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THE PERIODICITY OF RESIDUALS $\Delta\rho$ AND $\Delta\theta$ OF THE DOUBLE STAR ADS 11520

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Summary. The periodical variations of the residuals of radius $(O\text{-}C)_\rho$ and positional angle $(O\text{-}C)_\theta$ of double star ADS 11520 was remarked. From the observations made in period 1900—1976. the corrections of Van den Boss's orbital elements are computed and it is shown that the periodical variations of residuals relative to the new orbital elements exist.

D. Olević, D. Đurović, PERIODIČNOST REZIDUA $\Delta\rho$ I $\Delta\theta$ DVOJNE ZVEZDE ADS 11520 — Uočene su periodične promene $\Delta\rho$ i $\Delta\theta$ u funkciji vremena i to u odnosu na sve ranije računate putanjske elemente (Aitken 1935, Danjon 1942 i Van den Boss 1952). Pošto je od poslednjeg računa elemenata do danas broj posmatranja ovoga para skoro dupliran, autori su izračunali nove (tačnije) putanjske elemente po metodi Van den Boss-a i pokazali da se pomenuta periodičnost ponovo identifikuje, pa se stoga ona ne može objasniti greškama putanjskih elemenata. Kao jedno od mogućih objašnjenja autori smatraju da se u analiziranom slučaju ne radi o dvojnoj, već o trojnoj ili višestrukoj zvezdi.

1. INTRODUCTION

The orbital elements of double star ADS 11520 were computed by: Aitken (1935), he discovered this star in 1900., Danjon (1942) and Van den Boss (1952). Their and our results are presented in the Table 1.

Analysing the differences between the observed and computed radius ($\Delta\rho$) and positional angle ($\Delta\theta$) relative to the first three systems of elements we remarked its periodical change as the function of time. This initiated us to verify whether the remarked periodicity is explanable by the errors of the orbital elements. Having in mind that after 1952., when Van den Boss computed the orbital elements, this star has been observed for many times (the number of the observations at our disposal is, approximately, twice greather than number of the observations exploited by Van den Boss) we considered as possible to obtain the new orbital elements which accuracy is sufficient for verification of mentioned hypothesis.

2. THE NEW ORBITAL ELEMENTS AND RESIDUS

The computation of the new orbital elements has been made by the method of differential corrections (Aitken 1964) Van den Boss's elements:

$$A\,\Delta\Omega + B\,\Delta i + C\,\Delta\omega + D\,\Delta\varphi + F\,\Delta\tau + G\,\Delta n = \Delta\theta \qquad (1)$$

$$h\,\Delta a + b\,\Delta i + c\,\Delta\omega + d\,\Delta\varphi + f\,\Delta\tau + g\,\Delta n = \Delta\rho \qquad (2)$$

In the equations (1) and (2) $\Delta\Omega$, $\Delta i, \ldots$ are standard designations for orbital elements corrections; $A, B, \ldots, h, b, \ldots$ are the partial derivates of the corresponding function (θ or ρ) of the elements.

As the accuracy of orbital elements corrections computed from $\Delta\theta$ is greather than its accuracy from $\Delta\rho$, as definitive we have adopted the results obtained by solving the system (1) (method of least squares), except Δa, which is obtained by solving the system (2).

When we replaced these results in the equations (1) and (2), we obtained the residuals $(O\text{-}C)_\theta$ and $(O\text{-}C)_\rho$ which also have a periodical changes as the function of time. In the Table 2 and on Fig. 1 we presented the 5 successive residuals means. These residuals are previously put in order in function of variable τ:

$$\tau = \frac{t - 1900.0}{P} - \mathrm{INT}\left(\frac{t - 1900.0}{P}\right).$$

In the last equation t is the observation epoch, $P = 12.185$ years — the period from the Table 1. and INT-integer of the expression in the parentheses.

TABLE 1

Orbital elements of ADS 11520 ($\alpha = 18^h 33.^m2$; $\delta = -3°17'$)

	Aitken 1935	Danjon 1942	Van den Boss 1952	Authors 1980
P	12.ʸ2	12.ʸ0	12.ʸ18	12.ʸ185
n	29.°703	30.°000	29.°560	29.°544 ±0.°026
T	1910.10	1910.29	1922.17	1921.958 ±0.097
e	0.276	0.25	0.260	0.257 ±0.007
a	0.″176	0.″156	0.″196	0.″174±0.″005
i	117.°6	116°	117.°45	120.°28 ±1.°33
ω	269.°9	88°	78.°8	78.°25 ±1.°60
☊	182.°4	178°	174.°2	178.°36 ±1.°88

We consider that residuals $(O\text{-}C)_\theta$ and $(O\text{-}C)_\rho$ represent the discrete values of the periodical functions of time with periods $P_1 \approx P_2 \approx 6$ years and amplitudes $A_1 \approx 0.''02$ and $A_2 \approx 3°$.

Total number of the observations (105), its time distribution and accuracy are such that the computation of the sufficiently accurate elements on the shorter subintervals for analysis of the apscide line mouvement is impossible. Therefore we cannot prove whether this star system is triple. In spite of this, we suppose that the periodicity of $(O\text{-}C)_\theta$ and $(O\text{-}C)_\rho$ represents an argument in favor of the above hypothesis.

TABLE 2

τ	$(O\text{-}C)_\rho$	τ	$(O\text{-}C)_\theta$
0.031	—0.″026	0.037	2.°2
77	— 22	79	—3.5
139	— 21	138	—1.3
217	0	198	1.8
318	20	307	2.7
375	23	431	—1.9
484	0	537	—3.2
569	— 15	628	—0.3
667	6	668	5.5
722	12	865	—2.6
813	32	0.970	—0.3
929	9		
0.980	— 14		

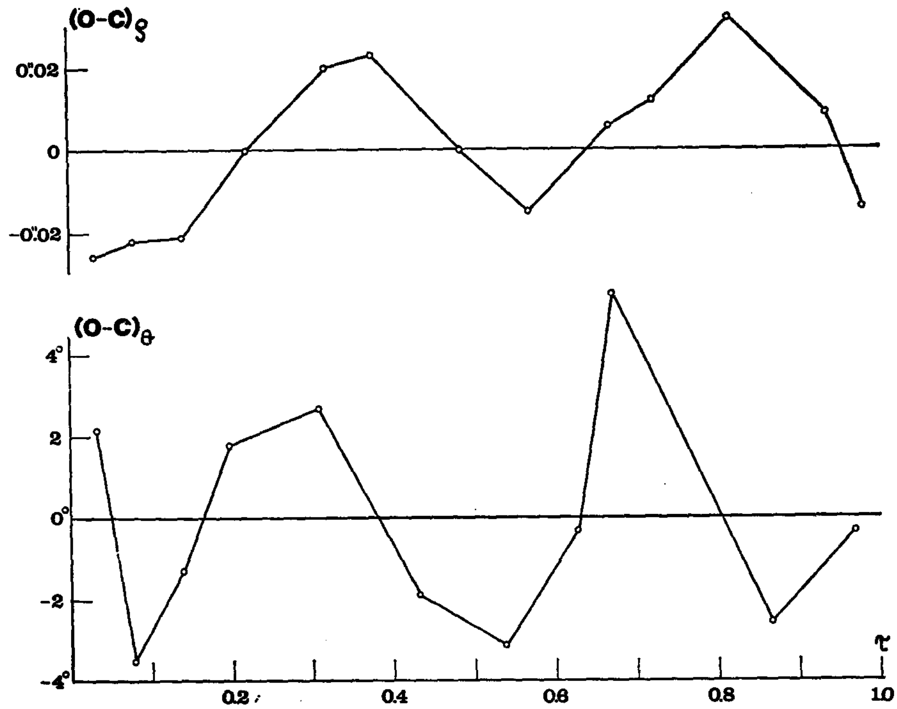

FIG 1

We would be satisfied if the astronommers paid attention to double star ADS 11520.

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