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Polarimetric studies of the closest of the binaries with the Wolf-Rayet component CQ Cep (II)

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Abstract.
Results are presented of measurements of linear polarization of CQ Cep made with the telescope "Zeiss-1000" of SAO RAS in August 1998 and in June, September 1999. The polarization curves plotted from the observations of these two years are in good agreement with each other and with the curve of CQ Cep of 1984 (Drissen et al., 1986). The results of the Fourier analysis made only for polarization observations of 1998 (the observations of 1999 contain considerable gaps in phases) also turned out close to the results obtained by Drissen and his colleagues. Since these results point to a great degree of concentration of the scattered matter to the orbital plane of the system and to a high degree of its symmetry about this plane, it can then be suggested that in 1984 and 1998 (as well as in 1999) a relatively quiescent state of CQ Cep was observed. This state, in which the system is likely to have been for the greater part of time, is characterized by polarization curve with a high amplitude of variations ($\Delta P \approx 0.8\%$) and an average level $\bar{P} \approx 5\%$. It follows from the said above that the averaged results of the analysis of polarization curves of CQ Cep of 1984 and 1998 must yield reliable parameters of the system orbit ($\bar{i}_{polar} = 80° \pm 2°$, $\bar{\Omega} = -24° \pm 5°$) and characterize well the "quiescent" state of its common envelope ($\overline{\tau_0 G} = 0.44 \times 10^{-3}$, $\overline{\tau_0 H} = 3.65 \times 10^{-3}$, $\overline{H/G} = 8.7$, $\overline{\Delta u'} = 4.8 \times 10^{-3}$ and $\overline{A_p} = 3.75 \times 10^{-3}$).

Key words: stars: Wolf-Rayet — stars: polarization: individual: CQ Cep

The paper continues the studies of long-term variations of linear polarization of the closest of WR binaries CQ Cephei started in 1994 (Kartasheva et al., 1998). The main aim of the investigations is to understand how stable the polarization curve of the system is and therefore how reliable the estimate of the orbit inclination (i_{polar}) is, which follows from its analysis and is used to refine the masses of the components. In the previous paper (Kartasheva et al., 1998) the general view of the problem of polarization variability of spectroscopic WR binaries was given, difficulties in studies of CQ Cep were noted, a review of all polarimetric investigations of the system known to us by that time was given. After the paper had been given to press, we came to know the results of another two polarimetric studies of CQ Cep: the paper by Piirola and Linnaluoto (1988) and the paper by Harries and Hilditch (1997). The observations presented in the first of the two papers coincided in time with the observations of Drissen et al. (1986), that is why, the agreement of the results of the analysis of these two series of polarization observations of the system is not surprising. The polarization investigations of CQ Cep were performed by Piirola and Linnaluoto for the first time in five filters, the run of P_λ with λ was constructed, which coincided with the run of interstellar polarization. This allowed the authors to conclude that the constant component of linear polarization associated with the WR star is absent. As to the spectropolarimetric studies by Harries and Hilditch performed in 1995, that is between our observations of 1994 and 1996, they are of value for checking our conclusions that in 1994–1996 CQ Cep was at the phase of increased activity. Unfortunately, Harries and Hilditch have not published the tables with observed estimates of the u and q Stokes parameters, but presented only a figure in which the curves of variations of these parameters derived from their data and from the results of observations of Drissen et al. (1986) are plotted. A closer scrutiny of this figure, however, separates the results of the 1995 observations. Their comparison with the curves of variations of u and q Stokes parameters that we obtained in 1994 and 1996 shows good agreement of the results of the 1995 and 1996 observations. In particular, the disappearance of the maximum at phases close to the main minimum of light ($0^p.0$) on the u curve of 1996, which resulted in the smoothing of the corresponding maximum on the polarization variation curve, is confirmed (for detail see Kartasheva et al., 1998). Thus, our deduction that the system was in an anomalous state in the years 1994–1996 and the assumption that in late 1994 and early 1995 an expulsion of the outermost parts of the system envelope took place are confirmed. The results of the Fourier analysis made by Harries and Hilditch from the u and q curves that united the 1995 and 1984 observations are not of interest to us since it is not clear which state of the system they represent. It was different in those years.

We carried out new observations of CQ Cep in 1998 August and 1999 June and September with the telescope Zeiss-1000 of SAO RAS. The two-channel polarimeter MINIPOL of the University of Arizone (Frecker and Serkowski, 1976) installed at the Cassegrain focus was employed. Quasisimultaneous measurements of the u and q Stokes parameters were made with the "B"-filter. Four-six-minute exposures were required to obtain the parameters with an accuracy of 0.04–0.06 %. To determine the instrumental polarization, the zero-polarization standard star HD 212311 was observed. The standard stars with known polarization, HD 204827 and HD 218342, were used to define the shift of the zero point of our system of counting position angles. Before and after the observations of the stars the sky background polarization was measured. First of all the observations of the stars were corrected for the contribution of the sky background polarization. The observations of CQ Cep and standard stars were then corrected for the instrumental polarization. After that the polarization standard stars were used to define the shift of the zero point of our system of measuring position angles, and the conversion of the u and q Stokes parameters to the equatorial coordinate system was performed. Table 1 contains final results of our observations of CQ Cep. The second column of Table 1 lists the Julian dates of observations reduced to the centre of the Sun. The third column gives the phases expressed in fractions of the orbital period. The phases were computed by the formula

$$T_{min1} = 2451025^d.656 + 1^d.641222271E,$$

derived from a more general ephemeris formula of Kilinc (1994). The zero phase corresponds to the moment of the main photometric minimum. The fourth — seventh columns of Table 1 give the normalized Stokes parameters ($u = U/I$ and $q = Q/I$) in the equatorial coordinate system, the degree of linear polarization of the system radiation $P = (u^2 + q^2)^{1/2}$ and the position angle of the polarization plane $\theta(tg2\theta = u/q)$. To illustrate the accuracy and stability of observations, Table 2 presents the estimates of P polarization standards obtained in the 1998 and 1999 observations and their catalogue values. The results of the accomplished polarimetric measurements are given also in Fig.1 from which it can be seen that the polarization curves plotted for CQ Cep in 1998 and 1999 agree fairly well both with one another and with the 1984 polarization curve of the system (Drissen et al., 1986). However, the variation curves of the u and q Stokes parameters obtained in 1998 and 1999 showed substantial differences reaching 0.4 % at the phases close to the first and the second maxima of light ($0^p.25$ and $0^p.75$, respectively).

The observations of 1999 contain considerable gaps in phases, which caused the Fourier analysis to be made only for the results of 1998 observations. As usual, we represented the u and q Stokes parameters in the form of expansion into a Fourier series to the second harmonic inclusive, that is:

$$u = u_0 + u_1\cos\lambda + u_2\sin\lambda + u_3\cos2\lambda + u_4\sin2\lambda,$$
$$q = q_0 + q_1\cos\lambda + q_2\sin\lambda + q_3\cos2\lambda + q_4\sin2\lambda, \quad (1)$$

where $\lambda = 2\pi\Phi$, Φ is the phase of the orbital period. The expansion coefficients determined by the least-squares method are given in Table 3. The curves that approximate the variations of the u and q Stokes parameters are displayed in Fig. 1 as solid lines. They are seen to represent well the 1998 observations. For the observations of 1998, in Fig. 2 are depicted the variations of the Stokes parameters in the (q, u) plane and also the (q_+u_+) trajectory, which represents an ellipse described by the second harmonics of the expansion (see paper by Brown et al., 1978). It can be seen from Table 3 that the role of the first harmonics in the expansion is not great. The latter, as follows from the model computations (Brown et al., 1978), points to a high degree of symmetry of scattering matter about the system orbital plane. To connect the derived expansion coefficients with geometric and physical characteristics of the system, the model of Brown et al. (1978) was used, which was developed for an optically thin envelope with an arbitrary density distribution, rotating together with the system and scattering light of an arbitrary number of point sources.

Table 1: *Log of polarimetric observations of CQ Cep in 1998 and 1999*

N	J.D.$\odot$ (2400000+)	Φ in frac. of P	$q(\%)$	$u(\%)$	$P(\%)$	$\theta°$
1	51040.273	0.906	-2.713	+4.077	4.897	61.8
2	51040.387	0.976	-2.972	+4.376	5.289	62.1
3	51040.439	0.007	-2.924	+4.463	5.335	61.6
4	51040.500	0.044	-2.845	+4.454	5.285	61.3
5	51041.281	0.520	-2.824	+4.611	5.407	60.7
6	51041.316	0.542	-2.720	+4.390	5.164	60.9
7	51041.382	0.582	-2.547	+4.423	5.104	60.0
8	51041.411	0.600	-2.531	+4.429	5.101	59.9
9	51041.442	0.618	-2.376	+4.298	4.911	59.5
10	51041.523	0.668	-2.418	+4.238	4.879	59.9
11	51043.325	0.766	-2.279	+4.245	4.818	59.1
12	51043.381	0.800	-2.197	+4.164	4.708	58.9
13	51043.388	0.804	-2.393	+4.299	4.920	59.6
14	51043.469	0.853	-2.474	+4.178	4.856	60.3
15	51043.493	0.868	-2.487	+4.354	5.014	59.9
16	51044.375	0.405	-2.833	+4.269	5.124	61.8
17	51044.436	0.443	-2.868	+4.395	5.248	61.6
18	51044.485	0.473	-2.962	+4.481	5.372	61.7
19	51044.509	0.487	-2.926	+4.590	5.444	61.3
20	51044.536	0.504	-2.919	+4.483	5.350	61.5
21	51045.279	0.956	-2.947	+4.408	5.302	61.9
22	51045.315	0.978	-2.902	+4.564	5.408	61.2
23	51045.373	0.014	-2.882	+4.595	5.424	61.6
24	51045.394	0.026	-2.917	+4.552	5.406	61.3
25	51045.446	0.058	-2.807	+4.448	5.259	61.1
26	51045.496	0.089	-2.483	+4.495	5.135	59.5
27	51045.544	0.118	-2.356	+4.373	4.967	59.2
28	51055.417	0.133	-2.412	+3.959	4.635	60.7
29	51055.439	0.147	-2.522	+3.995	4.724	61.1
30	51055.461	0.160	-2.403	+3.963	4.634	60.6
31	51055.485	0.175	-2.386	+4.051	4.702	60.3
32	51055.530	0.202	-2.390	+4.134	4.775	60.0
33	51055.552	0.216	-2.271	+4.105	4.691	59.5
34	51056.359	0.707	-2.371	+4.230	4.849	59.6
35	51056.407	0.737	-2.358	+4.193	4.811	59.7
36	51057.413	0.350	-2.615	+4.063	4.832	61.4
37	51348.484	0.699	-2.679	+3.807	4.655	62.6
38	51348.491	0.704	-2.691	+3.898	4.737	62.3
39	51348.499	0.708	-2.802	+4.027	4.906	62.4
40	51349.424	0.272	-2.863	+3.953	4.881	63.0
41	51349.431	0.276	-2.751	+3.944	4.808	62.5
42	51349.436	0.279	-2.877	+3.959	4.894	63.0
43	51349.461	0.294	-2.753	+3.988	4.846	62.3
44	51349.467	0.298	-2.770	+3.990	4.858	62.4
45	51349.494	0.315	-2.940	+3.985	4.952	63.2
46	51349.501	0.319	-2.872	+4.125	5.026	62.4
47	51350.436	0.888	-3.062	+3.833	4.906	64.3
48	51437.449	0.906	-2.820	+3.823	4.751	63.2
49	51437.457	0.911	-3.087	+3.802	4.897	64.5
50	51439.279	0.021	-3.304	+4.313	5.433	63.7
51	51439.312	0.040	-2.968	+4.365	5.279	62.1

Table 1: *Log of polarimetric observations of CQ Cep in 1998 and 1999 (continued)*

N	J.D.⊙ (2400000+)	Φ in frac. of P	$q(\%)$	$u(\%)$	$P(\%)$	$\theta°$
52	51439.321	0.046	-3.057	+4.231	5.220	62.9
53	51439.330	0.052	-2.881	+4.107	5.071	62.5
54	51439.340	0.058	-2.863	+4.267	5.139	61.9
55	51439.389	0.087	-2.802	+4.144	5.002	62.0
56	51439.436	0.116	-2.661	+4.038	4.836	61.7
57	51439.443	0.120	-2.653	+4.014	4.812	61.7
58	51439.492	0.150	-2.573	+4.050	4.798	61.2
59	51439.499	0.155	-2.655	+4.028	4.824	61.7
60	51439.546	0.183	-2.662	+3.900	4.722	62.2
61	51439.560	0.192	-2.658	+3.862	4.688	62.3
62	51439.567	0.196	-2.458	+3.841	4.560	61.3
63	51440.475	0.749	-2.690	+3.796	4.653	62.7
64	51440.504	0.767	-2.747	+3.799	4.688	62.9
65	51440.539	0.788	-2.820	+3.781	4.717	63.4
66	51440.568	0.806	-2.832	+3.832	4 765	63.2
67	51440.575	0.810	-2.774	+3.731	4.649	63.3
68	51440.580	0.813	-2.537	+3.785	4.557	61.9
69	51441.355	0.285	-2.765	+3.783	4.686	63.1
70	51441.399	0.312	-2.825	+3.800	4.735	63.3
71	51441.405	0.316	-2.807	+3.813	4.735	63.2
72	51441.488	0.366	-2.967	+4.002	4.982	63.3
73	51441.497	0.372	-3.033	+4.057	5.065	63.4
74	51441.505	0.377	-3.043	+3.995	5.022	63.7
75	51441.568	0.415	-3.029	+4.139	5.129	63.1
76	51441.576	0.420	-2.883	+3.946	4.887	63.1

Table 2: *The estimates of P polarization standards in the 1998 and 1999 observations and their catalogue values*

HD 204827	
$\bar{P}_{B1998} = 5.58\% \pm 0.07\%$	$P_{Bcatal} = 5.56\%$
$\bar{P}_{B1999} = 5.59\% \pm 0.03\%$	(Serkowski et al., 1969)
HD 218342	
$\bar{P}_{B1998} = 1.95\% \pm 0.07\%$	$P_{Bcatal} = 1.87\%$
$\bar{P}_{B1999} = 1.90\% \pm 0.05\%$	(Coyne, Gehrels, 1966)

Table 3: *Coefficients of expansion into a Fourier series of u and q Stokes parameters*

q_0	q_1	q_2	q_3	q_4
-2.5800	0.0026	-0.0407	-0.3022	0.0965
u_0	u_1	u_2	u_3	u_4
4.2719	-0.0109	-0.0953	0.2150	0.0273

Parameters of the CQ Cep orbit derived as a result of application of the above mentioned model (i - angle of orbit inclination, Ω — angle that characterizes the orbit orientation in space), as well as the numerical values of some spatial integrals ($\tau_0\gamma_1, \tau_0\gamma_2, \tau_0\gamma_3, \tau_0\gamma_4$) and their combinations [$\tau_0 G = \tau_0(\gamma_1^2 + \gamma_2^2)^{1/2}, \tau_0 H = \tau_0(\gamma_3^2 + \gamma_4^2)^{1/2}, H/G, \gamma_2/\gamma_1, \gamma_4/\gamma_3$] characterizing the features of matter distribution in the scattering envelope are given in Table 4. Besides, Table 4 presents the value of the difference $\Delta u' = u'_c - u'_I$ (u'_c is the coordinate of the centre of the ellipse described by the second harmonics, u'_I is u parameter of interstellar polarization) which allows one to judge whether the constant component associated with the system itself is present or absent in polarization. The last line of Table 4 gives the value of the semi-major axis of the ellipse described by the second harmonics (A_p), which, according to St-Louis et al. (1988), is directly proportional to the electron density of the envelope (n_e) and to the mass loss rate of the WR star ($\dot{M}_{WR}$). The first two columns of Table 4 show the results of the analysis of polarization observation of the system by Drissen et al. (1986) and Piirola and Linnaluoto (1988). In the third column are collected the results of analysis of our 1998 observations. As can be seen from Table 4, they turned out to be close to the results of

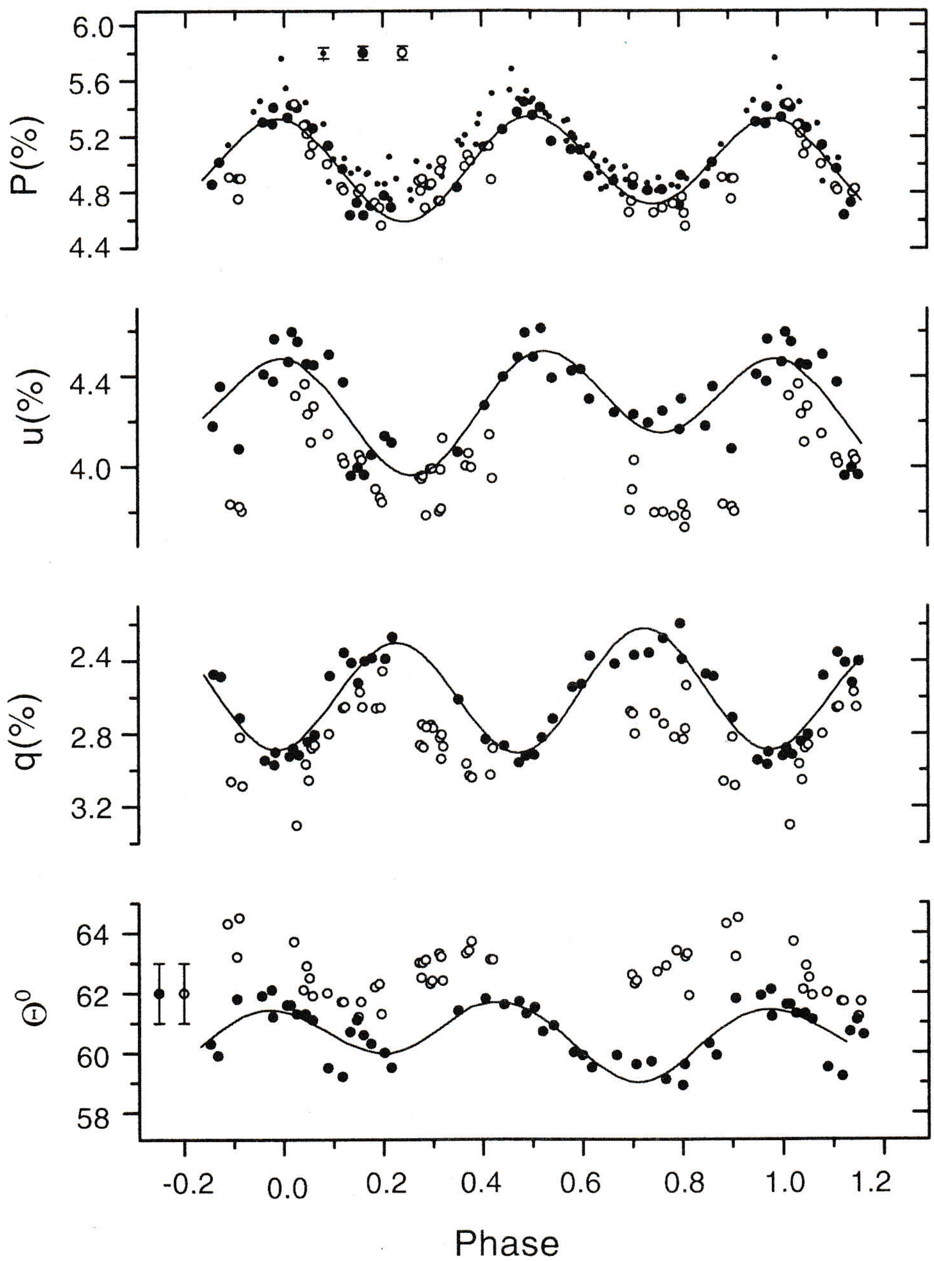

Figure 1: Variations of the linear polarization (P), u and q Stokes parameters and position angle of the polarization plane (Θ) with phase of the orbital period from the results of polarimetric observations of CQ Cep in 1998 (filled circles) and 1999 (open circles). For comparison, the dots represent the observations of P made by Drissen et al. in 1984. The solid lines are the theoretical curves for the 1998 observations.

Table 4: *Geometrical and physical parametres obtained from the analysis of polarization observation of CQ Cep in 1984 and 1998*

	1984 (Drissen et al.,1986)	1984 (Piirola, Linnaluoto, 1988)	1998 (this study)	average
i°	77.9	78.1	84.1 (84.6)	80 ± 2
Ω°	-16.5	-23.5	-33.3 (-32.7)	-24.4 ± 5
$\tau_0\gamma_1$	0.30×10^{-3}		0.57×10^{-3} (0.51×10^{-3})	
$\tau_0\gamma_2$	-0.19×10^{-3}		0.03×10^{-3} (0.04×10^{-3})	
$\tau_0\gamma_3$	2.93×10^{-3}		3.66×10^{-3} (2.99×10^{-3})	
$\tau_0\gamma_4$	2.05×10^{-3}		0.65×10^{-3} (0.44×10^{-3})	
$\tau_0 G$	0.36×10^{-3}		0.52×10^{-3} (0.46×10^{-3})	0.44×10^{-3}
$\tau_0 H$	3.58×10^{-3}		3.72×10^{-3} (3.02×10^{-3})	3.65×10^{-3}
H/G	10.2		7.2 (6.6)	8.7
γ_4/γ_3	0.70		0.18 (0.15)	
γ_2/γ_1	-0.62		0.05 (0.07)	
$\Delta u'$	5.2×10^{-3}		4.5×10^{-3} (4.7×10^{-3})	4.8×10^{-3}
A_p	3.74×10^{-3}		$3.76 \times 10^{-3}(3.05 \times 10^{-3})$	3.75×10^{-3}

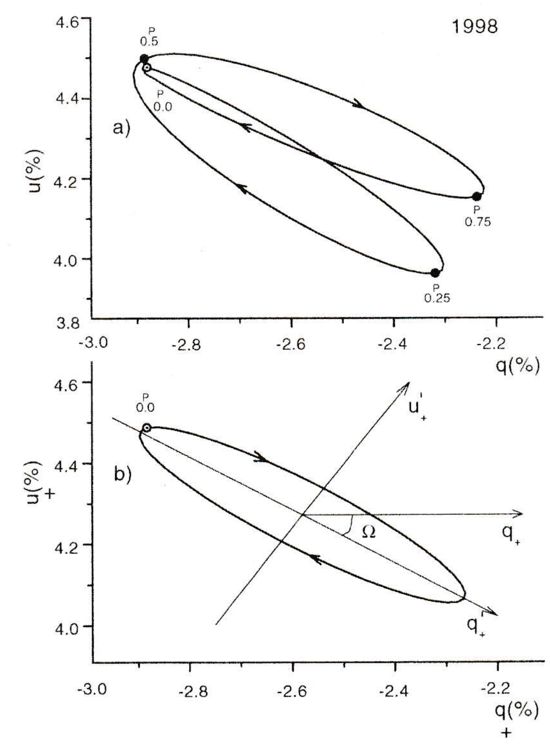

Figure 2: *Variations of the Stokes parameters in the (q, u) plane (a) and (q_+, u_+) trajectory (b) obtained from the harmonic analysis of the results of polarimetric observations of CQ Cep of 1998.*

analysis of the 1984 polarization observations. Since these results are indicative of high degree of concentration of scattered matter towards the system orbital plane and of high degree of symmetry of matter about this plane (H/G is high), this suggests then that in 1984 and 1998 (and, perhaps, in 1999 too) the system was in a relatively quiescent state. The fourth column gives the averaged results of analysis of polarization observations of CQ Cep in 1984 and 1998. The latter, in our opinion, must yield rather reliable values of the system orbit and characterize well the "quiescent" state of the common envelope. In particular, the data of Table 4 suggest that when CQ Cep is quiet, the constant component associated with the system itself is absent in the polarization (the value of $\overline{\Delta u}'$ is small and lies within the accuracy of determination of interstellar polarization). Besides, the estimate of $\bar{A}_p$, when compared with the data of Table 2 of the paper by St-Louis et al. (1988), points out that the electron density of the CQ Cep envelope is higher than that of the envelopes of many other WR systems and is comparable but with the density of the HDE 311884 envelope.

Table 5 lists the estimates of inclination of the CQ Cep orbit (i_{photom}) derived from the solution of the system light curves during the last two decades. From the comparison of the data of Table 4 and Table 5 it is seen that $\bar{i}_{polar} = 80^\circ \pm 2^\circ$ are essentially larger than $\bar{i}_{photom} = 68^\circ \pm 2^\circ$. A similar overestimation of the system orbit inclination obtained from the analysis of polarimetric studies was noted in many other WR binaries (Harries and Hilditch, 1997, Table 5). The cause of it is unclear yet. When trying

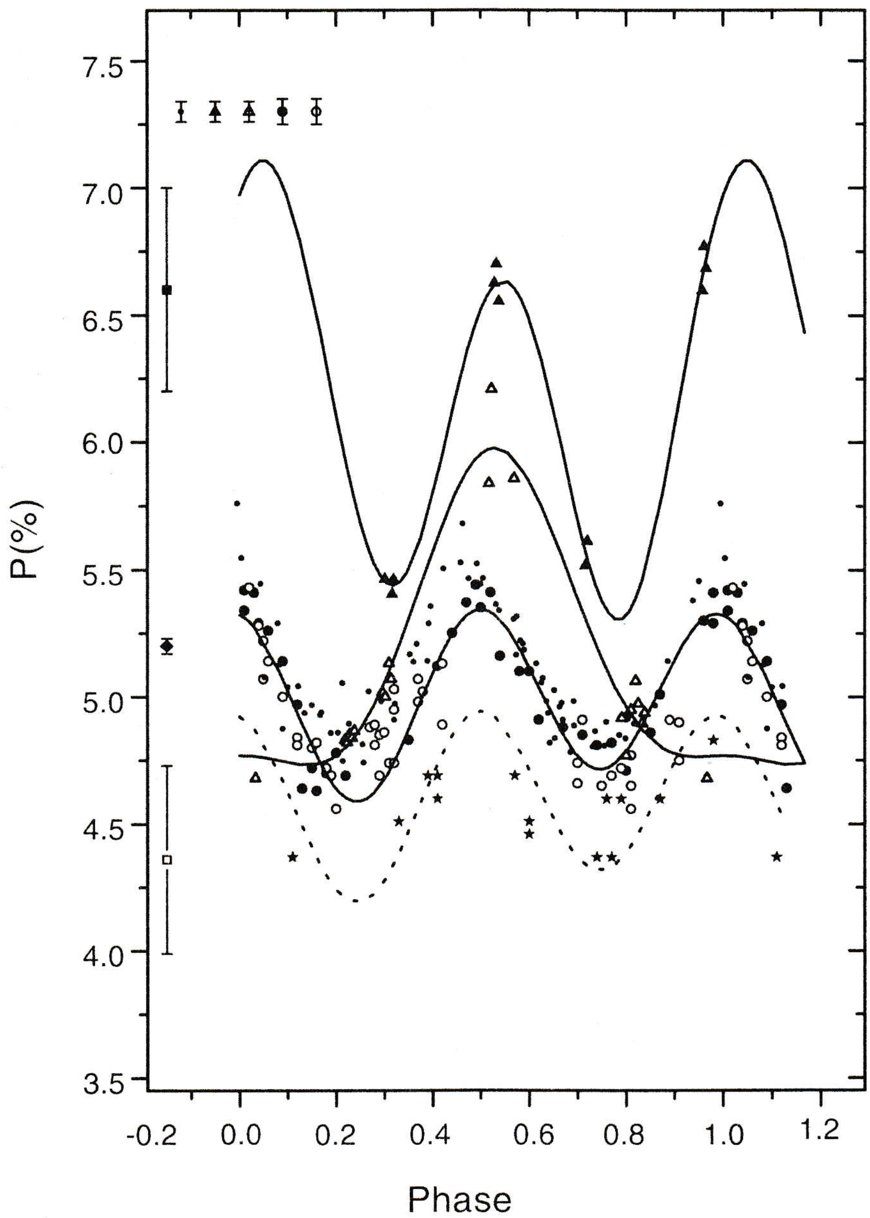

Figure 3: *The CQ Cep polarization curves plotted from the observations: Hiltner 1948 (stars), Drissen et al., 1994 (dots), our observations, 1994 (filled triangles), 1996 (open triangles), 1998 (filled circles) and 1999 (open circles). The solid lines — the theoretical representation of our 1994, 1996 and 1998 observations. The dashed line is the theoretical representation of our 1998 polarization curve lowered by 0.4 %. The mean values of P obtained in early observations of the system by Hiltner (1951), Dombrowski with Novochadova (1953) and Shakhovskoi (1964) are plotted along the polarization axis with a filled diamond, filled square and open square, respectively.*

Table 5: *Orbital inclination of CQ Cep obtained from the solutions of the light curves*

i°_{photom}	Author
65	Lipunova, Cherepashchuk, 1982
68	Leung et al., 1983
70	Stickland et al., 1984
69-70	Antokhina, Cherepashchuk, 1988
71	Harvig, 1989
59	Kartasheva, Svechnikov, 1996
69	Demircan et al., 1997
72.5	Harries, Hilditch, 1997
$i^{\circ}_{photom} = 68 \pm 2$	

to refine the estimate of i_{polar} we attempted, if even roughly, to take account of the effect arising because of the reduction of unpolirized light of the system components during eclipses. The method of this account is described well in the paper by Drissen et al. (1986). In view of the absence of simultaneous photometric observations, we used the nearest in time "B"-light curve of CQ Cep derived by Demircan et al. (1997). The correction of the curves of variation of the u and q Stokes parameters for the aforementioned effect led to very insignificant variations of the results of the analysis given in brackets in the third column of Table 4. An impression is evoked that it is primarily the photometric estimate of the system orbit inclination that requires refinement. In the analysis of the CQ Cep light curves their essential amplitude instability is disregarded. The third light (L_3), when solving the system light curves, should certainly be involved, and with a high degree of probability it belongs to a third star (Kartasheva and Svechnikov, 2000). However, in our opinion, this is not sufficient. The CQ Cep light curve is evidently of composite character (Kartasheva and Svechnikov, 1996; Kartasheva, 1995). Only half of the amplitude of the system light curve ($\Delta m/2 \approx 0^m\!.2$) is probably due to the effects of ellipsoidality of the components and their eclipses. The second half of the amplitude is most likely associated with additional emission in the continuous spectrum of the system, which originates, apparently, in the zone of collision of the winds of the components and varies with phase of the orbital period. It is probably this emission that is mainly responsible for the asymmetry of the branches in the net light curve of the system, while its time variability is responsible for the sharp amplitude instability of the light curve and for the inconstant visibility of the O-component lines in the spectrum of the system (Kartasheva, 1996). The most low-amplitude CQ Cep light curve obtained by Kurochkin (1979) from photographic observations of the system in July-August, 1937 ($\Delta m \approx 0^m\!.2$) and possibly free from the contribution of the additional emission deserves, certainly, special attention. Besides, the contribution to the CQ Cep light curve of variations of the additional radiation varies (decreases) obviously with increasing wavelength of the observed radiation. This is seen well from Fig. 15 of Stickland et al. (1984). The solution of their "K"-light curve of the system and also of the above mentioned low-amplitude light curve of the system of July-August, 1937 (Kurochkin, 1979; Kartasheva and Svechnikov, 1996) performed by present-day method must, in our opinion, make the problem clear. Considering reliable the estimate of the CQ Cep orbit inclination obtained from the analysis of polarimetric observations ($i_{polar} = 80°$), the results of spectroscopic studies of CQ Cep ($m_{WR}\sin^3 i = 11.7m_{\odot}, m_0\sin^3 i = 14.1m_{\odot}, A\sin i = 17.3R_{\odot}$; Kartasheva, Snezhko, 1985) lead to the following estimates:

$$m_{WR} = 12.3m_{\odot}, m_0 = 14.8m_{\odot} \text{and} A = 17.6R_{\odot}.$$

In Fig. 3 are collected the results of polarimetric observations of CQ Cep available. The polarization curves of Piirola and Linnaluoto (1988), Harries and Hilditch (1997) are not presented in Fig. 3 because we do not have numerical data on these curves. Considering the results presented, it can be concluded that the greater part of time CQ Cep is in a relatively quiet state, which is characterized by the polarization curve having a rather large amplitude ($\Delta P \approx 0.8\,\%$) and the mean polarization level $\bar{P} \approx 5\,\%$. Its Fourier-analysis leads to geometric and physical characteristics given in Table 4 and discussed above. The 1948 observations of Hiltner (1950), our observations of 1994 and 1996 (Kartasheva et al., 1998) and the observations of Harries and Hilditch (1997) are distinguished from the general series of observations by the values of $\bar{P}$ and ΔP. The opinion, that the CQ Cep polarization curve obtained by Hiltner in 1948 (Hiltner, 1950) shows an amplitude of P variation twice as low, is probably wrong. The dashed line in Fig. 3 is a plot of the theoretical curve that we obtained for the observations of 1998 and lowered by 0.4 %. It is seen to satisfy fairly well the 1948 observations of Hiltner. The large gaps in phases falling on the extreme values of the system polarization could decrease artificially the amplitude of variation of P in these observations. It is difficult to judge whether the lower polarization level of the system in 1948 ($\bar{P} \approx 4.6\,\%$) is real or not. On the one hand, in his catalogue based on more later observations Hiltner (1951) presents a higher estimate of CQ Cep polarization ($\bar{P} \approx 5.25\,\%$), on the other hand, the polarization observations of the system in 1961 (Shakhovskoi, 1964; $P = 4.4\,\%$) support the possibility of observing a lower average level of system polarization. The observations made in the interval 1994–1996 (Kartasheva et al., 1998; Harries and Hilditch, 1997) were sure to catch the system at the phase of enhanced activity. The sharp increase in both $\bar{P}$ (up to 6.6 %) and ΔP (up to 1.6 %) in 1994 and then the reduce of these parameters to nearly the "quiet" values in 1995 and 1996, but with the disappearance of the maximum of polarization at the phases close to the main minimum of light, seem explicable assuming that the rise of densities of the common envelope of the system is accompanied further by expulsion of its outermost parts. Indeed, since the O-component of CQ Cep is embeded completely in the envelope of the WR star, the variations of intensity of its unpolarized radiation, which are caused by the sharp variations of the envelope density, must have a strong effect on the system polarization ($P = I_{polar}/I_{unpolar} + I_{polar}$) and cause the observed effects. The Fourier analysis of the results of the 1994 and 1996 observations (see Table 3 of Kartasheva et al., 1998) confirms our assumption that the electron density of the envelope was strongly variable in the period 1994–1996. However, the estimates of the system orbit parameters (i and Ω) that follow from the separate analysis of the polarization observations of CQ Cep of 1994 and 1996 differ greately from one another and from the results of the 1984 and 1998 polarimetric studies of the system. The model of Brown et al. (1978) is likely to be ill suitable for analysis of anomalous polarization curves of CQ Cep.

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