

Supplementary Material

1 SUPPLEMENTARY TABLES

1.1 Light Minimum of IW UMa

Table A1: All available Light Minimum of IW UMa

HJD (2400000+)	Error	Meth.	E	O-C d	Ref.	HJD (2400000+)	Error	Meth.	E	O-C (d)	Ref.
50141.6354	0.0002	R	-12764	-0.0040	(1)	59621.0908	0.0017	ccd	-528	-0.0005	This study*
50142.4097	0.0004	R	-12763	-0.0044	(1)	59624.9647	0.0017	ccd	-523	-0.0001	This study*
50152.4807	0.0002	V	-12750	-0.0047	(1)	59625.7383	0.0017	ccd	-522	-0.0012	This study*
50396.5178	0.0003	R	-12435	-0.0038	(1)	59626.5139	0.0017	ccd	-521	-0.0004	This study*
51180.5370		ccd	-11423	0.0005	(2)	59627.2884	0.0017	ccd	-520	-0.0006	This study*
51274.2760		ccd	-11302	-0.0014	*	59628.0633	0.0017	ccd	-519	-0.0004	This study*
52721.4495	0.0011	ccd	-9434	-0.0015	(3)	59628.8378	0.0017	ccd	-518	-0.0006	This study*
53110.3577	0.0032	R	-8932	-0.0018	(4)	59629.6127	0.0016	ccd	-517	-0.0004	This study*
53110.3582	0.0033	V	-8932	-0.0013	(4)	59630.3877	0.0016	ccd	-516	-0.0002	This study*
53110.3583	0.0032	I	-8932	-0.0012	(4)	59631.1620	0.0017	ccd	-515	-0.0006	This study*
53743.6867	0.0004	ccdI	-8114.5	-0.0050	(5)	59631.9370	0.0016	ccd	-514	-0.0003	This study*
53754.1442		V	-8101	-0.0061	*	59632.7115	0.0017	ccd	-513	-0.0006	This study*
53849.4346		V	-7978	-0.0061	*	59633.4862	0.0016	ccd	-512	-0.0005	This study*
54186.4390	0.0004	-Ir	-7543	-0.0041	(6)	59634.2608	0.0017	ccd	-511	-0.0007	This study*
54186.4391	0.0004	-Ir	-7543	-0.0040	(7)	59635.0355	0.0016	ccd	-510	-0.0007	This study*
54200.3845	0.0003	V	-7525	-0.0035	(8)	59635.8103	0.0016	ccd	-509	-0.0006	This study*
54535.4534	0.0010	ccd	-7092.5	-0.0002	(7)	59609.0837	0.0017	ccd	-543.5	0.0006	This study*
54843.4058	0.0001	R	-6695	0.0017	(9)	59609.8585	0.0015	ccd	-542.5	0.0006	This study*
54848.8248	0.0006	V	-6688	-0.0023	(10)	59610.6328	0.0016	ccd	-541.5	0.0003	This study*
55235.4060	0.0005	-Ir	-6189	-0.0055	(11)	59611.4074	0.0015	ccd	-540.5	0.0001	This study*
55240.8300	0.0004	V	-6182	-0.0045	(12)	59612.1815	0.0016	ccd	-539.5	-0.0005	This study*
55577.8312	0.0008	V	-5747	-0.0058	(13)	59612.9565	0.0016	ccd	-538.5	-0.0002	This study*
55600.6947	0.0002	-Ir	-5717.5	0.0035	(14)	59613.7319	0.0014	ccd	-537.5	0.0005	This study*
55627.4153	0.0002	R	-5683	-0.0036	(15)	59614.5071	0.0014	ccd	-536.5	0.0010	This study*
55627.4158	0.0005	B	-5683	-0.0031	(15)	59615.2804	0.0015	ccd	-535.5	-0.0005	This study*
55627.4158	0.0004	I	-5683	-0.0031	(15)	59616.0558	0.0015	ccd	-534.5	0.0002	This study*
55627.4159	0.0004	V	-5683	-0.0030	(15)	59616.8306	0.0015	ccd	-533.5	0.0003	This study*
55945.8267	0.0005	V	-5272	-0.0014	(16)	59617.6049	0.0015	ccd	-532.5	-0.0001	This study*
56390.5116	0.0001	ccd	-4698	-0.0048	(17)	59618.3796	0.0016	ccd	-531.5	-0.0001	This study*
59628.8376	0.0003	V	-518	-0.0008	(18)	59619.1548	0.0015	ccd	-530.5	0.0004	This study*
59975.1365	0.0003	ccd	-71	-0.0009	This study	59619.9287	0.0015	ccd	-529.5	-0.0005	This study*
60030.1425	0.0002	ccd	0	0.0000	This study	59620.7042	0.0015	ccd	-528.5	0.0003	This study*
60348.1654	0.0005	ccd	410.5	0.0012	This study	59621.4784	0.0016	ccd	-527.5	-0.0003	This study*
59609.4700	0.0018	ccd	-543	-0.0005	This study*	59625.3501	0.0016	ccd	-522.5	-0.0021	This study*
59610.2447	0.0018	ccd	-542	-0.0005	This study*	59626.1289	0.0015	ccd	-521.5	0.0020	This study*
59611.0196	0.0017	ccd	-541	-0.0003	This study*	59626.9015	0.0015	ccd	-520.5	-0.0002	This study*
59611.7940	0.0018	ccd	-540	-0.0006	This study*	59627.6766	0.0015	ccd	-519.5	0.0002	This study*
59612.5689	0.0018	ccd	-539	-0.0005	This study*	59628.4509	0.0015	ccd	-518.5	-0.0001	This study*
59613.3433	0.0018	ccd	-538	-0.0007	This study*	59629.2253	0.0015	ccd	-517.5	-0.0005	This study*
59614.1184	0.0018	ccd	-537	-0.0004	This study*	59630.0005	0.0015	ccd	-516.5	0.0000	This study*
59614.8931	0.0019	ccd	-536	-0.0004	This study*	59630.7751	0.0014	ccd	-515.5	-0.0001	This study*
59615.6677	0.0017	ccd	-535	-0.0005	This study*	59631.5496	0.0014	ccd	-514.5	-0.0003	This study*
59616.4422	0.0018	ccd	-534	-0.0007	This study*	59632.3244	0.0015	ccd	-513.5	-0.0002	This study*
59617.2169	0.0017	ccd	-533	-0.0008	This study*	59633.0988	0.0014	ccd	-512.5	-0.0006	This study*
59617.9921	0.0017	ccd	-532	-0.0002	This study*	59633.8735	0.0015	ccd	-511.5	-0.0006	This study*
59618.7663	0.0017	ccd	-531	-0.0008	This study*	59634.6481	0.0014	ccd	-510.5	-0.0007	This study*

Continued on next page

Table A1 – continued from previous page

HJD (2400000+)	Error	Meth.	E	O-C d	Ref.	HJD (2400000+)	Error	Meth.	E	O-C (d)	Ref.
59619.5414	0.0018	ccd	-530	-0.0004	This study*	59635.4236	0.0014	ccd	-509.5	0.0000	This study*
59620.3160	0.0018	ccd	-529	-0.0005	This study*						

Notes: '*':O-C gateway; 'This study*':light minimums obtained by us based on the TESS light curves; (1)Borovicka and Sarounova (1996) (2)ADS (1999) (3)Diethelm (2003) (4)Zejda (2004) (5) Brát et al. (2007) (6) Hubscher (2007) (7) Hubscher et al. (2009) (8) Diethelm (2007) (9) Brat et al. (2009) (10)Diethelm (2009) (11)Hubscher et al. (2012) (12) Diethelm (2010) (13) Diethelm (2011) (14) Hubscher (2011) (15) Brat et al. (2011) (16)Diethelm (2012) (17)Hoňková et al. (2013) (18)Nelson and Alton (2022)

1.2 Light Minimum of V367 Gem

Table B1: All available Light Minimum of V367 Gem

HJD (2400000+)	Error	Meth.	E	O-C d	Ref.	HJD (2400000+)	Error	Meth.	E	O-C (d)	Ref.
51496.9156		ccd	-12621.5	0.0123	(1)	60281.6680	0.0001	CCD	-58	0.0012	This study*
52311.8658		V	-11456	0.0111	(1)	60282.3666	0.0001	CCD	-57	0.0006	This study*
52332.8418		ccd	-11426	0.0103	(1)	60283.0663	0.0001	CCD	-56	0.0011	This study*
52336.6920		ccd	-11420.5	0.0147	(1)	60283.7654	0.0001	CCD	-55	0.0009	This study*
53741.7889		ccd	-9411	0.0109	(1)	60284.4651	0.0001	CCD	-54	0.0014	This study*
55159.8243	0.0003	R	-7383	0.0099	(2)	60285.1639	0.0001	CCD	-53	0.0009	This study*
55187.0929		Rc	-7344	0.0086	*	60237.2698	0.0004	CCD	-121.5	0.0040	This study*
55188.1429		Rc	-7342.5	0.0097	*	60237.9679	0.0004	CCD	-120.5	0.0029	This study*
55568.1741		V	-6799	0.0100	*	60238.6669	0.0004	CCD	-119.5	0.0027	This study*
55835.9778	0.0002	ccd	-6416	0.0090	(3)	60239.3658	0.0004	CCD	-118.5	0.0023	This study*
57732.2842		C	-3704	0.0063	*	60240.0661	0.0004	CCD	-117.5	0.0034	This study*
58850.3473		V	-2105	0.0022	*	60241.4644	0.0004	CCD	-115.5	0.0033	This study*
60236.9191	0.0001	CCD	-122	0.0029	This study*	60242.1634	0.0004	CCD	-114.5	0.0030	This study*
60237.6182	0.0001	CCD	-121	0.0028	This study*	60242.8616	0.0004	CCD	-113.5	0.0020	This study*
60238.3172	0.0001	CCD	-120	0.0026	This study*	60243.5616	0.0004	CCD	-112.5	0.0028	This study*
60239.0163	0.0001	CCD	-119	0.0024	This study*	60244.2597	0.0004	CCD	-111.5	0.0016	This study*
60239.7157	0.0001	CCD	-118	0.0027	This study*	60244.9592	0.0003	CCD	-110.5	0.0019	This study*
60240.4145	0.0001	CCD	-117	0.0022	This study*	60245.6576	0.0004	CCD	-109.5	0.0010	This study*
60241.1139	0.0001	CCD	-116	0.0023	This study*	60250.5534	0.0004	CCD	-102.5	0.0023	This study*
60241.8130	0.0001	CCD	-115	0.0023	This study*	60251.2520	0.0004	CCD	-101.5	0.0017	This study*
60242.5123	0.0001	CCD	-114	0.0023	This study*	60251.9516	0.0004	CCD	-100.5	0.0020	This study*
60243.2117	0.0001	CCD	-113	0.0025	This study*	60252.6510	0.0004	CCD	-99.5	0.0022	This study*
60243.9109	0.0001	CCD	-112	0.0025	This study*	60254.0498	0.0004	CCD	-97.5	0.0025	This study*
60244.6096	0.0001	CCD	-111	0.0020	This study*	60254.7486	0.0004	CCD	-96.5	0.0021	This study*
60245.3085	0.0001	CCD	-110	0.0016	This study*	60255.4469	0.0004	CCD	-95.5	0.0012	This study*
60250.2028	0.0001	CCD	-103	0.0013	This study*	60256.1475	0.0004	CCD	-94.5	0.0025	This study*
60250.9021	0.0001	CCD	-102	0.0014	This study*	60256.8445	0.0004	CCD	-93.5	0.0004	This study*
60251.6012	0.0001	CCD	-101	0.0013	This study*	60257.5446	0.0004	CCD	-92.5	0.0012	This study*
60252.3005	0.0001	CCD	-100	0.0013	This study*	60258.2444	0.0004	CCD	-91.5	0.0018	This study*
60252.9994	0.0001	CCD	-99	0.0010	This study*	60258.9425	0.0004	CCD	-90.5	0.0006	This study*
60253.6985	0.0001	CCD	-98	0.0009	This study*	60263.8376	0.0003	CCD	-83.5	0.0011	This study*
60254.3979	0.0001	CCD	-97	0.0010	This study*	60264.5353	0.0003	CCD	-82.5	-0.0004	This study*
60255.0969	0.0001	CCD	-96	0.0008	This study*	60265.2344	0.0004	CCD	-81.5	-0.0006	This study*
60255.7960	0.0001	CCD	-95	0.0006	This study*	60265.9344	0.0004	CCD	-80.5	0.0002	This study*
60256.4955	0.0001	CCD	-94	0.0010	This study*	60266.6339	0.0004	CCD	-79.5	0.0005	This study*
60257.1945	0.0001	CCD	-93	0.0007	This study*	60267.3339	0.0004	CCD	-78.5	0.0013	This study*
60257.8936	0.0001	CCD	-92	0.0006	This study*	60268.0313	0.0004	CCD	-77.5	-0.0005	This study*
60258.5931	0.0001	CCD	-91	0.0009	This study*	60268.7306	0.0004	CCD	-76.5	-0.0005	This study*
60259.2885	0.0001	CCD	-90	-0.0029	This study*	60269.4315	0.0004	CCD	-75.5	0.0012	This study*
60264.1858	0.0001	CCD	-83	-0.0003	This study*	60270.1295	0.0004	CCD	-74.5	0.0000	This study*
60264.8852	0.0001	CCD	-82	-0.0001	This study*	60270.8294	0.0004	CCD	-73.5	0.0006	This study*
60265.5850	0.0001	CCD	-81	0.0004	This study*	60271.5287	0.0004	CCD	-72.5	0.0007	This study*
60266.2835	0.0001	CCD	-80	-0.0003	This study*	60272.2275	0.0004	CCD	-71.5	0.0002	This study*
60266.9826	0.0001	CCD	-79	-0.0004	This study*	60277.1219	0.0005	CCD	-64.5	0.0001	This study*
60267.6820	0.0001	CCD	-78	-0.0003	This study*	60277.8223	0.0004	CCD	-63.5	0.0012	This study*
60268.3813	0.0001	CCD	-77	-0.0002	This study*	60278.5203	0.0004	CCD	-62.5	0.0000	This study*

Continued on next page

Table B1 – continued from previous page

HJD (2400000+)	Error	Meth.	E	O-C d	Ref.	HJD (2400000+)	Error	Meth.	E	O-C (d)	Ref.
60269.0806	0.0001	CCD	-76	-0.0001	This study*	60279.2214	0.0004	CCD	-61.5	0.0019	This study*
60269.7798	0.0001	CCD	-75	-0.0001	This study*	60279.9204	0.0004	CCD	-60.5	0.0017	This study*
60270.4792	0.0001	CCD	-74	0.0000	This study*	60280.6199	0.0004	CCD	-59.5	0.0019	This study*
60271.1783	0.0001	CCD	-73	-0.0001	This study*	60281.3190	0.0004	CCD	-58.5	0.0018	This study*
60271.8775	0.0001	CCD	-72	-0.0001	This study*	60282.0185	0.0004	CCD	-57.5	0.0021	This study*
60272.5768	0.0001	CCD	-71	0.0000	This study*	60282.7177	0.0004	CCD	-56.5	0.0020	This study*
60276.7728	0.0001	CCD	-65	0.0006	This study*	60283.4167	0.0004	CCD	-55.5	0.0018	This study*
60277.4718	0.0001	CCD	-64	0.0004	This study*	60284.1168	0.0004	CCD	-54.5	0.0027	This study*
60278.1711	0.0001	CCD	-63	0.0004	This study*	60284.8155	0.0004	CCD	-53.5	0.0022	This study*
60278.8705	0.0001	CCD	-62	0.0006	This study*	60285.5147	0.0004	CCD	-52.5	0.0022	This study*
60279.5700	0.0002	CCD	-61	0.0009	This study*	60321.1756	0.0005	BVRcIc	-1.5	0.0024	This study
60280.2690	0.0001	CCD	-60	0.0007	This study*	60322.2221	0.0003	BVRcIc	0	0.0000	This study
60280.9684	0.0001	CCD	-59	0.0008	This study*						

Notes: '*': O-C gateway; 'This study*': light minimums obtained by us based on the TESS light curves; (1) Hintz and Brown (2007) (2) Nelson (2010) (3) Nelson (2012)

REFERENCES

- ADS (1999). 152. list of minima of eclipsing binaries. *Bulletin der Bedeckungsveränderlichen-Beobachter der Schweizerischen Astronomischen Gesellschaft* 119, 1–7
- Borovicka, J. and Sarounova, L. (1996). The Period and Lightcurve of NSV 4497. *Information Bulletin on Variable Stars* 4402, 1
- Brat, L., Trnka, J., Lehky, M., Smelcer, L., Kucakova, H., Ehrenberger, R., et al. (2009). B.R.N.O. Contributions #36, Times of minima. *Open European Journal on Variable Stars* 107, 1
- Brat, L., Trnka, J., Smelcer, L., Lehky, M., Kucakova, H., Lomoz, F., et al. (2011). B.R.N.O. Contributions #37 - Times of minima. *Open European Journal on Variable Stars* 137, 1
- Brát, L., Zejda, M., and Svoboda, P. (2007). B.R.N.O. Contributions #34. *Open European Journal on Variable Stars* 0074, 1
- Diethelm, R. (2003). 162-nd List of Minima Timings of Eclipsing Binaries by BBSAG Observers. *Information Bulletin on Variable Stars* 5438, 1
- Diethelm, R. (2007). 166. List of Timings of Minima Eclipsing Binaries by BBSAG Observers. *Information Bulletin on Variable Stars* 5781, 1
- Diethelm, R. (2009). Timings of Minima of Eclipsing Binaries. *Information Bulletin on Variable Stars* 5894, 1
- Diethelm, R. (2010). Timings of Minima of Eclipsing Binaries. *Information Bulletin on Variable Stars* 5945, 1
- Diethelm, R. (2011). Timings of Minima of Eclipsing Binaries. *Information Bulletin on Variable Stars* 5992, 1
- Diethelm, R. (2012). Timings of Minima of Eclipsing Binaries. *Information Bulletin on Variable Stars* 6029, 1
- Hintz, E. G. and Brown, P. J. (2007). Revised Periods for QS Geminorum and V367 Geminorum. *Publications of the Astronomical Society of the Pacific* 119, 274–283. doi:10.1086/516602
- Hoňková, K., Juryšek, J., Lehký, M., Šmelcer, L., Trnka, J., Mašek, M., et al. (2013). B.R.N.O. Contributions #38 Times of minima. *Open European Journal on Variable Stars* 160, 1
- Hubscher, J. (2007). Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. *Information Bulletin on Variable Stars* 5802, 1
- Hubscher, J. (2011). BAV-Results of Observations - Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. *Information Bulletin on Variable Stars* 5984, 1
- Hubscher, J., Lehmann, P. B., and Walter, F. (2012). BAV-Results of observations - Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. *Information Bulletin on Variable Stars* 6010, 1
- Hubscher, J., Steinbach, H.-M., and Walter, F. (2009). BAV-Results of observations - Photoelectric Minima of Selected Eclipsing Binaries and Maxima of Pulsating Stars. *Information Bulletin on Variable Stars* 5874, 1
- Nelson, R. H. (2010). CCD Minima for Selected Eclipsing Binaries in 2009. *Information Bulletin on Variable Stars* 5929, 1
- Nelson, R. H. (2012). CCD Minima for Selected Eclipsing Binaries in 2011. *Information Bulletin on Variable Stars* 6018, 1
- Nelson, R. H. and Alton, K. B. (2022). CCD Minima for Selected Eclipsing Binaries in 2022. *Open European Journal on Variable Stars* 234, 1–7. doi:10.5817/OEJV2022-0234
- Zejda, M. (2004). CCD Times of Minima of Selected Eclipsing Binaries. *Information Bulletin on Variable Stars* 5583, 1