COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4226

Konkoly Observatory
Budapest
10 August 1995

HU ISSN 0374 – 0676

PRECISION B,V,R,I LIGHT CURVES AND NEW DETERMINATION FOR V440 CASSIOPEIAE

V440 Cassiopeiae was discovered by Hoffmeister (1967), and classified as an Algol variable. His paper includes accurate positions, a finder chart, three times of minimum light, and maximum and minimum magnitudes. Busch and Häussler (1990) observed V440 Cas, reclassifying it as a W UMa type. They listed maximum and minimum magnitudes and calculated the ephemeris

$$\text{Min. I} = \text{J.D.}\,2447391.555 + 0^{\text{d}}.280692 \times \text{E} \qquad (1)$$

However, their light curve is either extremely noisy or improperly phased. Aside from these two papers, V440 Cas has apparently been ignored.

Our present observations were made on 27, 28, and 29 September 1994 at Kitt Peak National Observatory, Arizona, with the CCD photometer system (CCDPHOT) in conjunction with the 0.9 m Cassegrain reflector telescope. Approximate coordinates of the variable, comparison and the check star are given in Table 1 and are designated as star V, C, and K, respectively, on our CCD image (Figure 1). About 250 observations were taken in each passband, B, V, R, I.

Five mean epochs of minimum light were determined from observations made during three secondary and two primary eclipses. The bisection of chords technique was used in their determination. Our minima are given in Table 2 along with those by Hoffmeister (1967) and the epoch by Busch and Häussler (1990). Timings are accompanied by their probable errors in parentheses. These were introduced into a weighted least squares solution to obtain the following linear ephemeris:

$$\begin{array}{c}\text{JD Hel Min. I} = \text{J.D.}\,2449624.797 + 0^{\text{d}}.3256880 \times \text{E} \\ \qquad\qquad\qquad\qquad\quad \pm 3 \qquad\quad \pm 3\end{array} \qquad (2)$$

In this calculation, Hoffmeister's times were given a weight of 0.1, while our minima and the epoch by Busch and Häussler were assigned weights of 1.0. On 28 September, our observations covered a complete light curve affirming our new period. Thus, the 0.28 day period given by Busch and Häussler is in error, probably due to aliasing. The major source of uncertainty in the above empheris arises from the low precision of the previous timings. If timings reported by Hoffmeister are excluded from the analysis, the following improved ephemeris is obtained:

$$\begin{array}{c}\text{JD Hel Min. I} = \text{J.D.}\,2449624.79708 + 0^{\text{d}}.32568791 \times \text{E} \\ \qquad\qquad\qquad\qquad\quad \pm 8 \qquad\quad \pm 3\end{array} \qquad (3)$$

The residuals calculated from equation 2 are listed in Table 2 as $(\text{O}-\text{C})_1$, while the residuals of equation 3 are listed as $(\text{O}-\text{C})_2$.

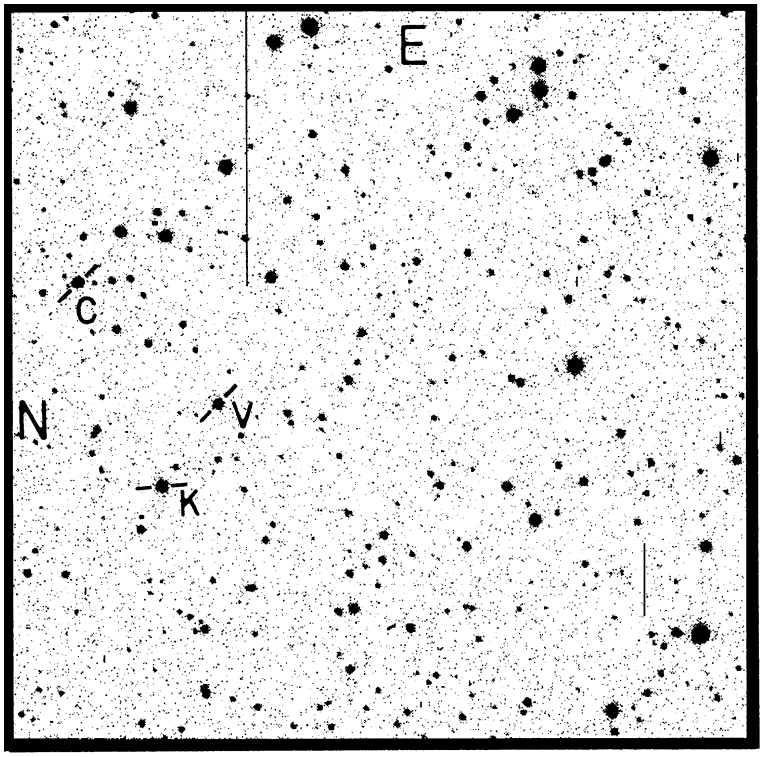

Figure 1. Finder Chart for V440 Cas. The stars marked "V", "C", and "K" are V440 Cas, the comparison star, and the check star, respectively.

Table 1

Star	R. A. (2000)	Dec. (2000)
V440 Cas	$23^h36^m40^s$	51°09' 29"
Comparison	$23^h36^m46^s$	51°10' 35"
Check	$23^h36^m36^s$	51°10' 38"

Table 2

JD Hel. 2400000+	Cycles	$(O-C)_1$	$(O-C)_2$	Source
29193.42	−62733.0	+0.0072	+0.0033	HO
30253.34	−59478.5	−0.0244	−0.0280	HO
30262.50	−59450.5	+0.0164	+0.0127	HO
47391.555	−6857.0	+0.0004	+0.0000	BH
49623.6574(8)	−3.5	+0.0001	+0.0002	PO
49623.8196(5)	−3.0	−0.0005	−0.0004	PO
49623.9828(5)	−2.5	−0.0001	−0.0001	PO
49624.6345(3)	−0.5	+0.0002	+0.0003	PO
49624.7971(1)	0.0	−0.0001	−0.0000	PO

PO=Present Observations, BH=Busch and Häussler (1990), HO=Hoffmeister (1967)

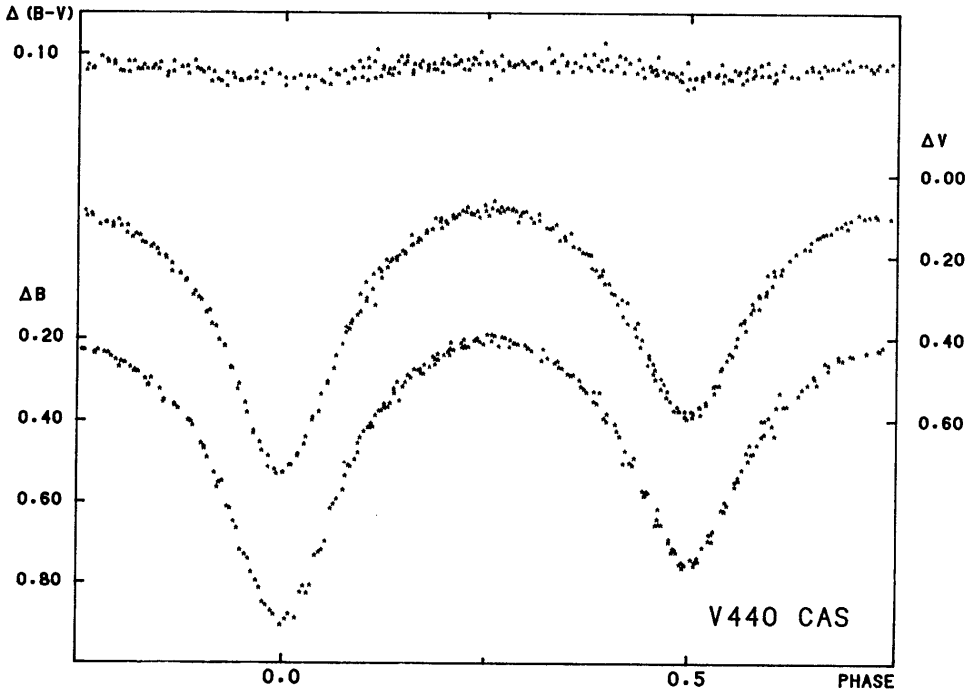

Figure 2. Photoelectric light curves in B and V of V440 Cas as defined by the individual observations.

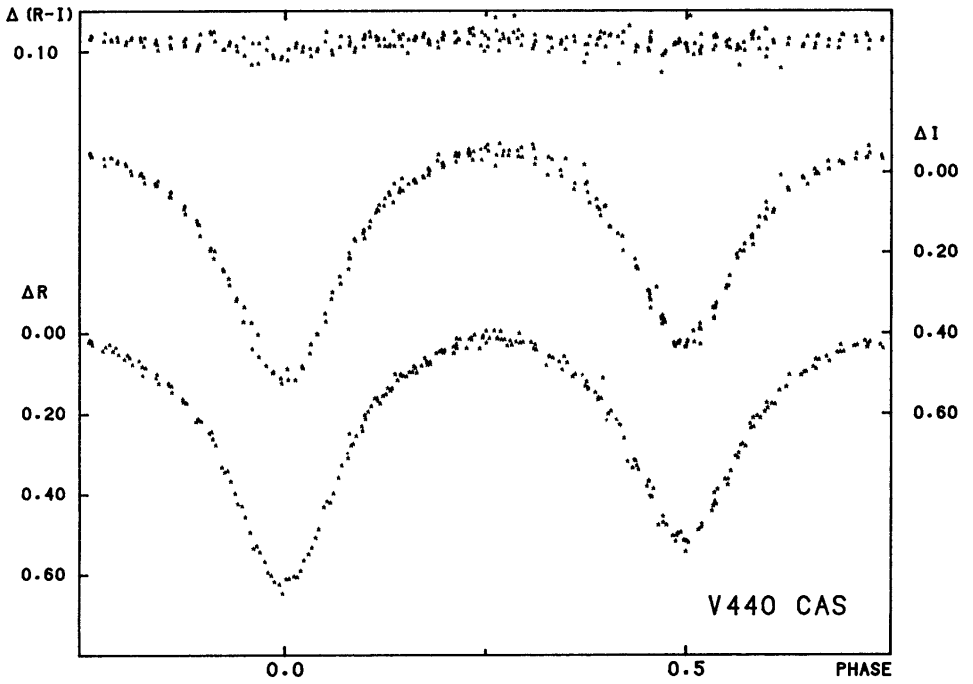

Figure 3. Photoelectric light curves in R and I of V440 Cas as defined by the individual observations.

More timings of minimum light are needed to determine the period behavior of this binary.

The B, V light curves of V440 Cas are shown in Figure 2, and the R, I light curves are shown in Figure 3. All light curves shown are as defined by individual observations and presented as differential magnitude (v−c) versus phase. Our light curves confirm Busch and Häussler's classification of V440 Cas as a W UMa variable. The analysis of the observations is underway.

Much of the present analysis was performed by JF as a part of her undergraduate summer research project, funded through the American Astronomical Society REU program.

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[1] This research was partially supported by funds from the National Science Foundation.
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