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PHOTOMETRIC OBSERVATIONS OF THE WR STAR ROBERTS 93

Presently more than 10 WR stars are known which are "WR + compact companion" system candidates (cf. Cherepashchuk and Aslanov, 1984 and references therein). The detection of strong enough ($\sim 10^{36}$erg/s) X-ray radiation due to accretion on the companion would be an important argument for binarity. However, for all the stars of this type observed with Einstein, X-ray luminosity is less than $\sim 10^{33}$erg/s (Moffat et al., 1981, Sanders et al., 1981).

Recently Hertz and Grindlay (1988) reported the detection of high X-ray flux of the WC5 star Roberts 93. The X-ray to optical flux ratio is f_x/f_o(0.15-4.5keV)=$10^{-1.7}$. The authors have suggested that this star is a probable candidate to binary of considered type. However Pollock (1987) has obtained the X-ray luminosity of this star L_x(0.2-4 keV)=$1.4 * 10^{33}$erg/s (which is a typical value for single WR stars) from the same X-ray flux due to the large interstellar extinction.

Moffat and Shara (1986) carried out photometric observations of Roberts 93 in B filter (13 estimates on 13 nights in 1984) and made no direct conclusion on the optical variability. The amplitude was $< 0^m.04$, a period of $4^d.6$ fits the data best, but its significance is small.

Our photometric observations of Roberts 93 were obtained on 29 nights during a 42 day interval in 1989 June-August using the 60 cm telescope of Sternberg Institute Maidanak Station. 151 individual light estimates were obtained in V filter with a pulse counting photoelectric photometer. The comparison stars c1, c2, c3 were used (Fig.1) with UBV magnitudes presented in Table 1. The data are available on request from I.I.A. The light curve is shown in Figure 2. The instrumental scatter was $\sim 0^m.03$ owing to the relatively small size of the telescope. A search for periodic variability in the frequency range 0-2 day^{-1} was made. The power spectrum was calculated as described in Doroshenko et al. (1985) and is shown in Figure 3. The maximum at ν_1 = 0.017 day^{-1} (P=59^d) and its aliases (arrows) arise due to a small

Table I

Name	V	B	U	n
c1	12.69	13.89	-	11
c2	10.42	12.23	-	11
c3	10.21	10.64	10.82	3
1	13.39	14.16	14.39	1
2	13.36	14.46	-	1
3	13.49	14.84	15.72	1

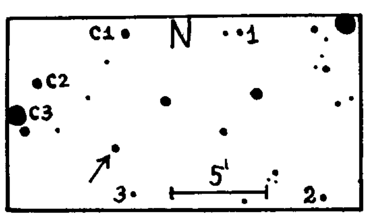

Figure 1

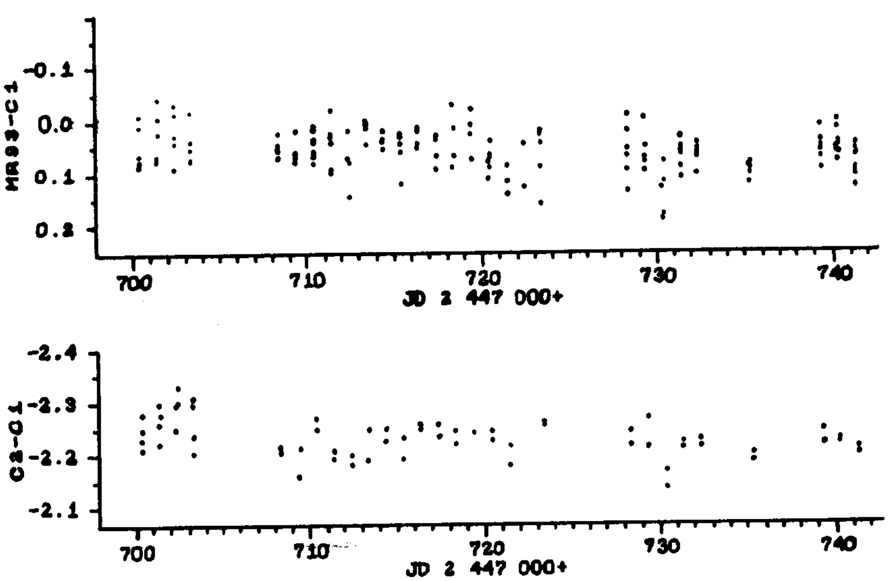

Figure 2. V magnitude difference versus time for Roberts 93

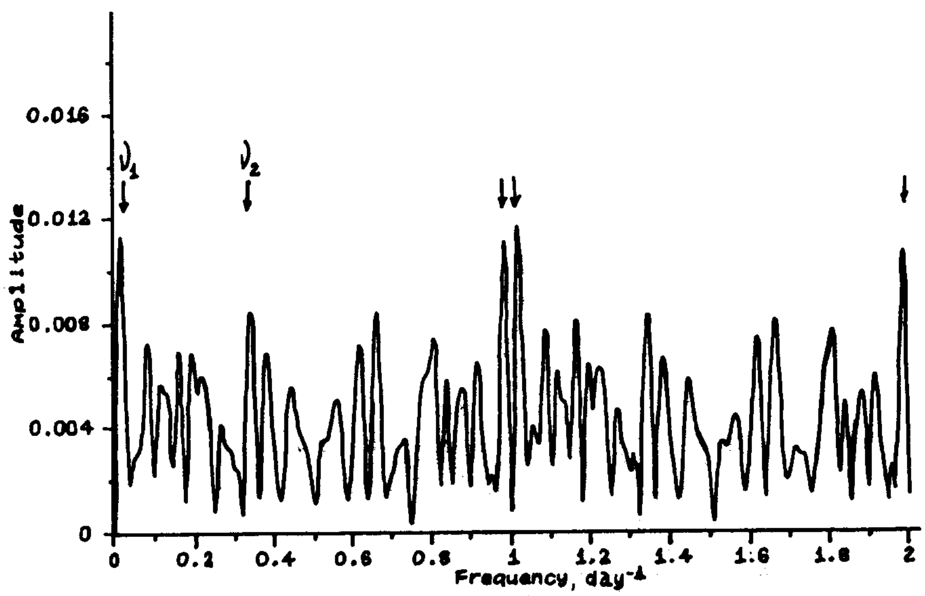

Figure 3. Periodogram of Roberts 93

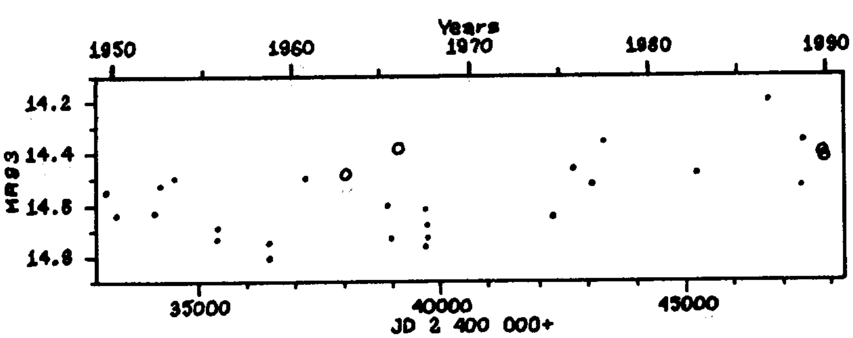

Figure 4. B magnitude versus time for Roberts 93. Open circles are photoelectric magnitudes.

trend in the brightness of c1 (cf. curves Roberts 93 - c1 and c2 - c1 in Fig.2). The same peaks are also visible in the c2 - c1 spectrum. c1, probably, is slightly variable. The maximum of the remaining peaks, at $\nu_2 = 0.34$ day^{-1}, shows the confidence level of 4% if calculated according to Doroshenko et al. (1985). It means that in the case of a pure white noise process the probability of occurrence of such powerful a peak is $\sim$4%. Evidently, this and other maxima are not significant with a usual confidence level of 1%. The amplitude of the corresponding harmonic component $a(\nu_2)=0^m.016$. Hence the full amplitude of regular variability is less than $\sim 0^m.03$.

The analysis of 25 plates from photographic archive of Sternberg Institute (the comparison stars 1, 2, 3 were used, cf. Fig.1, Table 1) has shown that the light of the star was $\sim 14^m.6-14^m.8$ (B) in 1949-1968 and became slightly brighter after 1973 ($14^m.3-14^m.5$ (B)), (cf. Fig.4). Probably, this points to the existence of long-term variability. One can note however, that photoelectric magnitudes of Hiltner et al. (1964) $B=14^m.48$, Pyper (1966) $B=14^m.38$ and our value (1989, $B=14^m.41$) are in satisfactory agreement.

Thus the lack of optical variability of Roberts 93 does not confirm the Hertz and Grindlay's assumption.

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