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THE EXTREMELY YOUNG CLOSE BINARY SYSTEM HERBIG BE-STAR V628 CAS = MWC 1080

V628 Cas = MWC 1080 is a well-known irregular variable Herbig Be star associated with bright and dark nebulosity. The first detailed description of its spectrum was given by Herbig (1960). He detected many strong FeII emission lines, Balmer series emission lines and strong dark H and K CaII lines which originate in the shell. The Balmer and strong FeII emission lines at 4924 A and 5018 A show deep P Cygni absorption fringes. Later Finkenzeller and Mundt (1984) stated that the spectrum of MWC 1080 showed two strongest narrow Na D_1 D_2 absorptions (at -15 and -45 km/s) and the third wide Na D_1 D_2 component (at -210 km/s) as well as P Cyg profile of Hα line. MWC 1080 was assigned to B8-A2 type (Dibaj, 1969) and B0 (Cohen and Kuhi, 1979). Mass loss from MWC 1080 is of $3\times10^{-6} - 10^{-5}$ $M_\odot$/year. MWC 1080 is an infrared source (Harvey et al., 1979) connected with radio sources (Curiel et al., 1987; Canto et al., 1984).

Shevchenko (1989) suspected a short-period component with periodicity of $\approx 1^d$. Here we present the photometric period of V628 Cas as a close binary system.

Our own observations of V628 Cas have been made at the Mt. Maidanak 60-cm Zeiss reflector with UBVR(I) pulse counting photometer since 1983. The annual limits of light variations, average V light and colours as well as number of observations are listed in Table I. Maidanak UBVR photometry is stored in Tashkent Astronomical Institute Data Bank: (Shevchenko V.S., Astronomical Institute of Acad. Sci. RUz., Astronomicheskaya str. 33, Tashkent, 700052 CIS (S.U.)), and are available. There are 930 UBVR observations during 9 years. Three 100 A/mm spectrograms were obtained in September 1988 using the Byurakan 2.6-m reflector with UAGS spectrograph equipped with an image tube.

To search for a period in light variability our observations made in 1984-1991 were analysed by methods of digital spectral analysis (Grankin et al., 1991). The analysis yields a period of 2.8869 days. Average light curves with the period in V are plotted in Figure 1. The annual average V light level was reduced to the mean <V> level (see Figure 1.). The "normal light" amplitude is $0^m.16$ V and elements are:

$$C = 2445607.374 + 2.886926\times E, \quad \text{Min II - Min I} = 0^p.60.$$

We believe that V628 Cas is a close binary system with 2.8869 orbital period. The asymmetric light curve and different heights of the first and secondary light maxima are testified as elliptical orbit of the system with the eccentricity $e \approx 0.2$-0.5. The moderate amplitude is due to a perceptible inclination angle (i) of the orbital plane. At the same time V628 Cas is an irregular variable $\Delta V \approx 0^m.3$.

Table I. Photometric data

JD 2400000+	n	V_{max}	V_{min}	<V>	<U−B>	<B−V>	<V−R>
45607–45707	37	11.36	11.73	11.516	0.18	1.38	1.55
45879–46061	81	11.34	11.77	11.564	0.16	1.37	1.58
46253–46399	98	11.29	11.79	11.528	0.20	1.38	1.57
46611–46805	89	11.42	11.78	11.593	0.21	1.37	1.60
46969–47173	83	11.34	11.78	11.584	0.12	1.36	1.56
47313–47543	124	11.33	11.77	11.580	0.10	1.36	1.52
47690–47887	94	11.34	11.75	11.521	0.11	1.36	1.53
48068–48279	110	11.34	11.75	11.556	0.10	1.36	1.53
48438–48586	216	11 14	11.66	11.375	0.18	1.38	1.53

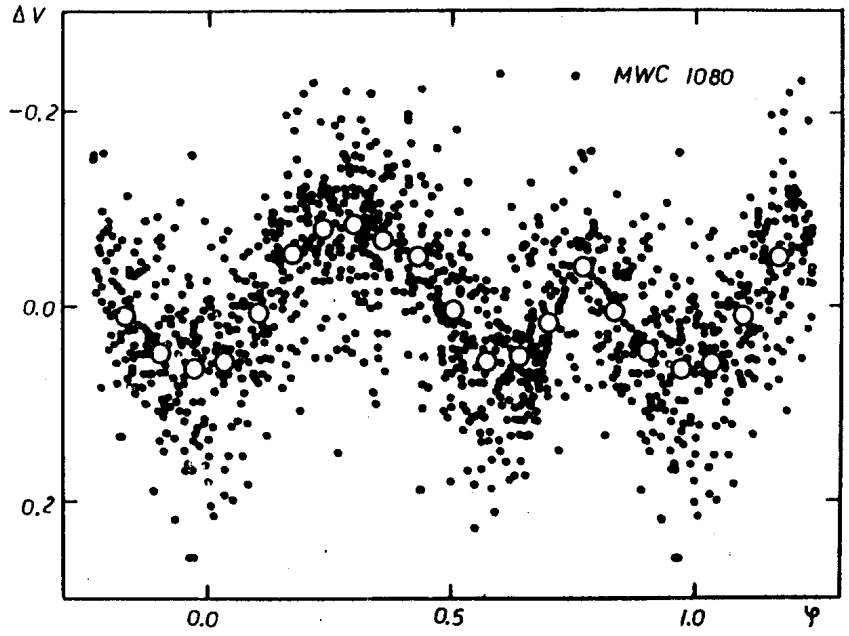

Figure 1. The folded light curve for V628 Cas

Canto et al. (1984) and Yoshida et al. (1991) found the distance of MWC 1080 to be of 2.3–2.5 kpc. The distance 2.2 kpc was obtained using our own UBVR- photometry of 12 faint stars ($13^m.0$–$15^m.3$ V) of B0 - A0 types in the close vicinity of MWC 1080. The interstellar extinction near MWC 1080 is $A_V=5^m.4$ and luminosity of the system is $M_V = -5^m.5$. The colour diagrams in Figure 2 show strong influence of the hot gas on the luminosity L_o of the system. If the luminosity of the gas shell and that of bright gas flows are equal to $\approx 1/3$ of L_o and the stellar component luminosities (L_*) are approximately identical, L_* of each component is $M_V = -4^m.3$ corresponding to a normal B0V type star.

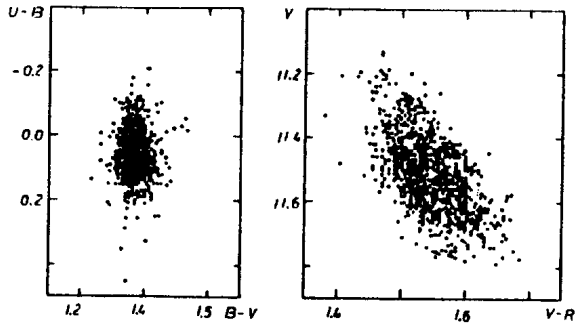

Figure 2. The two-colour diagram (U–B)–(B–V) and colour-magnitude diagram for V628 Cas.

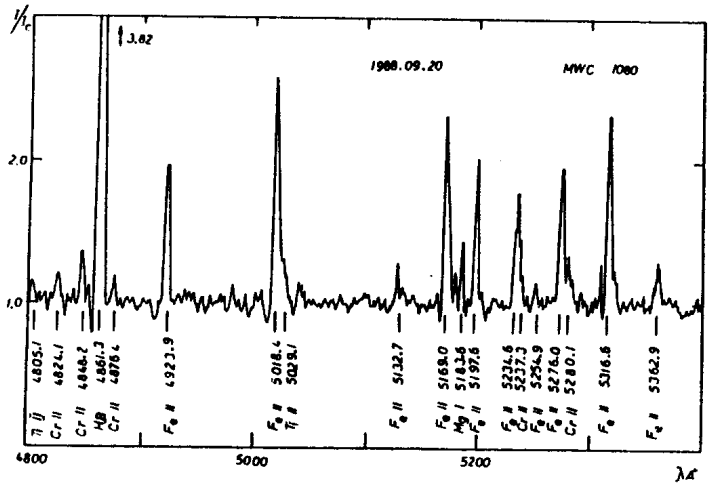

Figure 3. The spectrum fragment of V628 Cas

The Byurakan spectra show many strong ($I/I_c \approx 1.5$–2) emission lines such as FeII, CrII, TiII (see Figure 3.). Moreover the strongest four lines FeII 4923.9, 5018.4, 5169.0 and 5276, have P Cyg structure similarly to the Balmer emission lines.

The spectrum is very similar to the emission spectrum of V380 Ori. But we failed to find any stellar absorption lines in MWC 1080.

It might be that a closer examination using high dispersion would result in discovering the stellar lines. Preliminary calculations show that these lines must be consistent with axial $v_e sini \approx$ 100–150 km/s and a variable orbital $v_o sini \approx$ 300–400 km/s.

It is very important to perform such thorough high resolution spectroscopic investigations simultaneously with UBVRI - monitoring of V628 Cas.

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