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RS Boo. THE PECULIARITIES OF BLAZHKO EFFECT MANIFESTATION

The variability of RS Boo was discovered by Flemming (Pickering, 1907). Oosterhoff published a detailed investigation on the basis of 2418 photographic observations obtained in Leiden wherein he showed that the pulsation period and the star's light curve shape varied with a secondary period equal to 537 days. Kanyó (1980) confirmed the presence of the secondary period as long as 533 days and supposed a shorter secondary period $\Pi \sim 58 - 62$ days on the basis of photoelectric observations made at Konkoly Observatory between 1971 and 1979.

We carried out investigations of secondary periodicities in RS Boo using a more extensive material. We had at our disposal 192 moments of RS Boo maximum light (interval J.D. 2417668 - 2444842) published in the literature, as well as 112 moments of maximum light (interval J.D. 2437790 - 2446654) determined from the photometric observations made by G.A. Lange and the author (the depository of Odessa Astronomical Observatory).

The analysis of all the observational material showed that the pulsation period and the light curve shape of RS Boo changed with secondary periods $\Pi_1 = 531.9$ and $\Pi_2 = 47.7$ days. The periodicity with Π_1 and Π_2 retained throughout all the period of the observation of RS Boo.

The following plots are given in Figure 1:

a) the average curves O-C and $\Delta V(m)$ for $\Pi_1 = 530\overset{d}{.}2$ (observations by Kanyó, J.D. 2442443 - 2444008). The phases φ were calculated by the formula:

$$Max_{O-B} = 2443249 + 530\overset{d}{.}2 \cdot n \qquad (1)$$

b) The average curve O'-C' for $\Pi_2 = 47\overset{d}{.}7$ (observations made by the author, J.D. 2441770 - 2441923). The phases ψ were calculated by the formula:

$$Max_{O-A} = 2434207.9 + 47\overset{d}{.}70 \cdot N \qquad (2)$$

The series of observations of RS Boo at our disposal enabled us to carry out investigations of non-stability of the pulsation period P, that of the periods Π_1 and Π_2 as well as the variations in the amplitude of the Blazhko

Table I

Max_{O-B}	n	O-B	$Ampl_{O-B}$
2419823	0^d	0^d	$0^d.015$
26233	12	27	0.019
28363	16	30	0.022
30475	20	14	0.014
33124	25	4	0.015
34169	27	-15	0.015
37925	34	17:	0.025
39531	37	28	0.023
41128	40	29	0.025
42718	43	23	0.020
43249	44	22	0.017
45371	48	17	0.015

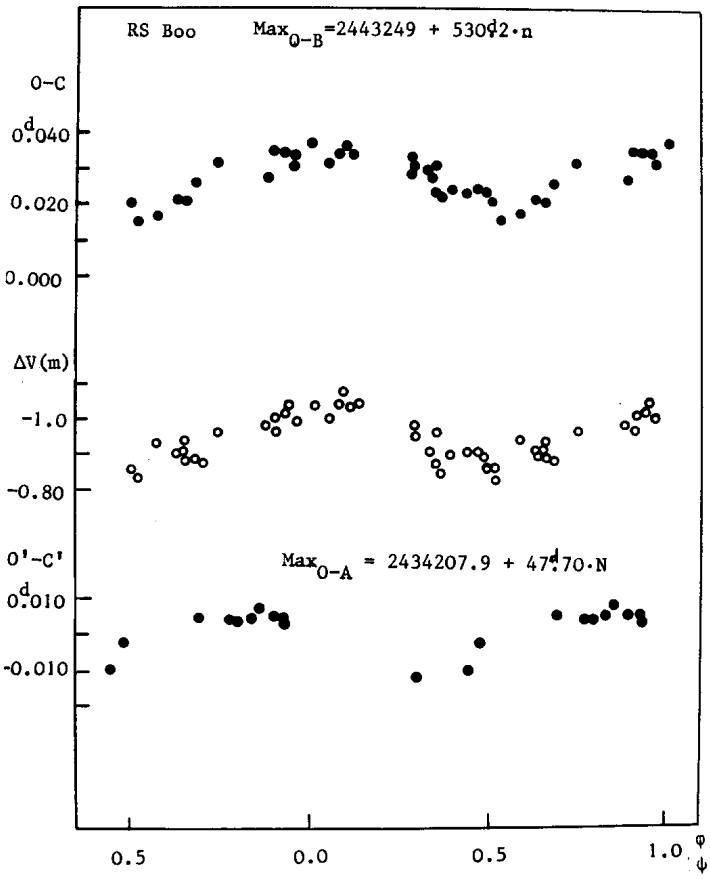

Figure 1

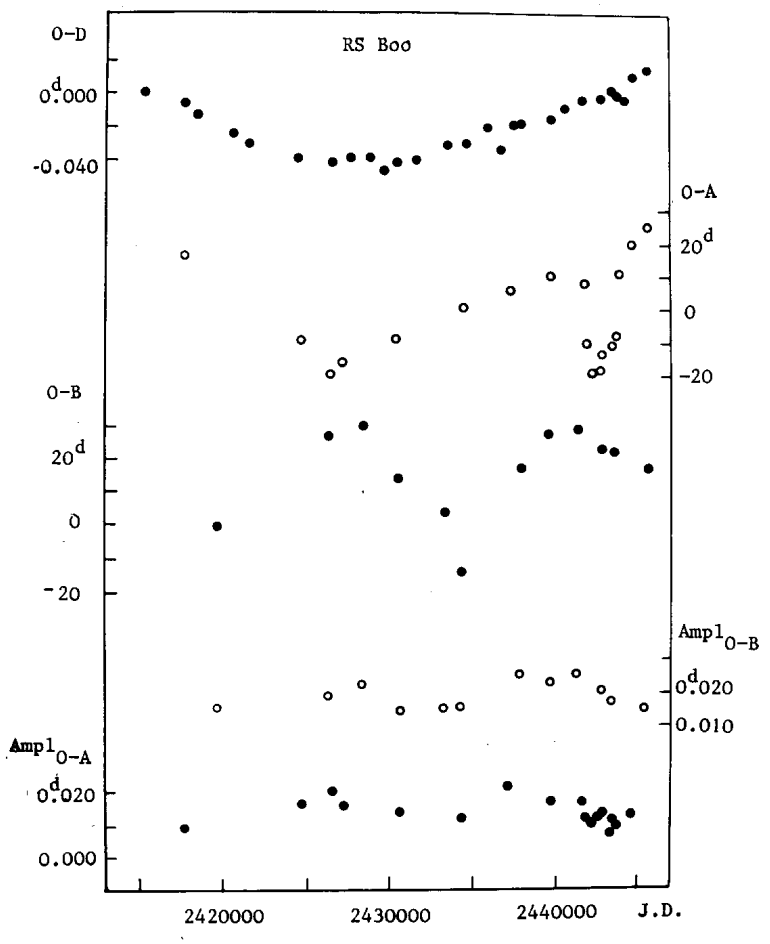

Figure 2

effect with Π_1 and Π_2 from cycle to cycle. To solve this problem, the average curves for cycles Π_1 and Π_2 were constructed. From the seasonal average curves the deviations of the moments of maximum O-B were determined for the cycle Π_1 and those of moments of maximum O-A for the cycle Π_2 as well as the amplitude of Blazhko effect $Ampl_{O-B}$ and $Ampl_{O-A}$ respectively. The values obtained are given in Tables I and II wherein the successive columns contain the following data: the moment of maximum O-B (the moment of maximum O-A); the number of the epoch n (the number of the epoch N); the residual O-B (the residual O-A); $Ampl_{O-B}$ ($Ampl_{O-A}$).

Table II

Max_{O-A}	N	O-A	$Ampl_{O-A}$
2417863.2	-343	$16^d.4$	$0^d.009$
24610.3	-201	- 9.9	0.016
26413.6	-163	-19.2	0.020
27036.2	-150	-16.7	0.016
30429.9	- 79	- 9.7	0.014
34207.9	0	0.0	0.012
37027.4	59	5.2	0.021
39655.5	114	9.8	0.017
41751.9	158	7.4	0.016
41828.9	160	-11.0	0.011
42201.7	168	-19.8	0.010
42393.2	172	-19.1	0.011
42780.3	180	-13.6	0.013
43259.5	190	-11.4	0.007
43549.2	196	- 7.9	0.011
43759.5	200	11.6	0.010
44530.5	216	19.4	0.013
45490.2:	236	25.1:	0.008

The residuals O-B were calculated with respect to the elements:

$$Max_{O-B} = 2419823 + 531^d.9 \cdot n \qquad (3)$$

while the residuals O-A were calculated with respect to the elements (2).

In Figure 2 there are given:

a) the O-D residuals for the period of pulsation of RS Boo calculated using the formula: Max.hel. J.D. = 2441770.486 + $0^d.37733657 \cdot E$ (Zessewitsch, 1986);

b) the O-A residuals calculated by the formula (2);

c) the O-B residuals calculated by the formula (3);

d) the plot $Ampl_{O-B}$;

e) the plot $Ampl_{O-A}$.

The analysis of Figure 2 shows that the pulsation period is increasing monotonously. The presence of two periods of Blazhko effect ($\Pi_1 = 531^d.9$ and $\Pi_2 = 47^d.7$) is a characteristic peculiarity of RS Boo pulsation. The variations of the O-A residuals and those of O-B residuals do not show any ordinary pattern of mirror image of the trend seen in the O-D residuals. However, the residuals O-A and O-B have a similar to each other character of variations, these change cyclically and in antiphase. A characteristic cycle duration is 36 years. The variations of $Ampl_{O-A}$ and $Ampl_{O-B}$ proceed with an analogous cycle but in synphase.

The absence of apparent relation between the nonstability of the pulsation period P and the character of amplitude instability and the periods

Π_1 and Π_2 of Blazhko effect shows that in the case of RS Boo we observe a multiparametrical manifestation of the Blazhko effect.

B.N. FIRMANYUK

Odessa Astronomical Observatory
Odessa, U.S.S.R.

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