

COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 1385

Konkoly Observatory
Budapest
1978 February 8

118 DAY OPTICAL VARIATIONS IN VV Cep

The long period eclipsing binary system, VV Cep, was observed on 40 nights, from August 1975 to December 1977, using H α and H β wide- and narrow-band filters. The observations were made with the 38-cm telescope at Villanova University Observatory using an uncooled EMI 9558QB photomultiplier. In September 1977 this cell was replaced by an RCA C31034A cell cooled to -10°C . At this time it was noticed that the H β filters had suffered some deterioration and were replaced by an Oxygen I (7774 \AA) wide- and narrow-band filter set.

The output of the photometer amplifier is fed to an integrating system with a digital output as well as a chart recorder. The observing sequence was the usual pattern of sky-comparison-variable-comparison-sky. The integration time was typically 50 seconds per reading. The comparison star was 20 Cep and BD+62 $^{\circ}$ 1994 served as the check star. No significant variations were detected between comparison and check stars. Differential extinction corrections between comparison and variable were applied although the corrections were small and the time of each observation was converted to heliocentric J.D. On a given night 5 to 10 observations of the variable star were obtained in each filter. The points plotted in Figure 1 represent the nightly means for the H α wide filter vs. JD Hel. The standard deviation for each normal is generally less than $0^{\text{m}}.006$. Similar variations are evident in the other wide-band filters.

Preliminary analysis indicates the existence of a light variation with a period of approximately 118.5 days. This period is considerably shorter than the period of ~ 150 days reported by Hayasaka et al. (1977) which is based on an observing interval of 248 days. It should be noted that at the wavelength of the H α filter (6563 \AA), the contribution of the B star is less than 3% of

the total light and the variations noted in Figure 1 inside and outside eclipse are mainly due to the supergiant M star. First contact is predicted to be JD 2443087 and second contact is predicted on 2443114.

The last eclipse of this system was in 1956-1957 and it was observed by Frederick (1960) and Larsson-Leander (1957,1959). Their data in the longer wavelength show some light variations other than that due to the eclipse. Assuming a period of 118.37 days and a minimum at JD 2443459.5 for the M star, we can predict minima in good agreement with those seen in both Frederick's and Larsson-Leander's data. The maxima although less definitive, are also in good agreement with the above period. This indicates that the period of this light variation has been stable over the last 20 years.

If we assume our period of light variation (118.37^d) to be equal to the pulsation period of the M star, a value of $\bar{\rho}/\rho_{\odot} = 1.05 \times 10^{-7}$ is found using the relationship: $P_0 = 0.0383\sqrt{\bar{\rho}_{\odot}/\bar{\rho}}$ given by Ledoux (1958). Combining this with the mass of $20 M_{\odot}$ (Wright, 1977) we find a radius of $\sim 575 R_{\odot}$ which is in agreement with the value of $\sim 580 R_{\odot}$ given by Frederick (1960), but in conflict with the value of $1600 R_{\odot}$ given by Wright (1977).

Superimposed on the 118 day cycle, there appears to be a cyclic variation in amplitude with a period of at least 825 days. The light variation of the M star in the VV Cep system is similar in some ways to those of α Ori and μ Cep, both supergiants.

Observations of VV Cep are continuing and a complete analysis of the light variations, including the eclipse, will be published in detail elsewhere.

We would like to thank M.Acierno, L.Casswell, R.Del Conte, O. Lupie, D. Turnshek, K. Young, for helping with the observations.

GEORGE P. MCCOOK
EDWARD F. GUINAN
Department of Astronomy
Villanova University
Villanova, Pennsylvania 19085
U.S.A.

References:

Frederick, W.F., 1960, A.J. 65, 628

Hayasaka, T., Sato, H., Saito, M., Saijo, K., Kitamura, M., 1977,
Tokyo Astr. Bull. Second Series, 247, 2865

Larsson-Leander, G., 1957, Arkiv Astron., 2, nr.12, 135

Larsson-Leander, G., 1959, Arkiv Astron., 2, nr.27, 301

Ledoux, P., 1958, Handbuch der Physik, Springer-Verlag, 51, 353

Wright, K.O., 1977, J.Roy.Astron.Soc.Can. 71, No.2, 152

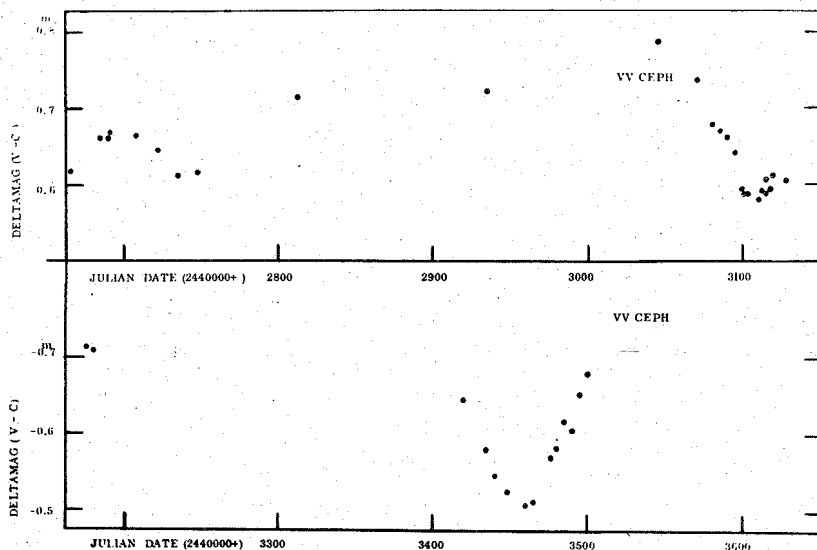


Figure 1 $H\alpha$ -wide normal points plotted against Heliocentric Julian Date for VV Cephei.