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V802 AQUILAE: A DWARF AW UMa-TYPE BINARY SYSTEM

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In a recent IBVS note, Van Cauteren's (2001) presented crucial, but unfiltered light curves of V802 Aql [GSC 5119 948, $\alpha(2000) = 18^{\rm h}58^{\rm m}54\overset{\rm s}{.}8$, $\delta(2000) = -03^\circ01'11\overset{''}{.}5$]. They show a shallow eclipse curve with an amplitude of only 0.35 mags, yet there was a total eclipse of long duration (0.1 phases). These characteristics reveal an extreme mass ratio system in a state of over contact like AW UMa and V902 Sgr. Such binaries may be in their final phases of coalescence into a single FK Comae/Blue Straggler-type stars. Also V802 Aql has a period of only $0\overset{\rm d}{.}2677$, making it the smallest of this rare group of binaries. Consequently, we included it as an important target on our observing run at CTIO in Chili. Our B,V,R,I light curves were taken at using a 0.9-m reflector with the CFIM T2K CCD camera (quad mode) and standard $UBVR_cI_c$ filters. The observations were taken by RGS and DRF on 6,7 and 9 June 2002; 130 in B, 160 in V, 147 in Rc, and 148 in Ic in the Johnson-Cousins system.

The stars GSC 5119 964 ($\alpha(2000) = 18^{\rm h}58^{\rm m}55\overset{\rm s}{.}0$, $\delta(2000) = -03^\circ02'52''$) and GSC 5119 358 ($\alpha(2000) = 18^{\rm h}58^{\rm m}45\overset{\rm s}{.}9$, $\delta(2000) = -03^\circ04'25''$) were used as comparison and check stars, respectively. A finding chart of V802 Aql (V), the comparison (C) and check star (K) are given in Figure 1. The light curves and color curves of the variable are given in Figure 2 as normalized flux versus phase. In addition to the characteristics mentioned above, our curves display a depressed primary maxima, (0.06 mag in B), suggesting the presence of heavy spot activity which would drive the coalescence via magnetic breaking.

Three mean epochs of minimum light were determined from U,B,V,R,I eclipse timing using parabola fits:

HJD MIN I =2452432.7562±0.0002
HJD MIN II=2452431.8216±0.00081
=2452434.8976±0.0011

We calculated the following linear ephemeris from our observations:

$$\text{HJD Tmin I} = 2452432.7571(2) + 0.267532 \pm 0.000042 \text{ d} \times \text{E}, \quad (1)$$

A linear fit to all available timings of minimum light gave:

$$\text{HJD Tmin I} = 2452432.7570(4) + 0.26769479 \pm 0.00000011 \text{ d} \times \text{E} \quad (2)$$

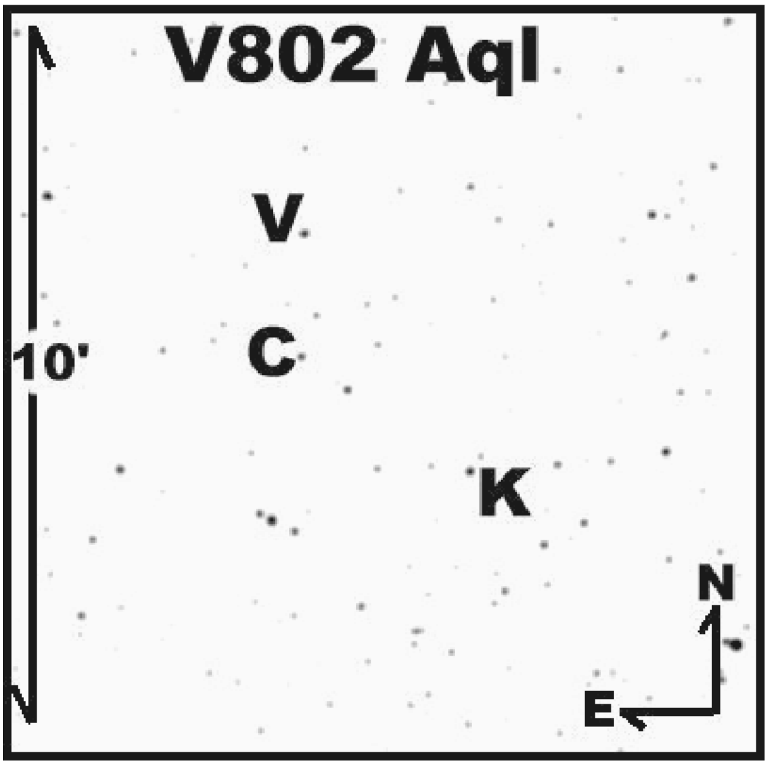

Figure 1.

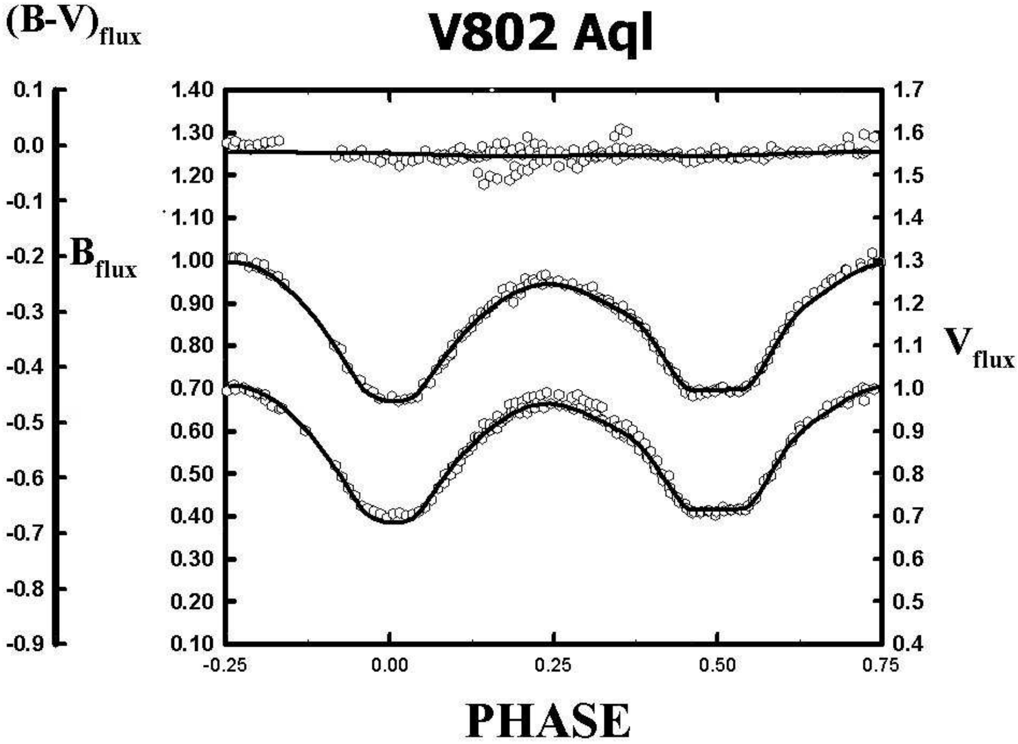

Figure 2.

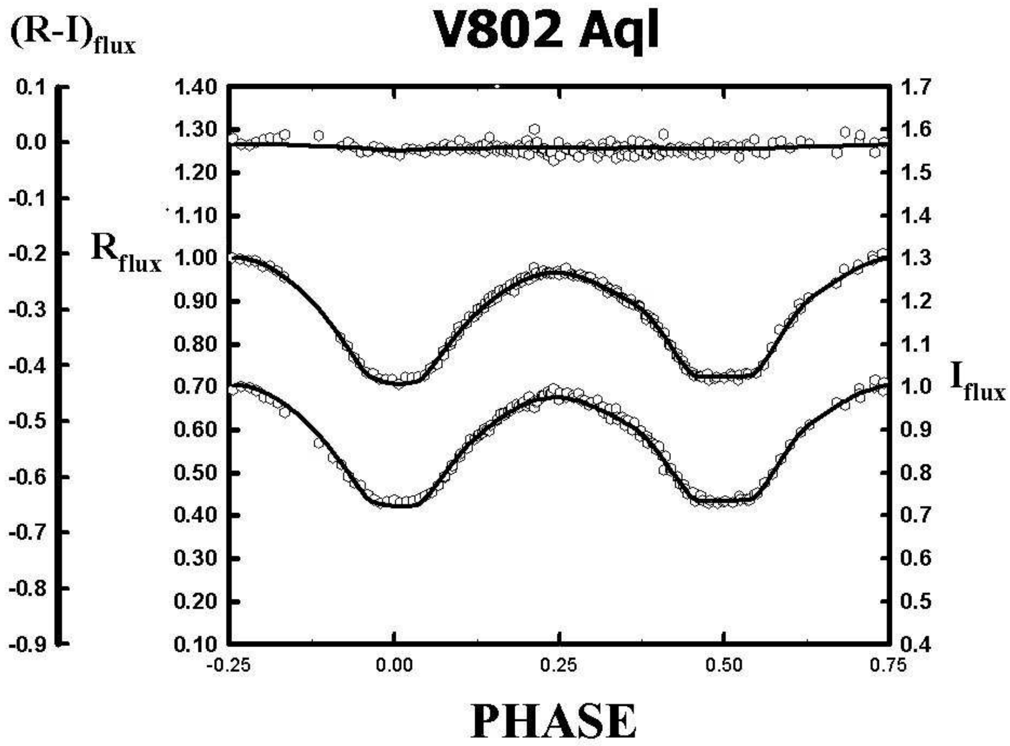

Figure 3.

Equation 1. is not consistent with Equation 2. and may indicate that the period is decreasing. This is the expected scenario, since the period should decrease as the mass ratio becomes more extreme.

Photometric spectral types have been determined from standard star observations on the June 9 2002. V802 Aql is of K0 to K2V type, its comparison star is G8 to G9V type ($V = 12.645 \pm 0.008$, $B - V = 0.762 \pm 0.006$) and the check star is G9 to K2V type ($V = 13.418 \pm 0.006$, $B - V = 0.842 \pm 0.007$). The V and $B - V$ magnitudes for the variable was 12.547 ± 0.003 and 0.810 ± 0.004 at phase 0.25 and 12.860 ± 0.004, and 0.827 ± 0.004 at phase 0.5, respectively. From this we fixed the surface temperature of the more massive component in light curve synthesis to be 5000 K.

Our preliminary Binary Maker 2.0 (Bradstreet, 1992) fits gave a mass ratio of 0.16. The results of the modeling provided input parameters for a complete simultaneous 5 color synthetic light curve solutions with the Wilson Code (Wilson & Devinney, 1971; Wilson, 1990, 1994). Our curves have not been transformed to the standard system but experience has shown that this introduces only minor changes in the models. Our results include a secondary temperature of 5120 K making the system, surprisingly, of W-type. The Roche-lobe fill-out was 30% and the mass ratio was 0.1608 ± 0.0002. The spotted region had a colatitude of 67°, a longitude of 281°, a spot radius of 20° and a temperature factor of 0.918. The spot was modelled on the more massive component. Our solution is shown overlaying the data in Figure 1. A geometrical representation of V802 Aql is given in Figure 3.

We would expect that the period is undergoing a constant decrease and the mass ratio is becoming more extreme. Plate archival searches and future monitoring of this system are needed to confirm the behavior of the system's orbital period.

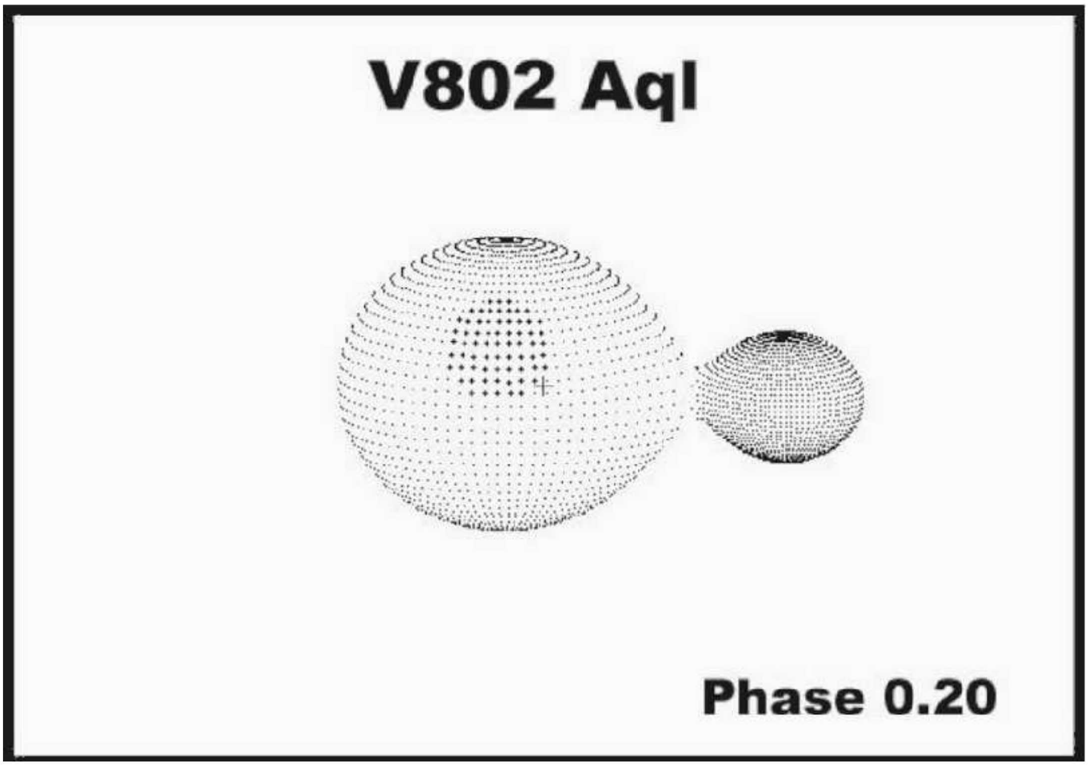

Figure 4.

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References:

Bradstreet, D. H., 1992, *BAAS*, **24**, 1125
Van Cauteren, P. and Wils, P., 2001, *IBVS*, 5057
Wilson, R. E., & Devinney, E. J. 1971, *ApJ*, **166**, 605
Wilson, R. E., 1990, *ApJ*, **356**, 613
Wilson, R. E., 1994, *PASP*, **106**, 921