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PHOTOELECTRIC PHOTOMETRY OF CARBON STARS IN THE VILNIUS SYSTEM

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Abstract. 368 observations of magnitudes and colour indices of 178 carbon stars in the Vilnius seven-colour photometric system are given.

Key words: carbon stars – Vilnius photometric system

1. Introduction

Carbon stars are traditional objects of research projects in the Radioastrophysical Observatory of the Latvian Academy of Sciences. Photographic photometry of carbon stars with the Schmidt telescope (240/120/80 cm) were initiated in 1967. However, the precision of the photographic method is about ± 0.1 mag and it is insufficient to solve the problem of membership of the carbon stars and other red giants to open clusters. Therefore, from 1978 the photoelectric photometry in the Vilnius system was undertaken with the 48-cm telescope of the Vilnius University and with the 1-meter telescope of the Lithuanian Academy of Sciences, both being placed on the Maidanak Mountain Observatory in Uzbekistan. The first results of this research have been published by Dzērvītis and Paupers (1981). Later on, photometric observations of carbon-rich stars in the Vilnius system have been made by Šleivytė (1985, 1987, 1988, 1992). At the same time, the authors of the present paper started a new series of observations of faint carbon stars in the Orion and Perseus spiral arms with the aim to obtain the abundance ratio of carbon to oxygen (Eglītis, 1993). Here we publish the results of this photometry.

2. Observations

The observations of carbon stars were made in nine runs listed in Table 1. The photomultiplier FEU-79 has been used as a light detector in the pulse counting mode. The bandpasses of the Vilnius system were realized by using a standard set of glass filters. Atmospheric extinction coefficients were obtained by the Nikonov's method (Straižys, 1977, 1992). For transformation of the observed colour indices and magnitudes from the instrumental to the standard system we have used colour equations determined from observations of 33 stars in the Cygnus Standard Region (Zdanavičius and Černienė, 1985), 20 stars in the SA 6 area near the North Celestial Pole (Meištas, 1988) and 10 faint stars in the M71 region (Janulis and Straižys, 1984).

Table 1. The observing runs.

Run	Year	Month	JD 2440000+	Telescope
1.	1988	XI, XII	7485–7507	1 m
2.	1989	IV, V	7641–7677	48 cm
3.	1989	XI, XII	7839–7861	1 m
4.	1990	IX	8143–8165	1 m
5.	1990	X, XI	8188–8208	1 m
6.	1991	IV, V	8375–8408	1 m
7.	1991	VI, VII	8409–8440	1 m
8.	1991	X, XI	8533–8580	1 m
9.	1992	XI, XII	8940–8953	1 m

Reductions of observations have been made with the BESM-6 computer of the Institute of Mathematics in Vilnius, Lithuania and the SM-1420 computer of the Radioastrophysical Observatory in Baldone, Latvia. The reduction software has been provided to us by A. Kazlauskas, J. Sūdžius and V. Strazdaitė. The mean square errors are ≤ 0.02 mag for indices $U-V$ and $P-V$, 0.01 mag for indices $X-V$, $Y-V$, $Z-V$ and $V-S$ and 0.02 mag for V magnitude.

The magnitudes V given in the catalogue are medium-band magnitudes of the Vilnius photometric system. For normal stars of spectral types from O to K they coincide within ± 0.01 mag with V-magnitudes of the UBV system. However, for M, S and carbon stars with the banded spectra the difference of V-magnitudes in both systems can be as large as ± 0.1 mag.

Table 2. Results of photometry in the Vilnius system.

Stephenson*	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
7.		10.09			3.59:	1.12	0.64	1.63	8541.25	8
		10.07			3.79:	1.13	0.66	1.63	8543.26	
10.		11.16	0.58:	0.97:	1.95	1.22	0.87	1.79	7854.25	3
		11.15	0.52:	1.08:	1.97	1.21	0.87	1.80	7857.30	
19.	UX Cas	10.12			3.45:	1.19	0.95	1.77	8534.28	8
		10.14			3.31:	1.20	0.93	1.77	8541.22	
32.	ST Cas	9.15	0.90:	2.08:	3.14	0.99	0.68	1.51	7854.18	3
		9.21	0.98:	2.14:	3.12	0.99	0.67	1.53	7857.22	
36.	VX And	8.49			4.46:	3.19	0.83	2.20	8143.40	4
		8.50			4.21:	3.26	0.84	2.21	8160.28	
		8.35			3.86:	3.46	0.93	2.17	8202.26	5
		8.34			3.74:	3.44	0.91	2.17	8203.27	
		8.41			4.52:	3.29	0.84	2.14	8940.25	9
43.	FR Cas	11.23			2.44:	2.42	1.03	2.27	8438.44	7
		10.37			4.18:	1.88	0.97	2.02	8534.27	8
		10.42				1.93	0.97	2.04	8546.33	
53.	NQ Cas	9.41	0.65:	1.44:	2.01	0.75	0.49	1.30	7850.19	3
		9.35	0.55:	1.45:	1.98	0.75	0.49	1.30	7854.19	
65.	AQ And	8.33			4.37:	2.63	1.12	1.92	7491.28	1
		8.34		3.42:	4.13:	2.61	1.12	1.93	7498.22	
		8.33			4.16:	2.56	1.12	1.92	7499.18	
		8.49			4.01:	2.23	1.01	1.91	8161.46	4
		8.50			3.99:	2.27	1.01	1.91	8162.43	
82.		11.41			2.73:	2.26	1.08	2.06	8549.27	8
83.	CP Cas	10.19			3.97:	2.07	0.97	2.10	8549.26	8
131.	OV Cas	11.68			3.61:	1.42	0.92	2.02	8534.29	8
		11.73			3.36:	1.45	0.92	2.02	8541.27	
136.	W Cas	10.07			4.25:	2.16	1.20	1.97	8534.30	8
		9.88			3.78:	2.05	1.15	1.89	8543.27	
		9.73			3.97:	1.98	1.13	1.81	8549.28	
165.	HO Cas	11.67			3.57:	1.27	0.68	2.13	8544.33	8
		11.66			3.04:	1.27	0.69	2.13	8545.28	
198.	Z Psc	7.26	0.74:	1.80:	3.22	1.46	0.75	1.75	8940.25	9
233.	V390 Cas	12.46				2.68:	1.21	2.03	8545.30	8
295.	X Cas	10.45				3.59:	1.36	2.48	7850.21	3
		10.51				3.72:	1.39	2.48	7854.22	
295.	X Cas	10.33			2.66:	3.41	1.50	2.54	8158.40	4
		10.25			1.95:	3.42	1.50	2.52	8162.45	
305.	BT Per	11.89				2.52:	0.89	2.15	8189.29	5
		11.91				2.57:	0.87	2.17	8190.29	

*Number from Stephenson's (1989) catalogue.

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
310.	CN Per	11.80			3.11:	1.30	0.89	1.87	8189.31	5
		11.98			2.90:	1.36	0.92	1.95	8202.31	
334.		11.34			1.93:	2.72	1.33	2.20	8536.39	8
		11.23			1.93:	2.68	1.31	2.22	8541.31	
342.		10.79			4.43:	1.78:	0.87	1.96	8188.34	5
		10.84			4.60:	1.79:	0.87	1.95	8189.22	
344.		11.83				3.01:	1.36	2.31	8542.35	8
		11.81				3.00:	1.36	2.30	8543.28	
348.	VZ Per	11.05			2.73:	1.02	0.49	1.71	7854.29	3
350.	BS Per	9.89			4.24:	2.51	1.04	2.07	8188.31	5
		9.91			4.01:	2.49	1.06	2.05	8189.24	
360.		10.83			4.84:	2.04	0.79	2.01	8189.33	5
		10.85			4.12:	2.03	0.78	2.03	8203.30	
372.	DY Per	11.57		1.33:	2.60	1.25	0.46	1.81	8203.33	5
		11.60		1.36:	2.50	1.25	0.46	1.81	8204.32	
379.	EH Per	11.92			3.42:	1.33	0.87	1.82	8204.35	5
384.	VZ Per	11.04	0.63:	1.81:	2.84	1.01	0.53	1.65	8189.27	5
403.		10.25		2.07:	3.18	0.88	0.79	1.46	8204.36	5
423.		11.57			3.42:	1.33	0.85	1.72	8542.33	8
		11.56			3.50:	1.36	0.85	1.71	8543.30	
447.		10.57			4.55:	2.15:	0.83	1.92	8204.38	5
451.	57°702	7.68	0.79	1.65	2.52	0.96	0.46	1.62	7843.29	3
		7.69	0.62	1.69	2.52	0.97	0.46	1.62	7845.28	
		7.70	0.66	1.67	2.49	0.96	0.45	1.63	7849.37	
		7.74	0.68	1.62	2.39	0.98	0.45	1.63	8158.40	4
		7.72	0.63	1.58	2.39	0.98	0.45	1.63	8160.44	
461.	V410 Per	9.51			3.58:	1.27	0.90	1.86	7843.26	3
		9.51			3.55:	1.30	0.90	1.85	7845.26	
500.	Y Per	9.11			3.55:	1.18	0.82	1.47	8149.49	4
		8.96			3.58:	1.15	0.80	1.44	8158.42	
505.		10.93				2.79:	1.02	2.01	8536.41	8
		11.00				2.80:	1.00	2.05	8538.42	
541.	V466 Per	8.58			4.33:	2.18	0.87	2.08	7843.27	3
		8.59			3.99:	2.18	0.86	2.09	7845.27	
		8.65			4.56:	2.24	0.88	2.08	8158.43	4
		8.66			4.28:	2.23	0.86	2.07	8160.46	
567.		12.17				2.30	1.09	2.41	8542.38	8
		12.20				2.31	1.05	2.44	8544.35	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
571.	EZ Per	10.91			4.46:	1.73:	0.71	1.95	8204.42	5
575.		11.69				2.79:	1.01	2.39	8204.46	5
578.	V385 Per	11.05			5.29:	1.58:	0.90	1.97	8189.41	5
		11.04			4.11:	1.57:	0.91	1.95	8204.44	
586.		11.99				1.83	0.85	2.09	8542.39	8
		11.99				1.86	0.85	2.09	8544.37	
623.		10.66			3.81:	1.38	0.77	1.89	8542.41	8
		10.71			4.08:	1.38	0.72	1.94	8544.38	
628.		11.63				1.67	0.94	2.17	8542.43	8
		11.63				1.69	0.94	2.18	8544.39	
634.	BC 190	9.17	1.03:	1.39:	2.12	0.94	0.61	1.36	8536.43	8
		9.33	0.93:	1.41:	2.18	0.90	0.63	1.43	8538.43	
641.		10.83			3.99:	1.46:	0.79	1.98	8188.38	5
		10.85			4.14:	1.47:	0.77	1.97	8189.39	
643.		9.44			4.21:	2.80	1.03	1.98	8536.45	8
		9.54			3.89:	2.77	1.11	2.17	8538.44	
644.	40°917	11.11			3.97:	1.41:	0.81	1.95	7854.29	3
		10.83			3.83:	1.22	0.79	1.85	8158.44	4
		10.81			3.90:	1.27	0.77	1.85	8160.47	
		10.84		1.39:	3.54:	1.23	0.74	1.87	8200.42	5
		10.83		1.63:	3.95:	1.19	0.75	1.88	8201.45	
649.		10.71			4.24:	1.33	0.85	1.78	8546.39	8
		10.70			3.81:	1.36	0.86	1.78	8548.34	
696.		11.80				1.50	0.71	1.79	8544.44	8
		11.80				1.44	0.69	1.81	8546.41	
707.		10.60			4.56:	1.75	0.76	1.78	8542.44	8
		10.60			4.36:	1.74	0.76	1.80	8544.41	
755.		12.72			2.16:	0.78	0.58	1.29	8544.46	8
		12.69			2.41:	0.77	0.64	1.27	8548.35	
793.	15°691	9.63			3.48:	1.18	0.85	1.82	7842.34	3
		9.64			3.54:	1.20	0.83	1.84	7844.33	
797.	V346 Aur	9.07			3.26:	1.29	0.98	1.95	7845.29	3
		9.04			3.29:	1.29	0.99	1.95	7849.38	
833.	R Lep	10.16				3.29:	1.60	3.29	7503.35	1
		10.16				3.20:	1.62	3.30	7504.33	
		10.16				3.22:	1.59	3.29	7505.34	
836.	EL Aur	8.93			4.27:	1.61	0.89	1.99	7842.45	3
		8.92			4.03:	1.59	0.90	1.98	7844.35	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
875.	SY Eri	8.45	0.66	1.29	2.72	1.14	0.82	1.65	7503.35	1
		8.45	0.68	1.29	2.72	1.15	0.82	1.65	7504.34	
		8.45	0.68	1.28	2.71	1.14	0.82	1.65	7505.36	
879.		11.73			2.02:	0.87	0.62	1.40	8548.40	8
904.	V348 Aur	9.23			3.41:	1.20	0.87	1.74	7849.39	3
		9.22			3.39:	1.19	0.87	1.74	7850.29	
941.	S Aur	12.33					1.63	3.07	8160.48	4
		12.16				2.89:	1.53	3.02	8165.43	
958.		10.60			3.89:	1.32	0.80	1.68	8542.46	8
		10.58			3.84:	1.32	0.80	1.68	8544.47	
990.	24°862	9.73	0.73:	1.74:	2.62	0.91	0.57	1.58	7849.40	3
		9.73	0.79:	1.64:	2.68	0.92	0.56	1.58	7850.28	
1043.	CP Tau	9.52		3.66:	3.56:	1.07	0.74	1.67	8544.48	8
1080.		11.18			3.55:	3.03:	1.06	2.34	8538.49	8
		11.14			3.57:	2.91:	1.02	2.33	8544.50	
1089.	29°1026	10.43		1.72:	2.94:	1.13	0.92	1.80	8544.51	8
		10.44		1.46:	3.24:	1.14	0.91	1.79	8546.46	
1128.	AZ Aur	12.60				2.00	1.46	2.91	8538.50	8
1136.	BQ Aur	11.05				2.16	0.81	2.00	8538.51	8
		10.99				2.13	0.81	1.98	8546.47	
1226.		9.34	0.60	1.10	1.41	0.45	0.38	0.77	8548.47	8
1246.	BN Mon	9.61			3.42:	2.84	1.13	2.10	8548.48	8
1401.	DF Mon	10.84				2.95:	1.07	2.21	8546.51	8
		10.87				2.95:	1.05	2.21	8548.49	
1453.	GY Mon	8.52	0.88:	2.01:	3.31	1.01	0.83	1.65	7505.38	1
1507.	V614 Mon	7.56	0.57	1.57	2.38	0.77	0.33	1.47	7850.31	3
1561.	R Cmi	9.47		1.58:	3.44:	1.41	0.99	1.98	7503.50	1
		9.52	0.72:	1.32:	3.38:	1.43	0.98	1.01	7505.49	
1569.		11.35				1.97	0.81	2.12	8548.51	8
1595.	VX Gem	11.63				2.68:	1.22	2.43	7503.51	1
		11.64				2.58:	1.20	2.42	7505.50	
1616.	5°1606	9.72			3.87:	2.67	0.85	1.96	8548.50	8
1703.	22°1680	9.83	0.21:	1.02:	1.39	0.60	0.24	0.74	7643.21	2
2165.	T Lin	11.70				3.58:	1.46	2.60	7503.53	1
		11.74				3.46:	1.48	2.62	7505.51	
2384.	T Cnc	8.57				3.59	1.20	2.32	7503.49	1
		8.55			3.85:	3.56	1.20	2.31	7505.52	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
2641.	Y Hya	7.19			4.23:	2.32	0.82	1.91	8200.53	5
		7.11			4.14:	2.32	0.83	1.91	8201.51	
2900.	16°2118	10.20	0.46:	1.16:	1.57	0.63	0.35	0.79	7643.24	2
3921.	T Dra	9.50			2.46:	2.84	1.10	1.78	8151.17	4
		9.47			2.33:	2.80	1.09	1.77	8152.16	
4038.	T Lyr	8.29			2.77:	4.14	1.22	2.45	8151.18	4
		8.27			2.97:	4.16	1.23	2.45	8152.17	
		8.47			2.65:	4.18	1.35	2.54	8203.10	5
		8.46			2.57:	4.18	1.35	2.55	8204.10	
4045.	V627 Oph	13.48				2.87:	1.33	2.07	8415.33	7
		13.47				3.17:	1.47	2.06	8418.34	
4055.		11.60			1.83:	0.66	0.49	1.03	8419.33	7
		11.60			1.71:	0.63	0.50	1.04	8420.33	
4082.	BW Ser	12.30				1.60	1.03	2.05	8419.35	7
		12.29				1.62	1.04	2.04	8420.34	
4088.		11.02		2.34:	3.24:	1.10	0.88	1.59	8415.34	7
		11.03		2.34:	3.22:	1.04	0.89	1.60	8417.34	
4089.	HK Lyr	8.65			4.05:	1.77	0.85	1.91	8151.18	4
		8.53			4.12:	1.67	0.85	1.92	8152.18	
		8.44		3.98:	4.12	1.83	0.91	1.91	8203.12	5
		8.40		3.86:	4.03	1.82	0.92	1.90	8204.12	
4099.	V874 Aql	12.71			2.07:	0.71:	0.69	1.26	8410.35	7
		12.77				0.76:	0.60	1.27	8411.37	
4122.	V874 Aql	11.18				2.89:	1.02	2.22	8410.33	7
		11.19				2.79:	1.06	2.22	8411.36	
4159.	10°3764	10.28			3.95:	1.47	1.04	2.10	8410.32	7
		10.28			3.53:	1.44	1.08	2.10	8411.35	
4180.		12.95	0.70:	0.56:	1.17	1.02	0.53	1.46	8420.36	7
		12.97	0.83:	0.55:	1.10	0.95	0.59	1.48	8424.33	
4198.	20°4072	9.63	0.92	1.53:	2.12	0.67	0.63	1.20	8410.37	7
		9.67	1.00:	1.51:	2.15	0.67	0.62	1.22	8411.38	
4208.		10.15	1.12:	1.59:	3.31	1.26	0.91	1.76	8410.38	7
		10.15	0.97:	1.80:	3.40	1.27	0.90	1.76	8411.40	
4211.		10.05	0.64	1.04	1.44	0.54	0.38	0.83	8417.40	7
		10.06	0.64	1.06	1.44	0.53	0.38	0.84	8418.36	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
4212.		12.11				4.28:	1.10	2.52	8415.36	7
		12.14				4.43:	1.08	2.55	8418.36	
4217.	CG Vul	9.96			4.67:	2.67	0.88	2.10	8410.36	7
		9.98			4.13:	2.66	0.89	2.10	8414.34	
4248.		11.87				2.39:	0.82	2.08	8415.37	7
		11.85				2.40:	0.83	2.07	8418.37	
4263.		11.23	0.35	0.98	1.45	0.74	0.28	1.17	8415.38	7
		11.17	0.37	0.95	1.45	0.72	0.33	1.12	8417.35	
4277.		11.95				1.59:	1.08	2.50	8410.39	7
		11.94				1.96:	1.07	2.52	8415.40	
4301.	V374 Aql	10.81			2.24:	0.99	0.63	1.48	8410.41	7
		10.84			2.22:	0.98	0.63	1.48	8414.36	
4342.		12.29			1.97:	0.99	0.42	1.66	8417.41	7
		12.25			2.07:	0.98	0.43	1.65	8419.36	
4343.		11.29		1.22:	1.70	0.53	0.48	0.93	8430.33	7
		11.31		1.18:	1.74	0.53	0.47	0.95	8436.33	
4346.		10.54			3.77:	1.15	0.48	1.47	8430.34	7
		10.53			3.51:	1.14	0.47	1.49	8436.34	
4348.		11.09	0.91:	1.27:	1.71	0.67	0.47	1.01	8415.42	7
		11.13	0.79:	1.21:	1.68	0.68	0.45	1.04	8417.36	
4380.	EK Cyg	10.22	1.09:	1.45:	2.08	0.72	0.55	1.25	8423.33	7
		10.20	0.95:	1.47:	2.11	0.74	0.55	1.23	8425.33	
4392.	BC 160	11.82				1.48	0.71	1.76	8418.40	7
		11.83				1.46	0.70	1.78	8419.38	
4410.	HV Cyg	11.46				1.86	0.87	1.97	8417.37	7
4415.	TT Cyg	7.62		3.54:	4.16	1.20	0.61	1.65	8152.22	4
		7.60		3.29:	4.10	1.17	0.63	1.63	8158.16	
		7.73	0.65:	3.56:	4.00	1.15	0.62	1.65	8203.14	5
		7.78	0.83:	3.46:	4.06	1.16	0.62	1.67	8204.09	
4430.		11.33				1.13	0.80	1.67	8410.41	7
		10.80				1.00	0.69	1.59	8414.37	
4437.		12.04			2.38:	1.09	0.56	1.85	8430.35	7
		12.07			2.94:	1.11	0.55	1.87	8438.40	
4471.	IQ Cyg	12.21				2.79:	1.28	2.16	8419.41	7
		12.11				2.93.	1.32	2.12	8425.35	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
4490.	CU Vul	11.49			3.03:	2.17	0.93	2.33	8420.38	7
		11.52			3.12:	2.20	0.94	2.33	8423.34	
4493.		13.29	0.83:	1.10:	0.80	0.47	0.52	1.25	8430.37	7
4497.		12.21			2.30:	0.77	0.58	1.25	8425.38	7
4511.		11.95				2.67:	1.16	2.29	84230.38	7
		11.93				3.58:	1.19	2.30	8438.41	
4569.	PU Cyg	12.06			2.61:	0.95	0.37	1.71	8425.37	7
4581.	AX Cyg	8.35			4.67:	2.14	0.82	1.90	7507.12	1
		8.11		2.91:	4.54	2.29	0.81	1.89	8152.21	4
		8.17		3.65:	4.28	2.29	0.82	1.89	8158.17	
4584.		10.65	0.93:	1.30:	2.06	0.73	0.60	1.20	8423.36	7
		10.64	0.81:	1.31:	2.05	0.75	0.60	1.20	8424.35	
4588.	V416 Cyg	12.06			3.84:	1.27	0.85	1.69	8418.42	7
		12.04			3.24:	1.24	0.84	1.66	8419.42	
4627.	V1583 Cyg	10.69				2.78:	0.98	2.21	8408.43	7
		10.67				2.85:	1.00	2.19	8409.35	
4633.		11.03	0.51:	1.16:	2.03	0.75	0.52	0.99	8420.42	7
4653.	X Sge	8.82			4.42:	1.65	1.04	1.70	8152.20	4
4654.	47°2999	11.26			3.72:	1.23	0.81	1.71	8418.43	7
		11.29			3.55:	1.27	0.77	1.75	8419.43	
4712.	AY Cyg	10.53				1.54	0.87	2.01	8409.37	7
		10.52				1.56	0.88	2.01	8411.44	
4716.	RY Cyg	8.35		3.49:	3.81	2.92	1.02	2.16	8203.17	5
		8.34		2.33:	3.81	2.91	1.03	2.16	8204.22	
4729.	V429 Cyg	11.14				3.48:	0.79	2.35	8409.37	7
		11.11				3.61:	0.82	2.31	8411.43	
4762.		11.21			2.98:	1.65	0.73	1.95	7672.38	2
		11.29			2.24:	1.56	0.82	1.96	7675.33	
4782.	V432 Cyg	11.67				2.81:	1.33	2.37	8409.39	7
		11.67				4.60:	1.32	2.38	8412.32	
		11.54				3.08:	1.28	2.36	8425.40	
4806.	WX Cyg	12.15				2.62:	1.38	2.69	8409.40	7
		12.14				2.70:	1.37	2.77	8412.33	
		12.33				2.87:	1.58	2.75	8425.41	
4817.	U Cyg	10.22			2.82:	2.91	1.46	2.68	7507.13	1
		9.00		0.78:	2.98:	3.08	1.53	2.32	8143.36	4
		8.85		1.22:	2.58:	3.02	1.50	2.21	8158.19	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
4817.	U Cyg	8.74		1.68:	2.81:	2.95	1.45	2.16	8165.21	
		8.36	0.87:	2.06:	3.06	2.74	1.36	1.98	8188.25	5
		7.94	0.81:	1.98:	3.12	2.46	1.28	1.85	8204.15	
		9.42		1.51:	2.75:	2.45	1.31	2.50	8386.40	6
		9.71	-0.07:	1.67:	2.78:	2.70	1.41	2.66	8407.40	7
		9.87			2.55:	2.77	1.50	2.73	8418.41	
		10.02			2.41:	2.91	1.56	2.80	8430.41	
		9.97			2.18:	3.83	1.79	2.85	8541.13	8
		9.75			1.52:	3.78	1.77	2.77	8549.22	
4851.	V744 Cyg	10.78			4.70:	1.48	0.60	1.87	8426.39	7
		10.77			4.50:	1.51	0.60	1.87	8428.34	
4900.		10.69	0.84:	1.41:	2.10	0.62	0.56	1.11	8420.43	7
4912.	V777 Cyg	10.95			3.45:	1.21	0.90	1.71	8426.37	7
		10.94			3.27:	1.17	0.92	1.71	8427.33	
4923.	V778 Cyg	10.46			4.60:	1.90	0.68	1.95	8426.38	7
		10.44			4.73:	1.89	0.68	1.92	8427.35	
4939.	V Cyg	11.75					1.86	3.47	8143.37	4
		11.05				4.85:	1.82	3.21	8158.21	
4946.	V569 Cyg	10.37				2.20	0.95	2.18	8409.41	7
		10.37				2.21	0.95	2.18	8414.39	
4988.	V1527 Cyg	11.87				2.13	0.96	2.28	8159.17	4
		11.91				2.11	0.95	2.23	8161.15	
5078.		11.70	0.63:	1.48:	2.28	0.79	0.56	1.36	8426.41	7
		11.71	0.67:	1.39:	2.26	0.79	0.54	1.36	8427.40	
5144.		10.75	1.15:	1.53:	2.25	0.79	0.63	1.26	8423.39	7
		10.80	1.01:	1.61:	2.27	0.78	0.59	1.28	8424.35	
5172.		10.14		1.89:	3.34:	1.05	0.90	1.58	8423.37	7
		10.14		1.87:	3.38:	1.05	0.89	1.59	8424.37	
5206.	V1554 Cyg	10.81	0.98:	1.50:	2.15	0.86	0.63	1.38	8203.20	5
		10.85	1.17:	1.54:	2.18	0.85	0.61	1.39	8206.13	
5254.		11.69			2.25:	0.63	0.58	1.15	8425.43	7
		11.70			2.19:	0.62	0.58	1.17	8427.41	
5303.	BC 61	12.20				2.24:	0.98	1.95	8428.33	7
		12.21				2.27:	0.94	1.94	8429.34	
5322.	AX Cep	12.81				3.26:	1.71	3.29	8429.37	7
		12.56				2.67:	1.63	3.16	8436.39	
5371.	LU Cep	10.00			3.97:	1.35	0.73	1.88	8423.42	7
		10.05			4.29:	1.33	0.76	1.88	8427.36	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
5406.	S Cep	7.21			3.03:	3.68	1.45	2.53	8158.22	4
		7.20			3.00:	3.69	1.43	2.57	8159.19	
		7.21			2.99:	3.68	1.44	2.52	8160.23	
		7.26			2.85:	3.67	1.43	2.54	8164.21	
		7.23			2.40:	3.59	1.44	2.52	8165.22	
		7.61			3.09:	3.72	1.42	2.63	8189.15	5
5487.	V1399 Cyg	12.38				1.94:	0.74	2.15	8428.35	7
		12.26				2.03:	0.74	2.12	8436.40	
5494.	LW Cyg	9.21			4.04:	2.39	0.87	2.07	8410.43	7
		9.24			4.42:	2.42	0.90	2.09	8414.40	
		9.31				2.50	0.93	2.10	8426.44	
5495.	V413 Cyg	9.43			4.39:	2.04	0.90	2.00	8427.38	7
6496.	RX Peg	10.12	0.92	1.37	2.13	0.65	0.57	1.17	8159.20	4
		10.11	0.79	1.48	2.18	0.65	0.58	1.14	8160.25	
5510.	BC 172	12.61	0.64:	1.00:	1.39:	0.62	0.46	1.05	8428.37	7
		12.63	0.61:	1.00:	1.22:	0.64	0.38	1.05	8429.35	
5534.	IS Cep	12.57				1.51	0.85	2.11	8428.38	7
		12.54				1.49	0.91	2.09	8429.38	
5570.	RZ Peg	7.81	0.92:	2.06:	3.59	1.52	0.86	1.52	7854.13	3
		7.80	1.09:	2.06:	3.54	1.46	0.85	1.51	7857.19	
5601.		13.31				3.38:	1.08	2.44	8429.41	7
5618.		11.31			3.09:	1.39	0.78	1.80	8545.17	8
5620.	KT Lac	11.98			3.90:	1.20	0.94	1.78	8429.43	7
		12.02			3.52:	1.22	0.93	1.79	8430.43	
5677.		11.24			3.08:	2.73:	1.03	2.40	8414.42	7
		11.26			2.46:	2.86:	1.02	2.40	8415.43	
5699.	BE Lac	10.52			4.01:	1.68	0.79	1.80	8427.43	7
		10.52			3.79:	1.65	0.79	1.81	8428.40	
5714.		11.53				2.16:	0.85	1.90	8424.41	7
		11.42				2.17:	0.88	1.84	8428.42	
5719.	DG Cep	9.05			3.73:	1.28	0.86	1.88	7860.19	3
5722.	DV Lac	9.78			5.39:	1.46	0.75	1.80	8410.44	7
		9.78			4.09:	1.42	0.77	1.79	8414.41	
5728.	TX Lac	10.48	0.69:	1.41:	2.22	0.85	0.37	1.53	8438.42	7
		10.38	0.52:	1.52:	2.21	0.83	0.41	1.47	8541.20	8
5774.	TV Lac	9.68			3.79:	1.22	0.63	1.69	8414.43	7
		9.69			3.82:	1.20	0.63	1.70	8415.43	

Table 2 (continued)

Stephenson	Name	V	$U-P$	$P-X$	$X-Y$	$Y-Z$	$Z-V$	$V-S$	JD 2440000+	Run No.
5789.		11.41				1.82:	0.98	1.62	8424.43	7
		11.32				1.70:	1.02	1.57	8428.43	
5791.	VY And	9.81			4.03:	2.01	0.52	1.79	8145.45	4
		9.83			4.61:	2.00	0.53	1.79	8146.47	
5794.		11.36			3.61:	1.97	0.90	1.85	8545.19	8
5848.	EU And	10.82			3.47:	1.50	0.78	1.85	8427.44	7
		10.81			4.17:	1.46	0.80	1.84	8428.44	
5861.	EV And	10.56			4.27:	2.16	0.86	1.98	8545.18	8
5865.	V353 Cas	9.93		1.87:	3.95:	1.37	0.57	1.85	8435.41	7
		9.93		2.01:	4.09:	1.37	0.60	1.83	8436.42	
5879.	EW And	9.34	0.69:	2.74:	3.37	1.17	0.88	1.71	7505.18	1
5890.	DS Cas	10.21		1.31:	2.84:	1.25	0.78	1.77	8435.43	7
		10.20		1.61:	2.75:	1.25	0.77	1.76	8436.44	
5903.	ST And	9.26			4.40:	2.08	0.93	1.70	7505.17	1
		9.76		1.37:	1.91:	0.53	0.48	0.95	7854.15	3
		9.78		1.31:	1.79:	0.52	0.48	0.96	7857.20	
5910.	PU Cep	9.92			2.97:	1.19	0.92	1.76	8435.42	7
		9.91			3.06:	1.17	0.93	1.75	8436.43	
5919.		11.62			3.40:	1.31	0.99	1.90	8545.20	8
5951.		11.44			2.03:	1.21	0.60	1.91	8541.24	8
		11.48			2.21:	1.26	0.61	1.93	8545.23	
5954.	V652 Cas	12.40				1.51	0.90	2.03	8545.21	8
5970.	V532 Cas	10.41				2.64:	1.15	1.99	7854.16	3
		10.44				2.66:	1.15	1.99	7857.21	
		11.89				2.78	1.21	2.63	8149.48	4
		11.89				2.80	1.24	2.66	8160.27	
		11.85				2.93:	1.31	2.62	8189.20	5
		11.68				2.92:	1.32	2.60	8190.25	
		11.68				3.02:	1.28	2.60	8190.26	
		11.55				2.92:	1.33	2.56	8201.27	
5987.	SU And	8.49	1.95:	2.73:	3.92	1.15	0.71	1.67	7505.19	1
**	V409 Per	10.29				2.04:	0.81	1.91	7850.23	3
		10.32				2.05:	0.81	1.91	7854.24	

** V 409 Per, $\alpha = 03^h06^m21^s$, $\delta = +45°46.'7$ (1950), Kholopov et al. (1987).

3. Results

The magnitudes V and colour indices $U-P, P-X, X-Y, Y-Z$, $Z-V$ and $V-S$ of the observed stars are given in Table 2. For some stars observations in the bandpasses U, P and X have not been made since they were too faint. Observations of lower accuracy are marked by a colon. The stars can be identified by numbers and coordinates in Stephenson's (1989) catalogue and by their names as variables. The last two columns give Julian Day of observation and the observing run number from Table 1.

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