view-point of fractional superhump period excess $\epsilon = (P_{superhump} - P_{orb})/P_{orb}$, (c.f. figure 1 of Molnar and Kobulnicky, 1992).

The period we found is clearly in good agreement with that of Lemm et al. (1993) This implies that T Leo is a normal SU UMa type dwarf nova in superhump period excess

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