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CCD TIMES OF MINIMA OF FAINT ECLIPSING BINARIES I

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The list given below contains 114 times of minima of 68 individual eclipsing binaries obtained during 1995–1997. All minima have been obtained by means of a SBIG ST 7 CCD camera attached to the 400-mm $f/1750$ Newton reflector at the N. Copernicus Observatory and Planetarium Brno, only several observations have been done by smaller instruments or by means of CCD camera SBIG ST 4 (see column Notes in the Table 1).

One of the purposes of the observing programs of our observatory is to derive timings of minima mainly of relatively faint stars (fainter than 12 mag in the minimum). The aim of our observations was to obtain times of minima and new information about the shape of the light curve of (neglected) eclipsing binaries. The observed stars were chosen mainly from the observing program of B.R.N.O. – Variable Star Section of Czech Astronomical Society. Detailed description and results of the running observational program can be found in Contributions of N. Copernicus Observatory and Planetarium Brno.

The camera was used without any filter so that only magnitudes in the instrumental, red sensitive (close to R-band) system could be obtained. The exposures ran mostly 60 s. The MUNIDOS software packet (Hroch & Novák, 1997) was used for observation processing. The results are given in the Table 1. The following data are given: The name of the star, the heliocentric JD of minimum (-2400000), the error of the determination of minimum obtained by the Gaspani's (1995) method having the meaning of a standard deviation of the determination, the abbreviation of the name of the observer(s), the total number of images used, the number of images (points) on the descending branch, the epoch and the $O - C$ value relative to the linear light elements taken from the 4th edition of the GCVS (Kholopov et al., 1985) or to another light elements. The cases of missing or wrong light elements in GCVS are marked by (*) at the name of the star. The others than GCVS's elements are given in the Table 2. The majority of minima given in the Table 1 are primary ones. Secondary minima are marked in the column *Notes*. The times of minima obtained by superposition of two or more parts of light curve from different nights are denoted as “normal min.” in the Table 1.

References:

- Gaspani, A., 3rd GEOS workshop on variable star data acquisition and processing techniques, 13-14 May 1995, S. Pellegrino Terme, Italy
Hroch, F., Novák, R., 1997, MUNIDOS, <http://ian.cz/munipack/>
Kholopov, P. N. et al., 1985, General Catalogue of Variable Stars, 4th edition, Moscow

Table 1: Times of minima of observed systems

Starname	JDhel	Error	Observer	Tot N	Desc N	Epoch	$O - C$	Notes
DO And	50773.3462	0.0014	JŠ	25	10	21904.5	-0.0078	sec. min.
HS And	50773.3166	0.0014	JŠ	35	25	5357.0	0.1976	
MO And*	50688.5397	0.0028	JŠ	24	9	6605.0	0.1579	
	50773.4726	0.0021	JŠ	45	32	6649.0	0.1516	
NSV14578 And*	50713.5217	0.0035	JŠ	48	26	15972.0	-0.0570	
UU Aqr*	50012.2867	0.0003	EŠ	39	19	22405.0	0.0305	
	50311.4758	0.0009	JŠ	19	10	24234.0	0.0335	filter I
V873 Aql	50662.5020	0.0090	MZ	20	13	33591.0	0.0230	
	50667.4136	0.0104	MZ, JŠ	16	7	33605.0	-0.0714	
V1075 Aql	50662.5283	0.0042	MZ	15	10	26138.0	-0.0101	
	50693.3596	0.0014	JŠ	26	8	26173.0	-0.0131	
V1299 Aql	49932.4548	0.0031	EŠ	33	15	5969.0	-0.0301	
V1355 Aql	49940.5474	0.0025	EŠ	30	6	28136.0	-0.1474	
	50000.3810	0.0020	EŠ	26	8	28252.0	-0.1462	
	50029.2634	0.0026	EŠ	16	8	28308.0	-0.1484	
SU Boo	50235.5048	0.0038	JŠ	49	28	18680.0	-0.0048	RL150
AR Boo	50180.4108	0.0028	JŠ	36	17	32441.0	0.1400	normal min.
AB Cas	50750.3718	0.0021	JŠ	20	10	5879.0	0.0580	
AE Cas	50708.4521	0.0014	JŠ	15	4	33324.0	0.0705	
CV Cas	50660.4749	0.0021	JŠ	29	16	4770.0	0.4751	
EP Cas	50773.2449	0.0014	JŠ	20	9	27776.0	-0.0299	
MS Cas	50601.4068	0.0021	JŠ	10	4	13239.0	0.0319	
	50750.3501	0.0014	JŠ	24	13	13366.0	0.0377	
V357 Cas	50773.3475	0.0028	JŠ	16	7	28021.0	-0.0562	
V360 Cas	50750.4661	0.0014	JŠ	32	20	12931.0	-0.0872	
V702 Cas*	50660.5150	0.0049	JŠ	27	18	4240.0	0.0011	
NSV14647 Cas*	50671.5404	0.0028	JŠ	25	14	22452.0	0.0279	
	50750.2849	0.0014	JŠ	39	20	22534.0	0.0302	
	50773.3254	0.0028	JŠ	35	18	22558.0	0.0242	
AE Cyg	49925.4765	0.0028	EŠ	19	10	5509.0	-0.0047	
PV Cyg	50658.4538	0.0021	JŠ	30	16	20812.0	0.1915	
V370 Cyg	50752.3584	0.0028	JŠ	28	12	20816.0	-0.0090	
V435 Cyg	50688.5497	0.0042	JŠ, MZ	16	10	3666.0	0.1670	
V443 Cyg	50234.4466	0.0030	JŠ	51	28	27597.0	0.0240	RL150
V706 Cyg	49987.5056	0.0024	EŠ	15	8	21171.0	-0.0275	
	50604.3658	0.0021	JŠ	10	4	22494.0	-0.0239	
	50624.4135	0.0014	JŠ	16	6	22537.0	-0.0252	
	50658.4507	0.0021	JŠ	18	11	22610.0	-0.0247	
	50671.5074	0.0021	JŠ	13	6	22638.0	-0.0231	
	50693.4161	0.0014	JŠ	16	8	22685.0	-0.0284	
V1048 Cyg	50609.4406	0.0014	JŠ	27	14	30876.0	0.0164	
	50658.4289	0.0014	JŠ	22	11	30942.0	0.0179	
V1130 Cyg	49926.4487	0.0022	EŠ	21	9	30405.0	-0.0279	
	50708.4090	0.0028	JŠ	16	10	31795.0	-0.0277	
	50713.4734	0.0014	JŠ	12	6	31804.0	-0.0264	
V1321 Cyg	50240.4371	0.0041	JŠ	41	30	36892.0	0.0471	RF150
	50643.4928	0.0056	JŠ	16	8	37999.0	0.0551	
	50671.5308	0.0028	JŠ	22	10	38076.0	0.0582	
	50752.3538	0.0014	JŠ	22	15	38298.0	0.0532	
	50707.5757	0.0056	JŠ	14	7	38175.0	0.0581	
V1414 Cyg	50667.4503	0.0056	MZ, JŠ	21	10	30656.0	0.0396	
	50686.4315	0.0035	JŠ	24	11	30683.0	0.0364	
	50693.4663	0.0014	JŠ	32	16	30693.0	0.0400	
V1723 Cyg	50671.4236	0.0021	JŠ	8	4	8967.0	0.0359	
V1856 Cyg*	50196.5539	0.0025	JŠ	31	15	2279.0	0.0107	
	50752.3265	0.0022	JŠ	29	11	2557.0	0.0112	
V1870 Cyg*	50657.3811	0.0026	JŠ	20	11	11917.0	-0.0148	
V1908 Cyg*	50658.3742	0.0021	JŠ	25	10	3128.0	-0.1565	

Table 1 (cont.)

Starname	JDhel	Error	Observer	Tot <i>N</i>	Desc <i>N</i>	Epoch	<i>O</i> – <i>C</i>	Notes
XY Dra	50601.4788	0.0021	JŠ	40	12	10743.0	0.4063	
V502 Her	50643.4751	0.0021	JŠ	18	7	53361.0	0.0028	
V719 Her	50284.4245	0.0019	JŠ	49	19	25862.0	−0.1234	RF150
BS Lac	50671.5431	0.0042	JŠ	33	21	4536.0	−0.2081	
	50688.4270	0.0048	MZ, JŠ	20	9	4542.0	−0.2094	
EL Lac	50609.4717	0.0028	JŠ	27	19	8945.0	0.1393	
EQ Lac	50643.4101	0.0021	JŠ	14	7	6853.0	0.0952	
IP Lac	50601.4654	0.0014	JŠ	20	9	19647.5	0.0641	sec. min.
	50604.4447	0.0014	JŠ	24	10	19651.0	0.0614	
	50624.4686	0.0021	JŠ	17	7	19674.5	0.0630	sec. min.
	50688.3722	0.0067	MZ	13	7	19749.5	0.0658	sec. min.
V344 Lac	50658.3828	0.0014	JŠ	18	12	13859.0	−0.0641	
DU Leo*	49811.4763	0.0041	JŠ	33	21	1064.5	−0.0011	sec. min., RF35+ST4
AH Lyn*	50184.4602	0.0025	JŠ	54	29	12335.0	−0.0038	
DU Lyr	50196.5354	0.0034	JŠ	33	22	24387.0	0.1464	
	50597.4615	0.0014	JŠ	23	15	24866.0	0.1495	
ET Lyr	50686.4243	0.0042	JŠ	34	6	6347.0	−0.0647	
FL Lyr	49909.5271	0.0029	JŠ	25	16	5366.0	−0.0019	RF35
PY Lyr	50713.4200	0.0021	JŠ	18	10	14501.0	0.1223	
V401 Lyr	50643.3897	0.0014	JŠ	33	9	14819.5	0.0044	sec. min.
V839 Oph	49919.4266	0.0040	JŠ	28	5	23157.0	−0.0909	RF35
V981 Oph	50604.3734	0.0014	JŠ	10	5	10175.0	−0.0084	
EF Ori	50096.3213	0.0021	JŠ	26	10	6714.0	−1.0755	
	50138.4277	0.0023	EŠ	111	53	6725.0	0.3177	
GU Ori*	50120.2312	0.0025	JŠ	25	8	14979.0	−0.0025	
	50138.3520	0.0031	JŠ	43	12	15017.5	−0.0029	sec. min.
	50139.2915	0.0020	JŠ	37	18	15019.5	−0.0048	sec. min.
	50147.2955	0.0035	JŠ	24	9	15036.5	−0.0024	sec. min.
	50163.2988	0.0021	JŠ	35	15	15070.5	−0.0022	sec. min.
	50773.5269	0.0014	JŠ	46	24	16367.0	−0.0120	
V648 Ori	50750.5648	0.0010	JŠ	26	16	15219.0	0.0383	
U Peg	50002.4319	0.0048	JŠ	25	14	35996.5	−0.0564	sec. min., RF35
	50006.3630	0.0034	JŠ	28	10	36007.0	−0.0605	RF35
BX Peg	50316.3607	0.0007	JŠ	34	15	21828.0	−0.0416	filter R, RF150
	50316.5003	0.0028	MZ	53	26	21828.5	−0.0422	filter R, RF150
	50707.5502	0.0028	JŠ	11	6	23223.0	−0.0391	
	50713.2946	0.0028	JŠ	18	11	23243.5	−0.0434	sec. min.
CE Peg	50030.3720	0.0031	EŠ	28	14	39315.0	−0.2443	
	50660.5290	0.0056	JŠ	20	13	40296.5	0.0911	sec. min.
CU Peg	50708.5489	0.0021	JŠ	48	27	1427.0	0.0538	
ER Peg	50708.3775	0.0042	JŠ	32	12	2278.0	0.1252	
DK Per	50750.3680	0.0007	JŠ	24	9	9187.0	0.0212	
PS Per	50713.6127	0.0014	JŠ	47	16	37293.0	0.0572	
TY Tri*	50773.3337	0.0021	JŠ	27	7	4435.0	−0.0831	
EU Vul	50667.2998	0.0118	MZ	22	4	15752.0	0.0266	normal min.
	50688.4954	0.0093	MZ, JŠ	15	9	15776.0	0.0291	
FF Vul	49940.4945	0.0025	EŠ	30	17	32032.5	0.0305	sec. min.
	50000.3466	0.0031	EŠ	27	13	32167.0	0.0319	
	50713.4240	0.0021	JŠ	22	12	33769.5	0.0193	sec. min.
FM Vul	50601.4163	0.0021	JŠ	15	9	8725.0	0.0172	
GI Vul	50597.4542	0.0014	JŠ	15	7	32257.0	−0.0124	
	50624.4151	0.0014	JŠ	13	7	32313.0	−0.0145	
	50662.4546	0.0069	MZ	19	9	32392.0	−0.0122	
GP Vul	50297.5357	0.0019	JŠ	45	17	15202.0	−0.0424	
NO Vul	50597.5005	0.0007	JŠ	19	6	11466.0	−0.0421	
	50652.3717	0.0007	JŠ	13	6	11614.0	−0.0447	

Observers: EŠ: E. Šafařová, JŠ: J. Šafař, MZ: M. Zejda

Table 2: Other published light elements used

Starname	Basic epoch	Period	Reference
MO And	2437937.852	1.930436	Kinman, T.D., Mahaffey, C.T., Wirtanen, C.A., 1982, <i>AJ</i> , 87 , 2, 314
NSV14578 And	2428021.390	1.4207481	Häussler, K., 1990, <i>VSS</i> , 10 , No. 4, 374
UU Aqr	2446347.2667	0.163579089	Goldader, J. D., Garnavich, P., 1989, <i>IBVS</i> No. 3361
V702 Cas	2440150.474	2.478783	Häussler, K., 1990, <i>MVS</i> , 12 , No. 4, 74
NSV14647 Cas	2429111.508	0.960271	Busch, H., et al., 1990, <i>VSS</i> , 10 , No. 4, 354
V1856 Cyg	2445640.412	1.99918	Margoni, R., et al., 1989, <i>AsApSuppl</i> , 81 , 393
V1870 Cyg	2441245.385	0.789797	Margoni, R., et al., 1989, <i>AsApSuppl</i> , 81 , 393
V1908 Cyg	2442950.490	2.4642074	Zemljannikova, S. V., 1986, <i>VS</i> , 22 , No. 3, 359
DU Leo	2448348.658	1.37418454	Williams, D. B., 1994, <i>IBVS</i> No. 3999
AH Lyn	2437647.022	1.016412	Kinman, T.D., Mahaffey, C.T., Wirtanen, C.A., 1982, <i>AJ</i> , 87 , 2, 314
GU Ori	2443069.903	0.470681	Samolyk, G., 1985, <i>JAAVSO</i> , 14 , No. 1, 12
TY Tri	2435778.460	3.38105	Meinunger, L., 1986, <i>MVS</i> , 11 , No. 1, 1