COMMISSION 27 OF THE I. A. U.
INFORMATION BULLETIN ON VARIABLE STARS
Number 3055

Konkoly Observatory
Budapest
29 July 1987
HU ISSN 0374-0676

UBV PHOTOMETRIC OBSERVATIONS OF DY PEGASI

DY Pegasi is a well known dwarf cepheid. The variability of this star was discovered by Morgenroth (1934) and it was often observed to study the nature and the period of its light variations. The observations obtained and the investigations published between 1934 and 1980 were summarized by Mahdy and Szeidl (1980). Soloviev (1938, 1940) who determined the first elements of the light variation of this star, indicated that the star had strong light curve variation. This variation was especially considerable in heights of light maxima (0.3 magn.). Although Lange (1944) questioned it, later on Grigorevsky and Mandell (1960) found significant light curve variation and suggested a period of 0.2554 day for this secondary variation. (This modulation period yields a period of 0.0567 day for the first harmonic mode and a period ratio $P_1/Po = 0.778$.) Modern photometric observations (Masani and Broglia, 1954; Hardie and Geilker, 1958; Broglia, 1961; Geyer and Hoffmann, 1975) have shown some non-repetitive character from cycle to cycle of the light curves but the changes in the heights of maxima have never exceeded 0.05 magn. Karetnikov and Medvedev's (1964) photometric observations, however, showed that the form of the light curve of DY Peg changed significantly and very rapidly. According to their investigation the variations in the amplitude exceeded 0.4 magn. Karetnikov and Medvedev proposed a period of 0.255413 day for the secondary variation.

The period changes of DY Peg have been discussed by Quigley and Africano (1979) and by Mahdy and Szeidl (1980) in detail. In the latter study about 100 times of maxima of DY Peg observed by photographic or photoelectric method have been collected and analyzed. The O - C residuals could be almost equally well approximated either by two straight lines or by a quadratic formula. In the first case the period has been constant with a sudden decrease of 7.5×10^{-8} day = -6.5 ms around J.D. 2437500 while in the other case the period has continuously decreased by -7.6×10^{-13} day·cycle^{-1} = 0.33 ms·year^{-1}.

Since both problems, the multiple periodicity and period changes of DY Peg which are essential in investigating the physics of dwarf cepheids are unsolved we decided to observe the star again in order to carry out a new period analysis and to investigate the possible light curve variation.

The 453 photoelectric observations were made at Kottamia Observatory, Egypt on the nights 2/3 , 3/4 , 4/5 and 6/7 August 1986 (J.D. 2446645, 2446646, 2446647 and 2446649). The one beam photoelectric photometer attached to the 74 inch telescope had an EMI 9558B photomultiplier. The amplified output of the tube was fed into a strip chart recorder. The U, B and V filters used were very close to the standard system of Johnson and Morgan. A number of standard stars were also observed to determine the extinction coefficients and the transformation constants. The star BD + 16°4878 served as the comparison and BD + 16°4876 as the check star.

The light curves observed in V and B light are shown in Figures 1 - 4. As can be seen from these figures the light curves are repeated fairly regularly but they also show some non-repetitive character from cycle to cycle. In the last three columns of Table I we have also indicated the brightness of the observed maxima in all the three colours as compared to the comparison star. Although the deviations are certainly larger than the observational errors, the variation at maximum in every colour is less than 0.04 magn. In a forthcoming paper we will carry out a detailed period analysis searching for secondary oscillation in this star.

From our observational material we could derive eight new times of light maximum of DY Peg and we extended the baseline of coverage to 48 years. These

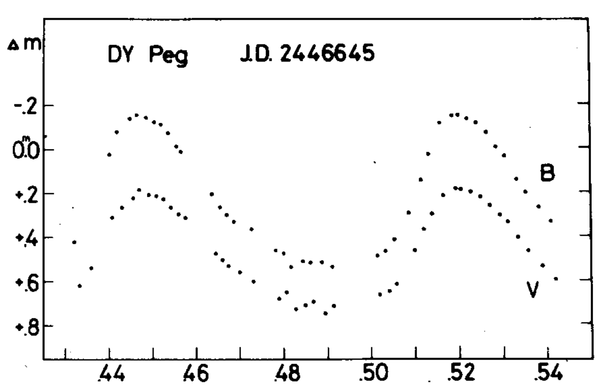

Figure 1

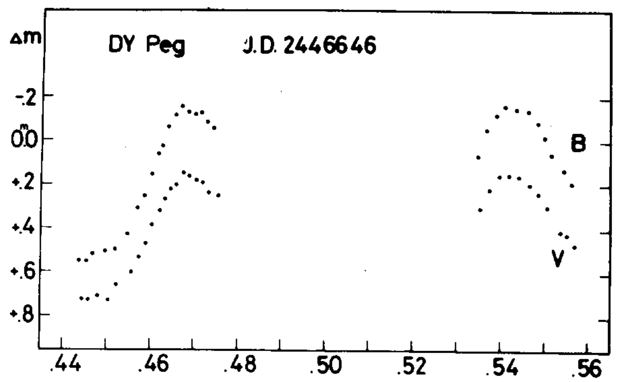

Figure 2

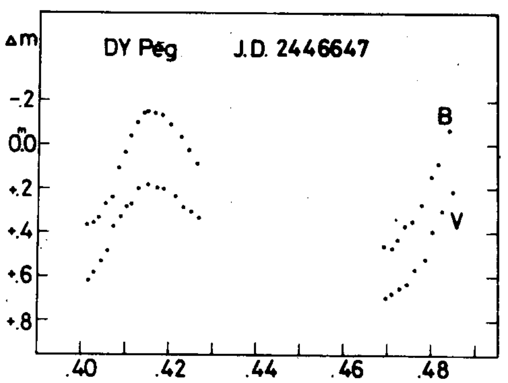

Figure 3

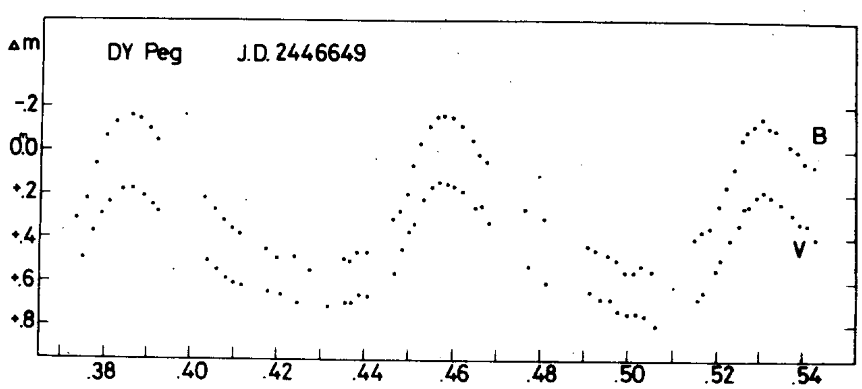

Figure 4

times of maxima are listed in Table I. We have not found any significant shift in time between the yellow, blue and ultraviolet maxima therefore each time of light maximum given in Table I is a mean value obtained from the yellow, blue and ultraviolet light curve.

Table I

Observed times and heights of maxima of DY Peg

Hel. max. J.D. 2446000+	E	$(O-C)_\ell$	$(O-C)_s$	ΔV_{max}	ΔB_{max}	ΔU_{max}
645.4466	190514	-0.0004	+0.0001	+0.186	-0.157	-0.061
645.5195	190515	-0.0004	+0.0001	+0.180	-0.155	-0.060
646.4675	190528	-0.0005	0.0000	+0.147	-0.153	-0.042
646.5408	190529	-0.0001	+0.0004	+0.147	-0.161	-0.034
647.4155	190541	-0.0005	0.0000	+0.181	-0.151	-0.037
649.3849	190568	-0.0001	+0.0004	+0.167	-0.161	-0.042
649.4578	190569	-0.0001	+0.0003	+0.148	-0.153	-0.038
649.5307	190570	-0.0002	+0.0003	+0.185	-0.145	-0.035

The list of light maxima given by Mahdy and Szeidl (1980) has been supplemented by the times of maxima of Table I and both linear and second order least - squares solutions have been carried out.

Mahdy and Szeidl (1980) suggested that a sudden decrease in the period of DY Peg might take place around J.D.2437500 therefere we used only those light maxima to the linear fit which have been observed since that time. The least-squares solution gave the linear ephemeris:

$$C_\ell(\text{Max. hel.}) = \text{J.D. } 2432751.9655 + 0\overset{d}{.}072926302 \cdot E$$

If the period had really a sudden change around J.D. 2437500, and before and after it the period was constant, the value of the period change was

$$\Delta P = -7.0 \times 10^{-8} \text{ day.}$$

The second order fit using all the maxima observed photographically or photoelectrically yielded the following formula:

$$C_s(\text{Max. hel.}) = \text{J.D. } 2432751.9614 + 0\overset{d}{.}072926365E - 2\overset{d}{.}31 \times 10^{-13}E^2.$$

In this case

$$\beta = -4.62 \times 10^{-13}\text{day}\cdot\text{cycle}^{-1} = -6.34 \times 10^{-12}\text{days}\cdot\text{day}^{-1} = -20.0 \text{ ms}\cdot\text{century}^{-1}.$$

The corresponding O-C residuals are given in Table I under the headings $(O-C)_\ell$ and $(O-C)_s$. At present we cannot decide which of the two approximations is correct. Further observations can only settle this important question.

The observation and investigation of DY Peg will be continued in the frame of the current observational program of dwarf cepheids at Kottamia Observatory.

HAMED A. MAHDY
Helwan Observatory
Helwan, Egypt

References:

Broglia, P., 1961, Mem. Soc. astr. It. 32. 7
Geyer, E.H. and Hoffman, M., 1975, Astr. Astrophys. Suppl. 21. 183
Grigorevsky, V.M. and Mandell, O.E., 1960, Per. Zvezdy 13. 190
Hardie, R.H. and Geilker, C.D., 1958, Astrophys. J. 127. 606
Lange, G.A., 1944, Astr. Tsirk, No. 28.3
Mahdy, H.A. and Szeidl, B., 1980, Mitt. Sternw. Ung. Akad. Wiss., Budapest, No. 74
Masani , A. and Broglia, P., 1954, Mem. Soc. astr. It. 25, 431
Morgenroth, O., 1934, Astron. Nachr. 252, 389
Quigley, R. and Africano, J., 1979, Publ. Astr. Soc. Pacific 91. 230
Soloviev, A. V., 1938, Tadjik Obs. Tsirk. No. 37
Soloviev, A.V., 1940, Per. Zvezdy 5. 340