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PHOTOELECTRIC PHOTOMETRY OF THE SUSPECTED CATACLYSMIC VARIABLE PG 0900+401

The object PG 0900+401 was suspected to be a new cataclysmic variable after the observations by Ferguson *et al.* (1984). They observed peculiar absorption lines in the spectrum of the star and suggested a thick accretion disk around the compact object responsible for these lines. Ferguson *et al.* obtained photoelectric photometry for the star: V = $12^m.87$, B-V = $+0^m.23$, U-B = $-0^m.96$, V-I =$+0^m.58$. The spectrum of the secondary corresponds to K3.

We started to observe the star PG 0900+401 photoelectrically *in* November, 1987. Now we have 15 nights of observations of the star during the interval JD 2447101 - 2448003. The observations at the date JD 2447292 were carried out by I.M.Volkov. In total it has been obtained 83 U, 280 B, 100 V, 4 R, and 5 W observations (the description of the W system can be found in Straižys, 1977). In the vicinity of the star PG 0900+401 also 11 nearby stars have been measured photoelectrically (the stars *a* - *n* in Fig.1 and in Table). The star "*g*" has been used as a comparison star in observations of PG 0900+401.

*	V	B	U	BD+40°
a	$6^m.366$	$6^m.673$	$6^m.703$	2138
b	9.29	10.30	11.0:	2147
c	10.10	10.73	10.67	2139
d	10.30	11.01	11.14	2154
e	10.84	11.39	11.33	
f	10.85	11.61	11.81	
g	11.738	12.183	12.12	
h	11.98	12.47	12.34:	
k	12.66	13.60	14.20:	
m	13.07	13.74	13.53:	
n	13.49	14.12	14.08:	
1		12.54		
2		12.76		
3		13.04		
4		13.24		

a: W= $6^m.64$ R= $6^m.08$
g: W=11.91 R=11.38

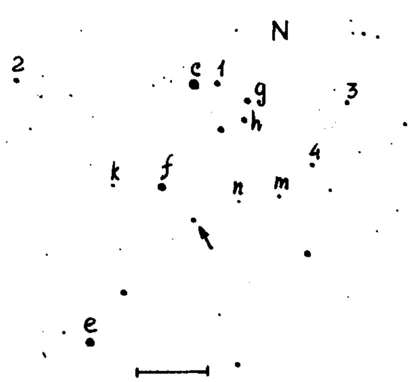

Figure 1

Remark : The stars *a*,*b*,*d* are outside the map.

Measurements were carried out with the one-channel photometers designed by V.M.Lyutyj, I.M.Volkov,and A.K. Magnitskij mounted at the 60-cm reflector in Crimea, 48-cm reflector at the Tian-Shan High-Altitude Observatory (near Alma-Ata),and 70-cm reflector in Moscow. In the nights JD 2447289, 2447949, and 2447953 the star PG 0900+401 was monitored continuously during 70 minutes, 210 minutes, and 110 minutes respectively.

The star PG 0900+401 was investigated also on 37 plates obtained with the 40-cm astrograph in Crimea (JD 2434062 - 47973) and on 12 plates obtained with the 10-cm equatorial camera of the Moscow observatory (JD 2417675-19125). The magnitudes of the comparison stars *1-4* were obtained by measuring photographic plates with the iris microphotometer (see the Table).The photographic data obtained on the basis of the rather homogeneous material from the 40-cm astrograph do not show any significant light variability ($B=12^{m}.95-13^{m}.10$). The light variations on the old plates, on the other hand,are between $12^{m}.6-13^{m}.1$ and seem to be due to inhomogeneous photographic material and uncertain photometric system: large errors may arise from an unjustified comparison of the object having a UV excess with an ordinary star.

So, all this looks as absence of any long-term or burst-like activity of the object. The photoelectric photometry of the star PG 0900+401 has not revealed any strong light variability as well. The mean stellar magnitude and color indices of the star from our measurements are as follows: $V=12^{m}.85$, $B-V=+0^{m}.2$, $U-B=-0^{m}.08$, $V-R=+0^{m}.3$, $W-B = -1^{m}.1$.

The power spectrum constructed on the basis of the photoelectric data revealed the periodic light variability with different amplitudes in different filters: $\Delta B = 0^{m}.10$, $\Delta U = 0^{m}.07$, $\Delta V < 0^{m}.05$ (see Fig.2a,b,c).The period of these variations is $P_1=0^{d}.33818$. In principle, the frequency in the power spectrum corresponding to this period has a one-day alias harmonic. The period of these alternative variations is $P_2= 0^{d}.514$. The light curve constructed with this latter period has somewhat greater scatter of the observational points. So, we give a preference to P_1 rather than P_2.

We have discovered also short periodic waves at the U and B light curves in the nights JD 2447289, 2447953 with the period 280 sec. Most significant are the light variations in the B range: $\Delta B \approx \approx 0^{m}.03$ (see Fig.3).

We suggest that the period $0^{d}.33818$ is the period of the orbital motion of a white dwarf in the close binary system of PG 0900+401.

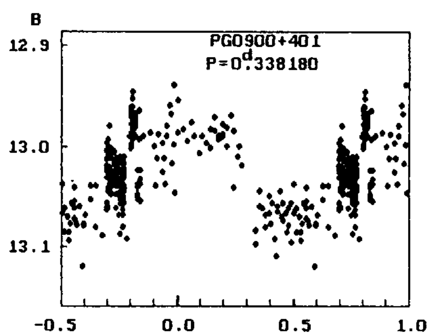

Figure 2a

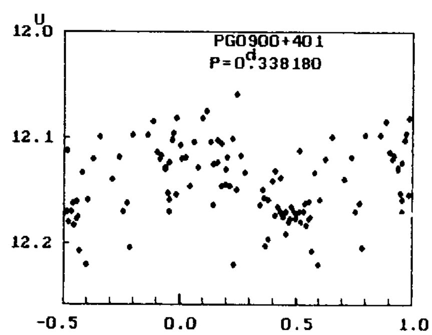

Figure 2b

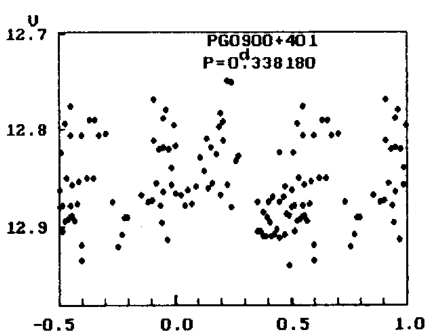

Figure 2c

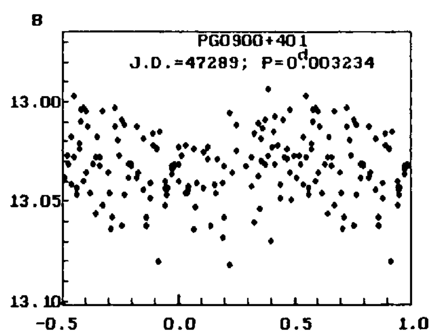

Figure 3

Though we cannot see any eclipses on the light curve due to obscurations of one component by another we do see the light variability connected somehow with the process of the orbital revolution. It may be, for example, explained by periodic appearances of the bright spot on the accretion disk around the white dwarf. If we suppose the masses of the components to be m(K3)$\approx$ $\approx$0,7 $M_{\odot}$, m(WD) $\approx$ 0,8 $M_{\odot}$, the separation will then be 1,8 $R_{\odot}$.

Since the period 280 sec is much shorter than the orbital one, we can suggest an accretion disk around the white dwarf in this binary system. In this case the white dwarf, an accretor, must be near the equilibrium state which is determined by the equality between the spin-up and spin-down torques in the binary. The equilibrium period can be found from the expression (Lipunov,1987):

$$P_{eq} \approx 100\ L^{-3/7}\ \mu_{32}^{6/7}\ m^{-2/7}\ R_{0,01}^{-3/7}\ \text{sec} \qquad (1)$$

where L is an accretion luminosity of the white dwarf in the units of the solar luminosity; $\mu_{32} = \mu/10^{32}$ G·cm^3, is the magnetic dipole moment; m, the mass of the white dwarf in the solar masses; $R_{0,01}$ = = R/0,01 $R_\odot$, the radius of the white dwarf. Substituting the period $P_{eq} \approx 280$ sec, luminosity L ≈ 1 $L_\odot$, mass m ≈ 0,8 $M_\odot$, and radius $R_{0,01} \approx 1$ into the expression (1), we can estimate the strength of the magnetic field at the surface of the white dwarf:

$$B \approx 10^{6}\ L_\odot^{1/2}\ P_{100}^{7/6}\ G \approx 3 \cdot 10^{6}\ G \qquad (2)$$

where P_{100} = P/100 sec is the spin period of the white dwarf.Such a magnetic field at the surface of the white dwarf is specific for the intermediate polars. So, it is very important to continue the observations of PG 0900+401 to discover if it is really a new intermediate polar.

In conclusion we would like to thank Dr. V.M.Lipunov for the fruitful discussions concerning the nature of the binary system PG 0900+401 and I.M.Volkov for the help in the observations.

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