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THE FIRST ECLIPSING BINARY OBSERVATIONS AT THE ULUPINAR ASTROPHYSICS OBSERVATORY

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Observatory and telescope:

The Çanakkale Onsekiz Mart University (ÇOMU) Ulupinar Astrophysics Observatory was built in 2001, close by the slopes of Mt. Ida, overlooking ancient Troy. The location (longitude: $01^h45^m54^s$ E, latitude: $40°06'01''$ N, altitude: 410 m) has about 200 clear nights in a year. It is only ten km from Çanakkale, but it is sheltered by a low ridge from most of scattered night glow. The observatory owns two (30 cm (T30) and 40 cm (T40)) Meade Schmidt-Cassegrain telescopes with an SBIG ST-237 CCD camera and a SSP-5A photometer, containing a Hamamatsu, R 4040 photomultiplier tube(PMT). Further details about the observatory and its equipment were given by Demircan (2003).

Method of data reduction:

Reduction of the CCD frames was made with MUNIDOS[1] software, and reduction of photoelectric observations was made by ATMEX[2] software.

Method of minimum determination:

Kwee – van Woerden method (Kwee & van Voerden, 1952), and in some cases, depending on the nature of the data set, several procedures written by A. Gaspani (1995) based on artificial neural networks were used.

[1]Hroch, F., Novák, R., 1997, MUNIDOS, `http://munipack.astronomy.cz/`
[2]Keskin, V., 2001, ATMEX, `http://astronomy.sci.ege.edu.tr/~keskinv/`

Observed star(s):							
Star name	GCVS	Coordinates (J2000)		Comp. star	Ephemeris		Source
	type	RA	Dec		E 2400000+	P [day]	
AB And	EB	23 11 32	+36 53 36	GSC 2763:0683	45502.1040	0.33188902	1
AD And	EB	23 36 45	+48 40 15	GSC 3641:0419	39002.4445	0.98619443	1
BX And	EW	02 09 03	+40 47 39	GSC 2833:0053	48237.4893	0.61011419	1
XZ Aql	EA	20 22 13	-07 21 03	GSC 5174:0186	47743.4700	2.13918369	1
OO Aql	EW	19 48 13	+09 18 32	GSC 1058:0409	39322.6916	0.50679190	1
V417 Aql	EW	19 35 24	+05 50 18	GSC 0490:2611	43016.2099	0.37031370	1
TZ Boo	EW	15 08 09	+39 58 12	GSC 3044:0740	52390.3886	0.29716474	present paper
AC Boo	EW	14 56 28	+46 21 44	GSC 3474:0880	52407.4388	0.35244147	present paper
TY Cap	EA	20 24 30	−12 57 55	GSC 5749:1055	44793.4527	1.42345612	1
RZ Cas	EA	02 48 56	+69 38 03	GSC 4312:1101	48960.2260	1.19524980	1
AB Cas	EA	02 37 32	+71 18 16	GSC 4320:0403	46849.2820	1.36687530	1
IR Cas	EB	23 06 52	+54 04 52	GSC 3998:1901	28750.2740	0.68068890	1
IV Cas	EA	23 49 31	+53 08 05	GSC 4001:1392	40854.6480	0.99851747	1
XX Cep	EA	23 38 20	+64 20 03	GSC 4288:0241	41539.5307	2.33732600	1
DK Cep	EA	21 58 33	+60 56 54	GSC 4262:2154	33590.5578	0.98590874	1
EG Cep	EA	20 15 57	+76 48 36	GSC 4585:0413	40050.4491	0.54462274	present paper
YY CrB	EW	15 50 32	+37 50 07	GSC 3054:1278	51674.3541	0.37656417	present paper
ZZ Cyg	EA	20 23 53	+46 55 18	GSC 3576:1596	45000.3501	0.62861631	1
V836 Cyg	EB	21 21 24	+35 44 11	GSC 2715:0264	44853.4914	0.65341148	1
V859 Cyg	EW	19 27 13	+28 56 50	GSC 2137:2999	34629.4119	0.40499999	1
RZ Dra	EA	18 23 06	+58 54 13	GSC 3916:1962	44177.5609	0.55087616	1
AI Dra	EA	16 56 18	+52 41 54	GSC 3886:0105	37544.5092	1.19881489	1
RZ Equ	EA	21 17 52	+09 50 06	GSC 1109:2135	37161.3730	1.96143000	2
EW Lyr	EA	18 33 16	+37 45 13	GSC 3105:1934	26499.6842	1.94874423	1
PY Lyr	EW	19 20 26	+28 56 44	GSC 2136:3105	34980.4372	0.38576273	1
V508 Oph	EW	17 58 49	+13 29 47	GSC 1019:1849	44785.3350	0.34479220	1
AT Peg	EA	22 13 24	+08 25 31	GSC 1136:1084	45640.4590	1.14609013	1
BB Peg	EW	22 22 57	+16 19 28	GSC 1682:1530	43764.3416	0.36150147	1
FG Sct	EW	18 44 57	−06 08 30	GSC 5126:4019	29017.5579	0.27057207	1
V Sge	E/NL	20 20 15	+21 06 09	GSC 1643:1423	50169.4910	0.51419534	1
V Tri	EB	01 31 47	+30 22 02	GSC 2293:1382	48573.6604	0.58520570	1
RT UMi	EA	17 04 06	+80 19 45	GSC 4576:0151	26631.3010	1.84197580	1
AH Vir	EW	12 14 21	+11 49 10	GSC 0869:0551	47569.6110	0.40752300	1

Source(s) of the ephemeris:
1. Kreiner et al., 2000
2. Khopolov et al., 1985

Times of minima:						
Star name	Time of min. HJD 2400000+	Error	Type	Filter	$O-C$ [day]	Rem.
AB And	52510.3486	3	I	–	0.0761	149, c
AD And	52505.4228	9	I	–	0.0042	47, c
BX And	52514.3830	5	I	–	−0.0068	21, c
XZ Aql	52492.5279	6	I	–	0.1740	126, c
OO Aql	52505.3277	7	I	–	−0.0348	104, c
	52508.3695	16	I	–	−0.0338	120, c
V417 Aql	52498.4486	16	II	–	−0.0550	77, c
	52511.4103	2	II	–	−0.0551	25, c
TZ Boo	52367.3542	7	II	B, V, R	−0.0041	37, p
	52387.4136	11	I	B, V, R	−0.0034	33, p
	52388.3060	10	I	B, V, R	−0.0024	39, p
	52390.3827	8	I	B, V, R	−0.0059	43, p
AC Boo	52407.4402	7	I	B, V, R	0.0014	37, p
	52409.3785	7	II	B, V, R	0.0013	32, p
TY Cap	52521.4056	3	I	–	0.0096	49, c
RZ Cas	52537.6186	3	I	B, V	0.0099	38, p
AB Cas	52490.4170	5	I	–	0.0406	236, c
IR Cas	52512.4113	1	I	–	−0.0315	29, c
	52527.3849	3	I	–	−0.0330	37, c
IV Cas	52497.3579	5	I	–	−0.0038	194, c
XX Cep	52515.5559	3	I	–	−0.0574	55, c
DK Cep	52495.3570	10	I	–	−0.0009	413, c
EG Cep	52577.3173	10	I	–	0.0006	180, c
YY CrB	52469.4692	4	II	B, V, R	−0.0001	35, p
	52473.4240	4	I	B, V, R	0.0007	39, p
ZZ Cyg	52493.4256	5	I	–	−0.0310	308, c
V836 Cyg	52528.4862	3	I	–	0.0236	31, c
V859 Cyg	52524.3749	9	I	–	0.0384	43, c
RZ Dra	52496.3363	7	I	–	−0.0055	89, c
AI Dra	52458.3834	5	II	V	0.0175	46, p
RZ Equ	52468.4761	11	I	–	0.1034	318, c
EW Lyr	52515.3885	1	I	–	−0.0312	63, c
PY Lyr	52469.4388	2	I	–	0.0625	265, c
	52470.4020	1	II	–	0.0613	237, c
V508 Oph	52486.4355	7	II	–	−0.0057	19, c
	52513.3314	1	II	–	−0.0036	23, c
AT Peg	52512.3486	8	I	B, V, R	−0.0668	36, p
BB Peg	52513.4118	2	I	–	0.0116	108, c
FG Sct	52472.3579	7	I	–	−0.0104	179, c
	52472.4943	3	II	–	−0.0093	194, c
V Sge	52523.3653	21	I	–	−0.0240	81, c
V Tri	52497.4679	3	I	–	0.0033	79, c
RT UMi	52529.4791	16	I	–	−0.0016	59, c
AH Vir	52397.4148	2	II	B, V, R	0.0826	41, p
	52398.4328	2	I	B, V, R	0.0818	32, p

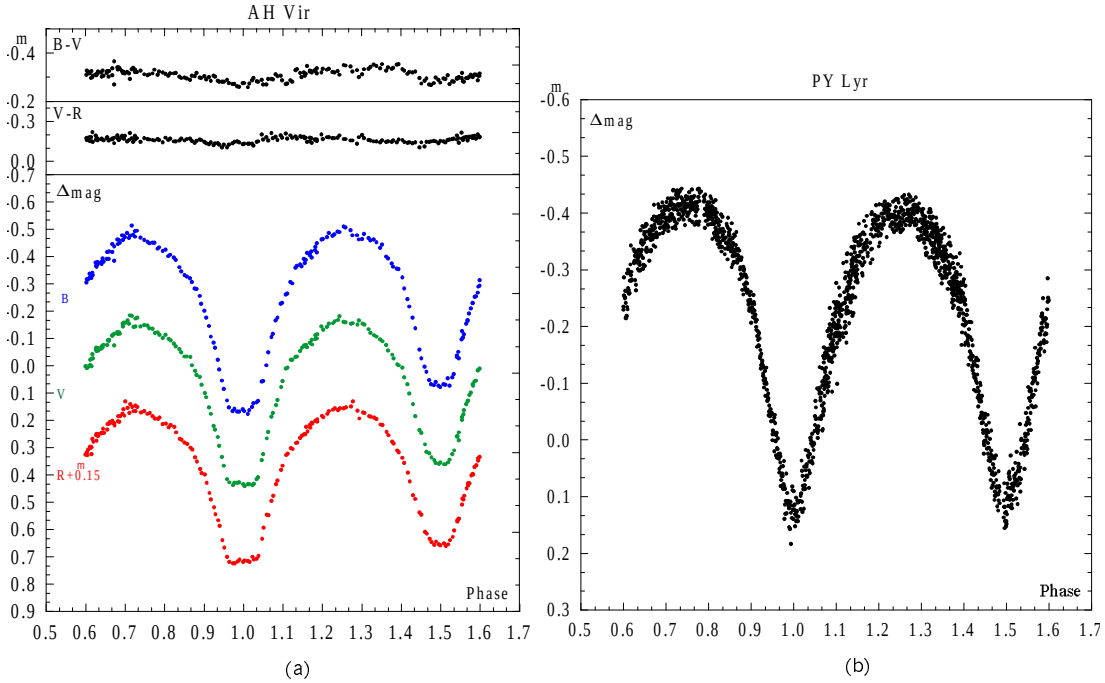

Figure 1. (a) Photoelectric light and color curves of AH Vir and (b) Unfiltered CCD light curve of PY Lyr

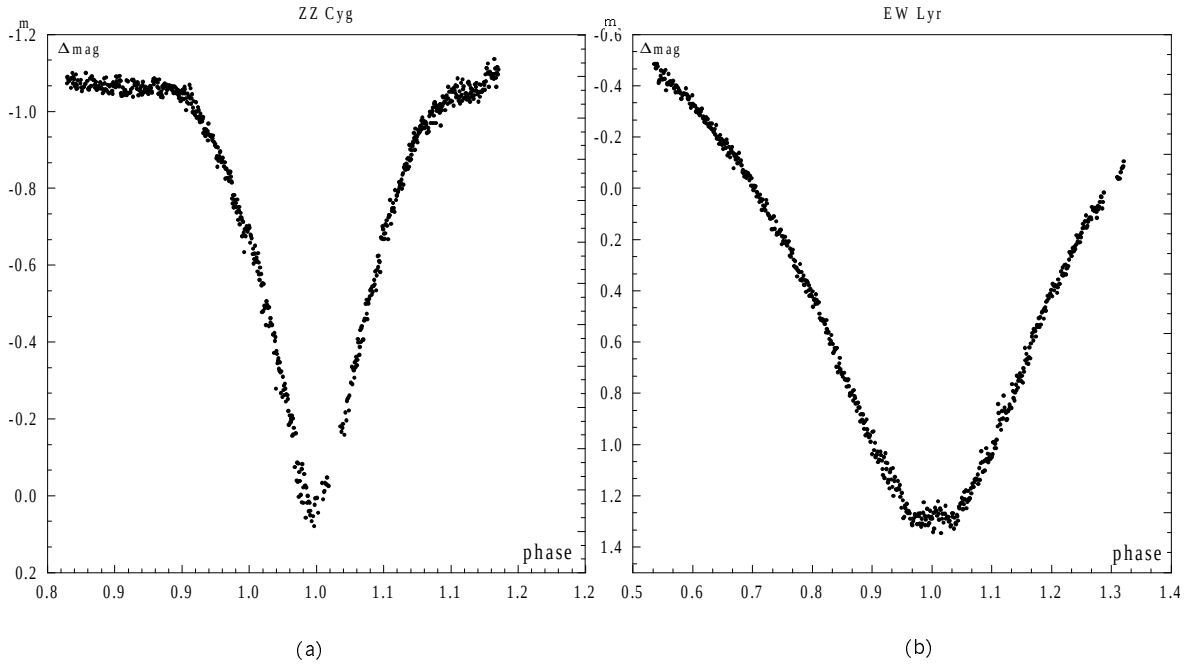

Figure 2. Unfiltered CCD minima of (a) ZZ Cyg and (b) EW Lyr

Remarks:

The 33 stars, whose details are listed in Table 1, were observed using either conventional filtered Johnson standard (BVR) photoelectric photometry with the SSP-5A or unfiltered with the ST-237. 45 times of minima, primary and some secondary, are listed in Table 2, together with $O-C$ values corresponding to the Table 1 ephemerides. The remarks column of Table 2, e.g. 147,c, gives first the number of data points used in the calculation of each minimum time followed by an identification of which system was used; thus "c" refers to the 30 cm + ccd combination and "p" means the single channel photometer on the 40 cm telescope. We show, in Figures 1, & 2, selected light curves corresponding to these reported results.

Figure 1a shows a typical light curve (AH Vir) obtained with the single channel photometer on the 40 cm telescope. In Fig 1b, the moderate low amplitude ∼12.5-13 mag W UMa binary PY Lyr light curve reflects a reasonable level of scatter for 20 sec integrations. The measured standard error on a run of 300 points is 0.018 mag, for example, as compared with 0.015 mag, corresponding to purely Poissonian counting statistics. Similar calculations for other binaries at comparable magnitudes show similar (∼2%) individual datum accuracies and point to essentially high steadiness of attainable conditions at the site. Light curves of such variables will be presented in more detail in subsequent IBVS articles.

Asymmetry around the outer tangencies of the short period system ZZ Cyg and the distinct totality observed for EW Lyr (Fig 2a,b) present interesting challenges for further study of these deep-minimum classical Algols.

Availability of the data:

Upon request

Acknowledgements:

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