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NEW PERIODS FOR VARIABLE STARS IN CYGNUS

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This work summarizes the results of photographic photometry obtained over 24 years at the Skalnaté Pleso (1979-1993) and Asiago (1969-1988) observatories. The periods of light variation, the epochs of the maxima or of the minima, the types of variability for 17 variable stars are presented.

A total of ninety photographic plates of 9x12 cm and 24x24 cm formats with emulsions ORWO ZU-2 and ORWO ZU-21 was obtained using the 30/150 cm astrograph of the Skalnaté Pleso Observatory. The limiting magnitude of the observational material is about 16.5 m_{pg} . The resulting photographic magnitude is close to the photoelectric B one. At the Asiago Observatory 85 photographic plates were taken using the Schmidt telescope (67/92/215 cm). On the basis of this material Margoni and Stagni (1984) and Margoni *et al.* (1989) found 99 new variable stars. Thanks to Professor Margoni (1993), who has provided us with his original material in the reduced form, we were able to extend our observational material and to double the time interval investigated by us. During the complex survey of the combined observational material, we have identified and selected 17 variable stars for next investigation. Stars from the close neighbourhood of V1329 Cygni whose magnitudes were measured by L. Kohoutek were used as comparisons, as well as those used as comparisons by Margoni, 18 objects in total.

On the basis of the measurements obtained by iris microphotometer we have constructed the sensitometric characteristic for each plate, with the help of which the photographic magnitudes of the individual stars studied were determined. Moreover, the heliocentric correction was applied to all the JD of the exposures. Our main aim was to determine new periods or improve the accuracy of the periods already known for all the variable stars studied. With this purpose in mind, we have performed a period analysis of all the data, using the method of Fourier analysis (Deeming 1975, Kurtz 1985), the phase dispersion minimization method (Stellingwerf 1978) and the method of Fourier harmonic analysis (Andronov 1995) which fits the first harmonic term of trigonometric polynomial to the observed data. The advantage of the last method is the fact that it provides one not only with the determination of the parameters of variability alone, but also with the determination of the corresponding errors. Further result of the analysis is determination of the moments of maxima (eventually minima) of the light changes through the routine by R. Komžík (1995), making use of the following methods: the parabola fit, the polynomial fit, the “center of mass”, Kwee and Van Woerden, the sliding integrations and the tracing paper polygonal line. The averages of values obtained through the individual methods

were considered as the resulting values. The moments of maxima and minima are determined at about the mid-time of the observational interval. The type of the variability was determined as the last parameter, on the basis of the length of the period, the amplitude of light changes, the shape of light curve and with the help of the characteristics defined in the GCVS.

All the results obtained through the analysis of seventeen variable stars which have been objects of our study are well-arranged described in Table 1.

Table 1: The resulting parameters for variable stars studied

GCVS/IBVS	MS	$\alpha_{1950.0}$	$\delta_{1950.0}$	Δm_{pg}	P [d]	T_{max} (JDhel.)	Type	Note
V375 Cyg		20 45 32	+35 42.1	11.9 - 14.6	335.9	2447395.0	SRA	1
V384 Cyg		20 44 39	+34 48.6	12.1 - 17.5	114.8-117.3	-	M	2
V523 Cyg		21 00 04	+35 06.9	11.6 - 18.0	379.4	2444458.4	M	3
V1838 Cyg	18	20 43 45	+36 33.2	12.0 - 18.0	340.7	2443967.7	M	3
V1854 Cyg	38	20 46 17	+36 41.5	13.4 - 15.5	106.5	2446240.0	SR	4
V1856 Cyg	40	20 46 21	+35 16.1	13.0 - 15.7	1.999201	2448785.201	EA	3, 5
V1863 Cyg	51	20 47 42	+37 02.6	13.3 - 15.5	7.322	2446499.7	CEP	4, 6
V1864 Cyg	53	20 48 09	+37 18.9	14.3 - 18.0	463.2	2443494.3	M	3
V1868 Cyg	63	20 49 17	+36 42.5	13.5 - 18.5	402.6	2443548.8	M	3
V1871 Cyg	66	20 49 42	+35 05.9	12.5 - 15.6	692.5	2444262.0	M:	3, 6
V1877 Cyg	73	20 50 42	+34 12.3	13.1 - 15.2	4.54091	2444183.904	CEP	4, 7
V1886 Cyg	83	20 54 16	+36 10.3	13.4 - 15.6	254.8	2446140.0	SR	4, 7
V1889 Cyg	86	20 55 09	+33 56.5	13.4 - 15.8	1.3311	2446092.26	CEP	6, 8
V1894 Cyg	95	20 58 43	+33 53.3	12.1 - 13.4	257.8	2443749.0	M:	6, 8
-	8	20 41 03	+35 19.3	12.1 - 13.7	0.2534	2446599.129	RR Lyr	4, 7
-	91	20 57 29	+36 26.6	12.4 - 15.4	0.345372	2447415.787	RR Lyr	4, 7
-	99	21 03 03	+35 28.1	13.9 - 16.7	-	-	SR	9

Notes to table 1

1. the value of the period is close to the originally published one (Margoni *et al.*, 1989)
2. the value of the period is changing in the interval indicated with a period of 16.3 years
3. accuracy of the value of the period has been improved
4. value of the period has been determined for the first time
5. epoch of minimum is presented
6. the original classification was not confirmed, a new type of variability was determined
7. type of variability has been determined for the first time
8. the originally determined value of the period was not confirmed, a new value of the period was determined
9. no unambiguous period could be determined

For all the variable stars studied (except of V384 Cyg and MS99, with respect to the character of their variability and the results found), new, more accurate values of the epoch of the extremum were determined

Table 1 summarizes the result of our study. The first two columns give the final designation according to the GCVS and IBVS (Kholopov *et al.*, 1987) or the preliminary designation given by Margoni and Stagni (1984). We also present equatorial coordinates for the equinox 1950.0 for each star, which is compatible with the GCVS. The parameters of variability of these stars are further presented there: the interval of light changes, the value of period, the epoch of maximum (or minimum for the eclipsing binary) and the type of variability. The note characterizes more closely the parameters obtained for the individual variable stars investigated by us or describes the relation of the results achieved by us to the results presented in the literature (GCVS, Margoni and Stagni 1984 and Margoni *et al.* 1989).

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