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1991 B,V,R_C ,I_C LIGHT CURVES OF THE SOUTHERN VERY SHORT PERIOD ECLIPSING BINARY V676 CENTAURI

The very short period (VSP) eclipsing binary V676 Centauri, (S4995, CoD $-38°9520$, $\alpha_{(2000)} = 14^h37^m50\overset{s}{.}8$, $\delta_{(2000)} = -38°50'46"$, galactic latitude: $19\overset{\circ}{.}5$) was discovered by Hoffmeister (1949) while conducting a massive photographic survey of Sonneberg plates. The variable was listed only as being short period with an amplitude of 0.5 magnitude. He later (Hoffmeister 1956) published photographic light curves, 83 timings of minimum light, and the following orbital elements:

$$\text{JD Hel Min. I} = 2434425.555 + 0\overset{d}{.}292397 \times \text{E}. \quad (1)$$

He classified the system as a W UMa contact binary with primary and secondary eclipse depths of $0\overset{m}{.}7$ and $0\overset{m}{.}6$, respectively. After nearly thirty years of being observationally neglected, V676 Cen was added to a study of short period eclipsing binaries (Gomez et al. 1988). Gomez and Lapasset (1988) published an informative IBVS note which included a partial photoelectric V light curve, 19 timings of minimum light from six eclipses, and an updated ephemeris.

$$\text{JD Hel Min. I} = 2446971.6152 + 0\overset{d}{.}2923901 \times \text{E} \quad (2)$$

They state that the system is a contact binary and that the difference in eclipse depths is ~0.15 magnitude. In a report on seven such systems (Gomez and Lapasset, 1988), complete B and V photoelectric light curves as well as an improved ephemeris were published.

$$\text{JD Hel Min. I} = 2446971.6152 + 0\overset{d}{.}29239057 \times \text{E} \quad (3)$$

Gomez et al. (1990) concluded their work on V676 Cen with a parameter search and solution. They found that the system had a (ΔT ~320 K, inclination ~84° and a fillout ~13%. No further work has been published on this system. V676 Centauri was observed as part of a continuing effort to obtain complete multiband photoelectric light curves of short period, solar type eclipsing binaries. The present observations were made in May 1991 at Cerro Tololo Inter-American Observatory (Chile). The Yale 1-m reflector was used in conjunction with B, V, R_C, I_C filters of the Johnson-Cousins' system and a dry-ice-cooled photomultiplier. A modified Digitized Sky Survey (DSS) image of the field is shown as Figure 1, in which the variable, comparison ($\alpha_{(2000)} = 14^h37^m50\overset{s}{.}1$, $\delta_{(2000)} = -38°51'14\overset{''}{.}0$), and check ($\alpha_{(2000)} = 14^h37\overset{m}{.}58\overset{s}{.}2$, $\delta_{(2000)} = -38°56'44\overset{''}{.}4$) stars are designated V, C, and K, respectively. Our comparison star provided the best color-match to the variable, with Δ(B−V) averaging $0\overset{m}{.}15$. Check minus comparison star measurements indicate that the comparison star's light output remained constant during the observing interval.

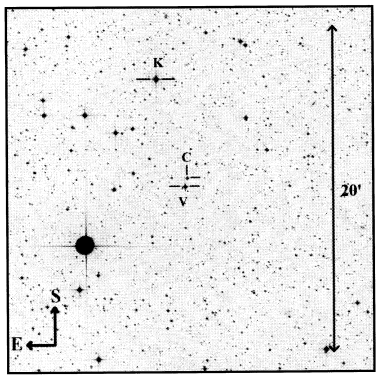

Figure 1. Finding chart (modified from a Digital Sky Survey image) of V676 Centauri (V), the Comparison star (C), and the Check star (K)

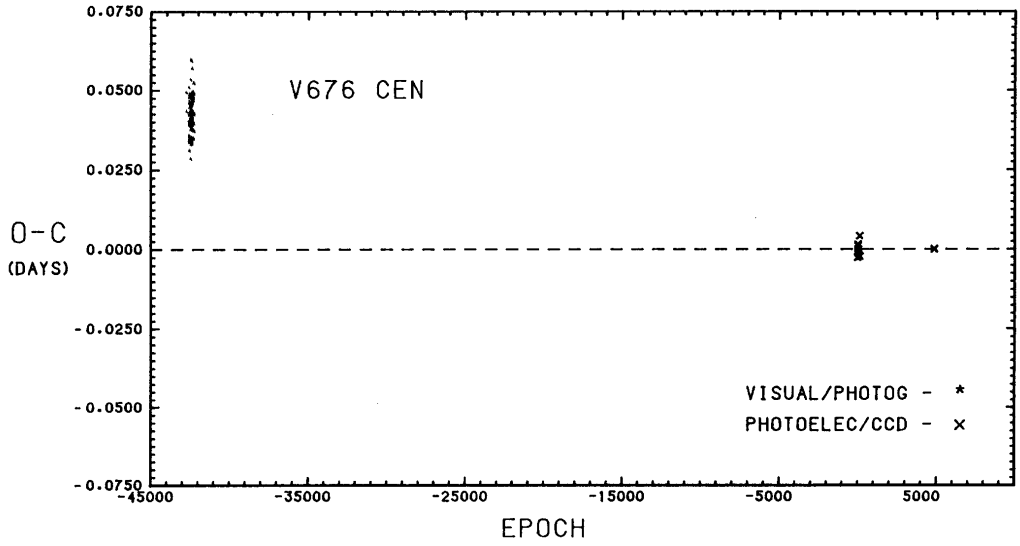

Figure 2. O−C residuals of V676 Centauri from Equation 4 (linear ephemeris)

Two new precision epochs of minimum light were determined from observations made during primary eclipses. The bisection of chords technique (Henden and Kaitchuck 1990) was used to determine both minima. Approximately 100 timings of minimum light, spanning ∼35 years, were collected from the literature. We have listed the new photoelectric epochs of minimum light in Table 1. The new minima are reported as mean times from the four passbands. All available epochs of minima were introduced into a weighted least squares calculation. Photographic and visual minima were included with assigned weights of 0 allowing residuals to be calculated. From this, we obtained the following improved linear ephemeris:

$$\begin{array}{rl} \text{JD Hel Min.} = 2446971.6154 & + 0\overset{\text{d}}{.}29239197 \times \text{E} \\ & \pm.0006 \quad \pm.00000024 \end{array} \tag{4}$$

The residuals are given as $(\text{O}-\text{C})_1$ in Table 1 and shown in Figure 2. A quadratic ephemeris was also calculated (using weights of 0.1 and 1.0 for photographic/visual and photoelectric minima respectively) and found to be marginally significant ($\sim 2.5\sigma$):

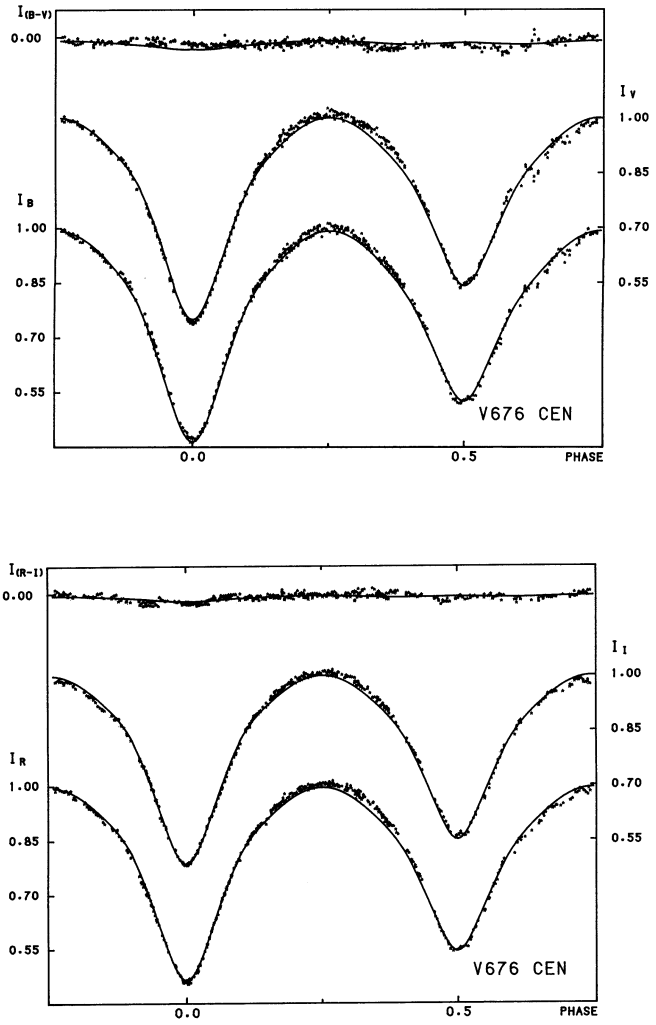

Figure 3. B, V, R_C, and I_C light curves of V676 Cen as defined by the individual observations with preliminary solution overlaid

$$\text{JD Hel Min.} = 2446971.6154 + 0.29239185 \times \text{E} + 4.1 \times 10^{-11} \times \text{E}^2 \qquad (5)$$
$$\pm.0005 \quad \pm.00000020 \quad \pm1.0$$

The residuals from Equation 5 are given as $(\text{O}-\text{C})_2$ in Table 1. The high scatter in the early timings and lack of good observational coverage precludes determination of long-term period variability at this time. New observations as well as recovery of plate minima are keys to understanding the period behavior of this system.

Table 1

JD Hel. 2400000+	Eclipse Type	Cycles	$(\text{O}-\text{C})_1$	$(\text{O}-\text{C})_2$
49695.8924(3)	I	4863.0	0.0034	−0.0001
49696.8232(1)	I	4867.0	0.0036	0.0002

The light curves reveal that V676 Cen is in a state of contact or near contact with continuous changes in light in the out-of-eclipse portions of the light curve. There is an O'Connell effect with the maximum at phase 0.25 (Max I) being higher than that at phase 0.75. The light curves of Gomez et al. (1990) indicate the opposite (phase 0.75 is higher than phase 0.25). Thus the region of enhanced activity has moved around the star. Our preliminary solution (Wilson 1990, 1994; Wilson and Devinney 1971) shows the system to be in a state of shallow contact (fillout of ~9%) with a rather high mass ratio (M_2/M_1) ~0.72 and an inclination ~82°. The primary and secondary component temperatures are 4550 K and 4819 K, respectively, with a phase shift of 0.50. A graphical representation of the preliminary solution fit to our observations is given in Figure 3. A thorough analysis of the observations is in progress and will be reported on elsewhere.

We would like to thank Dr. Kwan-Yu-Chen of the University of Florida for allowing our continued use of the Catalog of Interacting Binaries. Thanks also go to Mr. Franz Agerer for giving us the opportunity to access the BAV Database (Lichtenknecker 1990) in our search for complete period histories. We would like to acknowledge the Space Telescope Science Institute and all its affiliates for the use of DSS images in our work. Our gratitude goes to Mrs. Brenda Corbin and Mr. Gregory Shelton of the U.S. Naval Observatory Library for all their help in literature histories.

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ERRATUM

In IBVS No. 4359 issue, Table 1 contains incorrect data on the minima of V676 Cen. The revised table is as follows:

JD Hel 2400000+	Eclipse Type	Cycles	$(O-C)_1$	$(O-C)_2$
48393.5174(1)	I	4863.0	−0.0001	0.0001
48394.6872(1)	I	4867.0	0.0001	0.0002

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