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UBV PHOTOMETRY OF W Ser STARS

A long term project was initiated in 1993 with the main purpose to monitor long period interacting Algols (W Ser stars). Unfortunately, it turned out that all program stars cannot be observed continuously because of the weather conditions of our observatory. So, some of them have been cancelled from the programme. The photometric data of these stars are published here, in order to make this information available for future studies.

The observations were made by two different instruments: (a) an unrefrigerated DC *UBV* photometer attached to the 50cm Cassegrain telescope on the Mátra Mountain Station of the Konkoly Observatory, (b) a similar photometer attached to the 60 cm Newtonian telescope of the observatory in Budapest (data denoted by an asterisk in Table 2). More information about these photometers and filter combinations are available in Szabados (1977). The observations were generally made with two comparison stars in each colour according to the sequence $C_1C_2BVVC_1C_2BVV\dots$, where C_i indicate the comparison stars, B the background, V the variable, respectively. Comparison stars (see Table 1) were chosen within one degree from the variables in order to neglect the first-order extinction coefficients. The values for V and colour indices were taken from the literature (see reference column) or if there are no published measurements, the comparisons were tied to standards referred to in Table 1.

Table 2 contains the observational data. Each value of them was determined by 8–12 individual integrations. The integration time was about 10 sec. Average extinction coefficients were included in the reduction process implicitly through the applied telescope constants, only. The colour-dependent extinction was omitted. The estimated internal errors of the measurements are about $0^m.005$ in V and B while in U about $0^m.01$. Naturally, the intrinsic error might be more than the internal one. Thus, the third digits in the Table 2 serve to make perceptible trends, only.

Table 1. Comparison stars for *UBV* measurements

variable	comparison	V	$B - V$	$U - B$	reference
SY And	BD+42°27	9.55	0.14	0.126	HR 56
	BD+42°29	10.09	0.98	0.25	
	BD+43°23	10.58	0.41	-0.28	
UU Cnc	HD 66372	9.24	-0.19	-0.55	HD 66553
	BD+15°1732	9.74	0.73	0.33	
RX Gem	HD 49929	9.57	0.07	0.034	Hall & Walter (1975)
	HD 49805	8.47	-0.06	-0.31	Hall & Weedman (1971)
HD 37453	HD 37352	7.709	0.115	-0.147	Landolt (1983)
HD 43246	HD 43495	7.735	-0.192	-0.138	Dempsey et al. (1990)

Table 2. *UBV* measurements of W Ser stars

variable	HJD 2400000+	<i>V</i>	<i>B</i> − <i>V</i>	<i>U</i> − <i>B</i>
SY And	49609.5225	10.481	0.176	−0.012
	49682.3584	10.494	0.155	−0.143
	50001.4473	11.062	−0.237	0.400
	50002.4229	10.538	0.119	−0.210
	50005.3076	10.444	0.176	−0.218
UU Cnc	49047.3828	9.374	1.105	0.846
	49066.4287	8.706	1.443	1.417
	49682.5947	9.328	1.134	0.632
	49718.6064	9.351	1.096	0.995
RX Gem	49041.5469	9.050	0.032	−0.018
	49047.3359	9.283	0.173	0.112
	49066.3984	9.265	0.136	0.060
	49682.5508	9.222	0.201	0.160
	49718.5703	9.232	0.206	0.082
	49735.3516	9.245	0.149	0.121
HD 37453	49047.2910	8.199	0.748	0.236
	49066.3564	8.129	0.795	0.424
	49067.3496	8.189	0.826	0.412
	49682.4941	8.186	0.729	0.250
	49735.3135	8.121	0.749	0.226
HD 43246	49047.3164	7.366	0.216	−0.161
	49066.3799	7.455	0.202	−0.177
	49375.3477*	7.406	0.207	−0.193
	49682.5205	7.433	0.217	−0.193
	49718.5244	7.406	0.223	−0.221
	49734.4404	7.408	0.206	−0.170
	49735.3320	7.432	0.214	−0.198

Next, we briefly review the photoelectric photometric history of the stars involved in the paper.

SY And ($P=34^{\text{d}}908$, A0+K1) is a neglected star from photometric point of view. Although, there are some marks of its photoelectric observations in the literature (Hall, 1971; Nha, 1988), there is no available *UBV* measurement of the star. Consequently, there were no tested comparisons. The used comparisons were tied to the international system in two steps. HR 56 (= HD 1185A) served as a primary standard to the stars HD 915, HD 775 and HD 982 with the parameters $V = 6.15$, $B - V = 0.05$ and $U - B = 0.03$ (see Hoffleit, 1982). With the help of their determined values can be obtained photometric parameters for the used comparisons (Table 1).

UU Cnc ($P=96^{\text{d}}69$, ?+K4II–III) has an extended literature compared to its long period. The first non-complete photometry was published by Eggen (1973) using *UBVRI* system. The first complete light curve was obtained from a 13-year monitoring in colours *B* and *V* by Winiarski & Zola (1987). Other numerous, partly available, but thus far unpublished

observations have been made in Tallinn (see Kalv, 1983) and at Yonsei Observatory (see Lee, 1988) in *UBV*, moreover, by an APT (see Zola et al., 1994) in *BV*. In this work HD 66553 was used as a primary standard with the values $V = 8.48$, $B - V = 0.85$ and $U - B = 0.51$ (see Mermilliod, 1987).

RX Gem ($P = 12^d21$, A0+K2:) was observed photometrically by Hall & Walter (1975) in the frame of a comprehensive study. Since then, there were not any *UBV* measurements to publish, although they would be useful for detecting some possible period changes.

HD 37453 ($P = 66^d75$, F5II+Be) was recognised as an interesting star based on the studies performed with the IUE satellite (see Parsons et al., 1984), only. As far as we know, there are about 200 unpublished observations (see Bopp, 1992) obtained by an APT, but they were made in colour *V*.

HD 43246 ($P = 23^d1755$, B8V+F8II) has a similar history as HD 37453. The IUE satellite showed (ref. see above) its strange spectroscopic behaviour. The only photometric study was made by Dempsey et al. (1990) in the *UBV* system.

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References:

- Bopp, B. W., 1992, in *Robotic Telescopes in the 1990s* Ed. A. V. Filippenko, ASP Conf. Ser., **34**, 19
- Dempsey, R. C., Parsons, S. B., Bopp, B. W. and Fekel, F. C., 1990, *PASP*, **102**, 312
- Eggen, O. J., 1973, *PASP*, **85**, 42
- Hall, D. S., 1971, *BAAS*, **3**, 66
- Hall, D. S. and Walter, K., 1975, *A&A Suppl.*, **20**, 227
- Hall, D. S. and Weedman, S. L., 1971, *PASP*, **83**, 69
- Hoffleit, D., 1982, *The Bright Star Catalogue* 4th Ed., Yale Univ. Obs., New Haven
- Kalv, P., 1983, *IAPPP Comm.*, **11**, 31
- Lee, Y.-C., 1988, *Vistas in Astron.*, **31**, 323
- Landolt, A. U., 1983, *AJ* **88**, 853
- Mermilliod, J.-C., 1987, *A&A Suppl.*, **71**, 413
- Nha, I.-S., 1988, *Vistas in Astron.*, **31**, 185
- Parsons, S. B., Bopp, B. W. and Kondo Y., 1984, in *Future of Ultraviolet Astronomy based on six years of IUE Research*, Ed. Mead, J. M. et al, NASA CP-2349, p 396
- Szabados L., 1977, *Comm. Konkoly Obs. Budapest*, **70**, 1
- Winiarski, M. and Zola, S., 1987, *Acta Astron.*, **37**, 375
- Zola, S., Hall, D. S. and Henry, G. W., 1994, *A&A*, **285**, 531