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## V SAGITAE

There is now in press in the *Astrophysical Journal Supplements* a lengthy paper dealing with the well-known "nova-like" variable V Sagittae. We present here an abstract of that paper together with a proposal for revision of the traditional methods of observing this star, based on the new interpretation of the system.

The new observations were made at Lick Observatory in 1959-63: spectroscopically (with the 120-inch and Crossley reflectors) at 48 and 350 Å/mm, and photoelectrically in UVB. The complex light variations are resolvable into 3 apparently independent activities: (I) a strictly cyclic variation produced by an eclipsing binary system, with primary minima occurring at  $JD_{\odot} 2437889.9154 (\pm 0.0015) + 0^d514195 (\pm 0.000004) E$ ; (II) an occasional major and very sudden brightening of as much as 3 mag.; (III) minor fluctuations with a time scale of a few days. When the system is faint, additional minor, rapid fluctuations with a time scale of about one hour are present. It might be mentioned that the cycles of about 17<sup>d</sup> found by the early observers correspond to the resonance between the day and the eclipsing period of V Sge.

The spectrum of V Sge contains broad, hazy emission lines of H, He II, O III, O VI, N IV, and N V, much as in a WN5 star, on a hot continuum. A unique feature is the presence of sharp fluorescent O III lines at  $\lambda 3132$  and  $\lambda 3444$ ; these are double, and oscillate (180° out of phase) in the 0<sup>d</sup>.51 period with semi-amplitudes of  $K_1 = 320$  km/sec,  $K_2 = 85$  km/sec. Component 1 is the star of lesser mass and radius but higher surface brightness that is eclipsed at primary minimum. The hazy O VI emissions and the complex absorption reversals in the H, He II lines are produced by detached material in the binary system.

Analysis of the light curve and colors indicates that component 1 ( $\tau = 0.74\odot$ ,  $R = 1.07\odot$ ,  $T = 44\,000^\circ$ ) lies very near its limiting Roche surface while component 2 ( $\tau = 2.8\odot$ ,  $R = 1.40\odot$ ,  $T = 22\,000^\circ$ ) lies well within its lobe.

At the time of a major outburst (II, above), the emission lines become very broad and strong, the fluorescent O III lines vanish, and the eclipses become very shallow. The colors change, but this is due entirely to the effect of the strengthened emission lines on the UBV color system. The observational data at the time of the outburst can be explained by the sudden ejection from component 1 of a semi-opaque shell of hot material that very quickly (the spectra indicate an expansion velocity of 400-500 km/sec) envelops the entire binary system. The small-scale fluctuations of V Sge near minimum can be interpreted as due to minor changes in the effective dimensions of the same star.

The estimated reddening of V Sge ( $E_{B-V} = +0.40$ ) leads to a distance of 2.75 kpc and a total  $M_V = -1.0$  outside eclipse, but in the absence of activity of type II. Complete details will be found in the paper cited, which should appear in early 1965.

It is clear that in the future, random or inaccurately timed observations of V Sge will be of little value. It is suggested that in particular those variable star associations having V Sge on their programs consider best how to meet the new requirements. We tabulate below revised magnitudes for the comparison star sequence of Mitchell (Pub. McCormick Obs. 6, 289, 1935) which has been used widely (for example by the AA VSO), and recommend that after 1 January 1965, all visual (or photographic) observers change to these new magnitudes, which have been measured photoelectrically by Smak, mainly with the 24-inch reflector. The "magn" identifications are those of Mitchell.

"Magn"	V	B-V	No. obsns.	"Magn"	V	B-V	No. obsns.
7.8	7.13	-0.02	1	11.0	10.92	+0.86	2
8.3	8.21	+0.81	2	11.0	10.95	+1.27	2
8.6	8.37	+1.03	1	11.5	11.69	+1.00	2
9.4	9.16	+1.71	1	12.4	12.31	+1.59	2
9.7	9.91	+0.22	1	12.4	12.60	+0.45	1
10.5	10.68	+0.24	Std	13.0	13.10	+1.34	1
10.8	10.68	+1.12	1	13.4	13.94	+1.13	1

Since the color of V Sge is never far from  $B-V = 0.0$ , it is suggested that the very red comparison stars be avoided. Observers should also note that there is a companion of mag. 14 at  $9''.7, 267^\circ$ .

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