SPECTROSCOPIC ORBIT OF THE ECLIPSING SYMBIOTIC STAR CH Cyg

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Mikołajewski et al.(1987) quoted convincing arguments that CH Cygni is eclipsing binary system:

1. Photometric minima in U light were separated by 5700÷5780 days which is very close to the spectroscopic period (P=5750±250d) found by Yamashita and Maehara (1979).
2. Variations of Hβ and Hγ profiles during both minima can be succesfully interpreted as an eclipse of a rotating disk or envelope from which these profiles originate (see also Fernie et al., 1986).
3. The flickering activity was absent during the 1985 minimum while observed before and after the minimum.
4. Only forbidden lines were unaffected by the minimum.

Recently, additional arguments for the eclipsing nature of CH Cygni have been found:

5. Deep minimum in the IUE integrated flux was coincided with the minimum detected in U light (Mikołajewska et al., 1987a).
6. Changes of Balmer decrement and Balmer continuum emission measure suggest a presence of relatively small dense region occulted during the minimum and extended low density region coinciding with the radio jets (Mikołajewska et al., 1987b).
7. Radial velocity of the jet spatially resolved by Solf (1987) in the [OIII]5007 line suggests the jet is practically perpendicular to the line of sight.

Yamashita and Maehara (1979) basing on 54 radial velocity measurements for the M giant found the first solution for spectroscopic orbit (line 1 in Table 1). Mikołajewski et al.(1987) estimated preliminary orbital elements taking into account eclipses. Simultaneously, they showed that radial velocities of the "shell" absorption lines of ionized metals roughly reflect the orbital motion of the hot component. However, strong variability of these lines as well as the fact that they could be observed only during the active phase led to a formal solution for the orbit inconsistent with the eclipses. Therefore, in present study, we have determined the accurate orbit only for the M giant basing on 170 available data points (Fig.1). The mean velocity curve was analyzed by the method of Lehmann-Filhes. The orbital elements thus obtained, adopting the period P=5700 days, give the time of eclipse

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only 60 days (!) later than observed (table line 2) and strongly argue for the eclipsing nature of CH Cygni. Taking into account observed time of eclipse (T_{ecl}=JD2446275) and adopting P=5700d we have calculated in each iteration ω from Kepler´s equation basing on the remaining elements which have been obtained in the standard way. Such procedure is strongly convergent and gives orbital elements with significantly improved accuracy consistent with the observed eclipses (table line 3, Fig.1).

Table 1. Orbital elements derived for the M giant in CH Cygni.

	N_o	P [d]	V_o [km/s]	K [km/s]	e	ω [°]	T_o [JD]	Δ
1	54	5750±250	-58.4±0.3	6.8±0.5	0.29±0.07	201±15	2445773±250	+146
2	170	5700	-57.7±0.3	4.9±0.5	0.48±0.08	136±12	2445032±129	- 60
3	170	5700	-57.7±0.3	4.9±0.5	0.47±0.07	142± 5	2445086± 55	0

here: $\Delta = T_{ecl}(obs) - T_{ecl}(calc)$; N_o- number of observations

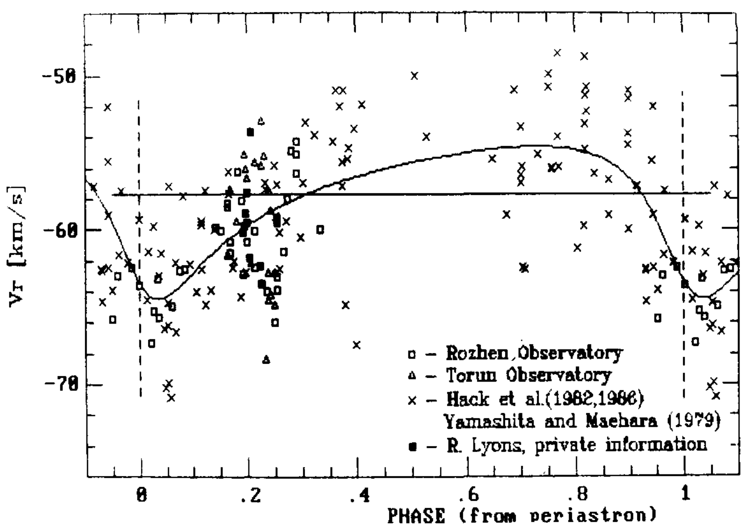

Fig.1 The radial velocity curve for the M giant of CH Cygni consistent with the observed eclipses (Table 1 line 3).

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