

**Light Curve Minima extracted from SuperWASP data for a Selection of Variable Stars**Analyze Jooste<sup>1</sup>, Derck P. Smits<sup>2</sup>, Anton Paschke<sup>3</sup>1) University of South Africa,  
Email: [ajooste.24@gmail.com](mailto:ajooste.24@gmail.com), ORCID 0009-0005-1650-63342) University of South Africa,  
Email: [derck.smits@gmail.com](mailto:derck.smits@gmail.com), ORCID 0000-0003-3593-97073) Bundesdeutsche Arbeitsgemeinschaft für Veränderliche Sterne e.V.,  
Email: [Anton@Paschke.com](mailto:Anton@Paschke.com)

July 2024

**Abstract:**

*Smits & Skelton [10] determined 1339 minima for the following 21 eclipsing binary stars: BS Hya, CD Hya, CH Hya, NSV5707, NSV5792, NSV5872, NSV6007, NSV6009, V1053 Cen, V1054 Cen, V1121 Cen, V1133 Cen, V1139 Cen, V1140 Cen, V1144 Cen, V448 Cen, V454 Cen, V461 Hya, V472 Cen, V600 Cen and V601 Cen.*

*Analyze Jooste determined 807 minima for the following four contact binary stars: BL Eri, V1112 Tau, V1119 Her and V1799 Ori.*

**Introduction**

Variable stars in High Latitude Field 356, a  $10^\circ \times 10^\circ$  field centred at  $\alpha_{J2000} = 12^h 45^m 23^s$  and  $\delta_{J2000} = -32^\circ 02' 50''$ , were investigated by Huruwata [4] using 102 photographic plates. Eclipsing binaries in this field have been re-examined by Smits & Skelton (2019) using observations obtained with CCD cameras. Several stars in the original investigation were misclassified, and have now been reclassified as binaries of type EA (detached), EB (semi-detached), EW (in contact) or cataclysmic variable type. Newly determined ephemerides for the eclipsing binaries of type EA, EB and EW are presented in Table 2 of Smits & Skelton [10]. Times of minima for 21 of these stars are presented here.

In addition the eclipse minima for BL Eri, V1112 Tau, V1119 Her and V1799 Ori as established from SuperWASP data are included as separately determined by Analyze Jooste.

**Instrumentation and Data**

Archived data for the 25 stars in this article were downloaded from the Wide Angle Search for Planets (WASP) database using the WASP Variable Star Investigator website<sup>1</sup>.

The WASP project was initiated during 2000 by a consortium of United Kingdom universities who operate robotic telescope installations located in La Palma, at the Observatorio del Roque de los Muchachos, (SuperWASP-N) and in Sutherland at the South African Astronomical Observatory (SAAO), (SuperWASP-S). A detailed discussion of the WASP and SuperWASP systems, including the history of these projects, is presented in Smith & WASP Consortium [9]. Each system consists of six cameras having a 482 square degree field-of-view per installation and a sensitivity

<sup>1</sup> <http://wasp.warwick.ac.uk/vsi2/vsi2.php?>

down to 15<sup>th</sup> magnitude, Smith & WASP Consortium [9]. The WASP V magnitude system is defined by the TYCHO-2  $V_t$  band pass (Pollacco et al. [8]) which is wider than the Johnson-Morgan system V-band filter.

The SuperWASP data has a time span ranging from about 2 years to slightly longer than 7 years for this selection of stars, but with densely measured, good quality data. SuperWASP captured two 30s exposures approximately 10 min apart each time an object was the target. A particular field of the sky was monitored for around five months at a time Smith & WASP Consortium [9].

Because more than one camera covered a given area of the sky, data from multiple cameras exist for some of the stars studied. These data give rise to many data points for a particular minimum, as can be seen from the large number of points listed for some of the minima.

### Method used to determine the eclipse minima

The magnitude  $y$  of points measured at times  $t$  about the minimum of a light curve eclipse are fitted to a second order quadratic curve given by

$$y(t) = at^2 + bt + c,$$

from which the parameters  $a$ ,  $b$  and  $c$  are determined via a least squares fit. The time of the minimum of the eclipse,  $T_{min}$ , is determined from the minimum of the parabola which is given by

$$T_{min} = \frac{-b}{2a}. \quad (1)$$

Using the definitions of variance,  $\text{Var}$ , and covariance,  $\text{Cov}$ , given in Feigelson & Babu [1], the uncertainty in,  $T_{min}$ ,  $\delta T_{min}$  is given by

$$(\delta T_{min})^2 = \text{Var}(T_{min}) = \frac{b^2}{4a^4} \text{Var}(a) + \frac{1}{4a^2} \text{Var}(b) - \frac{b}{2a^3} \text{Cov}(a, b). \quad (2)$$

A Python routine was used to perform the curve fit of each suitable eclipse minimum in the SuperWASP data, and then to derive the values of the parameters  $a$ ,  $b$  and  $c$ , as well as the variances  $\text{Var}(a)$  and  $\text{Var}(b)$ , and the covariance,  $\text{Cov}(a, b)$ . From these values, the times  $T_{min}$  and their uncertainties  $\delta T_{min}$  were calculated. These are the values tabulated here.

### Results: Eclipse Minima

#### Table Headings

- SN = Star name according to GCVS
- Con = Constellation according to GCVS
- K = Kind of minimum P = primary, S = secondary
- HJD = Heliocentric Julian Date of the eclipse minimum,  $T_{min}$  (equation (1))
- err =  $\delta T_{min}$ , (equation (2)), uncertainty of the determined time
- NM = Number of measurements used

Table 1 lists the eclipse minima used to derive results published by Smits & Skelton (2019) on the following stars: BS Hya, CD Hya, CH Hya, NSV5707, NSV5792, NSV5872, NSV6007, NSV6009, V1053 Cen, V1054 Cen, V1121 Cen, V1133 Cen, V1139 Cen, V1140 Cen, V1144 Cen, V448 Cen, V454 Cen, V461 Hya, V472 Cen, V600 Cen and V601 Cen

Table 2 presents the eclipse minima of BL Eri, V1112 Tau, V1119 Her and V1799 Ori and the results of any period changes of these four systems are included in the Section: Discussion and Results.

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
BS	Hya	P	2454152.5461	0.0025	24	BS	Hya	P	2454181.4122	0.0031	19
BS	Hya	P	2454205.2854	0.0035	34	BS	Hya	P	2454207.5066	0.0028	27
BS	Hya	P	2454211.3882	0.0025	20	BS	Hya	P	2454212.4985	0.0026	23
BS	Hya	P	2454225.2638	0.0028	24	BS	Hya	P	2454270.2361	0.0019	31
BS	Hya	P	2454271.3442	0.0016	26	BS	Hya	P	2454499.5044	0.0025	50
BS	Hya	P	2454560.5764	0.0031	28	BS	Hya	P	2455675.3005	0.0022	20
BS	Hya	P	2456033.3711	0.0015	13	CD	Hya	P	2454129.4618	0.0025	9
CD	Hya	P	2454145.5735	0.0012	12	CD	Hya	P	2454148.5445	0.0013	8
CD	Hya	P	2454180.5117	0.0012	10	CD	Hya	S	2454183.3584	0.001	14
CD	Hya	P	2454184.4741	0.0043	8	CD	Hya	P	2454186.4594	0.0008	8
CD	Hya	P	2454207.2709	0.002	15	CD	Hya	P	2454233.2917	0.0013	10
CD	Hya	S	2454272.3210	0.001	10	CD	Hya	P	2454537.5939	0.0021	9
CD	Hya	P	2454562.3734	0.0024	10	CD	Hya	S	2454583.3115	0.0016	8
CH	Hya	S	2454122.5141	0.0013	20	CH	Hya	S	2454132.5687	0.0032	17
CH	Hya	P	2454145.5601	0.0014	20	CH	Hya	P	2454151.4524	0.0012	14
CH	Hya	P	2454152.4899	0.0008	15	CH	Hya	P	2454153.5299	0.0015	15
CH	Hya	P	2454155.6131	0.0019	12	CH	Hya	P	2454160.4629	0.0054	14
CH	Hya	P	2454168.4317	0.0027	19	CH	Hya	P	2454170.5129	0.0017	20
CH	Hya	S	2454171.3802	0.002	14	CH	Hya	P	2454175.3661	0.0012	19
CH	Hya	S	2454175.5331	0.0023	14	CH	Hya	S	2454176.5792	0.0015	16
CH	Hya	S	2454180.3891	0.0015	18	CH	Hya	P	2454180.5617	0.0012	16
CH	Hya	S	2454181.4290	0.0012	16	CH	Hya	P	2454183.3309	0.0016	17
CH	Hya	S	2454184.5516	0.0018	13	CH	Hya	P	2454186.4493	0.0014	13
CH	Hya	P	2454199.2766	0.0016	19	CH	Hya	S	2454199.4483	0.0034	15
CH	Hya	P	2454200.3129	0.0013	16	CH	Hya	S	2454205.3414	0.0012	15
CH	Hya	P	2454207.2462	0.0008	23	CH	Hya	P	2454208.2853	0.0007	19
CH	Hya	S	2454208.4585	0.0014	14	CH	Hya	P	2454209.3257	0.0012	16
CH	Hya	P	2454212.4454	0.0012	12	CH	Hya	P	2454213.4843	0.0007	14
CH	Hya	S	2454215.3919	0.0033	14	CH	Hya	S	2454231.3301	0.0013	13
CH	Hya	P	2454233.2385	0.0008	17	CH	Hya	S	2454238.2642	0.0023	14
CH	Hya	S	2454239.3038	0.0017	14	CH	Hya	P	2454271.3603	0.0015	14
CH	Hya	S	2454272.2261	0.0012	20	CH	Hya	S	2454497.4778	0.0024	14
CH	Hya	S	2454498.5156	0.0021	17	CH	Hya	S	2454499.5569	0.0006	20
CH	Hya	P	2454501.4640	0.0013	16	CH	Hya	P	2454502.5018	0.0022	16
CH	Hya	P	2454503.5422	0.0013	20	CH	Hya	P	2454511.5129	0.0008	20
CH	Hya	P	2454526.4171	0.0025	14	CH	Hya	P	2454528.4935	0.0009	13
CH	Hya	P	2454536.4631	0.0014	14	CH	Hya	P	2454555.5243	0.0018	16
CH	Hya	P	2454556.5646	0.0014	15	CH	Hya	S	2454557.4310	0.0012	12
CH	Hya	P	2454560.3738	0.0017	16	CH	Hya	S	2454564.3607	0.0022	15
CH	Hya	P	2454564.5351	0.004	15	CH	Hya	S	2454565.4003	0.0016	13
CH	Hya	S	2454566.4423	0.0013	13	CH	Hya	S	2454567.4805	0.0009	15
CH	Hya	P	2454584.2882	0.0014	14	CH	Hya	P	2454592.2573	0.0014	18
CH	Hya	P	2454594.3367	0.0027	12	CH	Hya	S	2454615.3033	0.0012	14
CH	Hya	S	2455591.5270	0.0014	20	CH	Hya	P	2455619.4218	0.0013	10

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
CH	Hya	S	2455619.5934	0.0018	10	CH	Hya	P	2455620.4612	0.0016	8
CH	Hya	S	2455626.5237	0.0018	10	CH	Hya	S	2455634.4985	0.0014	12
CH	Hya	P	2455647.4901	0.0018	10	CH	Hya	P	2455648.5336	0.0022	9
CH	Hya	P	2455657.5395	0.0016	20	CH	Hya	S	2455675.3842	0.0024	8
CH	Hya	P	2455714.3737	0.0025	19	CH	Hya	P	2455954.5321	0.0006	10
CH	Hya	P	2455963.5467	0.0044	12	CH	Hya	S	2455983.4738	0.0016	8
CH	Hya	P	2455988.4943	0.0021	8	CH	Hya	P	2456004.4351	0.0018	8
CH	Hya	S	2456007.3843	0.0014	8	CH	Hya	P	2456015.5296	0.0045	10
CH	Hya	P	2456036.3141	0.0012	12	CH	Hya	S	2456039.2618	0.002	14
CH	Hya	S	2456059.3615	0.0016	12	CH	Hya	P	2456063.3472	0.0024	11
CH	Hya	P	2456064.3850	0.0007	12	CH	Hya	P	2456071.3190	0.001	12
CH	Hya	P	2456074.4330	0.0015	19	CH	Hya	S	2456091.2432	0.0014	16
NSV5707		P	2453898.3359	0.0055	59	NSV5707		P	2454140.5552	0.0039	80
NSV5707		P	2454151.4312	0.0027	78	NSV5707		P	2454169.5834	0.0054	106
NSV5707		P	2454179.5556	0.0022	40	NSV5707		P	2454181.3708	0.0032	62
NSV5707		P	2454199.5140	0.0045	49	NSV5707		P	2454211.3091	0.0025	72
NSV5707		P	2454231.2685	0.0055	56	NSV5707		P	2454551.4930	0.0076	138
NSV5707		P	2454572.3745	0.0034	41	NSV5707		P	2454581.4389	0.0021	80
NSV5792		P	2453863.2873	0.0044	14	NSV5792		S	2453863.4691	0.0072	14
NSV5792		S	2453886.3150	0.0016	12	NSV5792		S	2453890.3036	0.0014	12
NSV5792		S	2453902.2756	0.0026	12	NSV5792		P	2453904.2687	0.0041	12
NSV5792		S	2453906.2649	0.0017	12	NSV5792		S	2453907.3554	0.0029	14
NSV5792		S	2453910.2575	0.0014	18	NSV5792		P	2453917.3299	0.0025	12
NSV5792		P	2454129.5156	0.0024	18	NSV5792		S	2454140.5774	0.0039	23
NSV5792		P	2454145.4704	0.0049	16	NSV5792		S	2454148.5582	0.0024	16
NSV5792		S	2454151.4593	0.0015	16	NSV5792		S	2454152.5487	0.002	16
NSV5792		P	2454170.5023	0.0023	21	NSV5792		S	2454171.4091	0.0028	14
NSV5792		S	2454175.4004	0.0014	16	NSV5792		P	2454175.5838	0.0092	16
NSV5792		S	2454176.4869	0.0015	13	NSV5792		P	2454178.4803	0.0014	14
NSV5792		S	2454179.3876	0.0013	18	NSV5792		P	2454179.5689	0.0033	18
NSV5792		S	2454180.4791	0.0012	14	NSV5792		P	2454181.3776	0.0043	11
NSV5792		S	2454181.5625	0.0013	18	NSV5792		S	2454184.4652	0.0028	14
NSV5792		S	2454199.3385	0.0013	18	NSV5792		P	2454199.5165	0.0024	20
NSV5792		S	2454203.3272	0.0016	18	NSV5792		S	2454205.5005	0.0035	16
NSV5792		S	2454207.3160	0.0007	18	NSV5792		P	2454207.4979	0.0016	16
NSV5792		P	2454209.3080	0.0016	17	NSV5792		S	2454211.3076	0.0013	18
NSV5792		S	2454212.3927	0.0054	14	NSV5792		P	2454214.3908	0.0011	14
NSV5792		P	2454215.4788	0.0017	16	NSV5792		S	2454216.3845	0.0071	10
NSV5792		S	2454232.3423	0.0026	11	NSV5792		P	2454238.3285	0.0022	12
NSV5792		P	2454499.4851	0.003	16	NSV5792		S	2454501.4814	0.0027	14
NSV5792		P	2454503.4706	0.0017	16	NSV5792		P	2454527.4132	0.0027	16
NSV5792		S	2454527.5986	0.0037	14	NSV5792		P	2454536.4769	0.0106	11
NSV5792		S	2454557.3328	0.0017	19	NSV5792		S	2454562.4128	0.001	12
NSV5792		P	2454564.4059	0.0061	11	NSV5792		P	2454565.4983	0.0038	14
NSV5792		S	2454566.4060	0.0009	14	NSV5792		S	2454567.4891	0.0064	16

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
NSV5792		S	2454581.2700	0.0008	20	NSV5792		P	2454581.4585	0.0009	18
NSV5792		S	2454586.3545	0.0045	11	NSV5792		S	2454614.2805	0.0008	15
NSV5792		S	2454615.3714	0.0014	16	NSV5792		P	2455590.5338	0.004	10
NSV5792		S	2455621.5460	0.0015	12	NSV5792		P	2455626.4436	0.0042	8
NSV5792		P	2455984.4439	0.0041	10	NSV5792		S	2456012.5546	0.0038	12
NSV5792		S	2456018.3594	0.0041	12	NSV5792		S	2456034.3242	0.0015	12
NSV5792		P	2456041.3946	0.0018	11	NSV5792		S	2456064.4296	0.0069	10
NSV5792		P	2456089.2758	0.0023	16	NSV5792		S	2456091.2676	0.0015	18
NSV5792		S	2456095.2579	0.0011	16	NSV5872		P	2453862.3411	0.0019	7
NSV5872		P	2453880.3624	0.0054	12	NSV5872		P	2453881.3742	0.0042	14
NSV5872		S	2453905.2350	0.0047	10	NSV5872		S	2453911.2340	0.0069	17
NSV5872		P	2454175.3661	0.0022	18	NSV5872		P	2454178.3656	0.003	19
NSV5872		P	2454179.3687	0.0018	18	NSV5872		P	2454180.3677	0.0067	18
NSV5872		P	2454181.3659	0.0009	11	NSV5872		S	2454181.5385	0.0071	14
NSV5872		P	2455680.3855	0.0055	10	NSV5872		S	2455717.2579	0.003	14
NSV5872		S	2455978.5612	0.0023	12	NSV5872		S	2456031.2962	0.013	10
NSV6007		P	2453862.4212	0.0031	21	NSV6007		P	2453880.3314	0.0018	26
NSV6007		S	2453881.3618	0.0032	24	NSV6007		S	2453890.3251	0.0031	23
NSV6007		P	2453891.3469	0.0036	20	NSV6007		P	2453902.3853	0.0029	27
NSV6007		P	2453909.2663	0.0022	33	NSV6007		S	2453910.2987	0.0021	24
NSV6007		P	2453911.3280	0.0026	26	NSV6007		S	2453919.2568	0.0025	44
NSV6007		P	2453920.2911	0.0026	35	NSV6007		P	2454145.5465	0.0026	39
NSV6007		P	2454152.4380	0.0031	27	NSV6007		S	2454153.4688	0.0021	30
NSV6007		S	2454155.5357	0.002	28	NSV6007		S	2454175.5172	0.0032	25
NSV6007		P	2454176.5475	0.0026	27	NSV6007		P	2454181.3763	0.0016	26
NSV6007		S	2454184.4754	0.0021	23	NSV6007		S	2454200.3079	0.0054	32
NSV6007		P	2454203.4171	0.0025	24	NSV6007		P	2454207.5451	0.0021	39
NSV6007		S	2454211.3327	0.0023	29	NSV6007		P	2454212.3691	0.002	26
NSV6007		P	2454232.3476	0.0046	23	NSV6007		S	2454233.3807	0.0024	26
NSV6007		S	2454271.2665	0.0028	33	NSV6007		S	2454525.4660	0.0028	26
NSV6007		S	2454527.5288	0.0033	30	NSV6007		P	2454528.5630	0.0024	27
NSV6007		S	2454558.5312	0.0025	31	NSV6007		P	2455649.3583	0.0045	20
NSV6007		P	2455660.3786	0.0034	20	NSV6007		S	2455661.4131	0.0049	20
NSV6007		P	2455680.3551	0.0019	22	NSV6007		P	2455682.4250	0.0043	20
NSV6007		P	2455691.3733	0.0055	20	NSV6007		P	2455718.2393	0.0066	24
NSV6007		P	2455740.2843	0.0033	21	NSV6007		S	2455955.5613	0.0035	25
NSV6007		S	2455973.4737	0.0031	15	NSV6007		P	2455974.5025	0.0091	20
NSV6007		P	2455983.4629	0.0028	18	NSV6007		S	2455984.4949	0.0043	18
NSV6007		S	2456064.4047	0.0022	20	NSV6009		S	2453880.3217	0.0015	10
NSV6009		S	2453886.4197	0.0012	10	NSV6009		P	2453887.3137	0.0017	10
NSV6009		P	2453890.4383	0.0021	10	NSV6009		P	2453904.2782	0.0011	9
NSV6009		S	2453906.3603	0.0016	10	NSV6009		S	2453911.2690	0.0008	14
NSV6009		P	2454145.4594	0.001	13	NSV6009		S	2454153.4941	0.0017	13
NSV6009		S	2454159.5935	0.0016	12	NSV6009		P	2454171.4962	0.0007	13
NSV6009		P	2454179.3829	0.0018	13	NSV6009		P	2454179.5302	0.0036	12

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
NSV6009		S	2454180.4235	0.0014	14	NSV6009		S	2454180.5721	0.0014	12
NSV6009		P	2454181.4668	0.0022	10	NSV6009		S	2454184.4421	0.0021	12
NSV6009		P	2454199.6180	0.0044	23	NSV6009		P	2454200.3588	0.0014	12
NSV6009		S	2454203.3339	0.0059	14	NSV6009		P	2454205.4166	0.0046	12
NSV6009		P	2454207.3547	0.0025	13	NSV6009		P	2454207.4986	0.0008	12
NSV6009		S	2454208.3926	0.0015	12	NSV6009		S	2454211.5206	0.0009	11
NSV6009		S	2454212.2627	0.0016	18	NSV6009		P	2454212.5596	0.0018	11
NSV6009		S	2454214.3469	0.0016	10	NSV6009		S	2454216.2805	0.0014	14
NSV6009		S	2454216.4305	0.0033	11	NSV6009		P	2454231.3085	0.0039	10
NSV6009		P	2454233.2429	0.0018	14	NSV6009		P	2454265.2286	0.0014	16
NSV6009		P	2454265.3812	0.0008	12	NSV6009		S	2454266.2746	0.0009	16
NSV6009		P	2454271.3333	0.0017	14	NSV6009		S	2454274.3096	0.0032	15
NSV6009		S	2454287.2523	0.001	21	NSV6009		P	2454292.3140	0.0009	13
NSV6009		S	2454298.2620	0.0011	19	NSV6009		S	2454499.5713	0.0009	16
NSV6009		S	2454501.5050	0.0012	14	NSV6009		S	2454502.5435	0.0045	16
NSV6009		P	2454511.4760	0.0014	14	NSV6009		S	2454527.5407	0.0027	12
NSV6009		P	2454528.4350	0.0007	14	NSV6009		P	2454528.5828	0.0057	12
NSV6009		S	2454557.4481	0.0006	11	NSV6009		P	2454560.4239	0.0008	10
NSV6009		S	2454561.3188	0.0006	16	NSV6009		S	2454562.3536	0.0015	14
NSV6009		P	2454565.3308	0.0029	14	NSV6009		P	2454566.3765	0.0013	12
NSV6009		P	2454568.3093	0.0007	14	NSV6009		P	2454586.3099	0.001	14
NSV6009		P	2455646.4109	0.0042	7	NSV6009		S	2455655.3424	0.0007	8
NSV6009		S	2455657.5715	0.0047	12	NSV6009		P	2455661.4405	0.0012	10
NSV6009		P	2455683.3143	0.0016	10	NSV6009		S	2455691.3442	0.0047	10
NSV6009		P	2455981.4823	0.001	7	NSV6009		P	2455982.5227	0.0024	10
NSV6009		S	2456005.4360	0.001	7	NSV6009		S	2456005.5839	0.0025	11
V448	Cen	S	2453864.2725	0.0012	14	V448	Cen	P	2453880.3034	0.0009	10
V448	Cen	P	2453881.3165	0.0006	12	V448	Cen	P	2453886.3794	0.0005	12
V448	Cen	S	2453887.2205	0.0007	14	V448	Cen	S	2453888.2339	0.0017	12
V448	Cen	P	2453902.2419	0.0007	12	V448	Cen	P	2453904.2666	0.0004	10
V448	Cen	P	2453905.2775	0.0005	10	V448	Cen	P	2453906.2904	0.0007	12
V448	Cen	P	2453907.3044	0.0008	12	V448	Cen	S	2453917.2590	0.0007	15
V448	Cen	S	2454129.5446	0.0007	24	V448	Cen	P	2454140.5138	0.0007	20
V448	Cen	S	2454145.4077	0.0005	14	V448	Cen	S	2454148.4441	0.0006	14
V448	Cen	S	2454151.4809	0.0008	13	V448	Cen	S	2454152.4953	0.0006	16
V448	Cen	S	2454153.5072	0.0006	16	V448	Cen	S	2454155.5320	0.0006	16
V448	Cen	P	2454156.3749	0.0009	18	V448	Cen	S	2454159.5824	0.0005	16
V448	Cen	P	2454160.4267	0.0008	13	V448	Cen	S	2454168.3558	0.0011	16
V448	Cen	P	2454168.5247	0.0009	22	V448	Cen	P	2454169.5386	0.0007	17
V448	Cen	S	2454170.3835	0.0011	12	V448	Cen	P	2454170.5504	0.0008	19
V448	Cen	S	2454171.3955	0.0011	14	V448	Cen	S	2454175.4444	0.0007	14
V448	Cen	P	2454178.3131	0.0006	23	V448	Cen	S	2454178.4808	0.0008	12
V448	Cen	P	2454179.3263	0.0004	23	V448	Cen	S	2454179.4944	0.0014	12
V448	Cen	P	2454180.3380	0.0007	20	V448	Cen	S	2454180.5057	0.0005	14
V448	Cen	P	2454181.3500	0.002	15	V448	Cen	S	2454181.5180	0.0005	14

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V448	Cen	P	2454183.3751	0.0006	16	V448	Cen	P	2454184.3873	0.0004	15
V448	Cen	S	2454184.5556	0.0008	14	V448	Cen	S	2454199.4051	0.0015	13
V448	Cen	P	2454199.5743	0.0005	21	V448	Cen	P	2454201.2621	0.0006	23
V448	Cen	P	2454203.2870	0.0005	18	V448	Cen	P	2454205.3136	0.0004	15
V448	Cen	S	2454205.4809	0.0008	13	V448	Cen	P	2454206.3248	0.0007	15
V448	Cen	P	2454207.3376	0.0006	16	V448	Cen	S	2454207.5069	0.0006	14
V448	Cen	P	2454208.3502	0.0005	14	V448	Cen	S	2454212.2333	0.0006	20
V448	Cen	P	2454212.4002	0.0003	12	V448	Cen	S	2454213.2427	0.0006	21
V448	Cen	P	2454213.4109	0.0006	12	V448	Cen	S	2454214.2537	0.0008	18
V448	Cen	P	2454214.4255	0.0004	12	V448	Cen	P	2454215.4372	0.0004	14
V448	Cen	S	2454216.2817	0.0011	14	V448	Cen	P	2454216.4502	0.0007	16
V448	Cen	P	2454226.2361	0.0009	19	V448	Cen	S	2454230.4564	0.0015	12
V448	Cen	P	2454231.2985	0.0006	13	V448	Cen	S	2454231.4702	0.001	13
V448	Cen	P	2454232.3131	0.0005	14	V448	Cen	P	2454233.3241	0.0006	13
V448	Cen	P	2454238.3886	0.0004	14	V448	Cen	S	2454239.2318	0.0003	16
V448	Cen	P	2454239.3980	0.0005	11	V448	Cen	S	2454265.2181	0.0004	20
V448	Cen	P	2454265.3869	0.0007	12	V448	Cen	S	2454266.2311	0.0004	17
V448	Cen	S	2454267.2431	0.0007	20	V448	Cen	S	2454270.2811	0.0008	18
V448	Cen	S	2454271.2925	0.0009	15	V448	Cen	S	2454272.3059	0.0006	19
V448	Cen	S	2454273.3195	0.0007	15	V448	Cen	S	2454485.6023	0.0004	16
V448	Cen	P	2454495.5592	0.0004	26	V448	Cen	P	2454496.5703	0.0012	21
V448	Cen	S	2454499.4403	0.0008	14	V448	Cen	S	2454501.4637	0.0009	14
V448	Cen	S	2454502.4775	0.0007	14	V448	Cen	S	2454503.4879	0.0013	13
V448	Cen	P	2454511.4206	0.0006	17	V448	Cen	P	2454524.5827	0.0007	19
V448	Cen	S	2454525.4292	0.001	14	V448	Cen	S	2454526.4395	0.0006	14
V448	Cen	P	2454536.3948	0.0003	14	V448	Cen	S	2454537.5737	0.0013	13
V448	Cen	P	2454539.4329	0.0005	16	V448	Cen	P	2454551.5826	0.0006	31
V448	Cen	P	2454614.3560	0.0004	16	V448	Cen	P	2454615.3672	0.001	16
V448	Cen	S	2455590.5626	0.0009	11	V448	Cen	P	2455617.3911	0.0013	8
V448	Cen	P	2455626.5041	0.001	7	V448	Cen	P	2455646.4152	0.001	10
V448	Cen	S	2455646.5831	0.0014	14	V448	Cen	S	2455655.3592	0.0008	12
V448	Cen	P	2455656.5403	0.0007	10	V448	Cen	S	2455657.3849	0.0009	11
V448	Cen	P	2455657.5530	0.001	12	V448	Cen	P	2455661.2638	0.0008	16
V448	Cen	P	2455662.2760	0.0012	14	V448	Cen	P	2455673.4147	0.0011	11
V448	Cen	S	2455674.2556	0.0008	14	V448	Cen	P	2455674.4278	0.0011	12
V448	Cen	P	2455676.4524	0.0013	9	V448	Cen	P	2455680.5008	0.0008	12
V448	Cen	P	2455686.2398	0.0009	17	V448	Cen	P	2455691.2994	0.0006	11
V448	Cen	S	2455691.4702	0.0011	10	V448	Cen	P	2455714.2502	0.0006	12
V448	Cen	P	2455715.2629	0.0004	14	V448	Cen	P	2455716.2747	0.0008	13
V448	Cen	P	2455717.2882	0.0006	13	V448	Cen	P	2455718.3020	0.0011	9
V448	Cen	P	2455740.2385	0.0006	17	V448	Cen	P	2455744.2882	0.0005	14
V448	Cen	P	2455952.5181	0.0007	8	V448	Cen	P	2455953.5317	0.001	10
V448	Cen	P	2455954.5439	0.0011	10	V448	Cen	P	2455955.5557	0.0005	11
V448	Cen	P	2455972.4312	0.0005	6	V448	Cen	P	2455974.4543	0.0009	7
V448	Cen	P	2455978.5065	0.0008	10	V448	Cen	P	2455981.5425	0.0009	12

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V448	Cen	P	2455982.5557	0.0008	14	V448	Cen	P	2455983.5670	0.0007	12
V448	Cen	P	2455984.5803	0.0009	12	V448	Cen	P	2455987.6172	0.0005	14
V448	Cen	S	2456005.3378	0.0007	10	V448	Cen	P	2456006.5177	0.0009	12
V448	Cen	P	2456012.5932	0.0006	14	V448	Cen	P	2456015.2916	0.001	10
V448	Cen	P	2456015.6297	0.0009	16	V448	Cen	S	2456019.5094	0.0007	9
V448	Cen	S	2456028.2859	0.0009	15	V448	Cen	S	2456030.3113	0.0011	13
V448	Cen	P	2456030.4788	0.0013	10	V448	Cen	P	2456033.5166	0.0008	10
V448	Cen	P	2456037.2295	0.0007	13	V448	Cen	P	2456039.2539	0.0007	15
V448	Cen	P	2456040.2666	0.0009	14	V448	Cen	P	2456041.2787	0.0012	13
V448	Cen	S	2456063.3850	0.0011	10	V448	Cen	S	2456064.3962	0.0007	10
V448	Cen	P	2456071.3158	0.0005	13	V448	Cen	P	2456090.2151	0.0005	16
V448	Cen	P	2456091.2277	0.0005	17	V448	Cen	P	2456093.2518	0.0005	16
V448	Cen	P	2456094.2643	0.0005	15	V448	Cen	P	2456095.2778	0.0008	14
V454	Cen	P	2453862.3329	0.0041	12	V454	Cen	P	2453887.3977	0.0033	13
V454	Cen	P	2453888.2431	0.0039	14	V454	Cen	P	2453890.3676	0.0078	11
V454	Cen	P	2453902.2698	0.0031	12	V454	Cen	P	2453905.2478	0.0029	14
V454	Cen	S	2453906.3119	0.0047	15	V454	Cen	P	2454129.5339	0.0025	26
V454	Cen	S	2454171.3856	0.0078	18	V454	Cen	P	2454175.4145	0.002	20
V454	Cen	P	2454178.3897	0.0052	21	V454	Cen	P	2454184.3301	0.0019	22
V454	Cen	P	2454207.2806	0.004	21	V454	Cen	P	2454527.5784	0.0009	8
V454	Cen	P	2455589.5959	0.0018	13	V454	Cen	P	2455649.4924	0.0039	7
V454	Cen	P	2455650.3418	0.0046	12	V454	Cen	P	2455979.5624	0.0047	10
V454	Cen	P	2455982.5555	0.0148	13	V454	Cen	P	2455988.4907	0.0032	10
V461	Hya	P	2455589.5536	0.0015	9	V461	Hya	P	2455590.5658	0.0018	12
V461	Hya	P	2455591.5750	0.0006	9	V461	Hya	P	2455616.5447	0.0026	14
V461	Hya	P	2455617.5594	0.0043	13	V461	Hya	S	2455618.4052	0.0069	10
V461	Hya	P	2455618.5659	0.0024	12	V461	Hya	S	2455619.4124	0.0009	10
V461	Hya	P	2455619.5801	0.0022	12	V461	Hya	P	2455620.5889	0.0011	10
V461	Hya	P	2455621.6052	0.0021	8	V461	Hya	S	2455626.4974	0.0023	9
V461	Hya	S	2455632.5744	0.0019	14	V461	Hya	P	2455633.4140	0.002	10
V461	Hya	P	2455634.4270	0.0046	7	V461	Hya	S	2455636.6260	0.0084	10
V461	Hya	S	2455648.4262	0.0049	10	V461	Hya	S	2455649.4411	0.002	10
V461	Hya	S	2455657.5423	0.0015	12	V461	Hya	P	2455660.4047	0.0014	8
V461	Hya	P	2455675.2542	0.0013	14	V461	Hya	P	2455676.2671	0.0024	14
V461	Hya	P	2455679.3073	0.0064	12	V461	Hya	P	2455680.3120	0.0021	14
V461	Hya	S	2455680.4864	0.0017	12	V461	Hya	S	2455682.5062	0.0031	12
V461	Hya	P	2455714.3911	0.0015	10	V461	Hya	P	2455717.4308	0.0034	6
V461	Hya	S	2455718.2723	0.004	14	V461	Hya	P	2455731.2620	0.0021	14
V461	Hya	P	2455949.5597	0.0039	10	V461	Hya	P	2455974.5250	0.0021	12
V461	Hya	P	2455978.5749	0.0012	14	V461	Hya	P	2455979.5839	0.0014	14
V461	Hya	P	2455981.6096	0.0025	16	V461	Hya	P	2456005.5649	0.0017	14
V461	Hya	S	2456006.4070	0.0012	6	V461	Hya	P	2456007.5902	0.003	16
V461	Hya	S	2456012.4828	0.0041	10	V461	Hya	S	2456030.3633	0.0024	10
V461	Hya	P	2456030.5287	0.006	11	V461	Hya	S	2456034.4178	0.0028	12
V461	Hya	P	2456036.2685	0.0021	14	V461	Hya	P	2456040.3223	0.0022	9



SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V461	Hya	P	2456064.2714	0.0012	12	V461	Hya	S	2456074.2279	0.0012	14
V461	Hya	P	2456074.3909	0.0013	10	V461	Hya	P	2456089.2412	0.0024	15
V461	Hya	P	2456090.2564	0.0087	16	V461	Hya	P	2456094.3041	0.0022	12
V472	Cen	S	2455646.6014	0.0008	12	V472	Cen	P	2455675.5602	0.0008	9
V472	Cen	S	2455730.2966	0.0009	6	V472	Cen	S	2455989.4068	0.0008	6
V600	Cen	P	2453863.3400	0.0008	38	V600	Cen	P	2454155.4892	0.0008	37
V600	Cen	P	2454179.5668	0.0008	44	V600	Cen	P	2454184.3827	0.0008	54
V600	Cen	P	2454205.2520	0.0009	48	V600	Cen	P	2454266.2484	0.0005	50
V600	Cen	P	2454274.2774	0.001	72	V600	Cen	P	2454566.4195	0.0007	42
V600	Cen	P	2455590.5498	0.001	34	V600	Cen	P	2455619.4429	0.0009	30
V600	Cen	P	2455643.5219	0.0009	71	V600	Cen	P	2455656.3622	0.001	36
V600	Cen	P	2455680.4395	0.0009	35	V600	Cen	P	2455693.2809	0.0009	41
V600	Cen	P	2455701.3049	0.0008	40	V600	Cen	P	2455717.3569	0.0008	30
V600	Cen	P	2455956.5336	0.0009	33	V600	Cen	P	2456022.3517	0.0008	58
V600	Cen	P	2456030.3764	0.0009	34	V600	Cen	P	2456059.2709	0.0009	42
V600	Cen	P	2456067.2982	0.0009	38	V600	Cen	P	2456091.3749	0.0007	31
V601	Cen	P	2453862.3455	0.0008	64	V601	Cen	P	2454181.5102	0.0009	72
V601	Cen	P	2454528.5360	0.0008	63	V601	Cen	P	2454556.3999	0.0009	71
V601	Cen	P	2455673.4789	0.0009	70	V601	Cen	P	2455982.5135	0.0009	56
V601	Cen	P	2455987.5807	0.0009	37	V1053	Cen	P	2453860.4986	0.0003	6
V1053	Cen	S	2453862.2767	0.0004	10	V1053	Cen	P	2453862.4383	0.0007	7
V1053	Cen	S	2453863.2467	0.0006	10	V1053	Cen	P	2453863.4095	0.0002	8
V1053	Cen	P	2453864.3800	0.0004	8	V1053	Cen	S	2453870.3647	0.0005	12
V1053	Cen	P	2453880.2300	0.0006	8	V1053	Cen	S	2453880.3910	0.0002	7
V1053	Cen	S	2453881.3614	0.0003	10	V1053	Cen	P	2453887.3458	0.0003	10
V1053	Cen	P	2453890.2574	0.0002	6	V1053	Cen	S	2453890.4189	0.0005	8
V1053	Cen	S	2453892.3592	0.0005	8	V1053	Cen	S	2453896.2413	0.0006	12
V1053	Cen	P	2453896.4037	0.0004	11	V1053	Cen	P	2453897.3733	0.0003	35
V1053	Cen	S	2453902.3876	0.0004	10	V1053	Cen	S	2453904.3277	0.0003	8
V1053	Cen	S	2453905.2986	0.0002	10	V1053	Cen	S	2453906.2675	0.0003	6
V1053	Cen	S	2453907.2384	0.0002	6	V1053	Cen	P	2453911.2819	0.0003	12
V1053	Cen	P	2453913.2229	0.0003	10	V1053	Cen	S	2453917.2664	0.0004	18
V1053	Cen	P	2454122.5052	0.0003	12	V1053	Cen	P	2454132.5331	0.0003	12
V1053	Cen	P	2454134.4736	0.0009	8	V1053	Cen	S	2454140.4572	0.0006	12
V1053	Cen	P	2454140.6194	0.0003	18	V1053	Cen	P	2454145.4714	0.0002	10
V1053	Cen	S	2454148.5441	0.0004	8	V1053	Cen	S	2454151.4556	0.0002	8
V1053	Cen	S	2454152.4264	0.0004	10	V1053	Cen	P	2454152.5875	0.0003	10
V1053	Cen	S	2454153.3961	0.0003	11	V1053	Cen	P	2454153.5574	0.0002	10
V1053	Cen	P	2454155.4984	0.0002	10	V1053	Cen	P	2454159.3795	0.0004	11
V1053	Cen	S	2454159.5419	0.0003	10	V1053	Cen	S	2454160.5126	0.0006	10
V1053	Cen	P	2454168.4378	0.0003	14	V1053	Cen	S	2454168.5986	0.0002	25
V1053	Cen	P	2454169.4076	0.0004	9	V1053	Cen	S	2454169.5692	0.0003	18
V1053	Cen	P	2454170.3777	0.0002	9	V1053	Cen	S	2454170.5397	0.0002	12
V1053	Cen	P	2454171.3487	0.0004	9	V1053	Cen	S	2454171.5098	0.0003	10
V1053	Cen	S	2454175.3918	0.0003	10	V1053	Cen	P	2454175.5532	0.0002	8

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1053	Cen	P	2454176.5236	0.0002	8	V1053	Cen	P	2454178.4642	0.0002	8
V1053	Cen	S	2454179.5967	0.0003	12	V1053	Cen	P	2454180.4050	0.0002	9
V1053	Cen	S	2454180.5668	0.0005	9	V1053	Cen	S	2454181.5376	0.0003	8
V1053	Cen	P	2454183.3167	0.0003	15	V1053	Cen	S	2454184.4488	0.0003	8
V1053	Cen	S	2454199.3280	0.0003	10	V1053	Cen	P	2454200.4596	0.0003	8
V1053	Cen	S	2454201.2690	0.0003	14	V1053	Cen	P	2454203.3713	0.0003	8
V1053	Cen	P	2454205.3120	0.0003	10	V1053	Cen	S	2454205.4745	0.0005	10
V1053	Cen	P	2454206.2824	0.0002	14	V1053	Cen	P	2454207.2530	0.0002	16
V1053	Cen	S	2454207.4149	0.0003	8	V1053	Cen	S	2454208.3852	0.0003	8
V1053	Cen	S	2454211.2962	0.0002	12	V1053	Cen	S	2454213.2370	0.0002	13
V1053	Cen	P	2454213.3985	0.0003	8	V1053	Cen	P	2454214.3687	0.0006	8
V1053	Cen	S	2454215.5011	0.0003	9	V1053	Cen	P	2454216.3094	0.0002	8
V1053	Cen	S	2454216.4717	0.0003	10	V1053	Cen	P	2454225.3673	0.0005	12
V1053	Cen	S	2454231.3508	0.0002	8	V1053	Cen	S	2454232.3212	0.0005	8
V1053	Cen	S	2454233.2917	0.0004	10	V1053	Cen	P	2454233.4540	0.0005	8
V1053	Cen	P	2454238.3053	0.0003	8	V1053	Cen	S	2454238.4675	0.0002	10
V1053	Cen	P	2454239.2757	0.0002	10	V1053	Cen	S	2454239.4381	0.0006	8
V1053	Cen	S	2454246.2299	0.0004	12	V1053	Cen	S	2454265.3150	0.0002	14
V1053	Cen	S	2454266.2847	0.0003	12	V1053	Cen	S	2454267.2558	0.0002	12
V1053	Cen	S	2454268.2267	0.0002	12	V1053	Cen	P	2454271.2993	0.0003	12
V1053	Cen	P	2454272.2690	0.0002	12	V1053	Cen	P	2454273.2396	0.0002	12
V1053	Cen	P	2454274.2103	0.0003	14	V1053	Cen	P	2454483.4911	0.0002	10
V1053	Cen	S	2454485.5947	0.0005	12	V1053	Cen	P	2454495.4597	0.0003	9
V1053	Cen	P	2454496.4297	0.0001	8	V1053	Cen	S	2454498.5335	0.0004	12
V1053	Cen	S	2454499.5028	0.0004	8	V1053	Cen	S	2454501.4444	0.0003	10
V1053	Cen	P	2454502.5755	0.0002	12	V1053	Cen	P	2454503.5462	0.0003	10
V1053	Cen	S	2454511.4721	0.0003	10	V1053	Cen	P	2454524.5712	0.0002	13
V1053	Cen	S	2454525.3806	0.0004	12	V1053	Cen	P	2454525.5420	0.0003	9
V1053	Cen	S	2454526.3509	0.0004	11	V1053	Cen	P	2454527.4826	0.0003	10
V1053	Cen	S	2454527.6425	0.0001	12	V1053	Cen	S	2454536.3780	0.0003	10
V1053	Cen	P	2454536.5395	0.0004	8	V1053	Cen	P	2454539.4506	0.0004	8
V1053	Cen	S	2454544.4648	0.0004	8	V1053	Cen	S	2454545.4346	0.0009	8
V1053	Cen	P	2454551.4187	0.0004	18	V1053	Cen	S	2454551.5807	0.0002	35
V1053	Cen	P	2454552.3898	0.0004	11	V1053	Cen	S	2454552.5512	0.0004	13
V1053	Cen	S	2454553.5212	0.0004	10	V1053	Cen	P	2454554.3304	0.0002	14
V1053	Cen	S	2454554.4922	0.0007	8	V1053	Cen	S	2454555.4628	0.0003	8
V1053	Cen	P	2454556.2707	0.0007	16	V1053	Cen	S	2454556.4319	0.0008	8
V1053	Cen	S	2454557.4034	0.0003	10	V1053	Cen	S	2454560.3147	0.0003	12
V1053	Cen	P	2454560.4754	0.0003	8	V1053	Cen	S	2454561.2849	0.0005	13
V1053	Cen	S	2454562.2555	0.0004	17	V1053	Cen	P	2454562.4165	0.0005	8
V1053	Cen	S	2454562.5788	0.0004	13	V1053	Cen	P	2454564.3577	0.0003	10
V1053	Cen	S	2454564.5199	0.0003	9	V1053	Cen	P	2454565.3278	0.0001	12
V1053	Cen	S	2454565.4900	0.0001	10	V1053	Cen	P	2454566.2982	0.0002	12
V1053	Cen	S	2454566.4611	0.0002	9	V1053	Cen	P	2454568.2394	0.0002	16
V1053	Cen	S	2454570.3416	0.0004	10	V1053	Cen	S	2454571.3129	0.0003	10

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1053	Cen	P	2454571.4736	0.0004	7	V1053	Cen	S	2454572.2817	0.0005	12
V1053	Cen	S	2454581.3394	0.0004	10	V1053	Cen	P	2454581.5011	0.0004	16
V1053	Cen	S	2454583.2808	0.0002	12	V1053	Cen	S	2454584.2513	0.0003	13
V1053	Cen	P	2454588.2940	0.0004	10	V1053	Cen	P	2454609.3190	0.0005	10
V1053	Cen	S	2454614.3333	0.0002	10	V1053	Cen	S	2454615.3038	0.0003	16
V1053	Cen	S	2455590.5494	0.0003	8	V1053	Cen	S	2455591.5189	0.0005	6
V1053	Cen	S	2455606.3982	0.0006	6	V1053	Cen	P	2455617.5584	0.0002	8
V1053	Cen	S	2455618.3653	0.0004	6	V1053	Cen	P	2455618.5285	0.0003	8
V1053	Cen	P	2455619.4983	0.0002	6	V1053	Cen	P	2455620.4688	0.0004	6
V1053	Cen	S	2455629.3628	0.0003	6	V1053	Cen	P	2455634.3784	0.0007	6
V1053	Cen	S	2455636.4811	0.0008	7	V1053	Cen	P	2455636.6420	0.0003	10
V1053	Cen	S	2455644.5658	0.0008	14	V1053	Cen	P	2455646.3453	0.0003	6
V1053	Cen	S	2455646.5076	0.0005	6	V1053	Cen	P	2455647.3158	0.0004	7
V1053	Cen	S	2455647.4777	0.0002	8	V1053	Cen	S	2455648.4483	0.0002	6
V1053	Cen	P	2455648.6101	0.0003	8	V1053	Cen	P	2455649.5799	0.0003	8
V1053	Cen	S	2455650.3883	0.0003	6	V1053	Cen	P	2455650.5507	0.0001	6
V1053	Cen	P	2455656.3734	0.0001	5	V1053	Cen	S	2455656.5346	0.0002	8
V1053	Cen	P	2455657.3435	0.0004	6	V1053	Cen	S	2455657.5055	0.0003	8
V1053	Cen	P	2455660.2554	0.0004	10	V1053	Cen	S	2455660.4165	0.0001	6
V1053	Cen	P	2455660.5776	0.0005	9	V1053	Cen	S	2455661.3864	0.0001	6
V1053	Cen	P	2455661.5491	0.0002	8	V1053	Cen	P	2455664.4596	0.0008	5
V1053	Cen	S	2455673.3553	0.0002	7	V1053	Cen	P	2455673.5171	0.0006	12
V1053	Cen	S	2455674.3256	0.0002	8	V1053	Cen	P	2455674.4872	0.0004	10
V1053	Cen	S	2455675.2963	0.0003	8	V1053	Cen	P	2455675.4574	0.0007	7
V1053	Cen	S	2455676.2669	0.0003	8	V1053	Cen	P	2455676.4271	0.0003	8
V1053	Cen	S	2455677.2370	0.0002	12	V1053	Cen	P	2455680.3098	0.0002	8
V1053	Cen	S	2455680.4702	0.001	6	V1053	Cen	P	2455683.2213	0.0007	12
V1053	Cen	S	2455686.2938	0.0006	8	V1053	Cen	P	2455691.3067	0.0003	8
V1053	Cen	S	2455691.4695	0.0004	8	V1053	Cen	P	2455692.2788	0.0003	8
V1053	Cen	S	2455692.4403	0.0003	7	V1053	Cen	P	2455693.2481	0.0005	8
V1053	Cen	S	2455693.4104	0.0004	8	V1053	Cen	S	2455694.3805	0.0006	6
V1053	Cen	P	2455700.3656	0.0008	12	V1053	Cen	P	2455701.3347	0.0005	8
V1053	Cen	P	2455714.2741	0.0002	10	V1053	Cen	S	2455714.4352	0.0003	6
V1053	Cen	P	2455715.2437	0.0004	8	V1053	Cen	S	2455715.4064	0.0002	6
V1053	Cen	P	2455716.2145	0.0004	8	V1053	Cen	S	2455717.3460	0.0001	6
V1053	Cen	S	2455718.3170	0.0003	7	V1053	Cen	S	2455730.2844	0.0005	8
V1053	Cen	P	2455733.3569	0.0001	6	V1053	Cen	S	2455740.3128	0.0002	10
V1053	Cen	S	2455752.2801	0.0004	15	V1053	Cen	S	2455753.2516	0.0003	49
V1053	Cen	S	2455949.5944	0.0003	10	V1053	Cen	P	2455955.5786	0.0003	10
V1053	Cen	P	2455956.5491	0.0002	6	V1053	Cen	S	2455963.5041	0.0006	8
V1053	Cen	S	2455970.6187	0.0004	14	V1053	Cen	S	2455971.5896	0.0004	10
V1053	Cen	S	2455972.5602	0.0005	8	V1053	Cen	S	2455973.5308	0.0006	6
V1053	Cen	P	2455977.5732	0.0003	8	V1053	Cen	P	2455978.5442	0.0005	8
V1053	Cen	P	2455979.5136	0.0003	6	V1053	Cen	S	2455981.6171	0.0002	10
V1053	Cen	S	2455982.5873	0.0004	8	V1053	Cen	S	2455983.5577	0.0002	9

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1053	Cen	S	2455984.5277	0.0006	6	V1053	Cen	P	2455987.6012	0.0002	8
V1053	Cen	P	2455988.5712	0.0003	8	V1053	Cen	S	2455989.3792	0.0006	6
V1053	Cen	P	2455989.5412	0.0006	6	V1053	Cen	S	2455990.3507	0.0007	6
V1053	Cen	P	2455990.5125	0.0005	7	V1053	Cen	S	2455993.5849	0.0008	10
V1053	Cen	P	2455994.3942	0.0008	9	V1053	Cen	S	2455994.5565	0.0004	10
V1053	Cen	P	2455999.5688	0.0003	11	V1053	Cen	P	2456000.5390	0.0004	10
V1053	Cen	P	2456004.4212	0.0002	6	V1053	Cen	S	2456004.5834	0.0002	8
V1053	Cen	S	2456005.5536	0.0005	8	V1053	Cen	S	2456006.5235	0.0003	8
V1053	Cen	P	2456012.5074	0.0004	7	V1053	Cen	P	2456015.4190	0.0004	8
V1053	Cen	S	2456015.5808	0.0005	8	V1053	Cen	P	2456018.3300	0.0002	8
V1053	Cen	P	2456019.3006	0.0005	10	V1053	Cen	S	2456019.4624	0.0004	6
V1053	Cen	P	2456019.6234	0.0003	10	V1053	Cen	P	2456020.2714	0.0005	16
V1053	Cen	S	2456020.4330	0.0008	8	V1053	Cen	P	2456020.5940	0.0003	9
V1053	Cen	P	2456021.5645	0.0006	10	V1053	Cen	S	2456022.3745	0.0005	11
V1053	Cen	P	2456028.3571	0.0003	8	V1053	Cen	P	2456029.3276	0.0005	8
V1053	Cen	S	2456029.4892	0.0004	9	V1053	Cen	P	2456030.2975	0.0001	8
V1053	Cen	S	2456030.4596	0.0007	6	V1053	Cen	S	2456033.3718	0.0005	6
V1053	Cen	S	2456034.3418	0.0003	7	V1053	Cen	S	2456036.2831	0.0006	8
V1053	Cen	S	2456037.2532	0.0003	10	V1053	Cen	P	2456041.2962	0.0003	8
V1053	Cen	P	2456047.4432	0.0002	6	V1053	Cen	S	2456049.2214	0.0003	13
V1053	Cen	P	2456054.2343	0.0007	12	V1053	Cen	S	2456054.3951	0.0005	13
V1053	Cen	S	2456056.3377	0.0002	6	V1053	Cen	P	2456056.4980	0.0005	8
V1053	Cen	S	2456059.2487	0.0003	8	V1053	Cen	P	2456059.4095	0.0004	7
V1053	Cen	P	2456063.2915	0.0003	7	V1053	Cen	S	2456063.4538	0.0003	6
V1053	Cen	P	2456064.2620	0.0001	8	V1053	Cen	S	2456064.4246	0.0006	6
V1053	Cen	P	2456065.2302	0.0006	11	V1053	Cen	S	2456071.2168	0.0003	10
V1053	Cen	P	2456071.3785	0.0001	6	V1053	Cen	P	2456074.2893	0.0002	10
V1053	Cen	P	2456075.2598	0.0002	10	V1053	Cen	P	2456076.2304	0.0003	10
V1053	Cen	S	2456078.3326	0.001	7	V1053	Cen	S	2456082.2135	0.0008	17
V1053	Cen	P	2456082.3753	0.0007	22	V1053	Cen	P	2456083.3476	0.0006	10
V1053	Cen	P	2456085.2869	0.0008	8	V1053	Cen	S	2456089.3303	0.0002	8
V1053	Cen	S	2456090.3019	0.0003	8	V1053	Cen	S	2456091.2719	0.0003	10
V1053	Cen	S	2456093.2127	0.0004	10	V1053	Cen	P	2456094.3438	0.0001	6
V1053	Cen	P	2456095.3141	0.0002	8	V1053	Cen	P	2456106.3125	0.0002	10
V1053	Cen	P	2456107.2834	0.0003	26	V1054	Cen	S	2453860.4750	0.0002	8
V1054	Cen	S	2453863.2611	0.0003	9	V1054	Cen	P	2453863.4353	0.0002	8
V1054	Cen	S	2453864.3059	0.0002	8	V1054	Cen	S	2453870.2278	0.0002	11
V1054	Cen	P	2453870.4018	0.0003	16	V1054	Cen	S	2453880.3281	0.0001	8
V1054	Cen	S	2453881.3732	0.0001	10	V1054	Cen	P	2453886.2494	0.0003	8
V1054	Cen	S	2453886.4239	0.0002	8	V1054	Cen	S	2453887.2945	0.0002	8
V1054	Cen	P	2453892.3449	0.0002	9	V1054	Cen	S	2453896.3506	0.0003	14
V1054	Cen	S	2453897.3951	0.0002	23	V1054	Cen	P	2453898.2663	0.0003	12
V1054	Cen	S	2453902.2721	0.0002	9	V1054	Cen	S	2453904.3619	0.0001	8
V1054	Cen	S	2453909.2384	0.0002	12	V1054	Cen	S	2453910.2829	0.0001	12
V1054	Cen	P	2453913.2437	0.0001	12	V1054	Cen	S	2453916.2037	0.0005	8

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1054	Cen	S	2453917.2490	0.0002	18	V1054	Cen	P	2454129.5429	0.0001	16
V1054	Cen	P	2454134.4193	0.0005	10	V1054	Cen	S	2454134.5934	0.0004	8
V1054	Cen	S	2454140.5143	0.0002	16	V1054	Cen	P	2454145.5650	0.0002	13
V1054	Cen	S	2454148.5254	0.0002	10	V1054	Cen	P	2454151.4863	0.0001	10
V1054	Cen	P	2454152.5311	0.0002	10	V1054	Cen	S	2454153.4017	0.0001	12
V1054	Cen	P	2454153.5760	0.0001	10	V1054	Cen	S	2454155.4915	0.0001	12
V1054	Cen	P	2454156.3628	0.0003	12	V1054	Cen	P	2454159.4971	0.0002	11
V1054	Cen	S	2454160.3671	0.0002	12	V1054	Cen	P	2454160.5418	0.0003	10
V1054	Cen	P	2454168.5534	0.0002	16	V1054	Cen	S	2454169.4241	0.0002	14
V1054	Cen	P	2454169.5983	0.0001	28	V1054	Cen	S	2454170.4687	0.0002	14
V1054	Cen	P	2454170.6433	0.0001	24	V1054	Cen	P	2454171.3397	0.0001	10
V1054	Cen	S	2454175.3453	0.0002	14	V1054	Cen	P	2454175.5195	0.0002	10
V1054	Cen	P	2454176.5643	0.0001	10	V1054	Cen	S	2454178.4800	0.0001	10
V1054	Cen	S	2454179.5250	0.0001	8	V1054	Cen	S	2454180.5699	0.0001	10
V1054	Cen	P	2454181.4407	0.0002	8	V1054	Cen	S	2454184.4013	0.0001	12
V1054	Cen	S	2454189.2770	0.0002	16	V1054	Cen	S	2454199.3781	0.0001	11
V1054	Cen	P	2454199.5531	0.0002	17	V1054	Cen	P	2454203.3843	0.0006	9
V1054	Cen	P	2454205.4739	0.0003	10	V1054	Cen	S	2454206.3449	0.0003	10
V1054	Cen	S	2454207.3895	0.0001	8	V1054	Cen	P	2454207.5637	0.0002	10
V1054	Cen	P	2454208.2601	0.0002	12	V1054	Cen	S	2454208.4345	0.0001	8
V1054	Cen	P	2454212.4402	0.0002	8	V1054	Cen	P	2454213.4847	0.0001	10
V1054	Cen	S	2454214.3544	0.0007	8	V1054	Cen	S	2454215.4001	0.0002	9
V1054	Cen	P	2454225.3273	0.0003	14	V1054	Cen	S	2454225.5016	0.0004	13
V1054	Cen	P	2454227.4164	0.0006	8	V1054	Cen	S	2454230.3780	0.0005	10
V1054	Cen	S	2454231.4223	0.0004	10	V1054	Cen	P	2454232.2934	0.0003	10
V1054	Cen	S	2454232.4677	0.0002	9	V1054	Cen	P	2454233.3384	0.0001	8
V1054	Cen	S	2454238.3890	0.0002	10	V1054	Cen	P	2454239.2595	0.0005	10
V1054	Cen	S	2454239.4332	0.0002	11	V1054	Cen	S	2454265.2084	0.0001	12
V1054	Cen	P	2454265.3827	0.0002	10	V1054	Cen	S	2454266.2539	0.0001	14
V1054	Cen	S	2454268.3432	0.0001	9	V1054	Cen	P	2454269.2141	0.0002	12
V1054	Cen	P	2454270.2578	0.0003	14	V1054	Cen	P	2454271.3043	0.0003	14
V1054	Cen	P	2454272.3492	0.0002	10	V1054	Cen	S	2454273.2197	0.0002	20
V1054	Cen	P	2454484.4686	0.0002	10	V1054	Cen	P	2454485.5133	0.0003	13
V1054	Cen	S	2454488.4728	0.0007	10	V1054	Cen	S	2454495.4396	0.0002	10
V1054	Cen	P	2454495.6143	0.0002	15	V1054	Cen	S	2454496.4848	0.0003	12
V1054	Cen	S	2454497.5299	0.0001	12	V1054	Cen	P	2454499.4459	0.0001	10
V1054	Cen	P	2454501.5362	0.0003	13	V1054	Cen	S	2454503.4512	0.0003	10
V1054	Cen	S	2454511.4622	0.0002	10	V1054	Cen	S	2454525.3946	0.0002	12
V1054	Cen	S	2454526.4394	0.0002	8	V1054	Cen	P	2454528.3554	0.0003	14
V1054	Cen	P	2454536.3665	0.0002	10	V1054	Cen	S	2454539.3266	0.0001	17
V1054	Cen	P	2454552.3884	0.0002	14	V1054	Cen	P	2454554.4786	0.0003	9
V1054	Cen	S	2454555.3491	0.0002	12	V1054	Cen	P	2454557.2645	0.0003	15
V1054	Cen	P	2454560.4001	0.0004	9	V1054	Cen	S	2454561.2709	0.0004	14
V1054	Cen	S	2454562.3153	0.0002	14	V1054	Cen	P	2454565.2760	0.0001	15
V1054	Cen	P	2454566.3210	0.0002	12	V1054	Cen	S	2454568.2372	0.0002	15

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1054	Cen	S	2454569.2816	0.0002	13	V1054	Cen	S	2454570.3269	0.0006	10
V1054	Cen	P	2454580.2527	0.0002	14	V1054	Cen	S	2454584.2590	0.0002	14
V1054	Cen	S	2454592.2691	0.0007	9	V1054	Cen	S	2454614.2133	0.0003	13
V1054	Cen	S	2454615.2586	0.0001	14	V1054	Cen	S	2455589.4739	0.0001	6
V1054	Cen	S	2455590.5192	0.0001	8	V1054	Cen	S	2455591.5633	0.0002	8
V1054	Cen	S	2455599.5750	0.0002	8	V1054	Cen	P	2455600.4455	0.0001	4
V1054	Cen	P	2455617.5135	0.0003	6	V1054	Cen	S	2455618.3841	0.0002	8
V1054	Cen	P	2455618.5579	0.0001	8	V1054	Cen	S	2455621.5185	0.0002	6
V1054	Cen	S	2455626.3957	0.0002	7	V1054	Cen	P	2455629.3550	0.0003	6
V1054	Cen	S	2455633.3614	0.0003	6	V1054	Cen	S	2455634.4062	0.0002	6
V1054	Cen	S	2455636.4965	0.0002	6	V1054	Cen	S	2455643.4616	0.0003	12
V1054	Cen	S	2455644.5071	0.0002	10	V1054	Cen	S	2455646.5967	0.0002	10
V1054	Cen	S	2455647.2933	0.0002	8	V1054	Cen	P	2455648.5124	0.0001	6
V1054	Cen	S	2455649.3828	0.0002	8	V1054	Cen	P	2455649.5576	0.0002	8
V1054	Cen	S	2455655.3047	0.0002	10	V1054	Cen	P	2455655.4782	0.0001	6
V1054	Cen	S	2455656.3492	0.0001	8	V1054	Cen	P	2455656.5234	0.0001	12
V1054	Cen	P	2455656.5234	0.0001	12	V1054	Cen	S	2455657.3941	0.0001	7
V1054	Cen	P	2455657.5682	0.00004	8	V1054	Cen	P	2455658.2650	0.0003	10
V1054	Cen	P	2455660.3548	0.0002	8	V1054	Cen	S	2455660.5293	0.0003	8
V1054	Cen	S	2455661.5736	0.0001	10	V1054	Cen	S	2455662.2706	0.0002	10
V1054	Cen	S	2455671.3271	0.0005	9	V1054	Cen	P	2455671.5010	0.0004	16
V1054	Cen	P	2455673.2424	0.0002	10	V1054	Cen	S	2455673.4163	0.0001	8
V1054	Cen	P	2455674.2868	0.0002	8	V1054	Cen	S	2455674.4614	0.0001	8
V1054	Cen	P	2455675.3326	0.0001	8	V1054	Cen	S	2455675.5063	0.0001	8
V1054	Cen	P	2455676.3772	0.0002	6	V1054	Cen	S	2455677.2479	0.0002	10
V1054	Cen	S	2455679.3374	0.0002	4	V1054	Cen	S	2455680.3818	0.0002	8
V1054	Cen	P	2455681.2536	0.0002	12	V1054	Cen	P	2455682.2979	0.0004	10
V1054	Cen	S	2455682.4724	0.0002	6	V1054	Cen	S	2455686.3036	0.0001	9
V1054	Cen	P	2455691.3547	0.0002	8	V1054	Cen	S	2455692.2251	0.0002	10
V1054	Cen	P	2455692.3993	0.0005	7	V1054	Cen	S	2455693.2704	0.0002	10
V1054	Cen	P	2455693.4442	0.0007	8	V1054	Cen	P	2455694.4893	0.0003	6
V1054	Cen	S	2455695.3596	0.0002	8	V1054	Cen	P	2455699.3653	0.0003	16
V1054	Cen	S	2455700.2355	0.0005	14	V1054	Cen	P	2455700.4105	0.0003	14
V1054	Cen	S	2455701.2809	0.0002	10	V1054	Cen	P	2455701.4544	0.0005	20
V1054	Cen	P	2455701.4553	0.0002	20	V1054	Cen	S	2455703.3705	0.0004	5
V1054	Cen	P	2455714.3428	0.0002	7	V1054	Cen	S	2455715.2138	0.0002	10
V1054	Cen	P	2455715.3876	0.0002	8	V1054	Cen	S	2455716.2584	0.0004	9
V1054	Cen	S	2455717.3032	0.0001	8	V1054	Cen	S	2455726.3593	0.0004	17
V1054	Cen	S	2455731.2357	0.0001	12	V1054	Cen	P	2455731.4090	0.0001	8
V1054	Cen	S	2455733.3251	0.0001	8	V1054	Cen	S	2455740.2910	0.0002	10
V1054	Cen	P	2455744.2970	0.0002	8	V1054	Cen	P	2455750.2180	0.0003	12
V1054	Cen	P	2455952.5850	0.0003	12	V1054	Cen	S	2455953.4562	0.0002	6
V1054	Cen	S	2455954.5011	0.0002	5	V1054	Cen	S	2455955.5449	0.0002	6
V1054	Cen	S	2455956.5904	0.0002	10	V1054	Cen	S	2455963.5573	0.0003	11
V1054	Cen	S	2455970.5233	0.0003	8	V1054	Cen	S	2455971.5671	0.0004	9

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1054	Cen	P	2455974.5280	0.001	7	V1054	Cen	P	2455976.6179	0.0002	9
V1054	Cen	S	2455978.5339	0.0002	8	V1054	Cen	S	2455979.5791	0.0002	9
V1054	Cen	P	2455983.5843	0.0005	10	V1054	Cen	S	2455984.4553	0.0002	6
V1054	Cen	P	2455984.6292	0.0006	9	V1054	Cen	S	2455986.5454	0.0001	8
V1054	Cen	S	2455987.5895	0.0004	9	V1054	Cen	S	2455988.6343	0.0005	10
V1054	Cen	P	2455989.5052	0.0003	6	V1054	Cen	P	2455990.5503	0.0002	8
V1054	Cen	S	2455992.4671	0.0003	8	V1054	Cen	S	2455993.5111	0.0003	8
V1054	Cen	P	2455994.3815	0.0003	10	V1054	Cen	S	2455994.5562	0.0006	10
V1054	Cen	P	2455999.6058	0.0002	17	V1054	Cen	P	2456000.6503	0.0003	12
V1054	Cen	P	2456006.5728	0.0002	10	V1054	Cen	P	2456007.6173	0.0006	9
V1054	Cen	P	2456012.4940	0.0001	8	V1054	Cen	P	2456015.6292	0.0002	10
V1054	Cen	S	2456019.2864	0.0002	14	V1054	Cen	P	2456019.4599	0.0002	8
V1054	Cen	S	2456020.3306	0.0004	13	V1054	Cen	P	2456021.5499	0.0004	10
V1054	Cen	S	2456022.4204	0.0005	10	V1054	Cen	S	2456028.3417	0.0002	8
V1054	Cen	P	2456028.5158	0.0003	11	V1054	Cen	S	2456029.3870	0.0004	6
V1054	Cen	P	2456029.5614	0.0002	12	V1054	Cen	P	2456030.2578	0.0002	12
V1054	Cen	S	2456030.4317	0.0004	8	V1054	Cen	P	2456033.3929	0.0002	8
V1054	Cen	P	2456037.2258	0.0002	10	V1054	Cen	P	2456038.2691	0.0001	8
V1054	Cen	S	2456041.2301	0.0003	10	V1054	Cen	P	2456041.4035	0.0002	6
V1054	Cen	S	2456049.2400	0.0004	14	V1054	Cen	P	2456050.4598	0.0003	8
V1054	Cen	P	2456054.2910	0.0004	14	V1054	Cen	S	2456054.4647	0.0003	16
V1054	Cen	P	2456056.3801	0.0006	8	V1054	Cen	S	2456058.2957	0.0008	8
V1054	Cen	P	2456058.4705	0.0003	8	V1054	Cen	S	2456059.3417	0.0001	8
V1054	Cen	P	2456059.5154	0.0002	8	V1054	Cen	P	2456060.2135	0.0003	10
V1054	Cen	S	2456061.4313	0.0001	8	V1054	Cen	P	2456063.3468	0.0007	8
V1054	Cen	S	2456064.2180	0.0002	10	V1054	Cen	P	2456064.3921	0.0002	8
V1054	Cen	S	2456065.2627	0.0003	10	V1054	Cen	P	2456065.4368	0.0002	7
V1054	Cen	P	2456068.2233	0.0003	12	V1054	Cen	P	2456070.3128	0.0005	9
V1054	Cen	P	2456071.3585	0.0001	8	V1054	Cen	S	2456074.3189	0.0002	10
V1054	Cen	P	2456076.2347	0.0004	10	V1054	Cen	S	2456076.4082	0.0003	8
V1054	Cen	P	2456077.2798	0.0003	10	V1054	Cen	P	2456078.3242	0.0002	8
V1054	Cen	S	2456082.3302	0.0003	17	V1054	Cen	S	2456083.3750	0.0004	16
V1054	Cen	P	2456084.2455	0.0002	8	V1054	Cen	P	2456085.2898	0.0003	10
V1054	Cen	S	2456089.2958	0.0002	10	V1054	Cen	S	2456090.3412	0.0001	8
V1054	Cen	P	2456091.2121	0.0001	10	V1054	Cen	S	2456091.3855	0.0004	6
V1054	Cen	P	2456093.3013	0.0003	9	V1054	Cen	P	2456094.3463	0.0006	7
V1054	Cen	P	2456107.2334	0.0002	63	V1121	Cen	S	2453886.4340	0.0007	36
V1121	Cen	S	2453887.4311	0.001	28	V1121	Cen	S	2453892.4134	0.0008	18
V1121	Cen	S	2453896.3988	0.0006	36	V1121	Cen	S	2453898.3910	0.0005	42
V1121	Cen	S	2453902.3762	0.0005	22	V1121	Cen	S	2453904.3692	0.0003	22
V1121	Cen	S	2453905.3657	0.0003	22	V1121	Cen	S	2453906.3618	0.0004	20
V1121	Cen	S	2453907.3578	0.0005	20	V1121	Cen	S	2453911.3446	0.0004	16
V1121	Cen	S	2453917.3225	0.0003	36	V1121	Cen	S	2454122.5771	0.0007	39
V1121	Cen	S	2454129.5509	0.0003	37	V1121	Cen	S	2454132.5428	0.0004	35
V1121	Cen	S	2454134.5351	0.0004	34	V1121	Cen	S	2454136.5282	0.0003	35

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1121	Cen	S	2454140.5125	0.0006	38	V1121	Cen	S	2454145.4944	0.0003	34
V1121	Cen	S	2454148.4842	0.0003	28	V1121	Cen	S	2454151.4724	0.0003	30
V1121	Cen	S	2454152.4689	0.0004	28	V1121	Cen	S	2454153.4657	0.0003	28
V1121	Cen	S	2454156.4560	0.0006	22	V1121	Cen	S	2454159.4439	0.0003	30
V1121	Cen	S	2454160.4398	0.0003	30	V1121	Cen	S	2454168.4110	0.0003	40
V1121	Cen	S	2454169.4071	0.0003	34	V1121	Cen	S	2454170.4034	0.0003	32
V1121	Cen	S	2454175.3855	0.0003	36	V1121	Cen	S	2454178.3748	0.0003	36
V1121	Cen	S	2454179.3718	0.0002	36	V1121	Cen	S	2454180.3671	0.0003	35
V1121	Cen	S	2454181.3602	0.0005	21	V1121	Cen	S	2454183.3579	0.0003	36
V1121	Cen	S	2454184.3536	0.0003	35	V1121	Cen	S	2454199.2984	0.0002	39
V1121	Cen	S	2454201.2923	0.0003	38	V1121	Cen	S	2454205.2777	0.0003	40
V1121	Cen	S	2454206.2741	0.0002	39	V1121	Cen	S	2454207.2716	0.0003	41
V1121	Cen	S	2454208.2668	0.0003	40	V1121	Cen	S	2454209.2635	0.0002	42
V1121	Cen	S	2454211.2555	0.0002	38	V1121	Cen	S	2454212.2525	0.0003	38
V1121	Cen	S	2454214.2450	0.0003	34	V1121	Cen	S	2454216.2379	0.0005	30
V1121	Cen	P	2454524.6123	0.0007	36	V1121	Cen	P	2454527.6049	0.0007	32
V1121	Cen	P	2454565.4645	0.0006	28	V1121	Cen	P	2454566.4613	0.0008	27
V1121	Cen	P	2455649.5278	0.0009	22	V1121	Cen	P	2455656.5019	0.0006	20
V1121	Cen	P	2455657.4973	0.0009	22	V1121	Cen	P	2455661.4825	0.0009	22
V1121	Cen	P	2455671.4502	0.001	46	V1121	Cen	P	2455693.3677	0.0008	22
V1121	Cen	P	2455694.3646	0.0009	24	V1121	Cen	P	2455714.2917	0.0008	22
V1121	Cen	P	2455715.2884	0.0007	24	V1121	Cen	P	2455717.2797	0.0006	24
V1121	Cen	P	2455726.2452	0.0007	81	V1121	Cen	S	2456089.4242	0.0003	10
V1121	Cen	S	2456090.4228	0.0007	8	V1121	Cen	S	2456091.4183	0.0005	10
V1121	Cen	S	2456094.4089	0.0004	10	V1121	Cen	S	2456095.4052	0.0007	9
V1121	Cen	S	2456106.3649	0.0004	16	V1121	Cen	S	2456107.3612	0.0004	39
V1133	Cen	P	2453891.2660	0.0007	24	V1133	Cen	P	2453896.3462	0.0005	66
V1133	Cen	P	2453905.2382	0.0006	26	V1133	Cen	P	2454136.4375	0.001	30
V1133	Cen	P	2454155.4943	0.0006	36	V1133	Cen	P	2454169.4668	0.0004	64
V1133	Cen	P	2454178.3585	0.0007	51	V1133	Cen	P	2454206.3064	0.0005	44
V1133	Cen	P	2454216.4697	0.0005	39	V1133	Cen	P	2454239.3345	0.0009	32
V1133	Cen	P	2454267.2811	0.0006	34	V1133	Cen	P	2454272.3625	0.0008	40
V1133	Cen	P	2454484.5063	0.0005	40	V1133	Cen	P	2454498.4797	0.0008	37
V1133	Cen	P	2454526.4271	0.0008	38	V1133	Cen	P	2454545.4791	0.0008	23
V1133	Cen	P	2454554.3726	0.0007	42	V1133	Cen	P	2454564.5352	0.0008	44
V1133	Cen	P	2454615.3481	0.0005	55	V1133	Cen	P	2455649.3903	0.0008	24
V1133	Cen	P	2455673.5251	0.0006	42	V1133	Cen	P	2455682.4186	0.0006	28
V1133	Cen	P	2455701.4697	0.0007	34	V1133	Cen	P	2455733.2319	0.0004	32
V1133	Cen	P	2455752.2809	0.0006	59	V1133	Cen	P	2455988.5641	0.0006	30
V1133	Cen	P	2455992.3748	0.0008	28	V1133	Cen	P	2456006.3476	0.0009	23
V1133	Cen	P	2456020.3221	0.0005	45	V1133	Cen	P	2456021.5864	0.0007	36
V1133	Cen	P	2456034.2931	0.0006	28	V1133	Cen	P	2456067.3219	0.0006	22
V1133	Cen	P	2456095.2676	0.0005	36	V1139	Cen	P	2455591.5957	0.0011	10
V1139	Cen	P	2455606.4837	0.0033	9	V1139	Cen	P	2455618.4507	0.002	8
V1139	Cen	P	2455619.4213	0.0034	7	V1139	Cen	P	2455626.5396	0.0012	10



SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1139	Cen	P	2455627.5104	0.0022	10	V1139	Cen	P	2455632.3671	0.0016	8
V1139	Cen	P	2455636.5684	0.0037	6	V1139	Cen	S	2455647.4093	0.0018	8
V1139	Cen	S	2455649.3510	0.0024	10	V1139	Cen	S	2455650.3228	0.0023	10
V1139	Cen	P	2455654.3644	0.0018	10	V1139	Cen	S	2455656.4685	0.0016	10
V1139	Cen	S	2455657.4398	0.003	10	V1139	Cen	P	2455660.5143	0.002	11
V1139	Cen	P	2455661.4867	0.002	10	V1139	Cen	P	2455676.3659	0.0053	9
V1139	Cen	P	2455679.2789	0.0023	13	V1139	Cen	P	2455680.2536	0.0032	16
V1139	Cen	S	2455682.3498	0.0011	10	V1139	Cen	P	2455682.5131	0.0044	10
V1139	Cen	S	2455719.2364	0.0011	12	V1139	Cen	P	2455733.3136	0.0016	10
V1139	Cen	S	2455740.2673	0.0011	15	V1139	Cen	S	2455949.6005	0.0012	12
V1139	Cen	P	2455955.5925	0.0018	14	V1139	Cen	P	2455956.5606	0.0019	12
V1139	Cen	S	2455973.5553	0.0033	10	V1139	Cen	S	2455974.5221	0.004	8
V1139	Cen	P	2455977.5914	0.0022	13	V1139	Cen	P	2455978.5625	0.0024	13
V1139	Cen	P	2455979.5416	0.0032	12	V1139	Cen	P	2455981.4775	0.0009	6
V1139	Cen	S	2455983.5780	0.0054	12	V1139	Cen	S	2455984.5535	0.0023	11
V1139	Cen	S	2455988.4343	0.0025	7	V1139	Cen	S	2455989.4087	0.0001	4
V1139	Cen	P	2456005.4197	0.0014	8	V1139	Cen	P	2456006.3901	0.0012	8
V1139	Cen	P	2456012.5377	0.0016	12	V1139	Cen	S	2456034.3828	0.0025	10
V1139	Cen	S	2456036.3189	0.0017	11	V1139	Cen	P	2456063.3379	0.0017	10
V1139	Cen	P	2456064.3037	0.0014	10	V1139	Cen	P	2456074.3404	0.0013	9
V1140	Cen	S	2453881.4834	0.0008	9	V1140	Cen	S	2453905.3848	0.0008	9
V1140	Cen	S	2454180.4903	0.0009	10	V1140	Cen	S	2454268.2816	0.0009	16
V1140	Cen	P	2454497.5383	0.0009	15	V1140	Cen	S	2454614.2268	0.001	15
V1140	Cen	P	2455714.4351	0.0008	6	V1144	Cen	S	2453860.4779	0.0008	38
V1144	Cen	P	2453880.2640	0.001	37	V1144	Cen	P	2453881.3319	0.0011	38
V1144	Cen	S	2453888.2811	0.0008	28	V1144	Cen	S	2453890.4193	0.0009	35
V1144	Cen	P	2453898.4374	0.001	87	V1144	Cen	S	2453904.3223	0.0009	38
V1144	Cen	S	2453905.3901	0.0009	33	V1144	Cen	P	2453911.2748	0.0008	50
V1144	Cen	S	2453919.2963	0.0005	59	V1144	Cen	S	2453920.3617	0.0012	32
V1144	Cen	P	2453926.2490	0.0008	56	V1144	Cen	P	2454145.4765	0.001	46
V1144	Cen	S	2454153.4955	0.0007	45	V1144	Cen	P	2454160.4476	0.001	47
V1144	Cen	S	2454170.6061	0.0007	72	V1144	Cen	P	2454175.4197	0.0009	51
V1144	Cen	P	2454176.4875	0.001	41	V1144	Cen	S	2454184.5085	0.0007	40
V1144	Cen	S	2454199.4802	0.0008	52	V1144	Cen	S	2454200.5494	0.0008	50
V1144	Cen	P	2454205.3619	0.001	47	V1144	Cen	P	2454207.4998	0.0009	49
V1144	Cen	S	2454212.3122	0.0009	50	V1144	Cen	S	2454215.5310	0.0007	32
V1144	Cen	S	2454227.2876	0.0019	39	V1144	Cen	P	2454265.2498	0.0012	56
V1144	Cen	S	2454273.2694	0.0009	57	V1144	Cen	S	2454274.3413	0.0007	44
V1144	Cen	P	2454296.2623	0.0008	60	V1144	Cen	P	2454501.5895	0.001	24
V1144	Cen	P	2454544.3676	0.0013	39	V1144	Cen	P	2454562.5472	0.0011	31
V1144	Cen	S	2454614.4139	0.0007	25						

Table 1: Eclipse minima of 21 Contact Binary stars refer Table 2 of Smits & Skelton 2019 [10]

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
BL	Eri	S	2454721.6479	0.0008	16	BL	Eri	S	2454732.4863	0.0009	14

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
BL	Eri	P	2454738.5327	0.0003	18	BL	Eri	P	2454740.6171	0.0002	20
BL	Eri	P	2454743.5360	0.0007	12	BL	Eri	S	2454744.5781	0.0008	22
BL	Eri	S	2454746.6631	0.0003	24	BL	Eri	P	2454747.7049	0.0002	27
BL	Eri	S	2454749.5848	0.0018	12	BL	Eri	P	2454751.4573	0.0003	18
BL	Eri	S	2454752.4995	0.0004	24	BL	Eri	P	2454752.7079	0.0007	19
BL	Eri	S	2454754.5881	0.0007	66	BL	Eri	S	2454757.5031	0.0006	14
BL	Eri	P	2454758.5451	0.0003	16	BL	Eri	P	2454760.6302	0.0003	20
BL	Eri	P	2454763.5488	0.0003	34	BL	Eri	S	2454764.5914	0.0004	16
BL	Eri	P	2454766.4667	0.0003	13	BL	Eri	S	2454767.5076	0.0005	12
BL	Eri	P	2454768.5513	0.0002	14	BL	Eri	S	2454769.5943	0.0004	18
BL	Eri	S	2454770.4273	0.0006	12	BL	Eri	P	2454771.4692	0.0003	14
BL	Eri	P	2454774.3885	0.0002	14	BL	Eri	S	2454775.4309	0.0004	14
BL	Eri	S	2454777.5154	0.0003	16	BL	Eri	P	2454779.3911	0.0003	19
BL	Eri	S	2454780.4337	0.0005	24	BL	Eri	S	2454787.5215	0.0006	38
BL	Eri	P	2454788.5632	0.0003	19	BL	Eri	P	2454789.3966	0.0002	11
BL	Eri	S	2454789.6059	0.0004	20	BL	Eri	S	2454790.4391	0.0004	16
BL	Eri	P	2454792.3159	0.0002	18	BL	Eri	S	2454792.5241	0.0004	24
BL	Eri	P	2454794.4005	0.0004	13	BL	Eri	S	2454794.6097	0.0003	20
BL	Eri	S	2454795.4423	0.0023	22	BL	Eri	P	2454796.4855	0.0002	18
BL	Eri	S	2454798.3614	0.0005	15	BL	Eri	P	2454799.4032	0.0004	12
BL	Eri	S	2454800.4452	0.0003	16	BL	Eri	P	2454801.4880	0.0002	20
BL	Eri	P	2454802.3217	0.0003	22	BL	Eri	S	2454802.5329	0.0018	45
BL	Eri	P	2454804.4057	0.0004	26	BL	Eri	S	2454804.6166	0.0007	17
BL	Eri	S	2454805.4500	0.0006	38	BL	Eri	P	2454807.3262	0.0003	18
BL	Eri	S	2454807.5336	0.0004	26	BL	Eri	S	2454808.3670	0.0003	24
BL	Eri	P	2454808.5774	0.0002	20	BL	Eri	P	2454809.4097	0.0003	106
BL	Eri	S	2454813.3711	0.0006	23	BL	Eri	P	2454814.4134	0.0004	36
BL	Eri	P	2454816.4970	0.0003	27	BL	Eri	P	2454817.3310	0.0002	23
BL	Eri	S	2454817.5409	0.0003	23	BL	Eri	P	2454819.4185	0.001	39
BL	Eri	S	2454820.4576	0.0002	37	BL	Eri	P	2454821.4987	0.0007	35
BL	Eri	P	2454822.3343	0.0002	24	BL	Eri	S	2454822.5429	0.0003	20
BL	Eri	S	2454825.4606	0.0003	27	BL	Eri	P	2454826.5040	0.0002	26
BL	Eri	P	2454827.3371	0.0002	28	BL	Eri	P	2454829.4220	0.0002	20
BL	Eri	P	2454832.3403	0.0006	29	BL	Eri	S	2454833.3828	0.0002	61
BL	Eri	P	2454834.4250	0.0002	44	BL	Eri	S	2454835.4684	0.0004	22
BL	Eri	S	2454836.3002	0.0021	36	BL	Eri	P	2454836.5099	0.0002	18
BL	Eri	P	2454837.3440	0.0002	27	BL	Eri	P	2454852.3538	0.0002	45
BL	Eri	S	2454853.3949	0.0002	38	BL	Eri	S	2455093.5428	0.0007	14
BL	Eri	P	2455097.5030	0.0002	11	BL	Eri	P	2455101.6715	0.0003	22
BL	Eri	P	2455106.6749	0.0006	20	BL	Eri	P	2455107.5082	0.0004	19
BL	Eri	S	2455107.7174	0.0006	27	BL	Eri	P	2455109.5945	0.0006	72
BL	Eri	S	2455113.5558	0.0007	12	BL	Eri	P	2455114.5962	0.0004	16
BL	Eri	S	2455117.7232	0.0003	28	BL	Eri	S	2455118.5567	0.0007	23
BL	Eri	P	2455119.5995	0.0005	25	BL	Eri	S	2455120.6416	0.0004	20
BL	Eri	S	2455121.4770	0.0008	10	BL	Eri	P	2455121.6834	0.0002	27

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
BL	Eri	P	2455122.5172	0.0007	14	BL	Eri	P	2455124.6020	0.0005	26
BL	Eri	S	2455125.6484	0.0012	22	BL	Eri	P	2455126.6867	0.0003	30
BL	Eri	S	2455127.7294	0.0004	26	BL	Eri	S	2455128.5627	0.0004	16
BL	Eri	P	2455129.6052	0.0002	18	BL	Eri	P	2455134.6078	0.0002	24
BL	Eri	P	2455135.4431	0.0004	18	BL	Eri	S	2455135.6503	0.0003	32
BL	Eri	P	2455137.5274	0.0003	70	BL	Eri	P	2455142.5295	0.0003	16
BL	Eri	P	2455144.6153	0.0003	13	BL	Eri	S	2455145.6567	0.0004	17
BL	Eri	S	2455146.4900	0.0017	12	BL	Eri	P	2455147.5333	0.0002	14
BL	Eri	S	2455148.5746	0.0004	14	BL	Eri	P	2455149.6173	0.0004	17
BL	Eri	S	2455152.3265	0.0005	9	BL	Eri	P	2455155.4545	0.0002	20
BL	Eri	P	2455157.5421	0.0007	25	BL	Eri	P	2455160.4586	0.0003	13
BL	Eri	S	2455161.5007	0.0004	14	BL	Eri	P	2455162.5425	0.0003	27
BL	Eri	P	2455163.3779	0.0004	16	BL	Eri	S	2455163.5838	0.0005	18
BL	Eri	P	2455170.4641	0.0004	14	BL	Eri	S	2455171.5057	0.0008	14
BL	Eri	P	2455172.5487	0.0003	16	BL	Eri	S	2455173.5907	0.0005	16
BL	Eri	S	2455174.4249	0.0004	27	BL	Eri	P	2455175.4675	0.0003	14
BL	Eri	P	2455176.3019	0.0006	12	BL	Eri	P	2455180.4709	0.0003	16
BL	Eri	S	2455197.3547	0.0008	24	BL	Eri	P	2455198.3984	0.0005	20
BL	Eri	S	2455207.3613	0.0003	20	BL	Eri	S	2455212.3643	0.0004	25
BL	Eri	S	2455214.4487	0.0004	18	BL	Eri	P	2455216.3258	0.0008	20
BL	Eri	P	2455218.4097	0.0002	20	BL	Eri	P	2455470.6528	0.0004	16
BL	Eri	S	2455479.6144	0.0005	14	BL	Eri	P	2455482.7423	0.0003	20
BL	Eri	S	2455486.7017	0.0003	22	BL	Eri	P	2455490.6645	0.0004	22
BL	Eri	S	2455497.5435	0.001	14	BL	Eri	P	2455498.5865	0.0005	16
BL	Eri	S	2455499.6266	0.0003	18	BL	Eri	P	2455500.6708	0.0005	18
BL	Eri	S	2455502.5453	0.0007	13	BL	Eri	S	2455507.5486	0.0009	13
BL	Eri	S	2455509.6331	0.0003	16	BL	Eri	P	2455510.6749	0.0004	20
BL	Eri	P	2455511.5090	0.0013	12	BL	Eri	P	2455513.5943	0.0002	14
BL	Eri	S	2455514.6387	0.0007	15	BL	Eri	P	2455516.5128	0.0004	14
BL	Eri	P	2455518.5981	0.0004	16	BL	Eri	P	2455531.5219	0.0003	14
BL	Eri	S	2455532.5649	0.0004	16	BL	Eri	S	2455543.4040	0.0007	16
BL	Eri	P	2455544.4473	0.0004	14	BL	Eri	S	2455553.4100	0.0005	18
BL	Eri	P	2455554.4524	0.0004	16	BL	Eri	P	2455556.5371	0.0002	16
BL	Eri	P	2455562.3745	0.0003	25	BL	Eri	S	2455568.4204	0.0004	17
BL	Eri	P	2455572.3815	0.0003	20	BL	Eri	S	2455573.4227	0.0006	17
BL	Eri	P	2455574.4659	0.0003	18	BL	Eri	S	2455581.3429	0.0005	28
BL	Eri	S	2456172.5434	0.0016	43	BL	Eri	P	2456173.5879	0.0011	39
BL	Eri	P	2456178.5898	0.0009	42	BL	Eri	S	2456179.6306	0.0011	45
BL	Eri	P	2456181.5087	0.0006	30	BL	Eri	S	2456182.5492	0.001	36
BL	Eri	P	2456186.5116	0.0006	31	BL	Eri	S	2456187.5516	0.0009	37
BL	Eri	P	2456188.5974	0.0004	45	BL	Eri	S	2456190.4717	0.0008	30
BL	Eri	S	2456195.4736	0.0015	32	BL	Eri	P	2456196.5185	0.0008	38
BL	Eri	S	2456200.4801	0.0013	41	BL	Eri	P	2456211.5266	0.0004	45
BL	Eri	S	2456212.5692	0.0006	54	BL	Eri	P	2456213.6110	0.0004	63
BL	Eri	P	2456214.4439	0.0006	30	BL	Eri	S	2456225.4951	0.001	43

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
BL	Eri	P	2456226.5343	0.0005	55	BL	Eri	S	2456227.5797	0.0003	93
BL	Eri	P	2456229.4561	0.0017	41	BL	Eri	P	2456236.5419	0.001	61
BL	Eri	P	2456239.4597	0.0008	42	BL	Eri	S	2456240.5073	0.0006	57
BL	Eri	S	2456241.3395	0.0009	42	BL	Eri	P	2456241.5466	0.0004	65
BL	Eri	P	2456242.3792	0.0005	44	BL	Eri	S	2456242.5899	0.0006	109
BL	Eri	S	2456243.4238	0.0014	39	BL	Eri	S	2456244.6758	0.0005	40
BL	Eri	S	2456245.5084	0.0012	75	BL	Eri	S	2456246.3414	0.0007	44
BL	Eri	P	2456246.5488	0.0003	80	BL	Eri	S	2456247.5898	0.0015	131
BL	Eri	S	2456248.4267	0.0009	42	BL	Eri	P	2456249.4680	0.0005	53
BL	Eri	S	2456250.5113	0.0008	115	BL	Eri	S	2456251.3441	0.0009	42
BL	Eri	P	2456251.5518	0.0003	156	BL	Eri	S	2456253.4295	0.001	45
BL	Eri	P	2456254.4672	0.0012	109	BL	Eri	P	2456255.3036	0.001	42
BL	Eri	S	2456255.5170	0.001	75	BL	Eri	P	2456257.3876	0.0011	40
BL	Eri	P	2456261.5567	0.0007	115	BL	Eri	S	2456265.5199	0.0002	51
BL	Eri	P	2456266.5614	0.0002	51	BL	Eri	S	2456268.4367	0.0008	114
BL	Eri	P	2456270.3120	0.0004	65	BL	Eri	S	2456275.5257	0.0003	52
BL	Eri	P	2456276.5672	0.0002	50	BL	Eri	S	2456278.4439	0.0003	49
BL	Eri	P	2456279.4856	0.0001	52	BL	Eri	S	2456280.5286	0.0002	48
BL	Eri	S	2456281.3627	0.0008	66	BL	Eri	P	2456282.4006	0.0012	56
BL	Eri	P	2456289.4931	0.0002	106	BL	Eri	S	2456290.5341	0.0003	105
BL	Eri	S	2456291.3606	0.0013	198	BL	Eri	P	2456292.4107	0.0002	107
BL	Eri	S	2456293.4530	0.0003	84	BL	Eri	P	2456294.4963	0.0002	51
BL	Eri	P	2456295.3294	0.0013	150	BL	Eri	S	2456296.3726	0.0003	247
BL	Eri	P	2456297.4166	0.0002	191	BL	Eri	S	2456298.4555	0.0002	66
BL	Eri	P	2456299.4982	0.0004	68	BL	Eri	S	2456303.4588	0.0002	50
BL	Eri	P	2456305.3389	0.0002	140	BL	Eri	S	2456306.3777	0.0004	249
BL	Eri	P	2456307.4186	0.0007	107	BL	Eri	P	2456310.3397	0.0001	100
BL	Eri	S	2456311.3803	0.0002	107	BL	Eri	S	2456316.3857	0.0019	69
BL	Eri	P	2456317.4242	0.0011	56	BL	Eri	P	2456320.3475	0.0006	121
BL	Eri	S	2456321.3875	0.0008	135	BL	Eri	P	2456325.3484	0.0003	131
BL	Eri	S	2456326.3889	0.0009	59	BL	Eri	P	2456607.6070	0.0002	34
BL	Eri	S	2456608.6536	0.0003	48	BL	Eri	S	2456609.4868	0.0003	52
BL	Eri	S	2456611.5710	0.0003	56	BL	Eri	P	2456617.6133	0.0002	87
BL	Eri	P	2456618.4475	0.0002	49	BL	Eri	S	2456619.4925	0.0002	51
BL	Eri	S	2456622.4120	0.0003	42	BL	Eri	P	2456622.6149	0.0003	49
BL	Eri	P	2456625.5352	0.0011	35	BL	Eri	S	2456631.5838	0.0002	47
BL	Eri	S	2456644.5087	0.0005	50	BL	Eri	S	2456645.3413	0.0009	96
BL	Eri	P	2456645.5429	0.0012	191	BL	Eri	P	2456646.3808	0.0006	115
BL	Eri	P	2456648.4642	0.0008	100	BL	Eri	S	2456649.5110	0.0008	180
BL	Eri	P	2456650.5500	0.0002	50	BL	Eri	P	2456651.3836	0.0002	49
BL	Eri	S	2456652.4290	0.0006	44	BL	Eri	P	2456653.4681	0.0002	34
BL	Eri	P	2456656.3876	0.0007	97	BL	Eri	S	2456657.4318	0.001	122
BL	Eri	S	2456660.3518	0.0003	49	BL	Eri	P	2456660.5563	0.0001	47
BL	Eri	P	2456663.4749	0.0002	37	BL	Eri	S	2456685.3659	0.0005	169
BL	Eri	S	2456690.3697	0.0006	144	BL	Eri	P	2456691.4083	0.0006	59

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
BL	Eri	S	2456692.4536	0.0002	50	BL	Eri	P	2456694.3268	0.0007	136
BL	Eri	P	2456699.3297	0.0006	107	BL	Eri	S	2456892.5774	0.001	33
BL	Eri	P	2456893.6181	0.001	36	BL	Eri	S	2456902.5815	0.001	36
BL	Eri	P	2456903.6230	0.0007	41	BL	Eri	P	2456906.5381	0.002	28
BL	Eri	P	2456908.6212	0.0019	44	BL	Eri	P	2456921.5506	0.0007	38
BL	Eri	S	2456922.5878	0.0029	23	BL	Eri	S	2456925.5108	0.0021	35
BL	Eri	P	2456926.5549	0.0005	42	BL	Eri	P	2456934.4749	0.0012	23
BL	Eri	S	2456935.5195	0.0011	38	BL	Eri	P	2456936.5571	0.001	52
BL	Eri	S	2456937.6017	0.0024	53	BL	Eri	P	2456944.4784	0.0012	31
BL	Eri	S	2456945.5249	0.0022	43	BL	Eri	S	2456948.4430	0.0011	33
BL	Eri	P	2456949.4851	0.0006	43	BL	Eri	S	2456950.5281	0.0014	45
BL	Eri	P	2456952.4024	0.0007	30	BL	Eri	S	2456952.6104	0.0009	52
BL	Eri	S	2456953.4471	0.0013	36	BL	Eri	P	2456954.4876	0.0007	41
BL	Eri	P	2456980.3378	0.0009	38	BL	Eri	S	2456980.5440	0.0014	42
BL	Eri	S	2456983.4650	0.0019	48	BL	Eri	S	2456993.4691	0.0025	46
BL	Eri	S	2456998.4713	0.0018	40	BL	Eri	S	2457009.3150	0.0007	66
BL	Eri	P	2457010.3558	0.0005	60	BL	Eri	S	2457011.3994	0.0014	51
V1112	Tau	P	2454491.3741	0.0004	82	V1112	Tau	P	2454502.3928	0.0004	38
V1112	Tau	S	2454755.6376	0.0009	86	V1112	Tau	S	2454760.7237	0.0007	39
V1112	Tau	P	2454764.7514	0.0007	64	V1112	Tau	S	2454777.6785	0.0011	26
V1112	Tau	P	2454787.6382	0.0011	35	V1112	Tau	S	2454789.5482	0.0011	19
V1112	Tau	S	2454794.6324	0.0008	20	V1112	Tau	S	2454800.5682	0.0012	20
V1112	Tau	P	2454804.5935	0.0009	20	V1112	Tau	S	2454808.6201	0.0011	24
V1112	Tau	S	2454817.5205	0.0014	19	V1112	Tau	P	2454818.5801	0.0013	22
V1112	Tau	P	2454819.4300	0.0008	18	V1112	Tau	S	2454826.4232	0.0006	24
V1112	Tau	S	2454829.3943	0.0013	16	V1112	Tau	P	2454833.4159	0.0006	29
V1112	Tau	S	2454834.4766	0.0007	22	V1112	Tau	P	2454835.5336	0.001	24
V1112	Tau	S	2454845.4960	0.0017	21	V1112	Tau	P	2454852.4907	0.0008	24
V1112	Tau	P	2454853.3410	0.0008	48	V1112	Tau	P	2454855.4580	0.0011	20
V1112	Tau	P	2454861.3901	0.0007	52	V1112	Tau	S	2455114.6383	0.0019	28
V1112	Tau	P	2455118.6659	0.0008	41	V1112	Tau	S	2455119.7251	0.0006	44
V1112	Tau	P	2455124.5988	0.0007	28	V1112	Tau	S	2455125.6584	0.0007	42
V1112	Tau	P	2455126.7195	0.0006	55	V1112	Tau	S	2455128.6245	0.0008	34
V1112	Tau	P	2455129.6843	0.0007	53	V1112	Tau	P	2455135.6179	0.0012	50
V1112	Tau	S	2455136.6767	0.0013	42	V1112	Tau	S	2455142.6086	0.0009	43
V1112	Tau	S	2455147.6988	0.0008	42	V1112	Tau	S	2455148.5461	0.0009	14
V1112	Tau	P	2455149.6046	0.0007	37	V1112	Tau	S	2455150.6654	0.0005	49
V1112	Tau	P	2455155.5391	0.0007	48	V1112	Tau	P	2455160.6251	0.0005	47
V1112	Tau	P	2455161.4722	0.0009	39	V1112	Tau	S	2455162.5305	0.0021	31
V1112	Tau	P	2455163.5911	0.001	32	V1112	Tau	S	2455170.5831	0.0015	40
V1112	Tau	P	2455171.6409	0.0013	70	V1112	Tau	P	2455172.4930	0.001	37
V1112	Tau	S	2455173.5528	0.0007	48	V1112	Tau	P	2455174.6102	0.0005	46
V1112	Tau	P	2455175.4593	0.0007	39	V1112	Tau	S	2455185.4205	0.0011	43
V1112	Tau	S	2455207.4586	0.0005	46	V1112	Tau	P	2455208.5193	0.0005	31
V1112	Tau	P	2455209.3648	0.0012	54	V1112	Tau	P	2455211.4849	0.0011	29

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1112	Tau	P	2455214.4520	0.0005	49	V1112	Tau	S	2455215.5117	0.0013	40
V1112	Tau	S	2455216.3589	0.0006	71	V1112	Tau	S	2455218.4795	0.0007	48
V1112	Tau	P	2455220.3857	0.0008	67	V1112	Tau	S	2455221.4435	0.0008	64
V1112	Tau	P	2455231.4055	0.0004	57	V1112	Tau	S	2455232.4655	0.001	32
V1112	Tau	P	2455482.7379	0.0005	49	V1112	Tau	P	2455483.5853	0.0011	25
V1112	Tau	S	2455498.6317	0.001	43	V1112	Tau	P	2455499.6923	0.0009	62
V1112	Tau	P	2455500.5379	0.0008	21	V1112	Tau	P	2455502.6565	0.0006	34
V1112	Tau	S	2455506.6838	0.0007	42	V1112	Tau	S	2455507.5314	0.0008	31
V1112	Tau	S	2455509.6516	0.0007	37	V1112	Tau	S	2455510.5002	0.0006	20
V1112	Tau	P	2455510.7086	0.0005	55	V1112	Tau	P	2455511.5584	0.0007	38
V1112	Tau	P	2455513.6776	0.0008	37	V1112	Tau	P	2455514.5231	0.0013	26
V1112	Tau	P	2455516.6443	0.0006	36	V1112	Tau	S	2455518.5487	0.0013	40
V1112	Tau	P	2455531.4792	0.0008	27	V1112	Tau	S	2455532.5376	0.0008	31
V1112	Tau	S	2455543.5583	0.0007	33	V1112	Tau	S	2455544.4074	0.0008	24
V1112	Tau	P	2455553.5159	0.002	41	V1112	Tau	S	2455554.5739	0.0025	67
V1112	Tau	P	2455556.4833	0.001	34	V1112	Tau	S	2455558.3916	0.001	39
V1112	Tau	S	2455563.4718	0.0022	33	V1112	Tau	P	2455564.5382	0.0012	34
V1112	Tau	S	2455566.4445	0.0009	35	V1112	Tau	P	2455568.3509	0.0006	44
V1112	Tau	S	2455572.3787	0.0008	42	V1112	Tau	P	2455573.4366	0.0008	36
V1112	Tau	S	2455574.4987	0.0015	36	V1112	Tau	S	2455575.3421	0.0009	54
V1112	Tau	S	2455580.4306	0.002	57	V1112	Tau	S	2455597.3809	0.0013	46
V1112	Tau	P	2455598.4441	0.0008	24	V1112	Tau	S	2455829.6419	0.001	29
V1112	Tau	P	2455830.7018	0.0007	30	V1112	Tau	S	2455832.6110	0.0008	27
V1112	Tau	S	2455837.6946	0.0009	44	V1112	Tau	P	2455841.7217	0.0004	76
V1112	Tau	P	2455842.5717	0.001	22	V1112	Tau	S	2455843.6302	0.0012	29
V1112	Tau	P	2455858.6758	0.0008	76	V1112	Tau	S	2455859.7351	0.0005	77
V1112	Tau	P	2455861.6407	0.0023	42	V1112	Tau	S	2455862.7018	0.0005	79
V1112	Tau	S	2455863.5498	0.0006	29	V1112	Tau	P	2455863.7599	0.0028	47
V1112	Tau	P	2455864.6059	0.001	29	V1112	Tau	S	2455866.5168	0.0009	26
V1112	Tau	P	2455866.7297	0.0005	78	V1112	Tau	P	2455867.5735	0.0006	57
V1112	Tau	P	2455867.5735	0.0006	57	V1112	Tau	P	2455870.5425	0.0009	30
V1112	Tau	S	2455871.6007	0.0009	35	V1112	Tau	P	2455872.6598	0.0012	30
V1112	Tau	P	2455873.5106	0.0009	73	V1112	Tau	S	2455874.5691	0.0009	73
V1112	Tau	S	2455880.5039	0.0016	27	V1112	Tau	P	2455881.5596	0.0011	29
V1112	Tau	S	2455883.4699	0.0008	30	V1112	Tau	P	2455883.6799	0.0016	26
V1112	Tau	P	2455884.5287	0.0005	30	V1112	Tau	P	2455886.6466	0.0008	30
V1112	Tau	S	2455891.5251	0.0009	28	V1112	Tau	S	2455928.3981	0.0015	70
V1112	Tau	P	2455938.3555	0.0004	77	V1112	Tau	S	2455939.4151	0.0004	66
V1112	Tau	P	2455940.4741	0.0009	32	V1112	Tau	S	2455942.3819	0.0005	79
V1112	Tau	P	2455943.4407	0.0007	30	V1112	Tau	S	2455945.3476	0.0005	76
V1112	Tau	P	2455946.4069	0.0005	55	V1112	Tau	S	2455947.4673	0.0008	30
V1112	Tau	P	2455949.3755	0.0004	78	V1112	Tau	S	2455950.4345	0.0007	28
V1112	Tau	S	2455953.4012	0.0006	41	V1112	Tau	P	2456226.5649	0.0016	37
V1112	Tau	P	2456243.5172	0.0005	51	V1112	Tau	S	2456244.5777	0.0005	50
V1112	Tau	S	2456247.5462	0.0008	51	V1112	Tau	S	2456250.5110	0.0005	49

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1112	Tau	P	2456251.5708	0.0008	49	V1112	Tau	P	2456254.5383	0.0009	47
V1112	Tau	S	2456278.4844	0.0005	47	V1112	Tau	P	2456280.3921	0.0007	51
V1112	Tau	P	2456294.3791	0.0003	104	V1112	Tau	S	2456295.4402	0.0013	78
V1112	Tau	P	2456297.3453	0.0004	109	V1112	Tau	S	2456298.4056	0.0003	109
V1112	Tau	S	2456301.3716	0.0004	105	V1112	Tau	P	2456302.4309	0.0004	82
V1112	Tau	S	2456304.3435	0.0012	93	V1112	Tau	P	2456308.3657	0.0004	94
V1112	Tau	P	2456311.3347	0.0007	77	V1112	Tau	P	2456551.6570	0.0008	52
V1112	Tau	S	2456564.5811	0.0013	46	V1112	Tau	P	2456565.6435	0.0007	50
V1112	Tau	S	2456569.6692	0.0005	51	V1112	Tau	P	2456570.7302	0.0005	74
V1112	Tau	P	2456571.5774	0.0005	52	V1112	Tau	S	2456572.6380	0.0006	50
V1112	Tau	P	2456573.6972	0.0006	50	V1112	Tau	P	2456574.5451	0.0007	44
V1112	Tau	S	2456575.6049	0.0006	52	V1112	Tau	P	2456576.6645	0.0006	50
V1112	Tau	S	2456577.7241	0.0005	91	V1112	Tau	S	2456578.5700	0.001	51
V1112	Tau	P	2456579.6301	0.0006	52	V1112	Tau	S	2456580.6902	0.0005	59
V1112	Tau	P	2456581.7514	0.0006	89	V1112	Tau	P	2456582.6017	0.0009	81
V1112	Tau	S	2456594.6789	0.0008	44	V1112	Tau	S	2456595.5257	0.0006	50
V1112	Tau	P	2456595.7374	0.0005	44	V1112	Tau	P	2456596.5854	0.0006	48
V1112	Tau	S	2456598.4903	0.0008	52	V1112	Tau	P	2456598.7034	0.0006	52
V1112	Tau	S	2456600.6121	0.0008	34	V1112	Tau	P	2456601.6712	0.0006	48
V1112	Tau	S	2456603.5783	0.0006	44	V1112	Tau	P	2456604.6367	0.0007	40
V1112	Tau	S	2456605.6970	0.0005	48	V1112	Tau	P	2456607.6042	0.0006	34
V1112	Tau	P	2456608.4534	0.0007	44	V1112	Tau	S	2456608.6653	0.0006	49
V1112	Tau	S	2456609.5113	0.0008	50	V1112	Tau	P	2456622.4393	0.0005	50
V1112	Tau	S	2456622.6522	0.0008	46	V1112	Tau	S	2456623.4995	0.0025	43
V1112	Tau	S	2456625.6185	0.0007	50	V1112	Tau	S	2456631.5539	0.0008	32
V1112	Tau	P	2456644.4798	0.0016	43	V1112	Tau	S	2456645.5404	0.0017	84
V1112	Tau	P	2456647.4487	0.0008	49	V1112	Tau	P	2456649.5649	0.0022	45
V1112	Tau	S	2456651.4732	0.0008	34	V1112	Tau	P	2456653.3802	0.0005	51
V1112	Tau	P	2456656.3442	0.0006	52	V1112	Tau	S	2456656.5614	0.0026	39
V1112	Tau	S	2456657.4096	0.0033	32	V1112	Tau	P	2456658.4676	0.0008	35
V1112	Tau	S	2456660.3750	0.0006	50	V1112	Tau	S	2456662.4923	0.0007	45
V1112	Tau	S	2456663.3406	0.001	51	V1112	Tau	P	2456663.5535	0.0006	48
V1112	Tau	P	2456664.3997	0.0004	89	V1112	Tau	S	2456685.3808	0.0004	49
V1112	Tau	S	2456688.3480	0.0004	68	V1112	Tau	S	2456690.4672	0.0005	51
V1119	Her	P	2453902.5483	0.0005	18	V1119	Her	P	2453923.5271	0.0003	17
V1119	Her	S	2455337.4254	0.0016	28	V1119	Her	P	2455338.5106	0.0003	28
V1119	Her	P	2455341.4039	0.0015	48	V1119	Her	S	2455353.3413	0.0008	26
V1119	Her	P	2455359.4886	0.0003	26	V1119	Her	P	2455367.4462	0.0002	26
V1119	Her	S	2455368.5313	0.002	24	V1119	Her	P	2455375.4043	0.0002	40
V1119	Her	P	2455378.2978	0.0003	40	V1119	Her	S	2455379.3840	0.0007	28
V1119	Her	P	2455380.4685	0.0005	28	V1119	Her	S	2455390.2323	0.0015	32
V1119	Her	P	2455391.3196	0.0002	42	V1119	Her	P	2455396.3826	0.0012	20
V1119	Her	S	2455403.2555	0.001	56	V1119	Her	P	2455404.3408	0.0004	28
V1119	Her	S	2455408.3220	0.0009	34	V1119	Her	P	2455409.4049	0.0005	25
V1119	Her	P	2455412.2985	0.0002	38	V1119	Her	S	2455413.3858	0.0013	28

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1119	Her	S	2455416.2769	0.001	43	V1119	Her	P	2455420.2554	0.0002	58
V1119	Her	P	2455425.3193	0.0003	36	V1119	Her	P	2455649.5775	0.0004	28
V1119	Her	P	2455657.5350	0.0003	26	V1119	Her	S	2455661.5152	0.0014	24
V1119	Her	P	2455675.6195	0.0002	48	V1119	Her	S	2455682.4931	0.0006	24
V1119	Her	P	2455691.5348	0.0003	18	V1119	Her	S	2455692.6224	0.0018	26
V1119	Her	P	2455694.4282	0.0004	23	V1119	Her	S	2455695.5120	0.0013	18
V1119	Her	P	2455696.5977	0.0002	28	V1119	Her	S	2455703.4731	0.0022	14
V1119	Her	P	2455715.4070	0.0004	22	V1119	Her	P	2455731.3221	0.0003	28
V1119	Her	P	2455733.4931	0.0004	18	V1119	Her	S	2455740.3647	0.0012	20
V1119	Her	P	2455744.3432	0.0004	22	V1119	Her	P	2455752.3020	0.0004	42
V1119	Her	S	2455761.3428	0.0014	18	V1119	Her	S	2455764.2393	0.0007	34
V1119	Her	P	2455765.3232	0.0003	18	V1119	Her	P	2455773.2797	0.0002	26
V1119	Her	S	2455774.3658	0.0012	17	V1119	Her	S	2455790.2818	0.0007	23
V1119	Her	P	2455794.2589	0.0004	25	V1119	Her	P	2456015.6228	0.0004	33
V1119	Her	S	2456019.6034	0.0007	32	V1119	Her	P	2456023.5799	0.0004	42
V1119	Her	S	2456074.5812	0.001	20	V1119	Her	P	2456076.3898	0.0003	20
V1119	Her	P	2456078.5584	0.0004	20	V1119	Her	S	2456080.3676	0.0014	50
V1119	Her	P	2456089.4100	0.0004	20	V1119	Her	S	2456090.4961	0.0015	15
V1119	Her	S	2456093.3899	0.0007	20	V1119	Her	P	2456094.4752	0.0008	15
V1119	Her	S	2456098.4528	0.0012	16	V1119	Her	S	2456106.4135	0.0009	16
V1799	Ori	S	2454497.3950	0.0008	27	V1799	Ori	S	2454501.4583	0.0004	19
V1799	Ori	P	2454502.4736	0.0003	17	V1799	Ori	S	2454743.5715	0.0005	10
V1799	Ori	P	2454749.5232	0.0007	8	V1799	Ori	S	2454750.5386	0.0004	10
V1799	Ori	P	2454751.5559	0.0007	14	V1799	Ori	S	2454752.5709	0.0007	18
V1799	Ori	P	2454752.7151	0.0008	16	V1799	Ori	P	2454755.6192	0.0006	53
V1799	Ori	P	2454758.5249	0.0011	10	V1799	Ori	S	2454760.6998	0.0005	20
V1799	Ori	S	2454763.6027	0.0005	24	V1799	Ori	S	2454764.7652	0.0007	48
V1799	Ori	P	2454765.4901	0.0005	10	V1799	Ori	S	2454766.5053	0.0008	10
V1799	Ori	P	2454769.5544	0.0006	14	V1799	Ori	S	2454770.5688	0.0006	10
V1799	Ori	P	2454772.4571	0.0016	8	V1799	Ori	P	2454774.4893	0.0004	12
V1799	Ori	S	2454775.5056	0.0006	12	V1799	Ori	S	2454777.5376	0.0007	12
V1799	Ori	P	2454777.6824	0.0002	19	V1799	Ori	P	2454779.4249	0.0008	14
V1799	Ori	S	2454780.4413	0.001	16	V1799	Ori	S	2454786.5386	0.0013	16
V1799	Ori	S	2454787.4082	0.0011	9	V1799	Ori	P	2454787.5524	0.0006	28
V1799	Ori	S	2454787.6990	0.0004	65	V1799	Ori	S	2454788.5696	0.0004	16
V1799	Ori	S	2454789.4393	0.0007	12	V1799	Ori	P	2454789.5853	0.0005	14
V1799	Ori	P	2454790.4554	0.0004	10	V1799	Ori	S	2454790.6010	0.0016	18
V1799	Ori	P	2454792.4877	0.0006	13	V1799	Ori	S	2454794.3755	0.0005	12
V1799	Ori	P	2454794.5210	0.0015	28	V1799	Ori	S	2454794.6653	0.0004	19
V1799	Ori	P	2454795.3910	0.0006	10	V1799	Ori	S	2454795.5352	0.0004	19
V1799	Ori	S	2454796.4059	0.0005	10	V1799	Ori	P	2454796.5521	0.0004	14
V1799	Ori	S	2454798.4391	0.0008	12	V1799	Ori	P	2454798.5842	0.0006	21
V1799	Ori	P	2454799.4555	0.0003	12	V1799	Ori	S	2454800.4710	0.001	8
V1799	Ori	P	2454800.6166	0.0004	16	V1799	Ori	S	2454801.3432	0.0007	14
V1799	Ori	P	2454801.4870	0.0005	16	V1799	Ori	P	2454802.3587	0.0006	12



SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1799	Ori	P	2454804.3903	0.0004	14	V1799	Ori	S	2454804.5345	0.0004	14
V1799	Ori	S	2454805.4056	0.0011	12	V1799	Ori	P	2454805.5526	0.0005	22
V1799	Ori	P	2454806.4208	0.0006	12	V1799	Ori	S	2454807.4383	0.0004	12
V1799	Ori	S	2454808.3089	0.0008	16	V1799	Ori	P	2454808.4557	0.0018	26
V1799	Ori	S	2454808.5999	0.0005	20	V1799	Ori	P	2454809.3248	0.0004	15
V1799	Ori	S	2454809.4708	0.0007	31	V1799	Ori	P	2454811.3552	0.0007	27
V1799	Ori	S	2454811.5038	0.001	25	V1799	Ori	S	2454814.4065	0.0008	15
V1799	Ori	P	2454815.4204	0.0011	12	V1799	Ori	S	2454816.4379	0.0005	18
V1799	Ori	S	2454817.3081	0.0005	16	V1799	Ori	P	2454817.4545	0.0003	32
V1799	Ori	S	2454817.5998	0.0007	18	V1799	Ori	P	2454818.3248	0.0006	17
V1799	Ori	S	2454818.4699	0.0004	33	V1799	Ori	P	2454818.6151	0.0005	18
V1799	Ori	S	2454819.3436	0.001	15	V1799	Ori	P	2454819.4856	0.0003	15
V1799	Ori	P	2454820.3564	0.0006	16	V1799	Ori	S	2454820.5030	0.0006	22
V1799	Ori	P	2454821.5182	0.0004	39	V1799	Ori	S	2454822.5342	0.0004	46
V1799	Ori	S	2454825.4380	0.0004	16	V1799	Ori	S	2454826.3087	0.0004	16
V1799	Ori	P	2454826.4535	0.0005	34	V1799	Ori	P	2454827.3246	0.0004	22
V1799	Ori	S	2454827.4700	0.0003	22	V1799	Ori	S	2454829.5021	0.0004	14
V1799	Ori	S	2454832.4052	0.0003	20	V1799	Ori	P	2454832.5508	0.0007	14
V1799	Ori	P	2454833.4205	0.0004	40	V1799	Ori	S	2454833.5659	0.0004	20
V1799	Ori	S	2454834.4359	0.0005	37	V1799	Ori	S	2454835.3087	0.0004	20
V1799	Ori	P	2454835.4529	0.0003	18	V1799	Ori	P	2454836.3231	0.0005	22
V1799	Ori	S	2454836.4696	0.0004	34	V1799	Ori	S	2454837.3393	0.0006	22
V1799	Ori	P	2454837.4854	0.0003	22	V1799	Ori	P	2454844.4510	0.0006	38
V1799	Ori	P	2454845.3232	0.0004	20	V1799	Ori	S	2454845.4678	0.0005	16
V1799	Ori	S	2454846.3398	0.0005	39	V1799	Ori	P	2454846.4856	0.0011	21
V1799	Ori	P	2454847.3548	0.0004	17	V1799	Ori	S	2454848.3712	0.0005	15
V1799	Ori	P	2454849.3885	0.0006	15	V1799	Ori	P	2454851.4193	0.0005	10
V1799	Ori	S	2454852.4354	0.0005	23	V1799	Ori	P	2454853.4512	0.0004	27
V1799	Ori	P	2454854.3233	0.0004	14	V1799	Ori	S	2454855.3394	0.0004	37
V1799	Ori	P	2454856.3545	0.0003	13	V1799	Ori	S	2454857.3699	0.0005	12
V1799	Ori	P	2454858.3862	0.0003	12	V1799	Ori	S	2454861.4358	0.0003	20
V1799	Ori	P	2455111.5302	0.0011	11	V1799	Ori	P	2455113.5634	0.0009	10
V1799	Ori	S	2455118.6452	0.0006	14	V1799	Ori	S	2455119.5166	0.0008	8
V1799	Ori	P	2455119.6591	0.0006	14	V1799	Ori	S	2455120.6762	0.001	9
V1799	Ori	S	2455121.5477	0.0008	8	V1799	Ori	P	2455121.6922	0.0004	18
V1799	Ori	P	2455122.5634	0.0003	8	V1799	Ori	P	2455124.5945	0.0004	18
V1799	Ori	S	2455125.6109	0.0003	12	V1799	Ori	P	2455126.6271	0.0003	14
V1799	Ori	S	2455127.6444	0.0005	16	V1799	Ori	P	2455128.6595	0.0003	16
V1799	Ori	S	2455129.6760	0.0004	22	V1799	Ori	P	2455130.6922	0.0003	22
V1799	Ori	S	2455134.6110	0.0009	15	V1799	Ori	P	2455135.6259	0.0007	21
V1799	Ori	P	2455137.6577	0.0007	12	V1799	Ori	P	2455144.6269	0.0004	10
V1799	Ori	S	2455145.6416	0.0007	10	V1799	Ori	P	2455147.5289	0.0005	10
V1799	Ori	S	2455147.6735	0.0004	12	V1799	Ori	P	2455149.5612	0.0008	9
V1799	Ori	S	2455149.7067	0.0006	18	V1799	Ori	S	2455150.5774	0.0011	8
V1799	Ori	S	2455153.4810	0.0003	16	V1799	Ori	P	2455155.3664	0.0007	8

SN	Con	K	HJD	err	NM	SN	Con	K	HJD	err	NM
V1799	Ori	S	2455155.5135	0.0005	20	V1799	Ori	P	2455155.6574	0.0004	12
V1799	Ori	S	2455156.3830	0.0004	8	V1799	Ori	P	2455156.5273	0.0016	8
V1799	Ori	S	2455157.5451	0.0009	24	V1799	Ori	S	2455158.4167	0.0004	8
V1799	Ori	P	2455158.5612	0.0016	15	V1799	Ori	P	2455160.5923	0.0004	11
V1799	Ori	S	2455161.6086	0.0005	12	V1799	Ori	S	2455162.4808	0.0009	20
V1799	Ori	P	2455162.6234	0.0007	10	V1799	Ori	P	2455163.4966	0.0005	23
V1799	Ori	S	2455170.6084	0.0007	18	V1799	Ori	S	2455171.4785	0.0008	19
V1799	Ori	P	2455171.6241	0.0007	22	V1799	Ori	P	2455172.4957	0.0006	9
V1799	Ori	S	2455172.6406	0.0006	19	V1799	Ori	S	2455173.5116	0.0011	10
V1799	Ori	P	2455173.6565	0.0013	11	V1799	Ori	S	2455174.3832	0.0006	8
V1799	Ori	P	2455174.5276	0.0004	24	V1799	Ori	S	2455175.5435	0.0004	10
V1799	Ori	S	2455176.4150	0.0007	10	V1799	Ori	P	2455177.4313	0.0004	10
V1799	Ori	S	2455178.4465	0.0008	10	V1799	Ori	P	2455180.3339	0.0005	11
V1799	Ori	S	2455180.4778	0.0007	10	V1799	Ori	S	2455207.4768	0.0007	10
V1799	Ori	P	2455208.4926	0.0014	9	V1799	Ori	P	2455209.3642	0.0004	18
V1799	Ori	S	2455209.5080	0.0014	10	V1799	Ori	P	2455211.3962	0.0004	16
V1799	Ori	S	2455212.4114	0.0004	18	V1799	Ori	P	2455215.4598	0.0004	10
V1799	Ori	P	2455216.3314	0.0003	30	V1799	Ori	S	2455216.4772	0.0005	16
V1799	Ori	S	2455217.3479	0.0005	13	V1799	Ori	P	2455218.3630	0.0003	31
V1799	Ori	S	2455218.5078	0.0007	10	V1799	Ori	P	2455220.3950	0.0004	24
V1799	Ori	S	2455221.4103	0.0006	28	V1799	Ori	P	2455231.4262	0.0004	14
V1799	Ori	P	2455233.4584	0.0005	15	V1799	Ori	P	2455479.6355	0.0008	10
V1799	Ori	S	2455482.6834	0.0004	12	V1799	Ori	P	2455483.6999	0.0004	13
V1799	Ori	S	2455486.7478	0.0009	16	V1799	Ori	P	2455490.6670	0.0007	15
V1799	Ori	P	2455492.6986	0.0012	16	V1799	Ori	S	2455498.6499	0.0009	13
V1799	Ori	P	2455499.6661	0.0006	13	V1799	Ori	S	2455500.6823	0.0006	14
V1799	Ori	S	2455502.7142	0.0006	16	V1799	Ori	P	2455506.6339	0.0007	10
V1799	Ori	S	2455507.6496	0.0004	11	V1799	Ori	P	2455508.6669	0.0008	13
V1799	Ori	S	2455509.6818	0.0006	14	V1799	Ori	S	2455510.5527	0.0006	10
V1799	Ori	P	2455510.6980	0.0005	15	V1799	Ori	P	2455511.5686	0.0005	18
V1799	Ori	P	2455511.5686	0.0005	18	V1799	Ori	P	2455513.6005	0.0003	10
V1799	Ori	S	2455514.6171	0.0006	10	V1799	Ori	S	2455516.6491	0.0005	12
V1799	Ori	P	2455518.5366	0.0008	11	V1799	Ori	S	2455518.6818	0.0005	16
V1799	Ori	P	2455531.6004	0.0005	11	V1799	Ori	S	2455544.5177	0.0006	10
V1799	Ori	P	2455554.5332	0.0008	15	V1799	Ori	S	2455556.4216	0.0005	12
V1799	Ori	P	2455556.5668	0.0007	12	V1799	Ori	P	2455557.4376	0.0004	11
V1799	Ori	S	2455558.4520	0.0007	10	V1799	Ori	S	2455563.3884	0.0004	14
V1799	Ori	S	2455564.5503	0.0003	10	V1799	Ori	P	2455565.5649	0.0003	11
V1799	Ori	P	2455566.4363	0.0005	10	V1799	Ori	P	2455568.4687	0.0004	11
V1799	Ori	P	2455571.3722	0.0005	13	V1799	Ori	S	2455572.3877	0.0006	15
V1799	Ori	P	2455572.5310	0.0003	8	V1799	Ori	P	2455573.4038	0.0005	11
V1799	Ori	S	2455574.4197	0.0005	14	V1799	Ori	P	2455575.4360	0.0007	13
V1799	Ori	S	2455581.3853	0.0008	13						

Table 2: Eclipse Minima of four Contact Binary stars (Analyze Jooste)

## Discussion and Results: O–C analyses of the four Contact Binary stars - BL Eri, V1112 Tau, V1119 Her and V1799 Ori

The period analyses performed from the light curve data extracted from SuperWASP for the four contact binary stars, BL Eri, V1112 Tau, V1119 Her and V1799 Ori are presented. The O-C analysis was performed using a Python routine that calculated the minima presented in Table 2.

### BL Eri

The ASAS Catalogue for Variable Stars provides for the BL Eri binary system a period of  $P = 0.416\,92$  d. Liu et al. [5] determined  $P = 0.416\,915\,91$  d for BL Eri and observed that the orbital period has changed, but due to inadequate minima, could not further investigate the nature of the period changes. The article of Molik [7] summarises some of the difficulties due to errors and data challenges in identifying the period correctly as well as the evolving nature thereof, with a value of  $P = 0.416\,918\,55$  d given as of July 1986. From the SuperWASP data, a  $P = 0.416\,924\,9$  d was found, with a resulting ephemeris of  $T_0 = 2456\,653.468\,1$  HJD +  $0.416\,924\,9 E$ . The regression analysis yields a linear O–C residual outcome as shown in Fig. 1, yet superimposed there is an apparent underlying variability. One season of data showed significant scatter as was also evident in the light curve. Considering the earlier analysis by other researchers, and the period that had been determined, it would be plausible to assume that over a longer data baseline, that the period is indeed increasing.

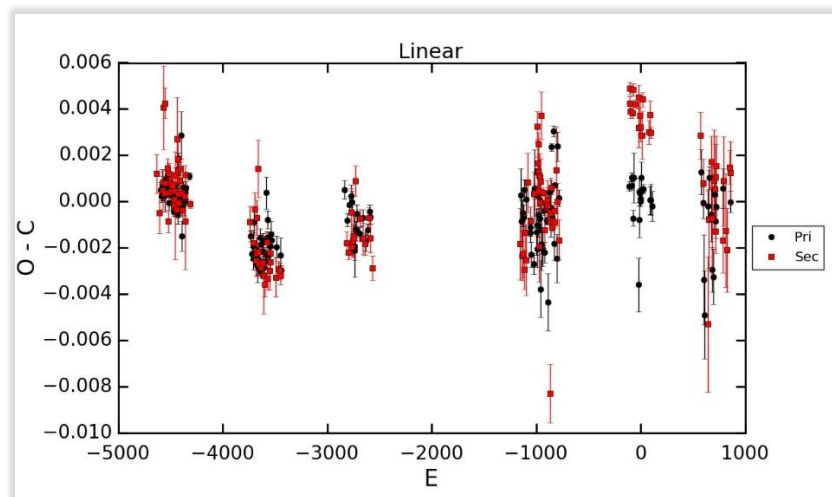


Fig. 1 First Order Regression results for BL Eri

### V1112 Tau

One of the earlier O–C analyses performed on V1112 Tau, was by Gomez-Forrellad & Garcia-Melendo [2] following its earlier discovery in 1940 (Hanley & Shapley, [3]). A  $P = 0.423\,82$  d was determined. From the SuperWASP data, the O–C analysis provides for a  $\sigma \approx 8$  which is regarded significant to confirm a period change. The SuperWASP data rendered  $P = 0.423\,841\,609$  d with  $T_0 = 2456\,656.344\,2$  HJD and an increasing period of  $dP/dt = 1.7 \times 10^{-6}$   $\text{d yr}^{-1}$  over the domain of SuperWASP data that stretched over 6.02 years. The second order O–C residuals shown in Fig. 2 depicts a sinusoidal influence of potentially a third body on the period of V1112 Tau. The Lomb-Scargle Periodogram service of the NASA Exoplanet Archive, <https://exoplanetarchive.ipac.caltech.edu/cgi-bin/Pgram/nph-pgram>, determined a  $P_3 = 3.913$  yr.

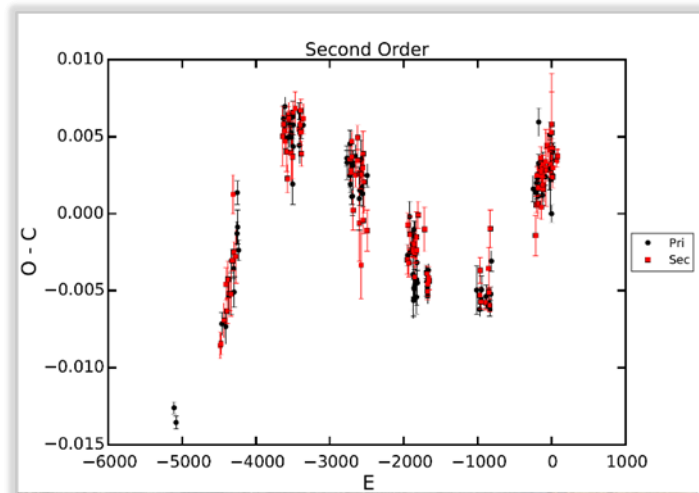


Fig. 2 Second Order Regression results for V1112 Tau

### V1119 Her

It would seem as if this system does not have a previous O–C determination. The GCVS website, <http://www.sai.msu.su/gcvs/gcvs/> provides  $P = 0.723\,41$  d. From SuperWASP data, the period of this binary star system is changing as suggested by  $\sigma \approx 7$  and increasing by  $dP/dt = 1.4 \times 10^{-6} \text{ d yr}^{-1}$ . V1119 Her has a period of  $P = 0.723\,4041$  d and  $T_0 = 2453\,902.548\,3$  HJD. The second order residual results are reflected in Fig. 3.

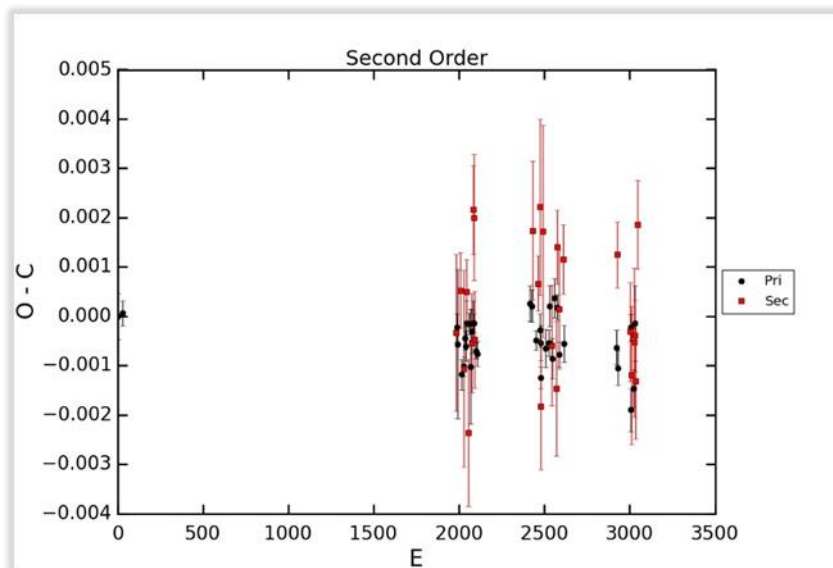


Fig. 3 Second order O-C Regression results for V1119 Her

### V1799 Ori

A photometric study by Liu et al. [6] found a  $P = 0.290\,303\,64$  d although an upward trend (increasing period) was also reflected on their studies. The period provided by ASAS is  $P = 0.290\,302$  d. The SuperWASP minima data indicated that the period of V1799 Ori is decreasing with  $dP/dt = -6.0 \times 10^{-7} \text{ d yr}^{-1}$  and a  $\sigma \approx 5$ . The SuperWASP based ephemeris for this system is  $T_0 = 2455\,128.659\,5 \text{ HJD} + 0.290\,303\,06 E$  and the O–C quadratic residuals are shown in Fig. 4.

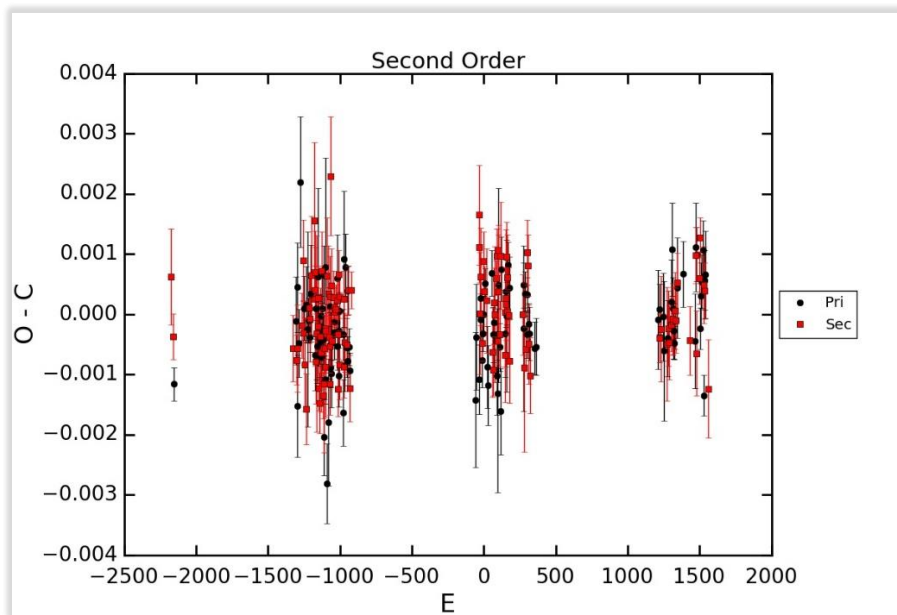


Fig. 4 Second order O-C Regression results for V1799 Ori

### Conclusion

Minima for a selection of contact binary stars from SuperWASP data are presented here. Two categories of data are included. The minima of 21 stars discussed by Smits & Skelton (2019) are presented as well as four other stars on which research is being undertaken.

A discussion of the period variations of the four stars has also been included.

## References

- [1] Feigelson E. D., Babu G. J., 2012, Modern Statistical Methods for Astronomy, doi:10.48550/arXiv.1205.2064.
- [2] Gomez-Forrellad J. M., Garcia-Melendo E., 1995, Information Bulletin on Variable Stars, 4282, 1
- [3] Hanley C. M., Shapley H., 1940, Harvard College Observatory Bulletin, 913, 9
- [4] Huruata M., 1940, Harvard College Observatory Bulletin, 913, 14
- [5] Liu Q., Soonthornthum B., Yang Y., Gu S., Niparugs S., Aniwat Sooksawat M. L., Wang B., Naksata M., 1996, 118, 453
- [6] Liu N.-P., Qian S.-B., Liao W.-P., He J.-J., Zhao E.-G., Liu L., 2014, Research in Astronomy and Astrophysics, 14, 1157
- [7] Molik P., 1998, Information Bulletin on Variable Stars, 4577, 1
- [8] Pollacco D. L., et al., 2006, PASP, 118, 1407
- [9] Smith A. M. S., WASP Consortium 2014, Contributions of the Astronomical Observatory Skalnaté Pleso, 43, 500
- [10] Smits D. P., Skelton P. L., 2019, New Astron., 67, 53