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# BVR PHOTOMETRY OF THE SHORT-PERIOD ALGOL SYSTEM VV UMa

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We present new $B$, $V$, $R$ light curves solutions of VV UMa. This Algol short-period binary was our main target in a number of different observing runs performed between January 1997 to March 2000. The observations were carried out with the 80-cm telescope at the Observatorio del Teide (Canary Islands, Spain). The telescope is equipped with a Thomson $1024 \times 1024$ CCD and broad band $B$, $V$ and $R$ Johnson filters (see Table 1). The CCD field is $7' \times 7'$. For comparison the brightest star in close proximity to VV UMa was used. The star is not catalogued and it is located about $1\farcm5$ south and $2'$ east of VV UMa (Figure 1). The data reduction was performed using the *IRAF*[1] photometry package. The estimated errors of the photometry are less than $0\overset{\mathrm{m}}{.}01$. The orbital phases were calculated using the ephemeris given by Šimon (1996), namely, HJD $= 2445006.2873 + 0\overset{\mathrm{d}}{.}68735545 \times E$.

Table 1: Observing run

| Observation date | Observed filters |
|---|---|
| 25–26 March 1997 | $B$, $V$, $R$ |
| 28–29 January 1999 | $B$, $V$, $R$ |
| 29–30 January 1999 | $B$, $V$, $R$ |
| 1–2 February 1999 | $B$, $V$, $R$ |
| 5–6 March 1999 | $B$, $V$ |
| 6–7 March 1999 | $B$, $V$ |
| 19–20 December 1999 | $B$, $V$, $R$ |
| 20–21 December 1999 | $B$, $V$, $R$ |
| 21–22 December 1999 | $V$, $R$ |
| 28–29 February 2000 | $V$ |
| 29 February–1 March 2000 | $V$ |
| 16–17 March 2000 | V |

[1]IRAF is distributed by the National Optical Astronomy Observatories

**Figure 1.** Identification chart ($7' \times 7'$) of VV UMa, in the center, with North up and East to the left. The comparison star is the brightest in the lower left quarter of the field

As far as we know only two sets of photometric broad band $U$, $B$ and $V$ light curves have been published by Wilson (1965) and Broglia & Conconi (1977). They give light curves solutions using different codes. Later these light curves were also analysed by Pustylnik (1969), Horak (1966) and Rafert (1990). We have analyzed our new light curves using the code *ILOT* based on the Limit Optimization Technique (Budding & Zeilik 1987). The $V$ light curves observed in the years 1997+1999 and 2000 were analyzed individually in order to avoid the intrinsic variability. Different sets of initial values, taken from previously published determinations, were used in different fits for each individual light curve. The temperatures were always fixed parameters adopting $T_1 = 9200$ K and $T_2 = 5500$ K. The limb-darkening coefficients were taken from the Claret et al. (1995) and Díaz-Cordovés et al. (1995) determinations.

As Figure 2 shows the models together with the observations and Table 2 lists the physical parameters yielded by the best fits. The analysis of *uvby* Strömgren light curves with *ILOT* suggested two possible solutions: $k = r_2/r_1 \approx 0.70$ and $i \approx 84^\circ$ or $k = r_2/r_1 \approx 0.82$ and $i \approx 80^\circ$, while the fits with a new code, *BINAROCHE*, yielded $i \approx 80^\circ$–$81^\circ$ (Lázaro et al. 2001). From our $B$, $V$ and $R$ light curves analysis with *ILOT* it seems that both solutions are possible, but the results of the Strömgren light curves with *BINAROCHE* suggest that the lower value of inclination angle is preferred.

Table 2: *ILOT* light curve solutions

| | 1997+1999 $B$ filter | 1997+1999 $V$ filter | 1997+1999 $R$ filter | 2000 $V$ filter |
|---|---|---|---|---|
| $L_1$ | $0.962 \pm 0.002$ | $0.958 \pm 0.002$ | $0.909 \pm 0.002$ | $0.936 \pm 0.002$ |
| $L_2$ | $0.037 \pm 0.002$ | $0.041 \pm 0.002$ | $0.091 \pm 0.002$ | $0.063 \pm 0.002$ |
| $r_1$ | $0.346 \pm 0.001$ | $0.355 \pm 0.001$ | $0.355 \pm 0.001$ | $0.352 \pm 0.001$ |
| $r_2$ | $0.269 \pm 0.001$ | $0.277 \pm 0.001$ | $0.284 \pm 0.001$ | $0.279 \pm 0.001$ |
| $k$ | 0.78 | 0.78 | 0.80 | 0.80 |
| $i$ | $81° \pm 0\overset{\circ}{.}1$ | $80° \pm 0\overset{\circ}{.}1$ | $79° \pm 0\overset{\circ}{.}1$ | $80° \pm 0\overset{\circ}{.}1$ |
| $\chi^2$ | 370 | 110 | 150 | 400 |
| $\varepsilon$ | 0.01 | 0.01 | 0.01 | 0.01 |
| N. points | 320 | 400 | 340 | 701 |

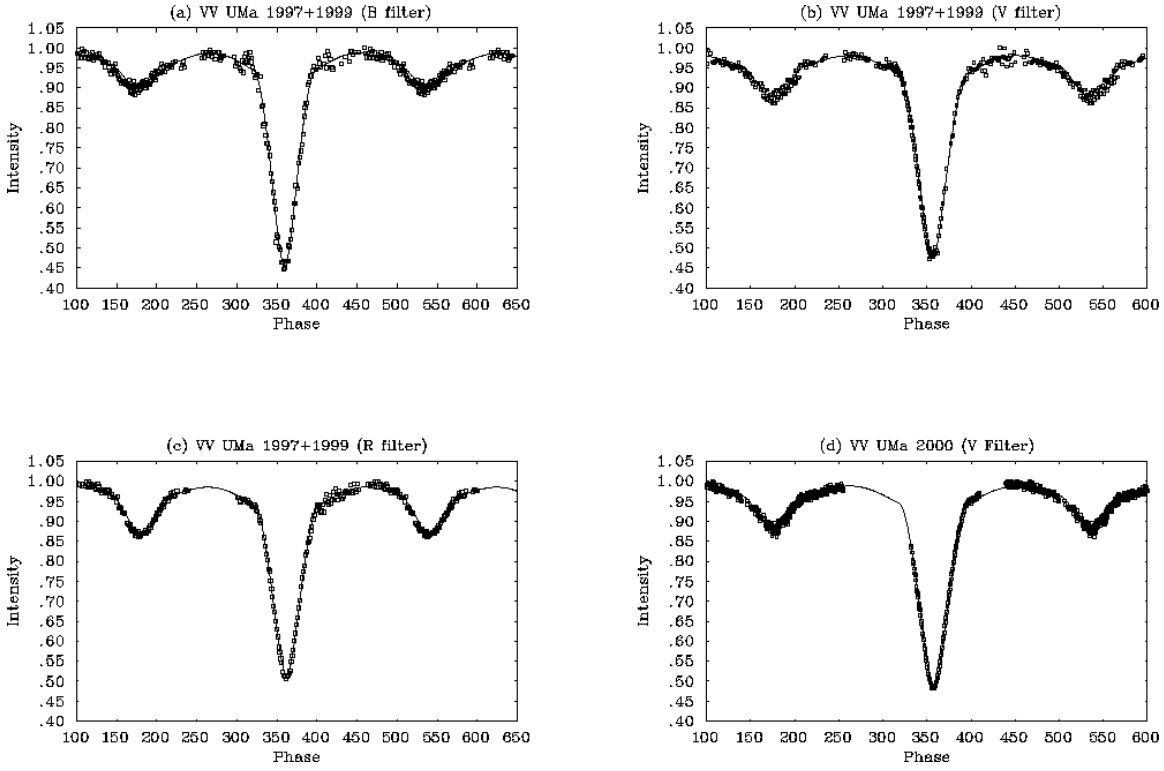


**Figure 2.** Observed light curves and the fits obtained with *ILOT*

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