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ON THE PERIOD OF THE HIGH AMPLITUDE δ SCUTI VARIABLE DW Psc†

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The star DW Psc (=GSC 614-01209; $\alpha_{2000} = 01^{\rm h}30^{\rm m}26\overset{\rm s}{.}9$; $\delta_{2000} = +08^\circ 41' 34''$) was discovered by Krugly (1999) as a new δ Scuti variable with a period of $0\overset{\rm d}{.}05875$ in the magnitude range $13\overset{\rm m}{.}7$-$14\overset{\rm m}{.}4$.

It was observed at Beersel Hills Observatory (BHO) on one night in November 1999 and six nights between November 2001 and February 2002. A total of 735 data points were obtained during 14.7 hours of photometry. The instrument used was a 0.4m telescope, equipped with a ST7E CCD camera. No filter was used. The exposure times varied between 60 and 120 seconds. In addition 36 datapoints were obtained during a 2 hour-run in November 2001 at the National Astrophysical Observatory (NAO) at Rohzen, (Bulgaria), with the Photometrics CE200A CCD camera attached to the 2.0m telescope. The exposures were taken in V-light with exposure times between 100 and 150 seconds. All images were reduced with the aperture photometry procedure of the Mira AP software package[1] and darkframed and flatfielded according to standard procedures.

The brightness of the variable was measured with respect to GSC 614-00524, while GSC 614-00592 was used as a check star. Both stars have $\Delta(B-V) = 0\overset{\rm m}{.}39$ with respect to the variable. These instrumental values of $\Delta(B-V)$ were determined at BHO from images in B and V light, using a filterset following Bessel's specifications. The nightly standard deviation of the differences in unfiltered magnitudes between the comparison and the check star measured at BHO, averaged $0\overset{\rm m}{.}03$. At Rozhen Observatory this standard deviation amounted to $0\overset{\rm m}{.}009$.

The following times of maxima have been determined by fitting a third degree polynomial through the data around maximum (the $O-C$ values are listed with respect to the ephemeris derived below):

†Based on observations made at Beersel Hills Observatory (Belgium) and the 2.0m telescope operated by the Institute of Astronomy (Bulgaria)

[1]The Mira AP software is produced by Axiom Research Inc.

JD Hel.	E	$O-C$ $[d]$	Observer	Instrument
2451498.3283	−12088	−0.0006	PVC	BHO, 0.4m
2451498.3892	−12087	0.0005	PVC	BHO, 0.4m
2452219.3644	0	−0.0001	PVC	BHO, 0.4m
2452223.3618	67	0.0008	PL	NAO, 2.0m
2452223.3618	67	0.0008	PVC	BHO, 0.4m
2452223.4198	68	−0.0009	PL	NAO, 2.0m
2452223.4203	68	−0.0004	PVC	BHO, 0.4m
2452224.2557	82	0.0000	PVC	BHO, 0.4m
2452224.3153	83	−0.0001	PVC	BHO, 0.4m
2452228.3119	150	0.0000	PVC	BHO, 0.4m
2452228.3714	151	−0.0002	PVC	BHO, 0.4m
2452228.4319	152	0.0008	PVC	BHO, 0.4m
2452232.3681	218	0.0001	PVC	BHO, 0.4m
2452308.3007	1491	−0.0003	PVC	BHO, 0.4m
2452308.3601	1492	−0.0005	PVC	BHO, 0.4m

From these maxima, the following ephemeris was derived:

$$\begin{aligned}\text{Max.} = \text{HJD } 2452219^{\text{d}}.3645 + 0^{\text{d}}.05964887 \times E.\\ \pm 0.0002 \pm 0.00000003\end{aligned}$$

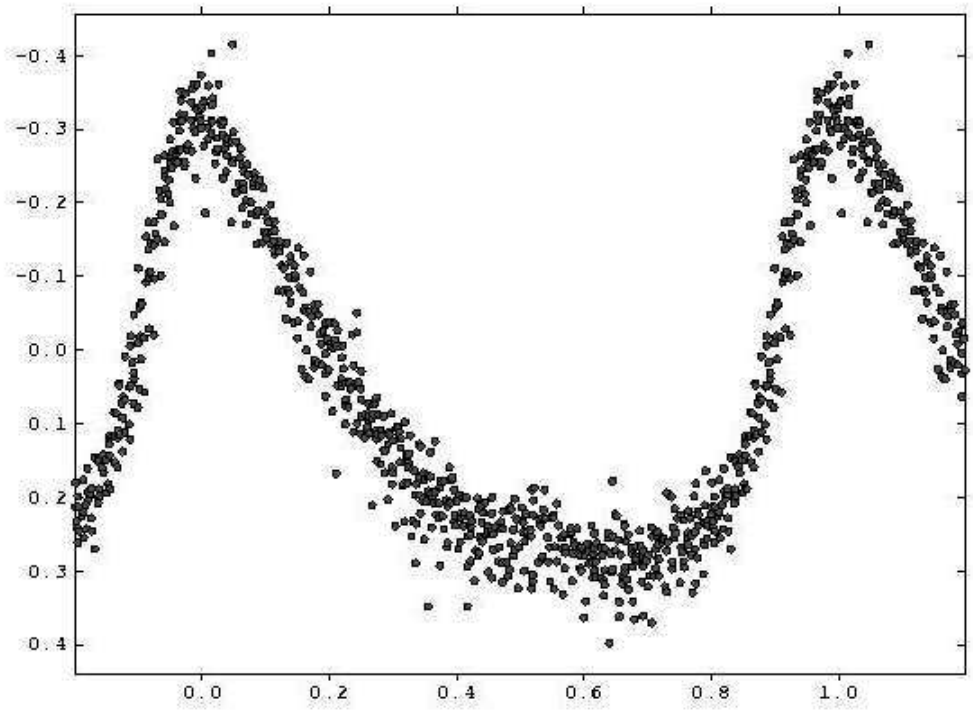

Figure 1. Phased light curve for DW Psc (BHO, unfiltered magnitudes with respect to GSC 614-00524).

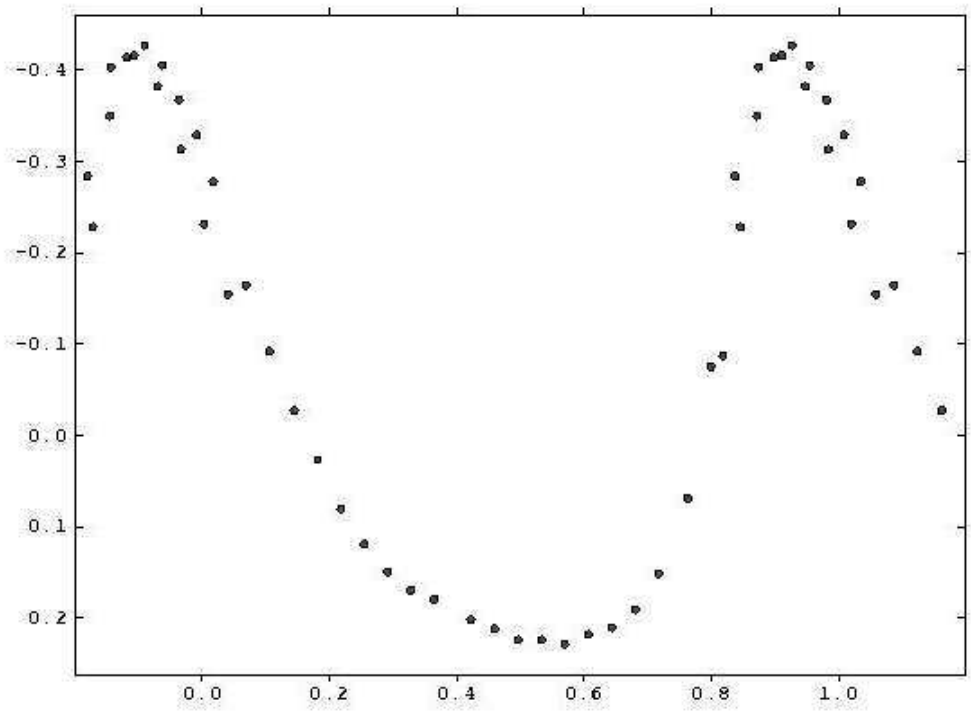

Figure 2. Phased light curve for DW Psc (NAO, V magnitudes with respect to GSC 614-00524).

Fig. 1 shows the phased light curve from the unfiltered BHO data (2001-2002) and Fig. 2 the phased light curve from the V data taken at NAO.

With the same method as above, a maximum was calculated from the data of Krugly (1999), giving HJD = 2450698.5135 and a large $O-C = 0\overset{\mathrm{d}}{.}0163$ (E = −25497). Adding one hour to this time of maximum would bring the $O-C$ back to $-0\overset{\mathrm{d}}{.}0017$ (E = −25496), which lies within the errors of the formula. However Krugly (2002, private communication) asserts that his observation times are correct (by comparing them with the positions of the asteroid 2100 Ra-Shalom which is on the images). If this is the case, the period of DW Psc has undergone a sudden change $\Delta P/P$ of at least -2×10^{-5} somewhere before the first observations at BHO in 1999. Thereafter the period seems to be constant. Although uncertain in this case, this sudden change is some 10 times larger than what is observed in Pop. II δ Scuti (SX Phe) stars (Breger and Pamyatnykh, 1998). However, we recall that an abrupt period break was detected in the case of V1162 Orionis (Hintz et.al., 1998). Intensive monitoring of this star later on showed that period changes of magnitude -1.6×10^{-5} are occurring (Arentoft et. al., 2001). Further observations of DW Psc would be needed to verify the constancy of the period or to disclaim it.

In the light curve of DW Psc at least four harmonics of the fundamental period can be detected. After prewhitening there is some evidence for further frequencies in the range 20−30 c/d, with an amplitude comparable to the observational error and a signal-to-noise ratio around 4. However, strong aliasing is involved. The timespan of the observations is too short to be conclusive about these frequencies. This is another reason to monitor the star in the future.

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