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COMPLETE CCD U,B,V,R,I LIGHT CURVES OF THE SHORT PERIOD ECLIPSING BINARY: V361 LYRAE

The 14th magnitude variable, V361 Lyrae, was discovered by Hoffmeister (1966) who classified it as an RR Lyrae-type star but gave no period. No further work was done for almost two decades until Galkina and Shugarov (1985) conducted a photographic study which indicated that V361 Lyr is actually a Beta Lyrae type eclipsing binary with an orbital period of about 7.5 hours. Andronov and Richter (1987) confirmed this conclusion while also noting an unusual difference between the heights of the maxima. They suggested that V361 Lyr is a semi-detached system undergoing vigorous mass transfer as evidenced by a hot spot on the mass accreting component. Kaluzny (1990) presented 1988 V, I photoelectric light curves and gave U,B,V standard magnitudes for some particular phases. He listed three times of minimum light and estimated the components to be of early K spectral type. Later, he (Kaluzny, 1991) published 1989 photoelectric V, I light curves as well as one primary epoch of minimum light. Shugarov et al. (1990) presented photoelectric U,B,V light curves accumulated over four observing seasons (1986-1989) listing standard magnitudes at key phases. They suggested that the secondary is accreting matter and give estimates of K1 V and K4 V for the primary and secondary components, respectively. Nations et al. (1994) indicated that they have B, V, R, I light curves and some preliminary models.

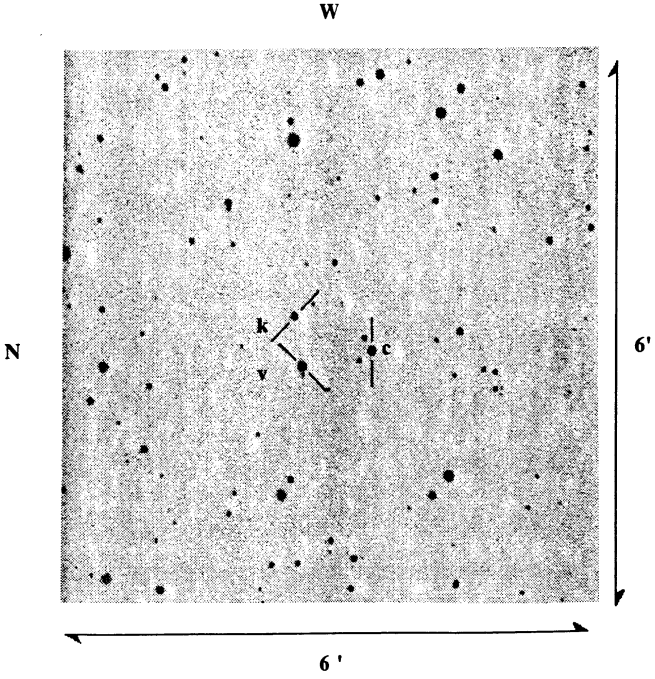

Figure 1

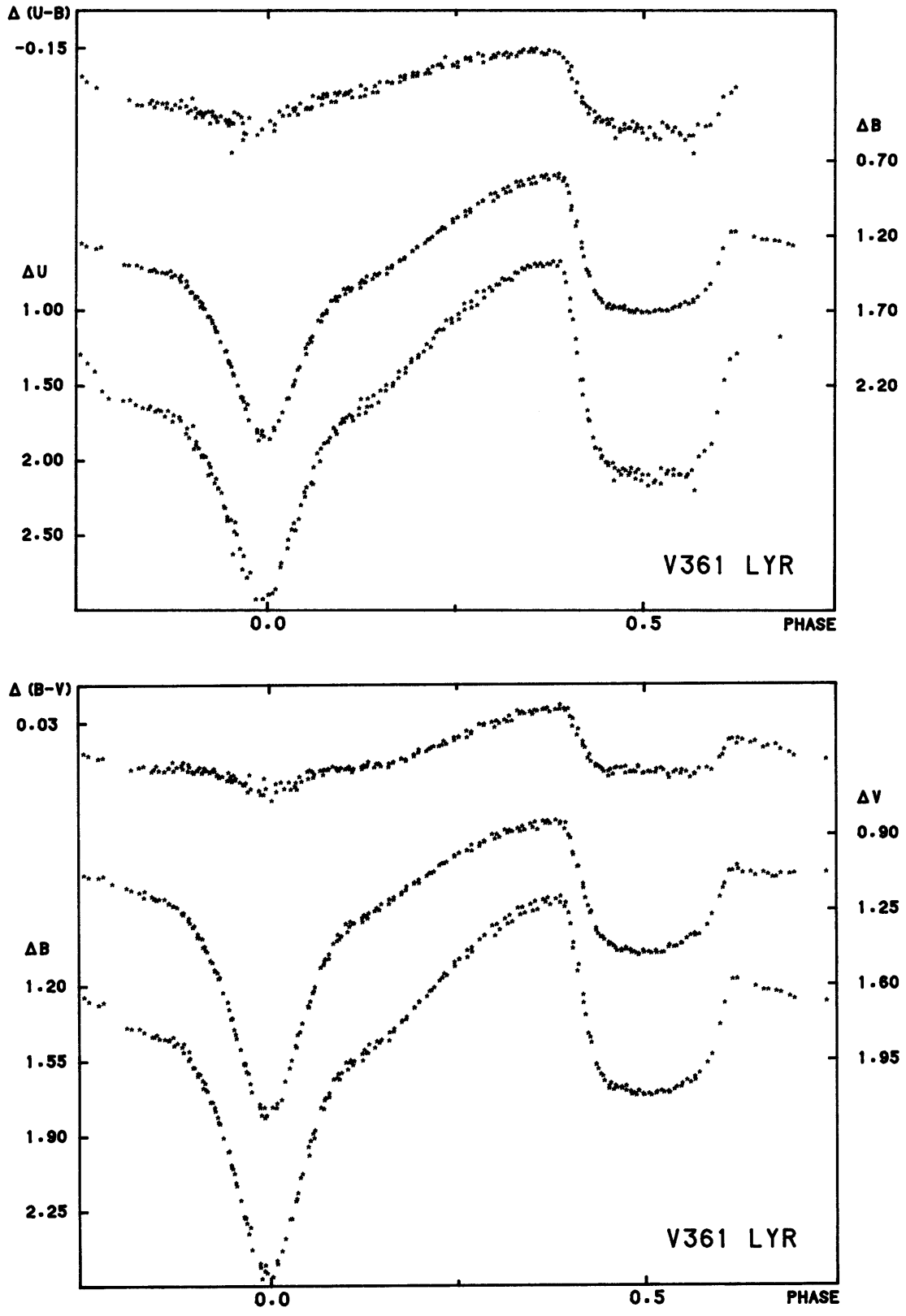
Δ (U-B)
-0.15
ΔU
1.00
1.50
2.00
2.50
ΔB
0.70
1.20
1.70
2.20
V361 LYR
0.0
0.5
PHASE
Δ (B-V)
0.03
ΔB
1.20
1.55
1.90
2.25
ΔV
0.90
1.25
1.60
1.95
V361 LYR
0.0
0.5
PHASE

Figure 2

Table 1

Star	RA(2000)	DEC(2000)
V361 Lyrae	$19^h02^m27^s$	46°58'59"
Comparison	$19^h02^m16^s$	46°57'43"
Check	$19^h02^m15^s$	46°58'30"

Table 2

JD Hel. 2400000+	Cycles	$(O-C)_1$	$(O-C)_2$
49163.8090(1)	0.0	0.0002	0.0001
49164.7381(3)	3.0	0.0000	−0.0001
49165.9762(6)	7.0	−0.0003	−0.0002
49168.7630(2)	16.0	0.0000	0.0001

Our present U, B, V, R, I CCD light curves of V361 Lyrae were obtained as part of our ongoing study of compact solar-type eclipsing binaries. The observations were made on 1993, June 23-25, inclusive, and 29-30 at Kitt Peak National Observatory (KPNO), Arizona. A Tektronix Te2K chip and CCD camera system was used in conjunction with the 0.9-m reflector. Between 225 and 250 observations were made in each passband.

A CCD image of the field is shown in Figure 1. The variable, comparison, and check stars are designated as v, c, and k, respectively with coordinates of each given in Table 1.

Four new precise epochs of minimum light were determined from the observations made during primary eclipses. Several secondary were also calculated but were later removed from our period analysis due to severe distortions in the light curve around the secondary eclipse (0.5 phase). The bisection of chords technique was used to determine all epochs of minimum light. These new primary minima are listed in Table 2. In Table 2 and throughout the paper, values are accompanied by their probable errors in parentheses.

The recent epochs of photoelectric and CCD minima were introduced into a least squares solution to obtain a new linear ephemeris which best represents the present observations:

$$\text{JD Hel Min.} = \underset{\pm 3}{2449163.8092} + \underset{\pm 7}{0^d.30961404} \times \text{E} \qquad (1)$$

The O−C residuals calculated from equation 1 are listed as $(O-C)_1$ in Table II. We then calculated a quadratic ephemeris by introducing all available times of minimum light and times of lowlight from Galkina and Shugarov (1985) and Andronov and Richter (1987) into a least squares quadratic solution:

$$\text{JD Hel Min.} = \underset{\pm 4}{2449163.8091} + \underset{\pm 7}{0^d.30961373}\times\text{E} - \underset{\pm 2}{3^d.6}\times 10^{-11} \times \text{E}^2 \qquad (2)$$

The quadratic term is statistically significant at greater than the 10 sigma level. This negative term would indicate that the secondary (less massive) component is the accretor. The residuals calculated from equation 2 are listed in Table 2 as $(O-C)_2$.

The standardized B,V,R_c,I_c light curves of V361 Lyrae as defined by their individual observations are shown in Figure 2 as differential magnitudes (variable−comparison) versus phase. The analysis of the observations is in progress.

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