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DAN MAOZ, AMIEL STERNBERG and ELIA M. LEIBOWITZ

*School of Physics and Astronomy,*
*Tel-Aviv University,*
*Tel-Aviv, Israel*

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# THE ANALYSIS OF THREE NOVAE: OLD NOVAE Q CYG, DI LAC AND N CYG 1992 = V1974 CYG.

V.P.GORANSKY AND S.YU.SHUGAROV
*Sternberg State Astronomical Institute*
*13, Universitetskii pr., Moscow V-234, 119899, Russia*
*email: goray@sai.msu.su, shugarov@sai.msu.su*

AND

E.S.DMITRIENKO AND E.P.PAVLENKO
*Crimean Astrophysical Observatory*
*Naychnii, Crimea, 334413, Ukraine*
*email: dmitrien@crao.crimea.ua, pavlenko@crao.crimea.ua*

## 1. Introduction

The analysis of periodicity of three novae stars is carried out using the photometric observations. The archive plates of the Moscow Sternberg Institute collection, $BVR$-observations carried out at TV-complex of 0.5-m Maksutov telescope of Crimean observatory (Abramenko et al, 1988), and $UBVRI$- and $WBVR$- electrophotometric observations carried out at 0.6-m, and 1.25-m reflectors of Crimea and 0.48-m, and 1.0-m reflectors of Tien-Shan observatory were used for analysis.

## 2. The photometric behavior of Q Cyg and DI Lac

Q Cyg is the old nova which bursted in November of 1876 up to $3^m$. At the beginning of our century nova returned to its initial light ($15^m$) and since that time observers note an unstable behavior of Q Cyg: the existence of flashes up to $1^m$. More detailed the photometric nature was studied by Shugarov (1983) and Shara et al (1991). The very similar photometric peculiarities are observed in Nova Lac 1910 = DI Lac.

The Fourier analysis reveals the following results.



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1. The 7-year cycle have been found earlier by Bianchini (1990) in Q Cyg, is refined ($2130^d$). It is caused, perhaps, by the red dwarf variability similar to 11-year solar cycle (See Fig.1ab).

2. The flashes of variable amplitude of $0.^m5 - 1^m$ in $B$ are also observed in quiescence with typical time of $64.^d69$ for Q Cyg and $20 - 30^d$ for DI Lac. These cycles seem to be more prominent in Q Cyg (see Fig 1a ). Probably, this variability is caused by accretion disk instability like that in U Gem type stars.

3. Three orbital period for DI Lac has been mentioned by Ritter, 1990, but no information exists on the orbit of Q Cyg. The search for orbital periodicity is difficult because of outbursts are described above and long-term variability. We analyzed the relatively quiet parts of light curves, or the residuals after subtraction of mean brightness of a few neighbor nights. The data analysis shows the most significant peaks corresponding to two periods, of $P_1 = 0.^d165$ ($1/P_1 = 6.06$) or $P_2 = 0.^d281$ ($1/P_2 = 3.56$). We suppose that these periods are connected with the spectral window details, as $1/P_1 - 1/P_2 = 2.5$, the frequency of 0.5 is seen in spectral window.

The more unequivocal period of $0.^d5324$, close to those given in the catalogue by Ritter ($0.^d543773$), is found for DI Lac. The periodogram is presented in Fig. 2a, and the corresponding data convolution - in Fig. 3b.

4. Q Cyg demonstrates also the brightness variations (the brightness increasing as well as decreasing) with typical time of tens minutes. Usually the amplitude of its variability does not exceed $0.^m15$. But twice the flares have been observed with amplitude of $0.^m4$ lasted 20 min. We suggest this variability may be caused by unstable accretion rate on a disk.

## 3. Observations of V1974 Cyg

1. Nova V1974 Cyg was discovered in outburst in 1992, February. It was identified with a $19^m.6$ $B$ star in the PSS plate by Annuk et al. (1993). Our astrometric survey showed considerable displacement between recent Nova image and PSS "prenova" image by about 2".2. So we do not consider this faint star as a prenova candidate.

2. The light curve in $V$ band are shown in Fig. 4. The photoelectric date from literature are added to fill the lack of our data near the maximum of the outburst and the first $200^d$.

The systematic deviations between the magnitudes obtained with different devices are due to strong emission lines ([Ne III], [Ne V] and [O III]) in the spectrum of V1974 Cyg.

The colors curves show pronounced variations. In the time range of JD 2448200 – 49300 the large UV excess developed up to the value of $2^m.2$. The excess was nonvariable in $U-B$ for about $250^d$. Note that $W-B$ color

reached $-4^m$! Near JD 2449350 the excess began to fade. At JD 2449600 all the colors returned to the level they had in maximum light.

3. Our monitoring of V1974 Cyg was carried out in six nights in the range from JD 2448867 till 50227. We found only the orbital period $P = 0^d.0812666$, close to value by Retter, but not the superhump period, which exists in the time range between JD 2449620 and 50041 (see Retter et al., 1996). A single night inside the range clearly shows no essential variability.

4. The result of O–C analysis of the orbital period is shown in Fig. 4. The elements are taken from Retter et al. (1996). Our 1996 spring observations confirm their formula. But earlier our minima (black points and squares in Fig.4), and minima by De Young and Schmidt (1994) (crosses) contradict to linear fitting. They suggest that period is variable. The formula by De Young and Schmidt is true until JD 2449600, and the formula by Retter et al. is true later than this date.

## 4. Conclusion

Our observations are subsequent analysis show several independent oscillations of different amplitude in the stars studied. The photometric variations with the orbital period in DI Lac and Q Cyg and the change of orbital period in V1974 Cyg were found.

## 5. Acknowledgments

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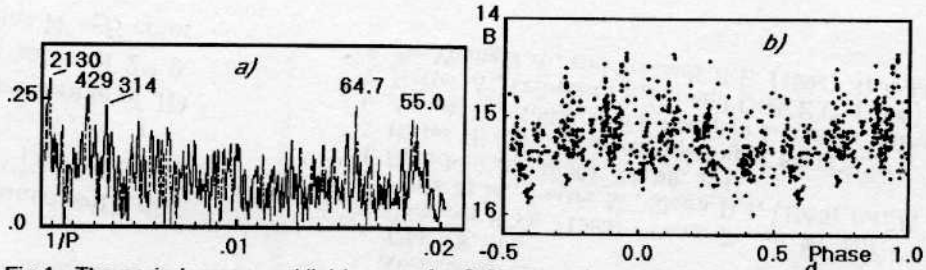


Fig.1. The periodogram and light curve for Q Cyg, constructed with P = 2130$^d$. Another value of the period is 64$^d$.7. There are one year aliases in the periodogram.

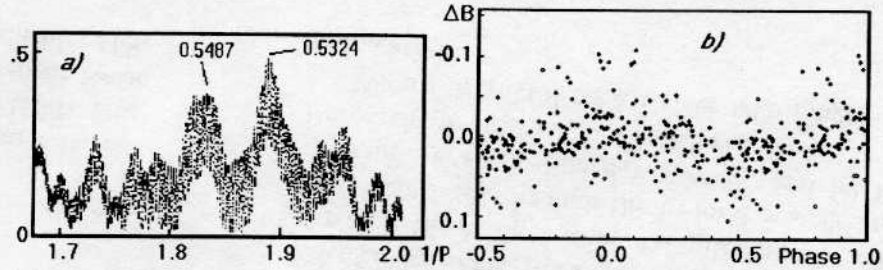


Fig.2. The periodogram and light curve for DI Lac, folded with P = 0.5324 day.

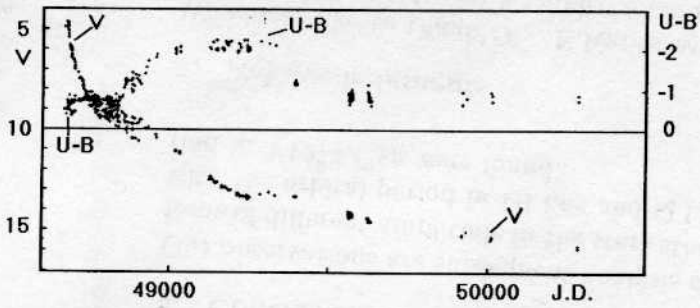


Fig.3 . The light and color U-B curves for V1974 Cyg.

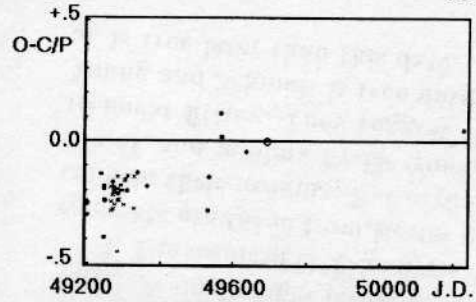


Fig.4. O-C residuals for V1974 Cyg, constructed with elements: J.D.$_{MAX}$=2449693.212 + 0$^d$.0812585·E