V SAGITTAE (201520)

by

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Abstract

The light curve is described and visual observations
of two recent eclipses are presented. Criteria for
future observations are suggested.

1. Background

The $\underline{General}$ $\underline{Catalog}$ $\underline{of}$ $\underline{Variable}$ $\underline{Stars}$ lists V Sge as a unique,
nova-like star with a visual range of $9\overset{m}{.}5$ to $13\overset{m}{.}9$. No definite
period has been found to date, except the period of 0.514195
days due to the eclipses. This period causes the eclipses to
repeat themselves - at least time-wise - every 18 days. Accord-
ing to Herbig $\underline{et}$ $\underline{al}$. (1965), the actual variable is the smaller,
hotter primary star (T_1 = 44000°K, 0.74 solar masses). The
secondary has 2.8 solar masses and a temperature T_2 = 22000°K.
The spectroscopically determined radial velocities are K_1 =
320 km/sec and K_2 = 85 km/sec. The separation is 2.05 solar
diameters and the center of gravity lies well within the sur-
face of the massive secondary. The adopted diameters are
d_1 = 0.52 $d_\odot$ and d_2 = 0.68 $d_\odot$ ($d_\odot$ = diameter of the sun).
Component 1 very nearly fills its limiting Roche lobe while
component 2 lies well within its lobe.

2. The Light Curve

The light curve of V Sge has been described several times
(Campbell 1938, Ryves 1932, Adams 1961 and 1964, Herbig $\underline{et}$ $\underline{al}$.
1965). Basically, four different types of light variations
have been found to be superimposed:
a) A sudden brightening by as much as 3 mag., apparently
   caused by ejection of hot gasses from the primary.
b) Minor fluctuations with a time scale of a few days, in-
   terpreted as due to small changes in the size of the
   primary.
c) Small, irregular fluctuations with a time scale of about
   one hour ("Flickering").
d) Cyclic variations due to the primary and secondary eclipses.

The shape and depth of the eclipses are not uniform but
usually change from cycle to cycle. Fig. 1 shows the portion
of the light curve between JD 2442200 and 2442300.
The author recently succeeded in recording two primary
eclipses of this star (Fig. 2 and Fig. 3). Times of primary
minima were calculated by the formula of Herbig $\underline{et}$ $\underline{al}$.(1965):

$$JD = 2437889.9154 + 0.514195 \ E \qquad (1)$$
$$(m.e.) \ \pm.0015 \quad \ \pm.000004$$

The mean error in the period presently corresponds to a time
deviation of ±52 minutes. As it turned out, the minima times
of both eclipses observed fell within the range of equation (1).

However, equation (1) should now be tentatively revised as follows:

$$JD = 2442570.650 + 0.5141965 \ E \qquad (2)$$

The average O-C value is 0.011 if the individual O-C values are weighted proportional to the number of data points.

3. Suggested Observing Program

After having studied individual data points from the computer print-out supplied by Headquarters, it seems that with one exception the observers had not been aware of the rapid change in brightness at the crucial times and most of them had recorded the time to the nearest 1/10 of a day, which is inadequate for this star. An entire eclipse could take place within this time span. This led the author to the conclusion that a comprehensive observing program ought to be established for amateurs in order to obtain more useful data in the future. The following items should be accounted for:

a) Approximate times of minima must be known in advance. Equation (2) can be used to determine the times of primary eclipses. The secondary eclipses are halfway between the primary eclipses. Equation (2) is corrected to heliocentric time; the eclipses can be up to 8 minutes earlier or later if the times calculated are used directly for earth-based observations.

b) V Sge has a faint companion: approx. $13^m.9$, 9.7" distant at position angle 267°, i.e. a little west of the variable. This should be excluded from the estimates, particularly when V Sge is faint. Powers of 200 or more are recommended.

c) During eclipses the time should be recorded to the nearest minute by using an adequate time signal (CHU, WWV, etc.), which is common practice for eclipsing stars in general. The duration of the eclipses is about 2.4 hours.

d) During "normal" phases the time should be noted to the nearest 0.01 day, as with all other irregular stars of eruptive nature.

It is suggested that data on eclipses of V Sge be sent to the Chairman of the Eclipsing Binary Committee of the AAVSO for reduction and publication. All other estimates should be sent to Headquarters as usual.

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Herbig, G.H., Preston, G.W., Smak, J., and Paczyński, B. 1965, Ap. J., 141, 617.

Ryves, P.M. 1932, Mon. Not. Roy. Astr. Soc., 92, 715.

Campbell, Leon 1938, Pop. Astr., 46, 112.

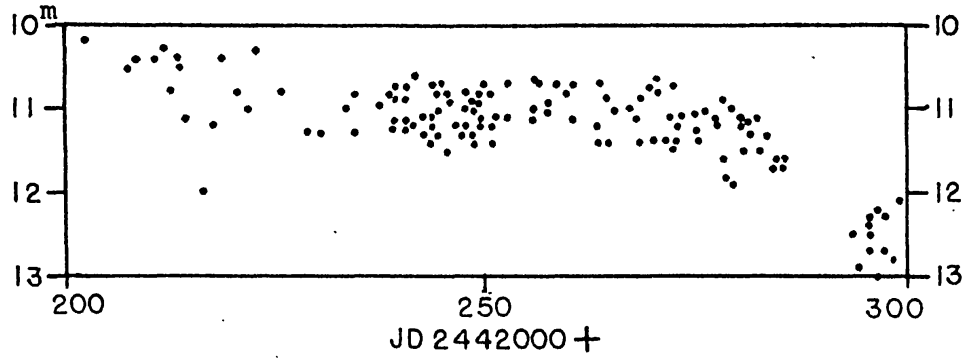Adams, R., AAVSO Abstr., May 1959, October 1961, April 1964.

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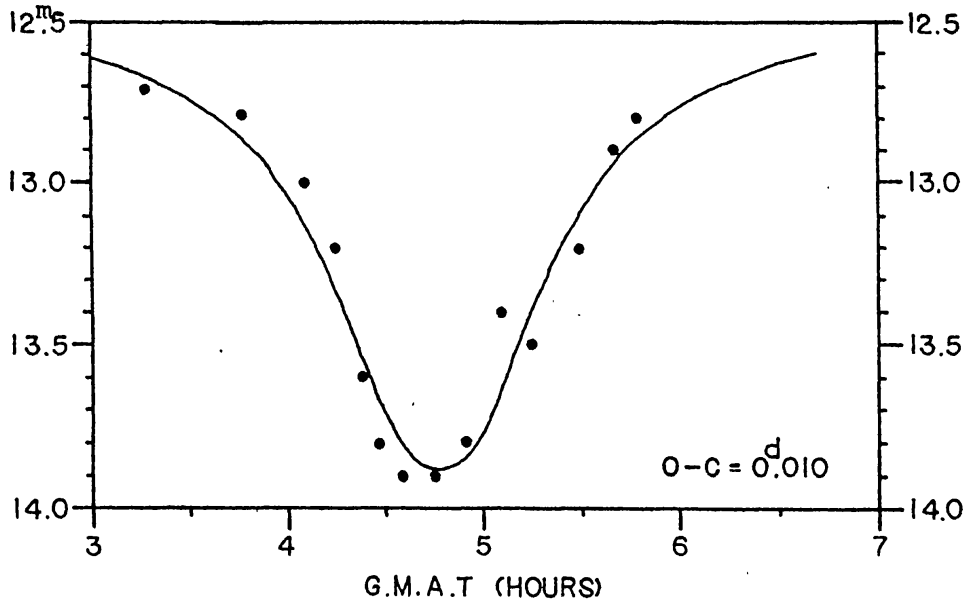Figure 1. AAVSO light curve of V Sagittae.

Figure 2. Minimum of V Sge observed on June 6/7, 1975. Time
scale contains heliocentric correction. Minimum =
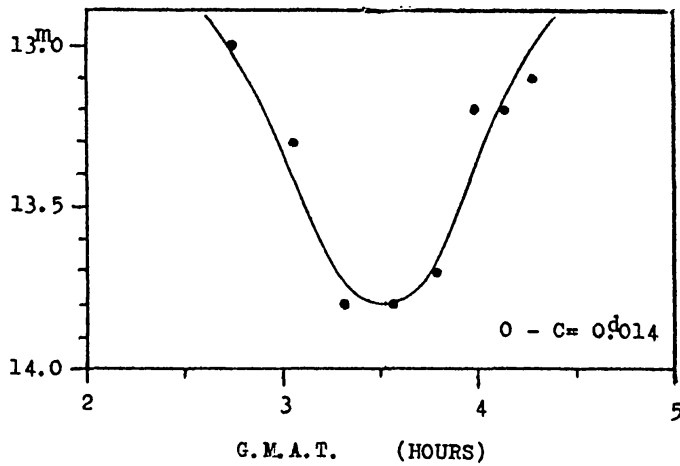JD 2442570.647 (4 hrs 46.4 min. G.M.A.T.).

Figure 3. Minimum of V Sge observed on June 8/9, 1975. Time
scale contains heliocentric correction. Minimum =
JD 2442572.699 (3 hrs 31.3 min. G.M.A.T.).

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