COMMISSION 27 OF THE I.A.U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3350

Konkoly Observatory
Budapest
7 July 1989

HU ISSN 0374 - 0676

PHOTOELECTRIC PHOTOMETRY RESULTS OF THE ALGOL-TYPE ECLIPSING BINARY SYSTEM RS VULPECULAE

RS Vulpeculae is an Algol-type variable consisting of a middle to late B-type main sequence primary and a slightly larger secondary whose spectrum is difficult to measure (Payne-Gaposchkin and Gaposchkin, 1938). Previous investigators (Popper 1957, Hutchings and Hill 1971) have classified the the secondary as early as B9 to as late as G2. The secondary eclipse is slightly displaced toward primary eclipse (Dugan 1923a) and various relative orbital eccentricities have been reported, most of them near 0.05 (Plaskett 1922, Sahade and Struve 1945). Baglow's (1952) solutions of earlier light curves indicate the primary eclipse is an occultation, with mid-eclipse being only partial. Dugan (1923b) found the duration of the primary eclipse to be on the order of 15 hours out of the 4.5 day period.

The observations were made on 43 different nights from 1976 to 1981 using an uncooled 1P21 photometer, with standard BV filters, mated to the f/15 20-inch Cassegrain of the Lehigh Valley Astronomical Society, Allentown, PA. Variable readings were flanked by comparison star and sky readings. Once or twice a night readings were also taken of the check star. There were no transformations made to the standard system, so all results are instrumental. However, they closely match published values of visual magnitudes. The comparison and check stars used were HD 180889 and HD 180811, respectively. For the first nine nights HD 180811 was used as the comparison and HD 180889 was used as the check; data reduction methods took into account this switch.

In the plotted light curves the values of the deltas are in the sense of variable - comparison, taking into account differential extinction and color corrections. All sky and comparison readings were interpolated in the data reduction program written by the author. Heliocentric phase was computed using the epoch (Scarfe, 1973):

$$\text{J.D. Hel Min} = 24432808.257 + 4^{d}.477635E$$

The most obvious feature of the light curves is the large primary and shallow secondary amplitudes, indicating widely separated components based on current EA variable theory. In the visual light curve (Figure 1) the primary amplitude A1 is 0.97 magnitude, and the secondary A2 is 0.05 magnitude. These numbers are close to the A1 = 0.965 and A2 = 0.082 found by Dugan (1923a) but are slightly less than the A1 = 1.00 and A2 = 0.11 obtained by Keskin (1985). Primary and

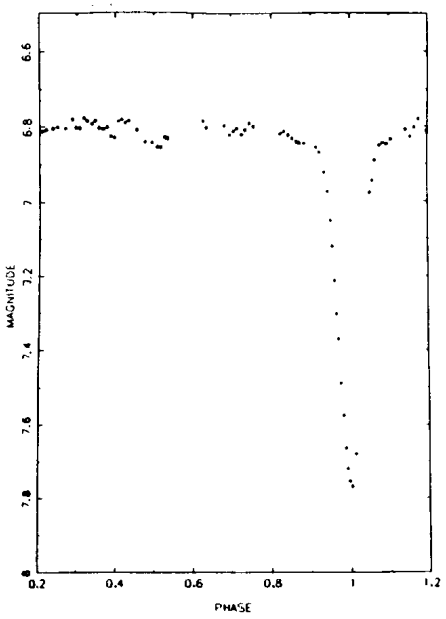

Figure 1 RS Vul visual

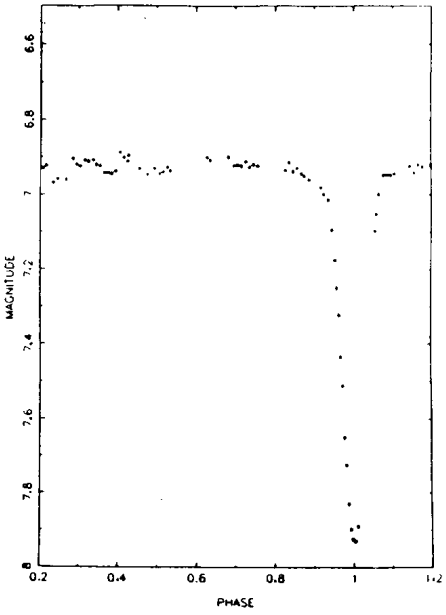

Figure 2 RS Vul blue

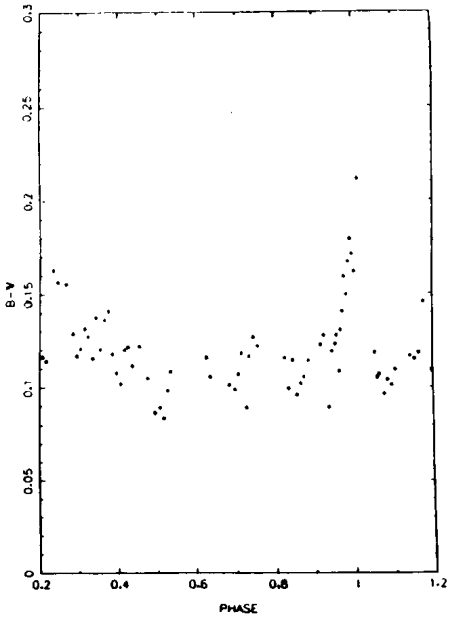

Figure 3 RS Vul color index

secondary amplitudes in blue light curve (Figure 2) were measured at A1 = 1.00 and A2 = 0.02 magnitude, again less than Keskin's values (A1 = 1.07, A2 = 0.10). In both cases, however, it can be seen that the blue primary amplitude is slightly greater than the visual primary amplitude.

The observed amplitudes are consistent with the B8 main sequence primary being the brighter component of the system as reported earlier (Dugan 1923b Lb = .804) and during primary eclipse most of its radiation being blocked off by the slightly larger subgiant secondary. This would indicate that primary eclipse is an occultation. Supporting this is the color index curve (Figure 3); leading up to primary eclipse (phase = 1.0) the color index becomes progressingly larger, indicating that the radiation from the hotter bluer star is being blocked by the secondary.

As seen from the visual curve the secondary is slightly displaced toward the primary by 0.01 in phase, or 1.0746 hours (0.045 days). This value is comparable to previous measurements of 0.03 to 0.04 days (Baglow 1952). The displaced secondary implies an elliptical orbit. The length of the primary eclipse seems to be slightly longer than 15 hours, in agreement with earlier measurements by Dugan. The rounded minimum implies a partial eclipse, suggesting a relatively highly inclined orbit. Previous estimates (Payne-Gaposchkin and Gaposchkin 1938, Baglow 1952) have inclinations of 78 and 79 degrees.

R. WASATONIC

Computer Sciences Corporation
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218
U.S.A.

REFERENCES

Baglow, R.L. 1952, Pub. David Dunlap II(1)
Dugan, R.S. 1923a, Pop Astr 31, 190
Dugan, R.S. 1923b, Pr. Cont, No. 6, 33
Hutchings, J.B. and Hill, G. 1971, Ap.J., 166, 382
Keskin, V. 1985, IVBS 2815
Payne-Gaposhkin, C. and Gaposchkin, S. 1938, Harvard Obs. Monographs, No. 5
Plaskett, J.S. 1922, Pub. Dominion Astrophysical Obs, Vol. 1, 141
Popper, D.M. 1957, Ap.J. Supp 29, Vol. III, 139
Sahade, J. and Struve, O. 1945, Ap.J., 102, 486(3)
Scarfe, C.D., et.al. 1973, IVBS 844