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PHOTOMETRIC OBSERVATIONS OF THE EXTREME MASS RATIO, HIGH CONTACT DWARF BINARY V902 SAGITTARII

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Ferwerda (1941, 1943) discovered V902 Sagittarii [V105, $a(2000) = 19^{\rm h}25^{\rm m}14\overset{\rm s}{.}155$, $d(2000) = -29°09'08\overset{''}{.}740$] in his study of faint variables near τ Sgr. An ephemeris ($P = 0\overset{\rm d}{.}2939444$), a finding chart, comparison stars and 28 times of minimum light are given in his paper. His photographic light curve gives evidence that V902 Sagittarii is a rare, high fill-out, small mass ratio, over contact binary. Ben (1943) suggested that V902 Sgr might be an RR Lyr type. Since this object appeared to be an interesting variable in need of further study, it was included as a target for our 1993 observing run at Cerro Tololo InterAmerican Observatory in Chile. Our present observations were taken with the 1.0-m Yale Reflector and a Ga-As PMT and standard filters on July 22-23, 1993, by RGS. Around 300 observations were taken in each pass band. Our I curves have higher scatter than the others. The comparison star (GSC 6888 991, RA(2000) = $19^{\rm h}24^{\rm m}33\overset{\rm s}{.}630$, DEC(2000) = $-29°12'10\overset{''}{.}30$) and the check star (GSC 6888 1052, RA(2000) = $19^{\rm h}24^{\rm m}36\overset{\rm s}{.}541$, DEC(2000) = $-29°12'22\overset{''}{.}06$) are shown in Figure 1 as COMP and CHK, with the variable, VAR. Kwee (1962), gave a photographic magnitude range of 14.4 to 14.78 for V902 Sgr.

Table 1: Time of Minimum Light, V902 Sagittarii

JD Hel. 2440000 +	Min	Cycles	$O-C$
9190.6293(2)	I	−3.5	−0.0018
9190.7797(15)	II	−3	0.0016
9191.6589(3)	I	0	−0.0010
9191.8081(10)	II	0.5	0.0011

Four mean epochs of minimum light were determined from two primary and secondary eclipses using the bisection of chords method. These precision epochs of minimum light are given in Table 1 along with their standard errors shown in parentheses. A linear ephemeris was calculated using our timings, Ferwerda's (1943) and one time from GCVS:

$$\text{J.D. Hel. Min I} = 2449191\overset{\rm d}{.}6599(84) + 0.29394574(17) \times E.$$

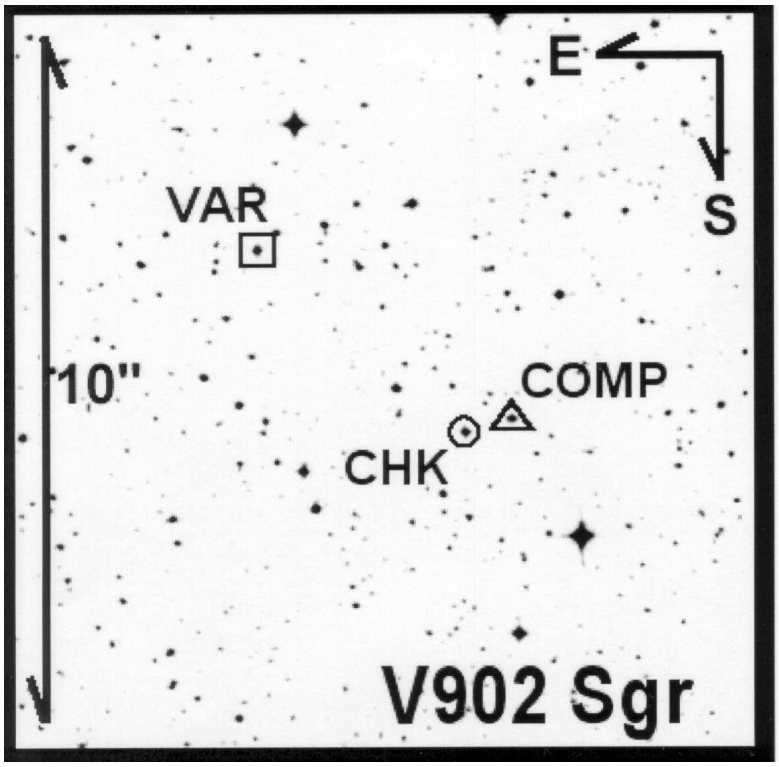

Figure 1. Finding chart of V902 Sgr, VAR, the comparison, COMP, and the check star, CHK

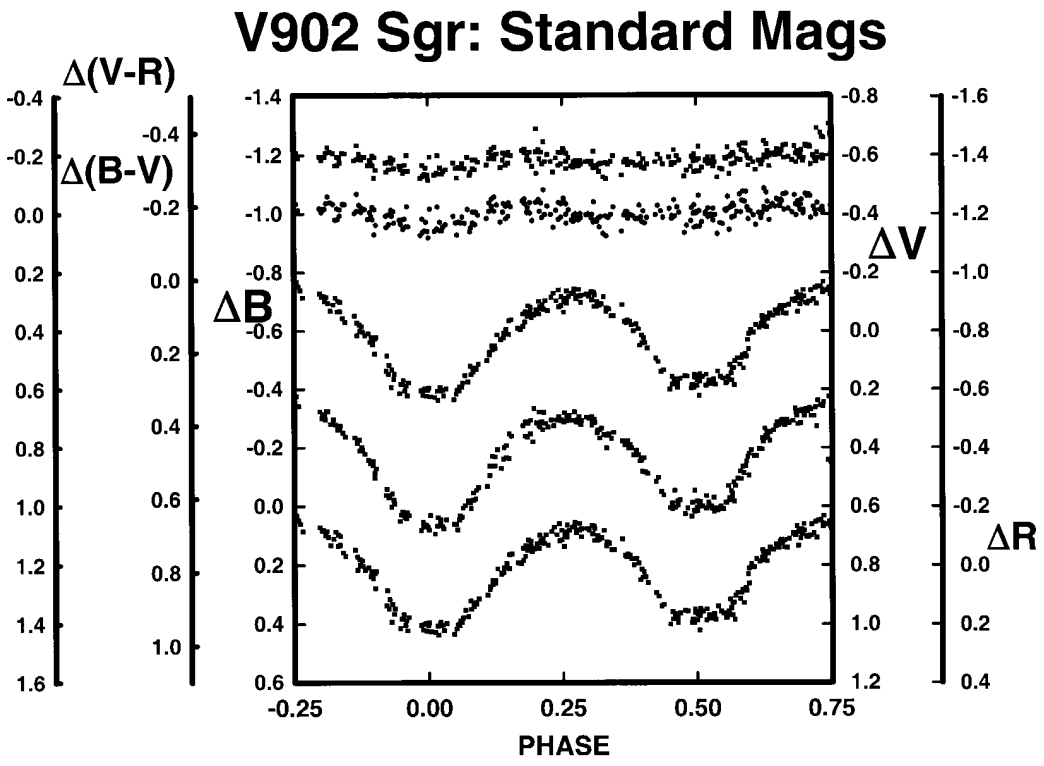

Figure 2. B, V, R standard magnitude light curves as defined by the individual observations

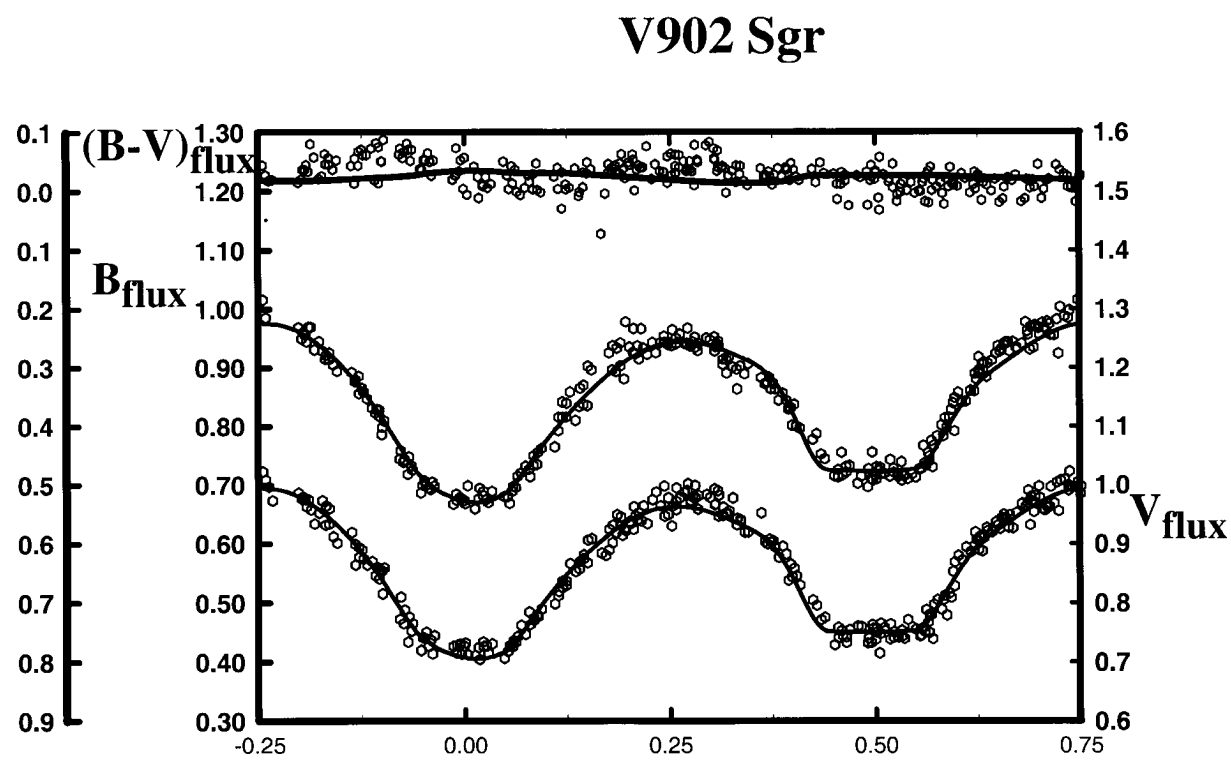

Figure 3. B, V, $B-V$ normalized flux light curves, and computed light curves for V902 Sgr

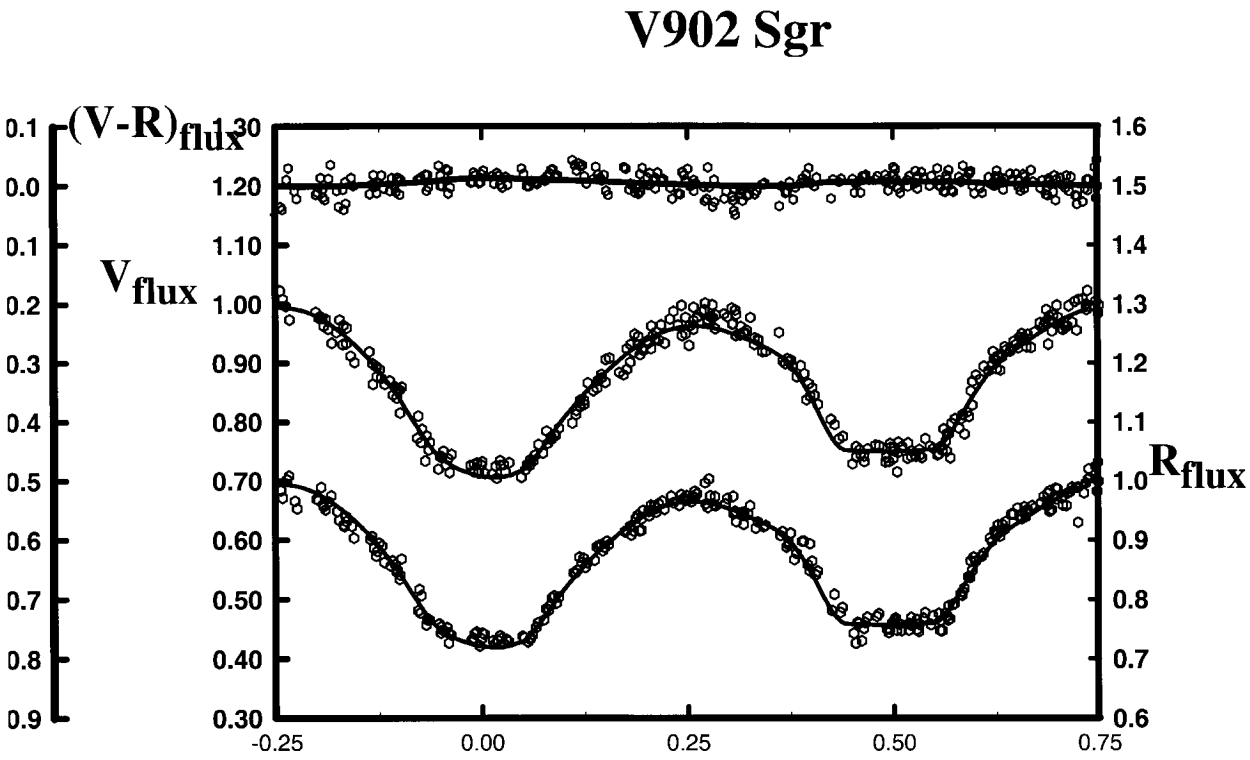

Figure 4. V, R, $V-R$ normalized flux light curves, and computed light curves for V902 Sgr

The standardized BVR_c magnitude light curves and the $B-V$ and the $V-R_c$ color curves of the variable are shown as Figure 2 as calculated from the differential magnitudes (VAR − COMP) versus phase. The probably errors of a single observation were $\sim 1\%$ in B, V, and R. The photometric spectral types of the dwarf comparison [$V = 13.95(2)$, $B-V = 0.85(2)$, $V-I_c = 0.88(3)$, $R_c-I_c = 0.41(2)$, $E(B-V) = 0.06$] and check stars [$V = 13.66(3)$, $B-V = 0.81(2)$, $V-I_c = 0.87(1)$, $R_c-I_c = 0.42(2)$] are K0 $\pm$ 0.3 and K0$\pm$1, respectively. The spectral type of the variable lies in the K4 to G4 range, averaging about G9V. The V magnitude range for the variable is 13.81(1)–14.18(2). These curves have been solved using the Wilson Code (Wilson 1994, 1990, Wilson & Devinney 1971). These yielded excellent fits to these asymmetric curves. The final parameters include $m_2/m_1 = 0.1199(3)$, fill-out 43(3)%, $T_2 - T_1 = 93(5)$ K. The curves were dominated by two spot regions, a hot spot on the secondary, less massive component, with a T factor of 1.186(6) and a radius of 30.8(6) degrees and a cool spot on the primary with a T factor of 0.927(1) and a radius of 28.0(2) degrees. The colatitudes were 129(1) and 104(1) degrees respectively. The solutions are shown in Figure 3 and 4 overlying the normalized flux curves. The early analysis of this binary was done as an undergraduate physics research project by SFC.

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ERRATUM FOR IBVS 5145

In IBVS 5145 the reference to the paper "Ben, A.J., 1943, *AN*, **11**, No. 3" is erroneous. The correct reference is:

P. Guthnick, H. Schneller, 1944, *Astronomische Abhandlungen (Ergänzungshefte zu den Astronomischen Nachrichten)*, **11**, 3.

The Editors