# COMMISSIONS 27 AND 42 OF THE IAU INFORMATION BULLETIN ON VARIABLE STARS 

# V842 Her: A W UMa STAR WITH CONSTANT PERIOD 

CSIZMADIA, SZ.<br>Konkoly Observatory of the Hungarian Academy of Sciences, H-1525 Budapest, P.O. Box 67, Hungary, e-mail: csizmadia@konkoly.hu

The poorly-studied variable star V842 Herculis $=\mathrm{BD}+50^{\circ} 2255=$ NSV $7457=$ BV 103 is a late-type contact binary system showing remarkable spot activity (Vandenbroere, 1993, Torres \& Melendo, 1996). The light-curve shows the so-called O'Connell-effect (the heights of the two maxima differ from each other, $\Delta V=V_{M a x I I}-V_{M a x I}$ ). Its rate is variable: Vandenbroere (1993) and Torres \& Melendo (1996) found $\Delta V=0{ }^{\mathrm{m}} 1$ and $\Delta V=0^{\mathrm{m}} 03$ magnitudes, respectively. The light curve has been analysed by Torres \& Melendo (1996). The radial velocity curve has been constructed by Rucinski \& Lu (1999).

According to Filatov (1960) the star was an RR Lyr variable but Vandenbroere (1993) has clearly showed that the object was a W UMa star. Vandenbroere (1993) also reviewed the history of the star by 1993, and suspected a period increase. Filatov (1960) published several moments of maxima and based on these moments Vandenbroere (1993) found the following ephemeris

$$
\begin{equation*}
\operatorname{Max}=\text { HJD } 2430850.002+0^{d} 4190076 \times E \tag{1}
\end{equation*}
$$

valid for 1943-1959. For the early 1990s Vandenbroere (1993) obtained the following ephemeris from her own new observations:

$$
\begin{equation*}
\operatorname{Min}=\text { HJD } 2447643.1786+0.4190306 \times E \tag{2}
\end{equation*}
$$

This period is longer by almost 2 seconds than that of given by Eq. (1).
Later, Torres \& Melendo (1996) published a different ephemeris based on their 1996 observations:

$$
\begin{equation*}
\text { Min }=\text { HJD } 2450177.4767+0.41906 \times E \tag{3}
\end{equation*}
$$

which period is again longer than the previously mentioned ones.
Since these values suggest about $30 \mathrm{sec} /$ century period variation we decided to observe the system. Note that the highest rates of similar long term period increases in W UMa stars are 2.7 seconds/century for V839 Oph (Wolf et al., 1996), 3.1 seconds/century for UZ Leo (Hegedüs \& Jäger, 1992) and 5.3 seconds/century for XY Boo (Molík \& Wolf, 1998).

V842 Herculis was observed on four nights in April and May, 2000 with the 60/90/180 cm Schmidt-telescope of Konkoly Observatory. The detector is described in Bakos (1998). The CCD-frames were corrected for cosmic-ray events, and they were bias-subtracted and flat-fielded. Individual instrumental magnitudes were determined by the IRAF/DAOPHOT
package. The following stars were used as comparison stars: GSC 3497-31, 3497-51, 3497239, 3497-346 and 3497-349. The data can be requested from the author.

List of the available minima (visual and CCD ones) and the corresponding $O-C$ values are found in Table 1.

In two cases we had to change the type of minima from primary to secondary or vice versa, because the published types seemed to be wrong. The period was constant between JD 2490000 and JD 2452 000. New ephemeris was determined based on CCD/PE minima tabulated in Table 1:

$$
\begin{equation*}
\operatorname{Min} \mathrm{I}=\text { HJD } 2450177.48(16)+0.419037(9) \times E \tag{4}
\end{equation*}
$$

and the corresponding residuals are listed in Table 1 as $O-C_{1}$. Note that the period remains the same when all minima are taken into account. Since period variation was suspected, a parabolic ephemeris was also computed using CCD/PE minima:

$$
\begin{equation*}
\operatorname{Min} \mathrm{I}=\operatorname{HJD} 2450177.48(02)+0.419035(8) \times E+1.047 \cdot 10^{-9} \times E^{2} \tag{5}
\end{equation*}
$$

The corresponding residuals are listed in Table 1 as $O-C_{2}$. This ephemeris would yield a rate of period variation of $\sim 8 \mathrm{sec} /$ century.

In the following analysis only the CCD/PE minima were used. The sum of squares of residuals is $5.7 \cdot 10^{-4} d^{2}$ and $4.1 \cdot 10^{-4} d^{2}$ for the linear and the parabolic ephemeris, respectively. In the case of the parabolic representation, one can estimate the period to be 0.4190206 at the time of Filatov's observations (see above). Thus, there is a 1 second discrepancy between this estimation and the period determined by Vandenbroere (1993) for that time.

Taken into account this, and the fact that the sums of squares of residuals are not significantly different for linear and parabolic approximations, we can state that the period of V842 Her has been constant in the last decade. However, sudden period change or changes in the past cannot be excluded. To solve the question of the period variation of this rather bright system further accurate CCD observations are needed.


Figure 1. O-C diagram of V842 Herculis. Squares and crosses are denoting CCD and visual minima, respectively. Dotted line: linear ephemeris (Eq. (4)), solid line: parabolic ephemeris (Eq. (5)).


Figure 2. Differential R light curve of V842 Her.

Acknowledgements. I thank Mrs J. Vandenbroere, Mr J.N. Torres, Mr E. G. Melendo for sending their data to me. This work was supported by the OTKA Grant T034551.

## References:

Agerer, F., Huebscher, J. 1997, IBVS, No. 4472
Agerer, F., Huebscher, J. 1998, IBVS, No. 4562
Bakos, G. A., 1998, Occasional Technical Notes of Konkoly Observatory, 11 available via the Internet: http://www.konkoly.hu/Mitteilungen/Mitteilungen.html
Diethelm, R., 1994, IBVS, No. 4011
Filatov, G.S., 1960, Astr. Circular, No. 215
Hegedüs T., Jäger Z., 1992, PASP 104, 733
Melendo, E. G., Torres, J. N., 2000, private communication
Molík, P., Wolf, M., 1998, IBVS, No. 4640
Rucinski, S. M., Lu, W., 1999, AJ, 118, 2451
Torres, J. N., Melendo, E. G., 1996, IBVS, No. 4365
Vandenbroere, J., 1993, IBVS, No. 3946
Vandenbroere, J., 2000, private communication
Wolf, M., Ŝarounová L., Molík P., 1996, IBVS, No. 4304

Table 1: List of minima of V842 Herculis

| Min $_{\text {HJD }}-$ <br> -2400000 | E | Type <br> of obs. | Error | $O-C_{1}$ | $O-C_{2}$ | Reference |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 49074.600 | -2632 | vis | 0.004 | +0.026 | +0.015 | BBSAG 105 |
| 49075.430 | -2630 | vis | 0.002 | +0.018 | +0.007 | $"$ |
| 49076.459 | -2627.5 | vis | 0.003 | -0.001 | -0.012 | $"$ |
| 49124.459 | -2513 | vis | 0.001 | +0.020 | +0.009 | $"$ |
| 49124.65948 | -2512.5 | PE | 0.00012 | +0.0106 | +0.0001 | Diethelm, 1994 |
| $49205.367^{*}$ | -2320 | vis | 0.006 | +0.053 | +0.044 | BBSAG 105 |
| 49237.375 | -2243.5 | vis | 0.005 | +0.005 | -0.004 | $"$ |
| 49296.265 | -2103 | vis | 0.003 | +0.020 | +0.013 | BBSAG 107 |
| 49780.662 | -947 | vis | 0.002 | +0.009 | +0.008 | BBSAG 110 |
| 49799.508 | -902 | vis | 0.004 | -0.001 | -0.003 | $"$ |
| 4999.4182 | -592 | CCD | 0.0012 | +0.007 | +0.009 | BBSAG 109 |
| 50144.3803 | -79 | CCD |  | +0.0027 | +0.0039 | Agerer \& Huebscher, 1997 |
| 50144.5898 | -78.5 | CCD |  | +0.0027 | +0.0039 | $"$ |
| 50151.5038 | -62 | CCD |  | +0.0025 | +0.0038 | $"$ |
| 50171.6089 | -14 | CCD | 0.0002 | -0.0062 | -0.0048 | Melendo \& Torres, 2000 |
| 50177.4766 | 0 | CCD | 0.0004 | -0.0050 | -0.0036 | $"$ |
| 50178.5247 | 2.5 | CCD | 0.0004 | -0.0045 | -0.0031 | $"$ |
| 50200.535 | 55 | vis | 0.003 | +0.006 | +0.008 | BBSAG 115 |
| 50207.4404 | 71.5 | CCD | 0.0004 | -0.0024 | -0.0009 | Melendo, 2000 |
| 50228.5892 | 122 | CCD | 0.0027 | -0.0150 | -0.0134 | $"$ |
| 50516.4872 | 809 | CCD | 0.0005 | +0.0039 | +0.0064 | Agerer \& Huebscher, 1998 |
| 50538.486 | 861.5 | vis | 0.006 | +0.003 | +0.006 | BBSAG 115 |
| 50541.4204 | 868.5 | CCD | 0.0010 | -0.0044 | +0.0068 | Agerer \& Huebscher, 1998 |
| 50556.499 | 904.5 | vis | 0.002 | -0.002 | +0.0001 | BBSAG 116 |
| 51030.441 | 2035.5 | vis | 0.005 | +0.008 | +0.009 | BBSAG 121 |
| $51327.534 *$ | 2744.5 | vis | 0.004 | +0.003 | +0.002 | $"$ |
| 51425.388 | 2978 | vis | 0.003 | +0.012 | +0.001 | $"$ |
| 51430.412 | 2990 | vis | 0.004 | +0.007 | +0.005 | $"$ |
| 51664.4431 | 3548.5 | CCD | 0.0002 | +0.0054 | +0.0012 | this paper |
| 51668.4211 | 3558 | CCD | 0.0006 | +0.0026 | -0.0017 | $"$ |
| 51722.475 | 3687 | vis | 0.003 | +0.001 | -0.004 | Vandenbroere, 2000 |

Abbreviations: vis: visual, PE: photoelectric
Asterisk means that published type of minimum was changed.

