COMMENTS ON THE APSIDAL PERIOD OF V1647 SAGITTARII

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Abstract

The apsidal motion of V1647 Sagittarii is reviewed and some doubts are put in evidence: for some photographic observed minima an absurd result is obtained ($cos\omega$ <-1), and from the photoelectric and spectroscopic observations it is found that two values of the apsidal period (U = 727 and U = 648 years) have the same degree of probability. The binary system V1647 Sgr is therefore recomended for new series of photoelectric and spectroscopic observations.

1. Introduction

The double-lined eccentric system V1647 Sagittarii (HD 163708) is the primary component of the visual double star *h*5000, this last one being a physical bound system. The photometric data are in good agreement with the position of a star of type F0 on the main sequence (Clausen *et al.* 1977).

The variability of V1647 Sgr was put in evidence by Ponsen (1956) who, from photographic observations, determined the first observed primary and secondary minima.

Clausen *et al.* (1977), using photoelectric observations, published a second series of observed minima and determined an apsidal period of U = 480 years.

New series of photoelectric and spectroscopic observations were published by Andersen and Giménez (1985), who, using only the above two series of photoelectric observations, computed an apsidal period U = 592.5 +/- 6.5 years.

Given the discrepancy of ΔU ~100 years, I decided to resume the apsidal period determination. Using the above-mentioned photoelectric and spectroscopic observations, I found that, for the moment, there are two possible apsidal periods (U_1 = 727 years and U_2 = 648 years) which have the same degree of probability.

2. A review of the apsidal period determination

Table 1 was prepared from the observational data published by Clausen *et al.* (1977) and Andersen and Giménez (1985).

In Table 1, * = observed minima, and ** = "computed" minima by using $t = t_{obs} \pm nP$, in order to have the two kinds of minima at the same epoch. The periastron longitudes, ω, were determined by using Sterne's (1939) formula. Because Clausen *et al.* and Andersen and Giménez accepted $\omega = 180°$ for the photographic observations, I computed, in this case, two mean values.

3. Remarks

Andersen and Giménez (1985) used only two points in order to determine the two constants from the equation:

$$\omega = \omega_o + \dot{\omega}E \, .$$

Table 1. Observational data on V1647 Sgr, from Clausen *et al.* (1977) and Anderson and Giménez (1985).

T_1	T_2	E	T_2-T_1	ω	References
2430533.303*	2430554.086**	-3435	$0\overset{d}{.}783$	$cos\omega$ <-1	*Ponsen (1956)*
2430576.279*	2430577.066**	-3428	$0\overset{d}{.}787$	$cos\omega$ <-1	*Ponsen (1956)*
	I_{pg} *mean value*	-3431	$0\overset{d}{.}7850$		
2431285.328*	2431286.150**	-3212	$0\overset{d}{.}822$	—	*Ponsen (1956)*
2431344.418**	2431345.263*	-3194	$0\overset{d}{.}845$	—	*Ponsen (1956)*
	II_{pg} *mean value*	-3203	$0\overset{d}{.}8335$	164° or 196°	
2441829.6951*	2441830.5549**	0	$0\overset{d}{.}8598$	—	*Clausen et al. (1977)*
2441934.7443**	2441935.6059*	32	$0\overset{d}{.}8616$	—	*Clausen et al. (1977)*
2441967.5723*	2441968.4336**	42	$0\overset{d}{.}8613$	—	*Clausen et al. (1977)*
	I_{pe} *mean value*	25	$0\overset{d}{.}8609$	203	
	Spectroscopic observations	379		206	*Andersen and Giménez (1985)*
2445069.8113*	2445070.7011**	987	$0\overset{d}{.}8898$	—	*Andersen and Giménez (1985)*
	II_{pe} *mean value*	987	$0\overset{d}{.}8898$	208	

Here $\omega_o = \omega$, (E = 0) and $\dot{\omega} = d\omega/dt$, while E (cycle) denotes a whole number of orbital periods, P. But, in such a case, the agreement between the observed and computed values must be perfect, and we are not able to speak about the corresponding errors of determination.

For the present apsidal period determination, in addition to the two series of photoelectric observations used by Andersen and Giménez, I used their spectroscopic observations. Nevertheless, the uncertainty remains high enough. Table 2 lists the values of the periastron longitudes, ω_C, computed with the following formulas:

$$\omega_{IC} = 203\overset{\circ}{.}5 + 0.004452E \quad (U = 727y) \tag{1}$$

and

$$\omega_{IIC} = 203\overset{\circ}{.}5 + 0.004907E \quad (U = 659y) \tag{2}$$

Here the longitudes ω_{obs} are determined by using Sterne's (1939) formula and are given in Table 1.

Therefore, from the last two columns it is evident that the two obtained values of the apsidal period (U = 727y and U = 659y) have the same degree of probability.

Table 2. Values of periastron longitude for V1647 Sgr.

ω_{obs}	E	ω_{IC}	ω_{IIC}	ω_{obs} - ω_{IC}	ω_{obs} - ω_{IIC}
203°	25	$203\overset{\circ}{.}61$	$203\overset{\circ}{.}62$	$-0\overset{\circ}{.}61$	$-0\overset{\circ}{.}62$
206°	879	205.19	205.36	+0.81	+0.64
208°	987	207.89	208.34	+0.11	-0.34

3. Concluding remarks

It is dangerous to use Ponsen's photographic minima for a study of apsidal motion of V1647 Sgr. The first series of photographic observations is not in agreement with theoretical considerations of the celestial mechanics ($cos\omega < -1$). In contrast, the second series of photographic minima leads to $\omega = 164°$ or $196°$.

The spectroscopic periastron longitudes lie a bit above in respect to the straight line determined using the photoelectric observations, making it possible to postulate an influence by a third body.

In view of the uncertainty in the actual apsidal period determination, and the fact that V1647 Sgr is a component of a visual double star, I recomend it for new series of photoelectric and spectroscopic observations.

References

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