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MINIMA OF ECLIPSING BINARIES AND NEW EPHEMERIDES FOR GSC 03881-00579 AND EZ LACERTAE

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The list below contains 163 times of minimum for 79 eclipsing binary stars (including the cataclysmic AM Her) calculated from CCD observations made by participants in the SSV-UAI Eclipsing Binaries Program. All the observatories are located in Italy; one is managed by the Physics Department of the University of Siena, while the others are privately operated. Some light curves were remotely obtained (via Internet) using the Italian and Australian telescopes of the Skylive-UAI Project, that are publicly available on the web site `http://www.skylive.it`.
The observations were reduced following standard procedures (see next section) and the light curves were analyzed using the Kwee−van Woerden algorithm (Kwee & van Woerden, 1956) to determine the times of minimum. All the times of minimum listed in this paper are heliocentric.
It is worth noting that most of the observed stars are neglected objects.

Observatory and telescope:
University of Siena Astron. Observatory: 32-cm Maksutov–Cassegrain (MC32)
Australian Skylive remote telescope: 36-cm Schmidt–Cassegrain (SC36)
Other private astronomical stations:
30-cm Schmidt–Cassegrain (SC30)
23-cm Schmidt–Cassegrain (SC23)
25-cm Newton (NW25)
25-cm Schmidt–Cassegrain (SC25)
20-cm Newton (NW20)
20-cm Schmidt–Cassegrain (SC20)
13-cm Maksutov–Cassegrain (MK13)
8-cm ED Refractor (ED8)

Detector:	Meade DSI Pro II Monochromatic CCD camera (DSI) QSI 516wsg CCD Camera SBIG ST-7 CCD Camera (ST7) SBIG ST-8XME CCD Camera (ST8) SBIG ST-9 CCD Camera (ST9) Sony ICX429ALL based CCD camera (CCD-UAI) Canon Eos 1100D DSLR(Eos)

Method of data reduction:

Frame calibration (dark subtraction and flat field correction) and photometric analysis (differential photometry on each image) were performed using MaxIm DL or Mira Pro software packages.

Method of minimum determination:

Times of minima, expressed as Heliocentric Julian Day (see the attached Table), were computed adopting the KW method (Kwee & van Woerden, 1956) using AVE (Barberá, 1996). This algorithm also provides an error estimate, that is the formal internal error of the KW method, which can be considered as a lower limit of the actual uncertainty on times of minimum. Together with that error, we provide an alternative estimate error according to the Arlot's (modified) method (Arlot et al., 2009) by adopting the formula $\sigma_{ToM} = \frac{1}{\sqrt{2}}\frac{\sigma_m}{\Delta m}\Delta t$, where σ_m is the error in magnitude and Δm is the magnitude drop during a time range Δt delimiting the part of the light curve where the speed of decrease in magnitude is the highest.
The types of minimum quoted in the Table were deduced according to the ephemeris provided by Kreiner's (2004) web site (`http://www.as.up.krakow.pl/ephem`), by B.R.N.O. – *O−C Gateway* web site (`http://var.astro.cz/ocgate`) or by our updated elements. In the latter case we are sure that the primary minimum (conventionally at zero phase) is the deepest one.

Times of minima:

Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V473 And	55836.3902	0.0006[a] 0.0004[b]	I	*V*	Martinengo/SC20/QSI 516
V473 And	55837.3928	0.0010 0.0005	II	*V*	Martinengo/SC20/QSI 516
V473 And	55837.5932	0.0013 0.0003	I	*V*	Martinengo/SC20/QSI 516
V473 And	55843.4114	0.0008 0.0005	II	*V*	Banfi/SC25/ST7
V473 And	55843.6124	0.0008 0.0005	I	*V*	Banfi/SC25/ST7
V473 And	55846.4217	0.0012 0.0004	I	*V*	Banfi/SC25/ST7
V473 And	55878.5260	0.0011 0.0003	I	*V*	Vincenzi/SC30/ST9
V480 And	55836.3021	0.0007 0.0004	I	*V*	Zambelli/SC25/ST8
V487 And	55830.5409	0.0029 0.0007	I	*V*	Banfi/SC25/ST7
V502 And	55804.4732	0.0015 0.0005	I	*V*	Banfi/SC25/ST7
V502 And	55836.3609	0.0007 0.0003	I	–	Corfini/NW20/CCD-UAI
V502 And	55879.4120	0.0009 0.0004	I	*V*	Corfini/NW20/CCD-UAI
XX Ant	55916.2133	0.0007 0.0009	II	*r*	Marino/SC36/ST8
CK Aqr	55791.4012	0.0006 0.0002	I	*V*	Vincenzi/SC30/ST9
GS Aqr	55838.3281	0.0003 0.0002	II	–	Corfini/NW20/CCD-UAI
AL Ari	55898.3071	0.0003 0.0001	I	*R*	Marino/NW25/ST7
EM Aur	55954.2639	0.0022 0.0005	II	*R*	Marino/NW25/ST7
MM Aur	55945.3071	0.0037 0.0011	I	–	Ruocco/SC25/ST7
MR Aur	55938.4642	0.0061 0.0019	I	–	Ruocco/SC25/ST7
V562 Aur	55915.3709	0.0017 0.0003	I	*Y*495	Corfini/NW20/CCD-UAI
V594 Aur	55904.2955:	0.0023 0.0020	I	–	Ruocco/SC25/ST7
TU Boo	55924.5934	0.0005 0.0001	I	*V*	Vincenzi/SC30/ST9

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
EF Boo	56036.3468	0.0006 0.0001	I	*R*	Marino et al./NW20/ST7
XZ CMi	55863.5173	0.0006 0.0001	I	*V*	Vincenzi/SC30/ST9
AE Cas	55940.2959	0.0002 0.0001	I	*R*	Marino/NW25/ST7
DO Cas	55919.3001	0.0005 0.0001	I	*R*	Marino/NW20/ST7
V541 Cas	55928.3368	0.0001 0.0001	II	*R*	Marino/NW25/ST7
DM CVn	56046.3212	0.0008 0.0004	I	–	Ruocco/SC25/ST7
EL CVn	56076.4101	0.0004 0.0001	I	*V*	Martinengo/SC20/QSI 516
EV CVn	56043.4320	0.0007 0.0004	II	–	Ruocco/SC25/ST7
EV CVn	56043.5978	0.0007 0.0003	I	–	Ruocco/SC25/ST7
UX CrB	56058.4798	0.0004 0.0001	I	–	Ruocco/SC25/ST7
V997 Cyg	55764.5449	0.0005 0.0003	II	*V*	Banfi/SC25/ST7
V1187 Cyg	55826.4039	0.0007 0.0002	I	*V*	Banfi/SC25/ST7
V1187 Cyg	55835.4441	0.0005 0.0002	I	*V*	Zambelli/SC25/ST8
V1191 Cyg	55826.4072	0.0007 0.0001	II	*V*	Banfi/SC25/ST7
V1905 Cyg	55765.4700	0.0001 0.0002	I	–	Ruocco/SC25/ST7
V1763 Cyg	55802.3573	0.0008 0.0006	I	*V*	Banfi/SC25/ST7
V2287 Cyg	55832.3206	0.0016 0.0009	I	*V*	Banfi/SC25/ST7
V2486 Cyg	55806.3740	0.0037 0.0012	I	–	Ruocco/SC25/ST7
CR Del	55820.3994	0.0027 0.0008	II	*V*	Banfi/SC25/ST7
KO Del	55834.3197	0.0003 0.0001	I	–	Corfini/NW20/CCD-UAI
HL Dra	55852.3251	0.0004 0.0002	I	–	Corfini/NW20/CCD-UAI
G3881.0579 Dra	55773.3453	0.0002 0.0001	I	–	Corfini/NW20/CCD-UAI
G3881.0579 Dra	56014.4160	0.0004 0.0002	I	*V*	Marchini et al./MC32/ST7
G3881.0579 Dra	56014.5801	0.0002 0.0001	II	*V*	Marchini et al./MC32/ST7
G3881.0579 Dra	56015.4038	0.0002 0.0001	I	*V*	Marchini et al./MC32/ST7
G3881.0579 Dra	56015.5680	0.0002 0.0001	II	*V*	Marchini et al./MC32/ST7
G3881.0579 Dra	56016.3917	0.0002 0.0002	I	*V*	Marchini et al./MC32/ST7
G3881.0579 Dra	56016.5560	0.0003 0.0001	II	*V*	Marchini et al./MC32/ST7
G3881.0579 Dra	56025.4483	0.0013 0.0002	II	–	Arena/NW20/DSI
G3881.0579 Dra	56025.6136	0.0013 0.0002	I	–	Arena/NW20/DSI
G3881.0579 Dra	56039.6080	0.0005 0.0002	II	–	Arena/NW20/DSI
G3881.0579 Dra	56042.4066	0.0006 0.0001	I	*R*	Arena/NW20/ST7
G3881.0579 Dra	56059.3676	0.0005 0.0001	II	*V*	Aceti et al./SC20/ST8
VV Eri	55877.5609	0.0016 0.0002	I	*V*	Vincenzi/SC30/ST9
VV Eri	55891.5794	0.0006 0.0002	I	*V*	Vincenzi/SC30/ST9
VV Eri	55895.4695	0.0034 0.0007	II	*V*	Vincenzi/SC30/ST9
VV Eri	55952.3246	0.0003 0.0001	I	*V*	Zambelli/SC25/ST8
VV Eri	55952.3248	0.0004 0.0001	I	*r*	Corfini/NW20/CCD-UAI
AM Her[c]	55834.3195	0.0006 0.0013	I	*V*	Banfi/SC25/ST7
V1072 Her	56036.4881	0.0054 0.0003	II	–	Arena/NW20/DSI
V1088 Her	56060.3817	0.0008 0.0009	II	–	Ruocco/SC25/ST7
V1088 Her	56060.5613	0.0008 0.0007	I	–	Ruocco/SC25/ST7
V1088 Her	56063.4342	0.0008 0.0003	I	–	Ruocco/SC25/ST7
V1088 Her	56075.4689	0.0009 0.0004	II	–	Ruocco/SC25/ST7
V1106 Her	55776.3528	0.0003 0.0002	I	–	Corfini/NW20/CCD-UAI
V1106 Her	55778.3904	0.0006 0.0002	I	–	Corfini/NW20/CCD-UAI
V1106 Her	55831.3476	0.0019 0.0004	I	*V*	Banfi/SC25/ST7
V1106 Her	55839.3658	0.0010 0.0002	II	*V*	Marchini/MC32/ST7
V1106 Her	55843.3139	0.0009 0.0003	I	–	Corfini/NW20/CCD-UAI
V1106 Her	55844.3320	0.0007 0.0003	I	–	Corfini/NW20/CCD-UAI
V1106 Her	55844.3323	0.0005 0.0003	I	*V*	Marchini/MC32/ST7
V1106 Her	55851.3321	0.0008 0.0002	II	–	Corfini/NW20/CCD-UAI
V1106 Her	56004.6007	0.0025 0.0006	II	–	Bonaventura/MK13/Eos

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
G1518.0913 Her	56038.4225	0.0021 0.0002	I	–	Arena/NW20/DSI
G1518.0913 Her	56038.5845	0.0013 0.0001	II	–	Arena/NW20/DSI
G1518.0913 Her	56051.4334	0.0013 0.0011	II	*V*	Aceti et al./SC25/ST8
EZ Lac	55881.3430	0.0006 0.0003	I	–	Ruocco/SC25/ST7
EZ Lac	55892.5071	0.0013 0.0002	I	–	Vincenzi/SC30/ST9
EZ Lac	55895.2961	0.0011 0.0003	I	–	Ruocco/SC25/ST7
EZ Lac	55948.3194	0.0010 0.0021	I	*V*	Marchini/MC32/ST7
EZ Lac	56118.5614	0.0016 0.0005	I	–	Marchini/MC32/ST7
EZ Lac	56121.3466	0.0072 0.0003	I	–	Marchini/MC32/ST7
EZ Lac	56125.5141	0.0056 0.0014	II	*I*	Zambelli/SC25/ST8
EZ Lac	56125.5326	0.0079 0.0017	II	–	Corfini/NW20/CCD-UAI
EZ Lac	56125.5384	0.0091 0.0012	II	–	Banfi/SC25/ST7
EZ Lac	56125.5631	0.0031 0.0012	II	–	Marchini/MC32/ST7
EZ Lac	56139.4754	0.0143 0.0022	II	*V*	Martinengo/SC20/QSI 516
EZ Lac	56139.4956	0.0169 0.0036	II	–	Marchini/MC32/ST7
FU Lac	55818.5718	0.0070 0.0081	I	–	Ruocco/SC25/ST7
FU Lac	55840.3395	0.0122 0.0024	II	–	Ruocco/SC20/ST7
FU Lac	55864.3560	0.0035 0.0011	I	–	Ruocco/SC25/ST7
XX Leo	56019.3106	0.0047 0.0005	II	*V*	Salvaggio,Lo Savio/SC23/ST7
VW LMi	55983.4129	0.0016 0.0005	I	–	Bonav., Marino/MK13/Eos
WZ LMi	56004.3405	0.0031 0.0008	II	–	Ruocco/SC25/ST7
AA Lyn	56001.3162	0.0003 0.0002	I	–	Ruocco/SC25/ST7
CW Lyn	56014.3550	0.0011 0.0003	I	*V*	Martinengo/SC20/QSI 516
DI Lyn	55942.3894	0.0044 0.0014	II	*H*	Corfini/NW20/CCD-UAI
EH Lyn	55974.4884	0.0014 0.0006	I	–	Corfini/NW20/CCD-UAI
EH Lyn	55979.3903	0.0005 0.0004	I	–	Zambelli/SC25/ST8
EH Lyn	55980.3702	0.0003 0.0003	I	–	Zambelli/SC25/ST8
EH Lyn	55984.4597	0.0011 0.0003	II	–	Corfini/NW20/CCD-UAI
EH Lyn	55988.3799	0.0015 0.0007	II	–	Corfini/NW20/CCD-UAI
HY Lyr	55825.3577	0.0008 0.0004	II	*V*	Banfi/SC25/ST7
PV Lyr	55803.4355	0.0017 0.0004	I	*V*	Banfi/SC25/ST7
QQ Lyr	55769.5520	0.0012 0.0008	I	–	Ruocco/SC25/ST7
V574 Lyr	55791.5070	0.0003 0.0002	II	*BVRI*	Arena/NW20/ST7
V574 Lyr	55795.4688	0.0003 0.0002	I	*BVRI*	Arena/NW20/ST7
V574 Lyr	55798.3359	0.0003 0.0003	II	*BVRI*	Arena/NW20/ST7
V574 Lyr	55798.4728	0.0003 0.0004	I	*BVRI*	Arena/NW20/ST7
V574 Lyr	55799.4278	0.0010 0.0003	II	*BVRI*	Arena/NW20/ST7
V574 Lyr	55800.3850	0.0007 0.0003	I	*BVRI*	Arena/NW20/ST7
V574 Lyr	55800.5196	0.0007 0.0010	II	*BVRI*	Arena/NW20/ST7
V574 Lyr	55801.3399	0.0003 0.0003	II	*BVRI*	Arena/NW20/ST7
V574 Lyr	55801.4776	0.0003 0.0004	I	*BVRI*	Arena/NW20/ST7
V574 Lyr	55802.4325	0.0005 0.0003	II	*BVRI*	Arena/NW20/ST7
G3108.0057 Lyr	55775.5515	0.0004 0.0002	I	–	Arena/NW20/DSI
DD Mon	55975.3123	0.0002 0.0001	I	*R*	Marino/NW25/ST7
V383 Mon	55985.4022	0.0019 0.0007	I	–	Ruocco/SC25/ST7
V383 Mon	55999.3652	0.0014 0.0009	I	–	Ruocco/SC25/ST7
V383 Mon	56007.3029	0.0024 0.0022	II	–	Ruocco/SC25/ST7
V464 Mon	55911.2019	0.0006 0.0002	I	–	Marino/SC36/ST8
V527 Mon	55909.2121	0.0009 0.0004	I	–	Marino/SC36/ST8
ET Ori	55876.1011	0.0002 0.0001	I	–	Bianciardi, Ruocco/SC36/ST8
BW Peg	55838.4471	0.0015 0.0004	I	–	Ruocco/SC20/ST7
BW Peg	55846.3719	0.0004 0.0005	I	–	Corfini/NW20/CCD-UAI
V365 Peg	55840.3521	0.0060 0.0005	II	*V*	Banfi/SC25/ST7
V963 Per	55922.2549	0.0002 0.0001	I	–	Ruocco/SC25/ST7
V963 Per	55923.4136	0.0009 0.0003	II	–	Ruocco/SC25/ST7
V963 Per	55923.6407	0.0005 0.0003	I	–	Ruocco/SC25/ST7
GR Psc	55818.5789	0.0010 0.0001	II	*V*	Banfi/SC25/ST7
CP Sge	55805.3585	0.0022 0.0008	I	*V*	Banfi/SC25/ST7

Times of minima:					
Star name	Time of min. HJD 2400000+	Error	Type	Filter	Rem.
V423 Tau	55948.3316	0.0061 0.0017	II	–	Ruocco/SC25/ST7
V423 Tau	55952.4212	0.0048 0.0008	II	–	Ruocco/SC25/ST7
V423 Tau	55953.4434:	– 0.0100	I	–	Ruocco/SC25/ST7
V423 Tau	55956.5144	0.0041 0.0022	II	–	Ruocco/SC25/ST7
V1374 Tau	55919.3776	0.0002 0.0003	I	$Y495$	Corfini/NW20/CCD-UAI
V1374 Tau	55937.4361	0.0003 0.0002	I	r	Corfini/NW20/CCD-UAI
BE Tri	55819.6384	0.0014 0.0004	I	V	Banfi/SC20/ST7
BE Tri	55835.3955	0.0006 0.0003	I	–	Corfini/NW20/CCD-UAI
BM Tri	55850.4697	0.0007 0.0002	I	V	Banfi/SC25/ST7
BX Tri	55838.4592	0.0010 0.0008	II	V	Banfi/SC25/ST7
BX Tri	55839.4206	0.0031 0.0009	II	V	Banfi/SC25/ST7
BX Tri	55839.5158	0.0009 0.0005	I	V	Banfi/SC25/ST7
BX Tri	55839.6150	0.0018 0.0004	II	V	Banfi/SC25/ST7
CM Tri	55825.6310	0.0015 0.0007	I	V	Banfi/SC25/ST7
CN Tri	55803.5678	0.0007 0.0003	I	V	Banfi/SC25/ST7
CS Tri	55924.4591	0.0018 0.0005	I	V	Banfi/SC25/ST7
XY UMa	56004.4285	0.0003 0.0001	I	–	Bonaventura/MK13/Eos
GZ UMa	55933.4127:	0.0044 0.0002	I	V	Lucidi/ED8/DSI
LL UMa	56013.4238	0.0012 0.0006	I	–	Ruocco/SC25/ST7
LL UMa	56013.5882	0.0016 0.0006	II	–	Ruocco/SC25/ST7
MS UMa	55983.4140	0.0007 0.0003	I	V	Aceti et al./SC25/ST7
EY Vul	55839.3213	0.0024 0.0007	I	V	Banfi/SC25/ST7
V384 Vul	55706.5493	0.0009 0.0003	II	V	Banfi/SC25/ST7
V384 Vul	55750.4349	0.0020 0.0004	II	V	Banfi/SC25/ST7
V384 Vul	55790.3715	0.0011 0.0001	II	V	Vincenzi/SC30/ST9
V384 Vul	55803.5366	0.0015 0.0001	II	V	Vincenzi/SC30/ST9
V384 Vul	55805.5119	0.0018 0.0003	I	V	Vincenzi/SC30/ST9
V384 Vul	55819.3355	0.0007 0.0003	II	V	Marchini/MC32/ST7
V467 Vul	55442.3386	0.0004 0.0003	II	V	Corfini/NW20/CCD-UAI
V467 Vul	55827.4316	0.0007 0.0002	II	–	Corfini/NW20/CCD-UAI

Explanation of the remarks in the table:

Rem.: Observer[s]/Telescope/Detector
[a] Arlot's modified method
[b] as given by KW method
[c] cataclysmic variable
: uncertain

Remarks:

GSC 03881-0579 − We found relevant discrepancies between our observed times of the minima and the computed times of the minima based on the period of $0^{\rm d}.3293363$ given by Devor et al. (2008). Our data better fit to the $0^{\rm d}.329333$ value given by Gettel et al. (2006). The best linear fit of the O−C vs. the epoch, leaving the initial epoch and period free to vary, including the time of minimum given by the VSX catalogue (deduced from Devor et al., 2008 data), leads to the following updated ephemeris:

$$T_{min}\ (\mathrm{HJD}) = 2453128.48509(\pm 0.00091) + 0^{\rm d}.3293313(\pm 0.0000001) \times E$$

EZ Lac − Considering our data together with those found in literature, the best linear fit of the O−C leads to the following average ephemeris:

$$T_{min}\ (\mathrm{HJD}) = 2429231.3909(\pm 0.0263) + 2^{\rm d}.7908638(\pm 0.0000035) \times E$$

Figure 1 shows the O−C diagram computed using the above mentioned average ephemeris. The high dispersion of the old data (photographic) does not allow to establish with certainty a variation of O−C or period in the range from the first observations (1938) up to our observations. However, the average ephemeris leads to a discrepancy of about half an hour with respect to the recent times of minimum. Our minima better fit to the following updated ephemeris:

$$T_{min}\ (\mathrm{HJD}) = 2455881.34265(\pm 0.0013) + 2^{\rm d}.790773(\pm 0.000025) \times E$$

obtained taking into account only our primary minima, whose depth allows a more precise timing of the minima.

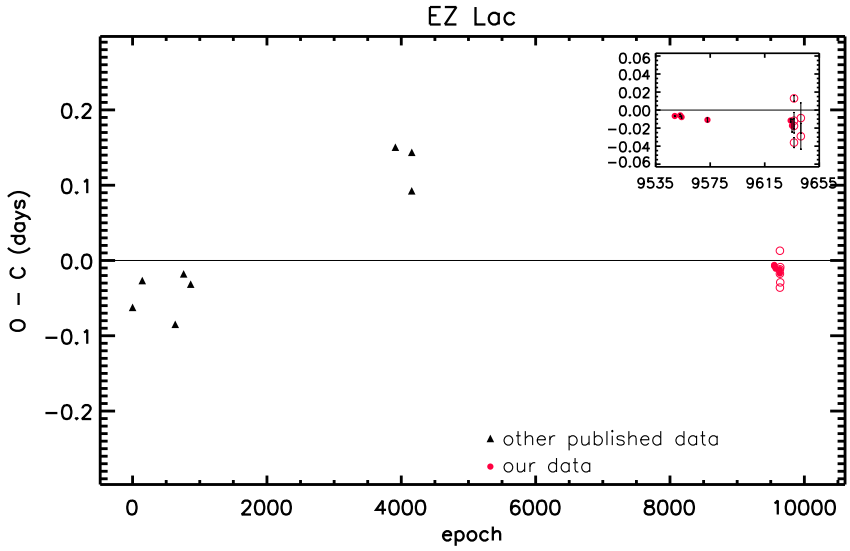

Figure 1. O−C diagram for EZ Lac. Empty symbols for secondary minima.

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