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V380 CYGNI - REQUEST FOR NEW OBSERVATIONS

ROMAN, R.[1]; ROMAN, S. A.[2]

[1] Astronomical Observatory, Cluj-Napoca, Romania. e-mail: rroman@math.ubbcluj.ro

[2] Northeastern University, Boston, MA, USA. e-mail: roman.s@neu.edu

The eclipsing binary system V380 Cygni is considered as having a long periodic apsidal motion. Semeniuk (1968) and Battistini et al. (1974) have determined U=2019 and U=1470 years, respectively, for the apsidal period. Therefore, in this case a sudden change in the longitude of periastron, ω, must be postulated. In the last time, Guinan et al. (2000), based on ,,a linear fit to observed time differences between primary and secondary minima" have reconsidered the apsidal motion for V380 Cygni, their result being U=1490 years. Nevertheless, nothing is said about an eventual variation of the apsidal motion. Consequently, before we can draw some important conclusions concerning the predictions of an independent test for stellar models, we have to re-examine the corresponding result.

Now we consider that a combination of the photometric and spectroscopic observations could help us with a greater number of observed values for the longitude of periastron, ω. With this in mind we performed the following two tables, where the epoch E is referring to the linear formula:

$$Min.hel.\ I = J.D.2441255.973 + 12\overset{\text{d}}{.}425612 \times E.$$

Table 1: Photometric observations

T_{II}-T_I	E	ω	w	References
$5\overset{\text{d}}{.}381 \pm 0\overset{\text{d}}{.}008$	-1422	$117^\circ \pm 2\overset{\circ}{.}9$	3.4	Guinan et al. (2000), p. 417
$5\overset{\text{d}}{.}199 \pm 0\overset{\text{d}}{.}0115$	-240	$124^\circ \pm 4\overset{\circ}{.}1$	2.4	Guinan et al. (2000), p. 417
$5\overset{\text{d}}{.}079 \pm 0\overset{\text{d}}{.}0035$	0	$129^\circ \pm 1\overset{\circ}{.}26$	7.9	Guinan et al. (2000), p. 417
$5\overset{\text{d}}{.}004 \pm 0\overset{\text{d}}{.}010$	+204	$133^\circ \pm 3\overset{\circ}{.}6$	2.8	Guinan et al. (2000), p. 417
$4\overset{\text{d}}{.}995 \pm 0\overset{\text{d}}{.}005$	+506	$133^\circ \pm 1\overset{\circ}{.}8$	5.6	Guinan et al. (2000), p. 417
$4\overset{\text{d}}{.}908 \pm 0\overset{\text{d}}{.}005$	+706	$138^\circ \pm 1\overset{\circ}{.}8$	5.6	Guinan et al. (2000), p. 417

In order to obtain the values of ω from the difference $T_{II} - T_I$ we have used Eq.(6) from Todoran (1972). We have adopted the following ,,constant" orbital parameters: $e = 0.22$, $i = 82^\circ 24'$, $P = 12\overset{\text{d}}{.}4257$.

Table 2: Spectroscopic observations

E	ω	w	References
−1740	115°.8 –	0	Batten, (1962), p. 100
−1680	121° ± 3°.0	3.33	Popper and Guinan, (1998), p. 573
−1524	120°.1 ± 2°.0	5.0	Batten, (1962), p. 103
−1524	116 –	0	Popper, (1949), p. 105
−1333	118°.5 ± 3°.3	3	Batten, (1962), p. 103
−737	118° ± 9°.0	1.1	Popper and Guinan, (1998), p. 573
−732	118° ± 6°.0	1.7	Batten, (1962), p. 100
−306	127°.2 ± 2°.1	4.8	Batten, (1962), p. 100
−306	129°.0 ± 3°.8	2.6	Popper and Guinan, (1998), p. 573
+663	133°.2 ± 3°.2	3	Popper and Guinan, (1998), p. 573

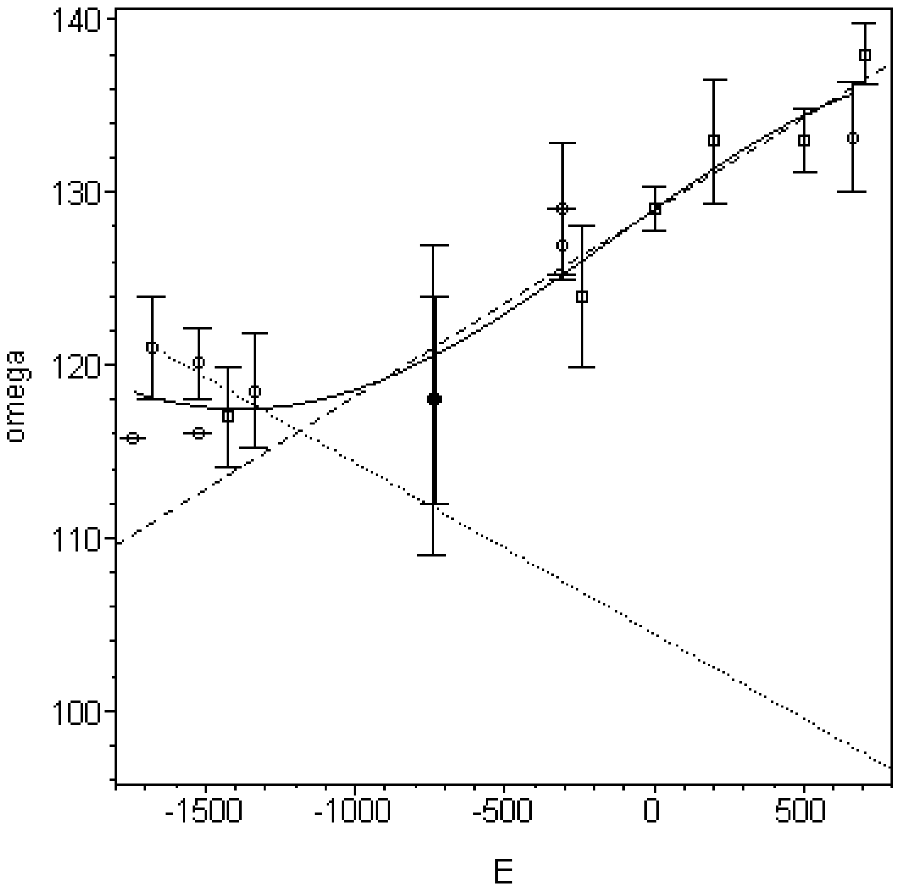

Figure 1. The nonlinear dependence $\omega = f(E)$. With squares are represented the photometric observations and with circles the spectroscopic observations.

The function $\omega = f(E)$ is illustrated in Figure 1.

Here we can put in evidence the following three possible situations:

a) We can divide the points into two series: for $-1740 \leq E \leq -1333$, and $-737 \leq E \leq 706$. Then the functions:

$$(i) \quad \omega = 104.473 - 0.009880 \times E$$

$$(ii) \quad \omega = 128.927 + 0.010751 \times E$$

obtained with the least squares method, are fitted well the points. These lines are represented in Figure 1 by dot-line and dash-dot-line. But, in such a case, a sudden change in the function $\omega = \omega(E)$ must be postulated, even if the corresponding reason, nowadays, cannot be interpreted.

b) If we accept a periodic function for $\omega = \omega(E)$, the existence of a third body could be assumed and the corresponding perturbations could be investigated. But for such a distinguished problem, we must be sure of the existence of the corresponding periodicity. In Figure 1 the curve:

$$\omega = 9.773 \times sin(0.001256 \times E) + 1.644 \times cos(0.001256 \times E) + 127.355$$

obtained with the least squares method, is used to fit all the points (the solid curve).

c) If the first series of observations ($-1740 \leq E \leq -1333$) is ignored, then, from the second series of observations ($-737 \leq E \leq 706$) it would be possible to determine an apsidal period, but, even in such a case, we must be sure that the relationship (ii) remains also valuable even if $E > 706$. In addition, we do not have a well-founded reason to ignore the first series of observations.

Therefore, in our days, it is very difficult to speak about a habitual apsidal motion in the binary system V380 Cygni. This is why we are considering that, very likely, a new series of observations could help us to solve such an ambiguous problem.

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