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No long-term variability of PG 0900 + 401

The Palomar Green (Green, Schmidt & Liebert, 1986, hereafter PG) survey object PG0900+401 (sometimes referred to as PG0900+400) has so far received little attention in the literature.

Ferguson, Green & Liebert (1984) obtained the following photoelectric photometry for the star: V=12.^{m}87, B-V=+0.^{m}23, U-B=-0.^{m}96, V-I=+0.^{m}58. They also noticed broad hydrogen absorption lines in the spectrum of the star. No strong emission lines have been detected. Assuming that the object is a binary with a composite spectrum, consisting of a hot subdwarf primary and a cool main-sequence secondary star, they used the flux-ratio diagram method to deconvolve the spectrum. They obtained the result that the secondary component has spectral type K3, and that the primary star's temperature is 31000K.

Lipunova & Shugarov (1990, 1991) carried out photometry of this object and investigated old photographic plates. Neither photographic nor photoelectric data revealed any long term or burst-like variability. Their photoelectric photometry for the star was as follows: V=12.^{m}85, B-V=+0.^{m}2, U-B=-0.^{m}08, V-R=+0.^{m}3. However, comparing their Fig.2a with Fig.2b it seems that the value of the U-B color was misprinted, which must be the reason for the large deviation from the U-B value obtained by Ferguson, Green & Liebert (1984). Lipunova & Shugarov (1991) performed a power spectrum analysis and found two alternative orbital periods: P_1=0.33818d and P_2=0.514d. They also reported the presence of rapid variability with a period of 280 seconds.

We investigated plate number 139 obtained on March 16/17 1963 in the framework of The Torun Spectral Sky Survey (Papaj, 1989). This plate was obtained using objective prism BK7, with a dispersion of 520Å/mm at H gamma; the type of emulsion used was IIa-F. The middle of the 60min exposure time was on JD2438105.405. To obtain the intensity scale of the photographic plate we used the spectra of surrounding stars, together with their photometry given by Lipunova and Shugarov (1991). After a transformation leading to linear dispersion, we used the spectra of the surrounding stars together with their spectral energy distributions (we assumed stars c, d, e, f, k, m to be unreddened dwarfs of types G2, G5, G0, G8, K2 and G5, respectively) from the catalogue of Sviderskiene (1988), and obtained an absolute flux scale by using the flux calibration of UBV photometry given by Straizys (1977). The absolute flux distribution of PG 0900 + 401 we obtained is shown in Fig.1. Table 1 shows fluxes calculated as means of 100Å intervals and their errors are below 10%.

Table 1.
Wavelengths expressed in Å and corresponding absolute fluxes in 10^{-14} ergs s^{-1} cm^{-2} $Å^{-1}$

3400	13.5	4000	4.16	4600	3.35	5200	2.69	5800	2.30	6400	2.18
3500	10.9	4100	3.97	4700	3.21	5300	2.80	5900	2.14	6500	1.95
3600	5.89	4200	3.87	4800	3.05	5400	2.53	6000	2.13	6600	1.70
3700	5.13	4300	3.60	4900	2.63	5500	2.49	6100	2.14	6700	1.87
3800	4.28	4400	3.43	5000	2.40	5600	2.16	6200	2.09	6800	1.86
3900	4.44	4500	3.50	5100	2.54	5700	2.29	6300	2.03		

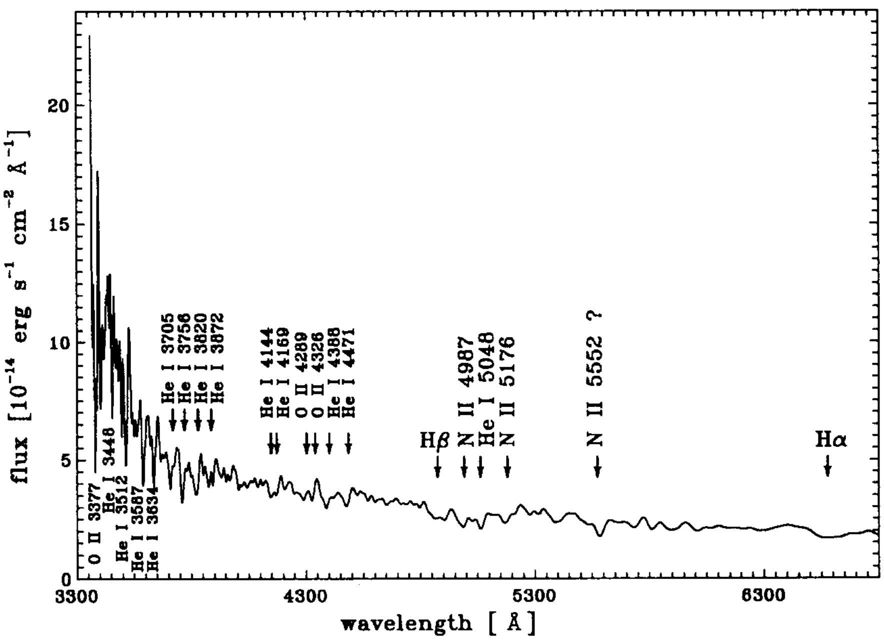

Fig.1. Absolutely calibrated spectrum of PG0900+401 obtained in 1963.

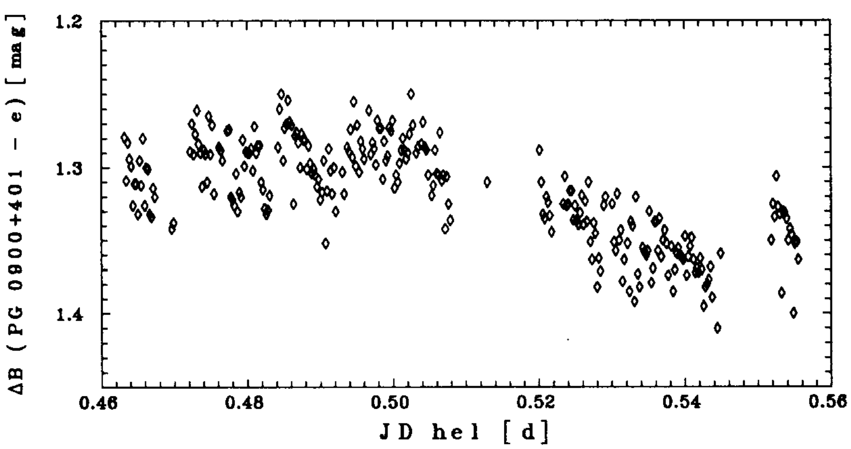

Fig.2. The differential B magnitude of PG0900+401 on Dec.16/17 '92

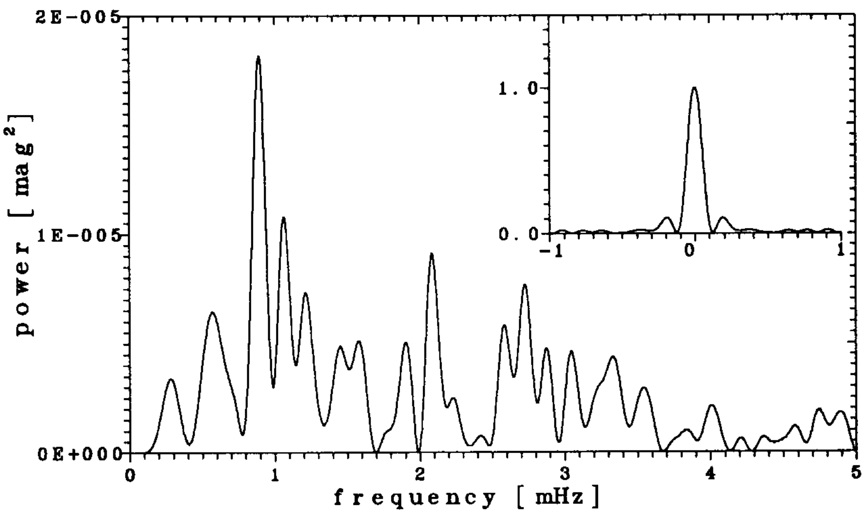

Fig. 3. The power spectrum (main panel) and the spectral window (top right panel) for observations carried out on Dec. 16/17 1992.

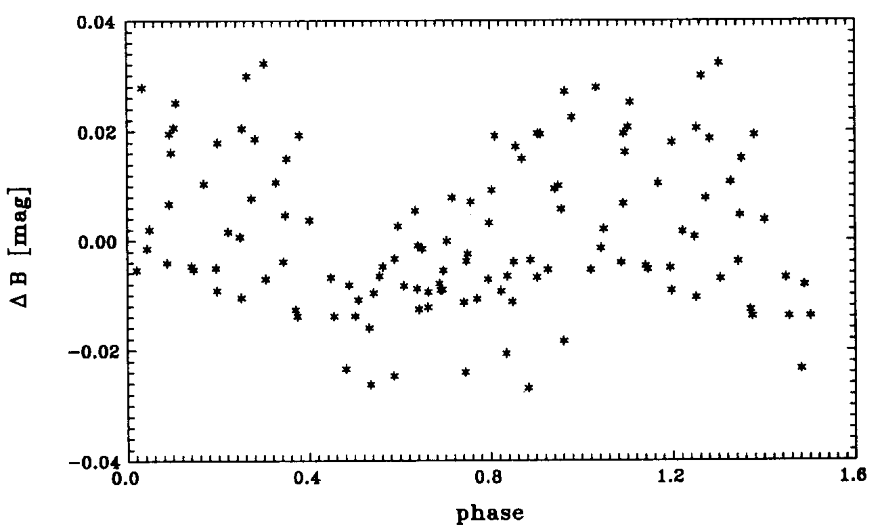

Fig. 4. Residuals of the December 16/17 data folded with period 1117.3s and binned (each bin consists of 3 observational points). Phase was chosen arbitrarily.

The spectrum is dominated by the DB white dwarf of temperature 20 000 - 30 000 K. A possible faint main-sequence companion star of type K may slightly contaminate the spectrum. Absorption lines of He I are the most prominent in the spectrum of PG 0900+401 (especially He I 3756Å, He I 3820Å, He I 4388Å, He I 4471Å). The presence of N II, O II and C II absorptions is also possible (N II 4987Å, N II 5176Å and others). The hydrogen lines are extremely weak and disappear with H gamma.

We observed PG0900+401 photometrically during two nights on December 16/17 1992 and January 12/13 1993. The observations were carried out at Mt.Suhora Observatory of Cracow Pedagogical University, using the 60-cm Cassegrain telescope with a double-beam photometer. The star "e" from the finding chart published by Lipunova & Shugarov (1991) has been used as the comparison star. According to Lipunova & Sugarov (1991) the photometry of the comparison star is as follows: V=10.^{m}84, B=11.^{m}39, U=11.^{m}33. Fig.2. presents differential B photometry of PG 0900+401 on December 16/17 1992. The integration time was equal to 20s. The variability in the B filter during these observations was less than 0.^{m}16. The time covered by our monitoring was about 0.^{d}1.

We have analyzed our observations using a power spectrum method (Deeming, 1975), searching for any periodicities on time scales of minutes. To eliminate low frequency modulations on a time scale of hours, we subtracted the general trends present in our observations using first or second degree polynomials. The spectral window and power spectrum obtained from our first set of data is shown in Fig.3. There is one dominant spike present at the frequency 0.895 mHz, which would imply a period of 1117.3 seconds. There is no significant feature at the frequency 0.357mHz, corresponding to the 280s period reported by Lipunova & Shugarov (1991). In Fig.4. we present the residual B light curve binned and folded with a period of 1117.3s. The amplitude of this variation is about 0.^{m}03. In our opinion these oscillations should be attributed to the white dwarf rather than to a hypothetical accretion disc around it, as was suggested by Lipunova & Shugarov (1991). The same method applied to our second set of observations yields a power spectrum corresponding to a broad distribution of power over a large range of frequency probably just reflecting the much worse quality of this set of data.

We also estimated photometry of PG 0900+401 for 16/17 March 1963 using the spectrum shown in Fig.1 and UBV filters' profiles given by Straizys (1977): V=12.^{m}97, B-V=0.^{m}17, U-B=-0.^{m}97. Such values mean that the object does not manifest any prominent secular changes. Further observations are needed both to find the orbital period and to ascertain whether the 1100s modulation detected by us is real.

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