KG
11365
430

Asteroid 109 Elements
and Ephemerides 1877 1878

KG11365.430

♄ $m = \frac{1}{3501.6}$ $\lg \overset{40'}{m' k} = 1.60780$

KG 11365.430

π_0
Red. 1870
π'
Ω
Red 1870
1880 Ω

i_0
Red 1870
i

1880 Ω'	112°	37'	00"
1870 Red.		−5	07
Ω' 1870	112	31	53
i' 1880	2	29	25
Red 1870		+	1
i 1870	2	29	26

New Discussion of (109)

Elements for
Oct 31.0 1869 Berlin M.T.

$M = 343^\circ\ 54'\ 39''.18$
$\Omega = 4\ \ 56\ \ 59.9 + 49''.49$
$\omega\ \ 51\ \ 04\ \ 48.96$
$i = 8\ \ 2\ \ 58.43 + 0.46$
$\varphi = 17\ \ 28\ \ 9.73$
$\mu = 802.0077$
$\log a = .4305544$
$\pi = 56\ 00\ 5$[illegible]$ + 50.245$

Perturbation Constants

♃

$m = \frac{1}{1047.879}$ log 40m′k = 2,13176
log 120k .31476

♄

$m = \frac{1}{3501.6}$ log 40m′k = 1.60780

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Jupiter Eq: 1880

	M.Eq. 1870.	1870	1872	1873	1875	1877	1878 9	~~1877~~ 1879 80
π		56° 1′ 44″	55 58 49	55 56 42	56 0 59	56 36 38	56 52 18	56 ~~52~~ 40 56 52 18
Ω		4 56 55	4 54 46	4 54 13		4 36 12	4 28 58	4 28 58
Ω'		99 5 43	99 05 43	99 5 43		99 11 31	99 11 24	99 12 30
$\Omega'-\Omega$		94 8 48	94 10 57	94 11 30		94 35 19	94 42 26	94 43 32
$\frac{1}{2}(\Omega'-\Omega)$		47 04 24	47 05 28	47 5 45		47 17 40	47 21 13	47 21 46
− i'		1 18 36	1 18 36	1 18 36		1 18 33	1 18 33	1 18 40
i		8 2 58	8 2 45	8 2 46		8 0 13	8 0 29	8 0 29
$i'+i$		9 21 34	9 21 21	9 21 22		9 18 46	9 19 02	9 19 09
$i'-i$		6 44 22	−6 44 09	−6 44 10		−6 41 40	−6 41 56	−6 41 49
$\frac{1}{2}(i'+i)$		+4 40 47	4 40 40	4 40 41		+4 39 23	+4 39 31	4 39 34
$\frac{1}{2}(i'-i)$		−3 22 11	−3 22 04	−3 22 5		−3 20 50	−3 20 58	−3 20 55
$\sin\frac{1}{2}(\Omega'-\Omega)$		9.86465	9.86477	9.86480		9.86620	9.86661	9.86668
$\sin\frac{1}{2}(i'+i)$		8.91161	8.91143	8.91146		8.90948	8.90966	8.90973
1 $\sin\frac{1}{2}I\sin\frac{1}{2}(N+N')$		8.77626	8.77620	8.77626		8.77565	8.77627	8.77641
$\sin\frac{1}{2}I\cos\frac{1}{2}(N+N')$		8.60241n	8.60201n	8.60201n		8.59769n	8.59751n	8.59731n
$\log\operatorname{tg}\frac{1}{2}(N+N')$		0.17385	0.17419	0.17425n		0.17796	0.17876n	0.17910
$\frac{1}{2}(N+N')$		−56 10 20	56 11 39	56 11 52		−56 25 26	−56 28 20	−56 29 35
$\frac{1}{2}(N+N')$		123 49 40	123 48 21	123 48 8		123 34 34	123 31 40	123 30 25
$\frac{1}{2}(N-N')$		47 01 40	47 02 43	47 2 59		47 14 58	47 18 23	47 19 01
N	1871	170 51 20	170 51 04	170 51 7		170 49 [illegible]	170 50 03	170 49 26
ω	51 03 09	51 04 49	51 04 03	51 2 29		52 0 24	52 23 20	52 23 20
$\omega'=\omega-N$	240 11 49	240 13 29	240 12 59	240 11 22	240 07 04	241 10 57	241 33 17	241 33 54
N'	76 45 00	76 48 00	76 45 38	76 45 9		76 [illegible]	76 13 17	76 [illegible]
Ω'	99 5 43	99 5 43	99 05 43	99 5 43		99 11 31	99 11 31	99 12 30
$N'+\Omega'$	175 53 43	175 53 43	175 51 21	175 50 52	175 59 25	~~175 41 57~~ 175 31 19	175 24 48	175 23 54
1 $\cos\frac{1}{2}(\Omega'-\Omega)$		9.83319	9.83304	9.83300		9.83138	9.83091	9.83082
$\sin\frac{1}{2}(i'-i)$		8.76922n	8.76897n	8.76901n		8.76631n	8.76660	8.76649
						8.59769n	8.59751	8.59731
$\sin\frac{1}{2}I$		8.85681	~~8.60201~~ 8.85664n	8.85668		8.85498	8.85530	8.85534
$\frac{1}{2}I$		4 7 26	4 07 20	4 7 22		4 6 21	4 6 34	4 6 36
I		8 14 52	8 14 40	8 14 44	8 14 44	8 12 42	8 13 08	8 13 12
2 $\cos\frac{1}{2}(\Omega'-\Omega)$		9.83319	9.83304	9.83300		9.83138	9.83091	9.83082
$\cos\frac{1}{2}(i'-i)$		9.99920	9.99920	9.99921		9.99927	9.99926	9.99926
						9.83065	9.83017	9.83008
$\sin\frac{1}{2}(\Omega'-\Omega)$		9.86465	9.86477	9.86480		9.86620	9.86661	9.86668
$\cos\frac{1}{2}(i'+i)$		9.99855	9.99855	9.99855		9.99856	9.99856	9.99856
2 $\cos\frac{1}{2}I\sin\frac{1}{2}(N-N')$		9.86320	9.86332	9.86335		9.86476	9.86517	9.86524
$\cos\frac{1}{2}I\cos\frac{1}{2}(N-N')$		9.83244	9.83229	9.83225		9.83065	9.83017	9.83008
$\operatorname{tg}\frac{1}{2}(N-N')$		0.03076	0.03103	0.03110		.03411	0.03500	0.03516
				$i=$	8 2 59		8 0 29 //	
φ		17 28 10	17 24 49	17 23 49	17 22 35	17 14 52	17 14 17	
$\frac{1}{2}\varphi$		8 44 05	8 42 24	8 41 54	8 41 17	8 37 26	8 37 08	
$\cos\varphi$		9.97949	9.97963	9.97967	9.97971	9.98002	9.98004	
$\cos^2\varphi$		9.95898		9.95934	9.95942	9.96004	9.96008	
$\log a$		.43055	43052	43066	.43058	.43139	43081	
$\log p$		~~.42041~~ .38953	38978	.39000	.39000	.39143	.39085	
$\frac{1}{2}i$		4 01 29	(8 2 45) 4 1 22	4 1 23	4 1 28	4 0 6	4 0 14	
$\log e$		9.47741	9.47606	9.47566	9.47516		9.47179	
$\log e^4$		4.79183	4.79049	4.79009				
$\log a(1+e)$		.27228	.27211	27213		.27208		
$\log a(1-e)$		(13777)	.13804	13819		.13932		
(1)	1.93700	~~1.41304~~	1.93687	1.93676	1.93676	1.93605	1.93632 1	
(2)	0.85279		0.85398	0.85396	85377	.85625	.85601 2	
(3)	.41004		.41045	41033	41029	41[illegible]	.41085 3	
(4)	0.91212		91372	91434	.91484	.91940	.91910 4	
(5)	0.32259		.52394	52434	52484	52797	.52821 5	
(6)	8.84733		8.84712	8.84715	8.84730	8.84483	8.84507 6	
(7)	9.57688		9.57556	9.57509	9.57463	9.57110	9.57115 7	
(8)	.48902		.48928	48943	.48947	.49050	.49025 8	
(9) =	9.57604		9.57487	9.57467	9.57415	9.57231	9.57151 9	
(10)	0.28032	(10)	.28066	28070	.28074	10 .28105	.28107 10	
(11)	9.18[illegible]	(11)	9.18509	9.18467	9.18415	11 9.18088	9.18062 11	
(12)	0.89161	(12)	.89384	.89401	.89455	12 .89942	.89914 12	
(13)	0.50208	(13)	.50366	.50411	.50455	13 .50789	.50825 13	

Saturn, Constant for perturbations

	M. Eq. 1870 1869.		1875	1877 (Eq 1880)		1878-9
π	56 1 44	55 57 42		56 36 38	56 52 18	56 52 18
Ω	4 35 53	4 34 13		4 36 12	4 28 58	4 28 58
Ω'	112 31 53	112 31 53		112 34 41	112 34 41	112 38 00
$\Omega'-\Omega$	107 34 58	107 37 40		107 58 29	108 05 43	108 09 02
$\frac{1}{2}(\Omega'-\Omega)$	53 47 29	53 48 50		53 59 15	54 02 52	54 04 31
i	2 29 26	2 29 26		2 29 19	2 29 19	2 29 24
i'	8 2 58	8 2 46		8 0 13	8 0 29	8 0 29
$i'+i$	10 32 24	10 32 12		10 29 32	10 29 48	10 29 53
$i'-i$	-5 33 32	5 33 20		-5 30 54	5 31 10	-5 31 05
$\frac{1}{2}(i'+i)$	5 16 12	5 16 6		+5 14 46	5 14 54	5 14 56
$\frac{1}{2}(i'-i)$	-2 46 46	-2 46 40		-2 45 27	-2 45 35	-2 45 32
$\sin\frac{1}{2}(\Omega'-\Omega)$	9.90680	9.90693		9.90789	9.90822	9.90837
$\sin\frac{1}{2}(i'+i)$	8.96307	8.96294		8.96111	8.96128	8.96134
$\sin\frac{1}{2}I\sin\frac{1}{2}(N+N')$	8.86987	8.86987		8.86900	8.86950	8.86971
$\sin\frac{1}{2}I\cos\frac{1}{2}(N+N')$	8.45705n	8.45653n		8.45158n	8.45129n	8.45087
$\tan\frac{1}{2}(N+N')$	0.41282	0.41332n		.41742n	0.41821	0.41884
$\frac{1}{2}(N+N')$	-68 52.2	-68 53 22		-69 4 14		-69 07 59
$\frac{1}{2}(N+N')$	111 7 38	111 6 38		110 55 46		110 52 01
$\frac{1}{2}(N-N')$	53 42 26	53 43 30		53 54 18		53 59 34
N	164 50 24	164 50 28	164 50 28	164 50 06		164 51 35
ω	57 4 48	57 2 29	50 58 20	52 0 24		52 23 30
$\bar{\omega}=\omega-N$	246 14 24	246 12 1	246 07 57	247 10 29		247 31 45
N'	57 25 32	57 22 48	57 28 15	56 01 37		56 52 27
Ω'	112 31 53	112 31 53	112 34 41	112 34 41		112 38 00
$N'+\Omega'$	169 57 25	169 54 41	180 2 56	165 ~~2 13~~ 36 08		169 30 27
$\cos\frac{1}{2}(\Omega'-\Omega)$	9.77139	9.77115		9.76935	9.76872	9.76843
$\sin\frac{1}{2}(i'-i)$	8.68566n	8.68540n		8.68223	8.68257	8.68244
		8.45653n		8.45158n	8.45128	8.45087
$\sin\frac{1}{2}I$	8.90011	8.90004		8.89864		8.89917
$\frac{1}{2}I$	4.33 26	4 33 23		4 32 30		4 32 32
I	9 6 52	9 6 46	9 6 34	9 05 00		9 05 40
$\cos\frac{1}{2}(\Omega'-\Omega)$	9.77139	9.77115		9.76935	9.76872	9.76843
$\cos\frac{1}{2}(i'-i)$	9.99949	9.99944		9.99950	9.99950	9.99950
$\sin I$	9.19977	9.19970		~~9.76703~~	9.76822	9.76793
$\cos I$	9.99442	9.99448		.76885		
$\sin\frac{1}{2}(\Omega'-\Omega)$	9.90680	9.90693		9.90789	9.90822	9.90837
$\cos\frac{1}{2}(i'+i)$	9.99816	9.99816		9.99818	9.99818	9.99818
$\cos\frac{1}{2}I\sin\frac{1}{2}(N-N')$	9.90496	9.90509		9.90607	9.90640	9.90655
$\cos\frac{1}{2}I\cos\frac{1}{2}(N-N')$	9.77088	9.77064		9.76885	9.76822	9.76793
$\tan\frac{1}{2}(N-N')$	0.13408	0.13445		0.13722	0.13818	0.13862
φ	17 28 10					
$\frac{1}{2}\varphi$	8 44 5					
$\cos\varphi$	9.97949					
$\cos^2\varphi$	9.95898					
$\log a$	.43055					
$\log p$	.38958					
$\log\frac{1}{2}i'$	4 1 29					
$\log e$	9.47741					
$\log e''$	4.79183					
$\sqrt{a(1+\varepsilon)}$	.27227					
$\sqrt{a(1-\varepsilon)}$	.13776			1.41209		1.41236
(1)	1.41304	1.41280	1.41280	~~1.39211~~		
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

	1869 Oct 13.0	Nov 22.0	Dec 32.0	1870 Feb. 10	Mar 22	May 1	June 10	July 20	Aug 29	Oct 8	Nov 17
M	339 54 03 ~~343 54 39~~	~~348 48 43~~	~~357 43 23~~	~~6 38 03~~ 45	~~32 43 30~~	~~[illegible] 27 23~~	~~33 22 03~~	42 19 54	51 14 48	60 9 43	69 04 37
E'	331 45 48	344 06 00	356 44 49	9 27 42	21 59 09	34 05 59	45 40 18	56 41 57	67 04 46	76 54 19	86 13 48
$\frac{1}{2}E$	165 52 54	172 3 0	178 22 25	4 43 51	10 59 31	17 2 59	22 50 10	28 20 58	33 32 23	38 27 10	43 06 54
$\sin\frac{1}{2}E'$	9.38726	9.44085	8.45304	8.91632	9.28028	9.46717	9.58894	9.671655	9.74234	9.79370	9.83472
$\cos\frac{1}{2}E$	9.98668n	9.99580n	9.99982n	9.99852	9.99196	9.98048	9.96455	9.94452	9.92091	9.89383	9.86332
$\sqrt{2}\sin\frac{1}{2}v$	9.65954	9.41313	8.72532	9.18860	9.55256	9.73945	9.86122	9.94873	.01452	.06588	.10690
$\sqrt{2}\cos\frac{1}{2}v$	.12445	.13357n	.13759n	.13629	.12973	.11825	.10232	.08227	.05866	.03158	.00107
$\tan\frac{1}{2}v$	9.53508n	9.27956n	8.58773n	9.05231	9.42283	9.62120	9.75890	9.86646	9.95586	.03430	.10883
$\frac{1}{2}v$	−18 55 26	−10 46 39	−2 12 59	6 26 9	14 49 43	22 41 10	29 51 19	36 19 37	42 05 37	47 15 38	51 54 47
$\frac{1}{2}v$	161 04 34	169 13 21	177 47 1								
v	322 09 08	338 26 42	355 34 2	12 52 18	29 39 26	45 22 20	59 42 38 ~~71 42 16~~	72 35 14	84 11 14	94 31 16	103 49 34
u = v+ω	13 13 56	29 31 30	46 38 50	63 57 6	80 44 14	96 27 8	110 47 26	128 44 03	135 16 03	145 36 05	154 54 23
log sin u	9.35964	9.69267	9.86162	9.95348	9.99430	9.99724	9.97076	9.91993	9.84745	9.75201	9.62747
log r	.29716	.28260	.27584	.27808	.28888	.30644	.32832	.35226	.37646	.39984	.42176
cot u	9.98831	9.93959	9.83663	9.64258	9.20672	9.05067n	9.55017n	9.74456n	9.85150n	9.91652n	9.95691n
log r	.29716	.28260	.27574	.27808	.28888	.30644	.32832	.35226	.37646	.39984	.42176
l sin v	9.78786n	9.56513n	8.88812n	9.34785	9.69444	9.85229	9.93626	9.97979	9.99776	9.99865	9.98723
l cos v	9.89743	9.96857	9.99870	9.98895	9.93902	9.84664	9.70275	9.47440	9.00552	8.89667	9.37835
l cos E	9.94498	9.98306	9.99930	9.99405	9.96721	9.91806	9.84433	9.73960	9.59046	9.35519n	8.81740n
cos v	+ .78965	.93006	.99702	.97458	.86900	.70250	.50437	+.29813	+.10128	∓.07883	−.23898
cos E	+ .88101	.96175	.99839	.98640	.92728	.82806	.69677	+.54904	+.38946	∓.22656	+.06575
cos v + cos E	+1.67066	1.89181	1.99541	1.96128	1.79628	1.53056	1.20394	+.84717	+.49074	+.14773	−.17323
log 2 sin u	9.65680	9.97527	.13746	.23156	.28318	.30368	.29908n	.27219	.22391	.15785	.04923
log r cos u	.28547	.22219	.11247	9.92067	9.49560	9.35711n	9.87849n	.09682n	.22796n	.31636n	.37871n
l p	.09237	.10693	.11369	.11145	.10065	.08309	.06121	.03720	.01300	9.98862	9.96770
p^2	1.23700	1.27920	1.29926	1.29256	1.26081	1.21810	1.15137	10894	10304	97640	92834
p^2+1	2.23700	2.27920	2.29926	2.29256	2.26081	2.21830	2.15137	~~.04497~~	.39422	.38849	.40899
$\log(p^2+1)$	0.34965	0.35778	0.36159	.36032	.35426	.34500	.33292	.32265 .32002	.30758	.29587	.28517
log 2 sin u	0.08502	9.84773n	9.16396n	9.62593	9.98332	.15873	.26458	~~.37422~~	~~.37849~~	~~.40899~~	~~.40880~~
$l(p^2+1)2\sin u$	~~.45977~~ 0.43469n	.20537n	9.52555n	~~9.98681~~ 9.98625	.33758	~~.51309~~ .50373	~~.49727~~ .59729	.65207	.68180	.69436	.69416
~~log(cos v + cos E)~~											
log(cos v + cos E)	0.22289	.27688	.30003	.29254	.25437	.18485	.08034	9.92797	9.69085	9.16947	9.23862n

	1870 Dec 27	1871 Feb 5	Mar 17	Apr 26	June 5	July 15	Aug 24	Oct 3	Nov 12	1871 Dec 22	1872 Jan 31
M	77 59 32	86 54 26	95 49 21	104 44 15	113 39 10	122 34 04	131 29 41	140 24 34	149 19 27	158 14 20	167 09 13
E'	95 06 52	103 36 52	111 47 06	119 40 23	127 19 22	134 46 18	142 03 20	149 12 10	156 14 35	163 12 06	170 06 18
$\frac{1}{2}E$	47 33 25	51 48 26	55 53 33	59 50 12	63 39 41	67 23 09	71 01 40	74 36 05	78 07 18	81 36 04	85 03 09
$\sin\frac{1}{2}E'$	9.86803	9.89539	9.91892	9.93681	9.95240	9.96526	9.97574	9.98412	9.99060	9.99532	9.99838
$\cos\frac{1}{2}E$	9.82921	9.79121	9.74877	9.70111	9.64707	9.58492	9.51203	9.42412	9.31346	9.16457	8.93572
$\sin\frac{1}{2}v\sqrt{2}$	.14021	.16757	.19020	.20899	.22458	.23744	.24789	.25627	.26275	.26747	.27053
$\cos\frac{1}{2}v\sqrt{2}$	9.96696	9.92896	9.88652	9.83886	9.78482	9.72267	9.64987	9.56196	9.45130	9.30238	9.07356
$\log\tan\frac{1}{2}v$	.17325	.23861	.30368	.37013	.43976	.51477	.59802	.69431	.81145	.96509	1.19697
$\frac{1}{2}v$	56 08 13	60 00 11	63 34 30	66 54 15	70 02 07	73 00 15	75 50 17	78 34 17	81 13 29	83 48 54	86 21 52
v	112 16 26	120 00 22	127 09 00	133 48 30	140 04 14	146 00 30	151 40 34	157 08 34	162 26 58	167 37 48	172 43 44
u = v+ω	163 21 15	171 05 11	178 13 45	184 53 19	191 09 03	197 05 19	202 43 43	208 11 43	213 30 07	218 40 57	223 46 53
log sin u	9.45706	9.19018	8.48971	8.93054n	9.28644n	9.46813n	9.58700n	9.67438n	9.74190n	9.79588n	9.84005n
log r	.44188	.46006	.47626	.49054	.50300	.51366	.52260	.52994	.53672	.54002	.54282
log cos u	9.98141n	9.99472n	9.99979n	9.99842n	9.99172n	9.98039n	9.96489n	9.94514n	9.92111n	9.89244n	9.85813n
log 2 sin u	9.89894	9.65024n	8.96597	9.42108n	9.78944n	9.98179n	.10960	.20432	.27762n	.33590	.38289
log r cos u	.42329	.45478n	.47605	.48896n	.49472n	.49405n	.48749	.47508	.45683	.43246	.40135
log sin E'	9.96632	9.93751	9.90149	9.85853	9.80743n	9.74747	9.67619 −	9.58932	9.47935 −	9.33086 −	9.10231 −
log r	.44188	.46006	.47626	.49054	.50300	.51366	.52260	.52994	.53572	.54002	.54282
log cos v	9.57868	9.69906	9.78097n	9.84026n	9.88470	9.91862	9.94462	9.96445	9.97930n	9.98980n	9.99649
log cos E'	8.95008n	9.37178n	9.56952	9.69465n	9.78270n	9.84775n	9.89686	9.93398	9.96157n	9.98106n	9.99349
cos v	−.37904	−.50011	−.60391	−.69225	−.76684	−.82913	−.88028	−.92147	−.95346	−.97680	−.99196
cos E'	−.08914	−.23539	−.37113	−.49505	−.60632	−.70430	−.78861	−.85898	−.91526	−.95734	−.98513
cos v + cos E	−.46818	−.73550	−.97504	−1.18730	−1.37316	−1.53343	−1.66889	−1.78045	−1.86872	−1.93414	−1.97709
log(cos v + cos E)	9.67041n	9.86658n	9.98902n	0.07456n	0.13772n	0.18566n	.22243n	.25053n	.27154n	.28649n	.29603n
log p	9.94758	9.92940	9.91820	9.89892	9.88646	9.87580					
$\frac{p^2}{2}$	.88630	.84997	.81885	.79236	.76995	.75128	.73604	.72381	.71424	.70720	.70266
$\log(\frac{p^2}{2}+1)$	.27561	.26717	.25979	.25342	.24795	.24334	.23955	.23649	.23407	.23225	.23113
	~~.39737~~	~~.37775~~	~~.34887~~	~~.31048~~			9.99879 −	.11926 −	.01507 −	9.87088	9.64513 −
	.40820	.39757	.37775	.34887	.31043	.26113					
$\log(\frac{p^2}{2}+1)2\sin u$	.68381	.66474	.63754	.60229	.55838	.50447	.43894	.35575	.24914	.10316	9.87626

ω = 51 03 09 ω = 51 04 03

	1872 Mar 11	Apr 20	May 30	July 9	Aug 18	Sept. 27	1872 Nov 6	Dec 16	1873 Jan 25	Mar 6
M	176 04 06	184 58 59	193 53 52	202 48 45	211 43 38	220 38 31	229 31 52	238 26 36	247 21 20	256 16 04
E	176 58 29	183 50 04	190 42 25	197 36 54	204 34 57	211 38 02	218 47 28	226 05 24	233 33 40	241 14 11
½E	88 29 14	91 55 02	95 21 12	98 48 27	102 17 28	105 49 01	109 23 40	113 02 42	116 46 50	120 37 06
sin ½ E′	9.99983	9.99976	9.99810	9.99485	9.98993	9.98324	9.97463	9.96388	9.95072	9.93479
cos ½ E′	8.42144	8.52446	8.96986	9.18501n	9.32813n	9.43547n	9.52123n	9.59268n	9.65377n	9.70699n
V sin ½ v	.27200	.27197n	.27025n	.26700n	.26208	.25539	.24674n	.23599n	.22285n	.20690n
V cos ½ v	8.55928	8.66230	9.10770	9.32286	9.46597	9.57331	9.65927	9.73072	9.79181	9.84503
ν₂ v	1.71272	1.60961n	1.16255	.94415	.79611	.68208	.58749	.50525	.43102	.36187
x₂ v	88 53 24	−88 35 34	−86 03 56	−83 30 43	−80 54 52	−78 15 14	−75 30 15	−72 39 02	−69 39 44	−66 30 30
v		91 24 26	93 56 04	96 25 17	99 05 08	101 44 46	104 29 45	107 20 58	110 20 16	113 29 30
log N	177 46 48	182 48 52	187 52 08	192 58 34	198 10 16	203 29 32	208 59 30	214 41 56	220 40 32	226 59 00
u = v + ω	228 49 57	233 52 01	238 55 17	244 01 43	249 13 25	254 32 41	260 03 33	265 45 59	271 44 35	278 03 03
log sin u	9.87667n	9.90722n	9.93271n	9.95376n	9.97080n	9.98400n	9.99343n	9.99881n	9.99980n	9.99570n
log r	[illegible]	54408	54256	53968	53512	52916	.52158	.51242	.50156	.48894
log cos u	[illegible]	9.77060n	9.71281n	9.64140n	9.54988n	9.42567n	9.23712n	8.86819n	8.48312	9.14629
log r sin u	[illegible]	.45730n	.47527n	.49334n	.50592n	.51316	.51501	.51123	.50136	.48464
log r cos u	[illegible]	.31468n	.25537n	.18098n	.08500n	9.95483n	9.75870n	9.38061n	8.98468n	9.63523n
log sin v	[illegible]	8.69110n	9.13642n	9.35130n	9.49895n	9.60057n	9.68547n	9.75531n	9.81410n	9.86401n
log cos v	[illegible]	9.99948	9.99587n	9.98876n	9.97778	9.96242n	9.94185n	9.91495	9.87991	9.83392n
log cos E	9.99939n	9.99902n	9.99237n	9.97915n	9.95873	9.93014n	9.89179n	9.84106n	9.77376n	9.68232n
cos v	−99925	−99881	−99060	−97446	−95013	−91711	−87469	−82215	−75843	−.68222
cos E	−99860	−99777	−98260	−95314	−90935	−85142	−77946	−69353	−.59397	−48120
cos v + cos E	−1.99785	−1.99658	−1.97320	−1.92760	−1.85948	−1.76853	−1.65415	−1.51568	−1.35240	−1.16342
log (cos v + cos E)	.30056n	.30028n	.29517n	.28502n	.26939n	.24761n	.21857n	0.18061n	.13111n	.06573n
p	70049	70062	70308	70792	.71523	.72511	0.73825	75859	.78308	.79087
log (p/2 + 1)	23057	23061	23123	23247	23432	23682	24011	24393	24873	25428
	9.13228	9.23518	9.67898	9.89088	.02907	.12923	.20704	.26778	.31566	.35295
log (p/2 + 1) r sin v	9.36285	9.46579n	9.91021n	.12335n	.26365n	.36653n	.44715n	.51171n	.56439n	.60723n

	1873 Apr 15	May 25	July 4	Aug 13	Sept 2[illegible]	[illegible] 1	1873 Dec 11	1874 Jan 20	Mar 1	Apr 10
M	265 10 48	274 05 32	283 00 16	291 55 00	300 49 4[illegible]	[illegible] 28	318 39 12	327 3[illegible]	336 26 26	345 20 53
E	249 09 19	257 21 38	265 54 04	274 49 49	284 12 [illegible]	[illegible] 05 19	304 31 36	315 31 [illegible]	327 08 50	339 1[illegible]
½E	124 34 39	128 40 49	132 57 02	137 24 54	142 06 11	147 02 36	152 15 48	157 45 5[illegible]	163 34 25	169 38 42
sin ½ E	9.91559	9.89245	9.86448	9.83038	9.78834	9.73560	9.66783	9.57993	9.45145	9.25467
cos ½ E	9.75398	9.79586n	9.83338n	9.86704	9.89714	9.92880	9.94699n	9.96645n	9.98190n	9.99287n
	.18770n	.16456n	.13659n	.10249n	.06045n	.00771n	9.93994	9.85006	9.72358	9.52686
	9.89202	9.93350	9.97142	0.00508	.03518	.06184	.08503	.10464	.12009	.13106
tan ½ v	.29568n	.23066n	.16517n	.09741n	.02527n	9.94587n	9.85491n	9.74542	9.60345	9.39574
½ v	−63 09 06	−59 32 48	−55 38 31	−51 22 21	−46 39 59	−41 26 19	−35 36 09	−29 05 37	−21 52 00	−13 58 05
½ v	116 50 54	120 27 12	124 21 29	128 37 39	133 20 01	138 33 41	144 23 51	150 54 23	158 08 00	166 01 54.5
v	233 41 48	240 54 24	248 42 58	257 15 18	266 40 02	277 07 22	288 47 42	301 48 46	316 16 00	332 03 49
u = v + ω	284 45 57	291 58 27	299 47 01	308 19 21	317 44 05	328 11 25	339 57 45	352 51 15	7 18 29	23 06 18
log sin u	9.98542n	9.96725n	9.93847n	9.89461n	9.82773n	9.72190n	9.53680n	9.09484n	9.10450	9.59375
log r	47448	.45808	.43972	41944	.39768	.37394	.34980	32642	30504	28820
log cos u	9.40627	9.57309	9.69612	9.79246	9.86926	9.92932	9.97261	9.99661	9.99646	9.96369
r sin u	.45990n	.42533n	.37819n	.31405n	.22511n	.09584n	9.88660n	9.42122n	9.40954	9.88195
r cos u	9.88075	.03117	.13584	.21190	.26664	.30326	.32241	.32303	.30150	.25189
log sin v	9.90628n	9.94143n	9.96932n	9.98917n	9.99926n	9.99664n	9.97620n	9.92930n	9.83967n	9.67070n
log cos v	9.77237n	9.68685n	9.55989n	9.34364n	8.76444n	9.09341	9.50810	9.72193	9.85888	9.94619
log cos E	9.55125n	9.34008n	8.85417n	8.92533	9.38989	9.61079	9.75842	9.85349	9.92431	9.97099
cos v	−59207	−.21882	−36296	−.22062	−.05814	+.12400	+.32218	+.52715	+.72257	+.88346
cos E	−35584	−48624	−07148	+.08420	+.24541	+.40812	+.56679	+.71367	+.84026	+.93539
cos v + cos E	−94791	−.70506	−43444	−13642	+18727	+.53212	+.88897	1.24082	+1.56283	+1.81885
log (cos v + cos E)	9.97677n	9.84823n	9.63792n	9.13488n	9.27247	9.72601	9.94889	.09371	.19385	.25979
p	.82282	85448	89138	.93399	.98266	103715	109645	115770	121608	126416
log (p/2 + 1) r sin v	.26074	.26822	.27678	.28646	.29726	.30902	.32148	.33459	.34559	.35490
	.38076n	.39951	.40904	.40861	.39664n	.37058n	.32600n	.25572n	.14471	9.95890n
log (p/2 + 1) r sin v	~~.64150n~~	~~.66773~~	~~.68582~~	~~.69507~~	~~.69350~~	~~.67960~~	~~.64748~~			
(p/2 + 1) r sin v	64150n	66773n	68582n	69507n	69350n	67960n	64748n	.59071n	.49030n	.31380n

ω = 51 02 29
1874

	May 20	June 29	Aug 8	Sept 17	Oct 27	Dec 6	Jan 15	Feb 24	Apr 5	May 15	June 24
						1874	1875	ω = 50 58 20			
M	354 15 20	3 9 47	12 4 14	20 58 41	29 53 08	38 47 35	47 42 02	56 40 39	65 35 16	74 29 53	83 24 30
	351 49 03	4 30 38	17 06 40	29 23 00	41 09 39	52 21 30	62 57 32	73 2 42			
	175 54 31	2 15 19	8 33 20	14 41 30	20 34 50	26 10 45	31 28 46	36 31 21			
	8.85338	8.59497	9.17251	9.40418	9.54595	9.64462	9.71783	9.77462			
	9.99889	9.99966	9.99514	9.98556	9.97136	9.95800	9.93086	9.90505			
	9.12551n	8.86710	9.44464	9.67631	9.81808	9.91675	9.98996	.04666			
	.13708	.13785	.13333	.12375	.10955	.09119	.06905	.04331			
	8.98843	8.72925	9.31131	9.55256	9.70853	9.82556	9.92091	.00335			
	−5 33 41	+3 4 25	11 34 25	19 38 32	27 04 23	33 49 29	39 48 45	45 13 16			
	174 26 19							90 26 32			
v	348 52 38	6 8 15	23 08 50	39 17 04	54 08 46	67 34 54	79 37 26				
u	39 55 07	57 10 44	74 11 19	90 19 33	105 11 15	118 37 23	130 39 54	144 24 52			
	.27826	27694	.28450	.29958	.31990	34310	36720	39102			
l sin u	9.80733	9.92447	9.98325	10.00000	9.98456	9.94039	9.87997	9.79496			
	.27826	27694	28450	29958	.81990	34310	.36720	39102			
l cos u	9.88477	9.73401	9.43532	7.75487n	9.41827	9.68038	9.81400	9.89303n			
2 sin u	.08559	.20141	.26775	29958	.30446n	.28649n	.24715n	.18598			
2 cos u	.16303	.01095	9.71982	8.05445	9.73817	.02348	.18120	.28405n			
l sin v	9.28536n	9.02904	9.59450	9.80152	9.90876n	9.96580n	9.99284n	9.99999n			
l cos v	9.99176	9.99750	9.96355	9.88875	9.76769	9.58134	9.25555	7.88751n			
l cos E	9.99556	9.99865	9.98034	9.94020	9.87672	9.78584	9.65766	9.46482n			
cos v	+98122	+.99426	+91950	+77403	+58572	+38137	+.18012	−00772			
cos E	+98983	.99690	95575	87137	+75297	+61072	+45463	+29162			
cos v + cos E	+1.97105	+1.99116	+1.87525	+1.64540	+1.33869	+.99209	+.63475	+.28390			
log(cos v + cos E)	.29469	.29910	.27305	.21627	.12668	9.99655	9.80260	9.45317			
p	12934	129735	127513	123147	117517	111405	105390				
$\log(\frac{p}{2}+1)$	36048	.36122	.35701	.34860	.33750	.32511	.31258	.30053			
$\log\frac{p}{2}\sin u$	9.56362	9.30598	9.87900	.10110	.22866	.30897	.36004	.39101			
	9.92410n	9.66720	.23601	.44970	.56616	.63408	.67262	.69154			

	Aug 3	Sept 12	Oct 22	Dec 1	Jan 10	Feb 19	Mar 30	May 9	June 18	July 28	Sept 6
				1875	1876						1876
	X				X				X		
M	92 19 7	101 13 44	110 8 21	119 2 58	127 57 35	136 52 12	145 46 49	154 41 26	163 36 03	172 30 40	181 25 17
	108 32 30				139 04 04			160 25 25	167 20 55	174 13 51	181 05 41
½E	54 16 15				69 34 32			80 12 42	83 40 27	87 06 56	90 32 50
	9.90944				9.94180			9.99363	9.99785	9.99945	9.99998
	9.76638				9.54279			9.23047	9.04211	8.70176	7.98005n
	.18148				.24384			.26567	.36939	.27149	~~.27200~~ 1.27202
	9.90464				9.68105			9.36873	9.18037	8.84002	8.11829n
	.27684				.56279			.89694	1.08902	1.43147	2.15873
½v	62 8 15				74 41 43			82 46 29	85 20 33	87 52 46	90 24 8
v	124 16 30				149 23 26			165 32 58	170 41 06	175 45 32	180 48 16
v + ω = u	175 14 50				200 21 46			216 31 18	221 39 26	226 43 52	231 46 36
log r	46998				51904			53826	54166	54358	54406
sin u	8.91532				9.54153n			9.77461n	9.82261n	9.86213n	9.89520
log r	46998				57904			.53826	54166	.54358	.54406
log cos u	9.99850n				9.97198			9.90506	9.87340n	9.83606n	9.79150
log r sin u	9.38830				.06057n			−.31285	.36427n	.40571n	.43926n
log r cos u	.46848n				.49102n			−.44332n	.41506n	.37964	.38556n
sin v	9.91716				9.70687			9.39715	9.20915	8.86896	8.14736
cos v	9.75064n				9.93483n			9.98604n	9.99423n	9.99881	9.99996n
cos E	~~9.97685~~ 9.50242n				9.87877			9.97414n	9.98933	9.99775	9.99952n
	−.56318				−.86066			−.96837	−.98681	−.99725	.99992
	−.31800				−.75644			−.94220	−.97574	−.99493	.99982
	−.88118				−1.61710			−1.91057	−1.96255	−1.99220	1.99974
cos v + cos E	9.94506n				0.20874n			.28117n	.29281n	.29933n	.30096n
$\log\frac{p}{2}+1$	.26288				.24129			.23320	.23178	.23099	.23081
$\log\frac{p}{2}\sin v$	.38714				.22591			9.93541	9.75081	9.41257	8.69142
	.65002				.46720			.16861	9.98259	9.64353	8.92223n

	1876	~~1876~~	~~1877~~							
~~At~~	Oct 16	~~Nov 25~~	~~Jan 4~~	~~Feb 13~~	~~Mar 25~~	~~May 4~~	June 14	July 23	~~Sept 1~~	~~Oct 11~~
~~At~~	Oct 16	Nov 25	Jan 4	Jan 24	~~Feb 13~~	Mar 5	~~Mar 25~~	Apr 14	May 4	May 24
M				212 36 26	217 03 44	221 31 02	225 58 20	230 25 38	234 52 56	239 20 14
	190 19 54	159 14 31	208 09 08	~~212 03 45~~	~~225 58 22~~	~~234 52 19~~	~~243 47 36~~	~~252 42 13~~	~~261 36 50~~	~~270 31 27~~
E	~~194 51 15~~ 187 57 41	194 51 15	201 47 53	205 17 44	208 48 53	212 21 32	215 55 52	219 32 06	223 10 27	226 51 10
½E	93 58 50	97 25 37	100 53 56	102 38 52	104 24 26	106 10 46	107 57 56	109 46 03	111 35 13	113 25 30
lg sin ½E	9.99895	9.99634	9.99209	9.98933	9.98612	9.98245	9.97829	9.97362	9.96842	9.96264
lg cos ½E	8.84147n	9.11148n	9.27664n	9.34036n	9.39587n	9.44506n	9.48918n	9.52918	9.56574	9.59941
√r sin ½v	0.27099	.26838	.26413	.26137	.25816	.25445	.25033	.24566	.24046	.23468
√r cos ½v	8.97973n	9.24974	9.41490	9.47862	9.53413	9.58332	9.62744	9.66744	9.70400	9.73767
tg ½v	1.29126	1.01864	.84923	.78275	.72403	.67117	.62289	.57822	.53646	.49701
½v	92 55 39	95 28 20	98 3 15	99 21 52	100 41 27	102 2 11	103 24 11	104 47 40	106 12 45	107 39 43
v	185 51 18	190 56 40	196 06 30	198 43 44	201 22 54	204 04 22	206 48 22	209 35 20	212 25 30	215 19 26
u = v + ω	236 49 38	241 55 00	247 04 50	249 42 04	252 21 14	255 02 42	257 46 42	260 33 40	263 23 50	266 17 46
lg Vr										
lg sin u	9.92274n	9.94560n	9.96428n	9.97210n	9.97907n	9.98504n	9.99004n	9.99408n	9.99711n	
log r	.54312	.54072	.53686	.53440	.53150	.52828	.52464	.52060	.51616	.51130
log cos u	9.73812n	9.67279n	9.59044n	9.54023n	9.48164n	9.41173n	9.32572n	9.21483n	9.06064n	
log 2 sin u	.46586n	.48632	.50114		.51057		.51468		.51327	
log 2 cos u	.28124n	.21351n	.12730n		.01314n		9.85036		9.57674n	
log sin v	9.00865n	9.27843n	9.44319n		9.56179n		9.65410n		9.72932n	
log cos v	9.99773n	9.99203n	9.98260n		9.96903n		9.95063n		9.92639n	
~~log cos v~~										
log cos E	9.99579n	9.98524n	9.96778n		~~9.95623~~ 4259		9.90834n		9.86289n	
cos v	−.99480	−.98182	−.96073		−.93118		−.89255		−.84410	
cos E	−.99036	−.96659	−.92850		~~−.87018~~		−.80974		−.72928	
cos v + cos E	−1.98516	−1.94841	−1.88923		~~−1.83530~~ 1.80736		−1.70229		−1.57338	
log (cos v + cos E)	.29780n	.28968n	.27628n		.25705n		.23104n		.19684n	
log R/r										
R/r + 1										
log (R/r + 1)	.23119	.23218	.23378		.23601		.23880		.24252	
log 2 sin v	9.55177n	9.81915	9.98005n		.09329n		.17879n		.24548n	
log (R/r + 1) …	9.78396	.05133	.21383n		.32930n		.41969n		.48800n	
		~~Nov 20~~	~~1877~~ ~~Dec 30~~							
~~At~~ v + A + ω'			342 00 22	344 37 36	347 16 46	349 58 14	352 42 14	355 29 12	358 19 22	~~361~~ 1 13 18
v + B + ω'			252 25 55	255 03 09	257 42 19	260 23 47	263 07 47	265 54 45	268 44 55	271 38 51
v + ω'			250 52 12	253 29 26	256 08 36	258 50 04	261 34 04	264 21 02	267 11 12	270 05 08
sin (v + A + ω')			9.48984n	9.42350n	9.34281n	9.24093n	9.10879n	8.89593n	8.46641	8.32880
log r a			.53683	.53437	.53147	.52825	.52461	.52057	.51613	.51127
sin (v + B + ω')			9.97926n	9.98505n	9.98992n	9.99387n	9.99687n	9.99889n	9.99990n	9.99982n
log r b			.46777	.46531	.46241	.45919	.45555	.45151	.44707	.44221
log sin (v + ω')			9.97533n	9.98172n	9.98717n	9.99170n	9.99528n	9.99789n	9.99948n	10.00000n
log r c			.25468	.25222	.24932	.24610	.24246	.23842	.23398	.22912
x			−1.06335	−.90756	−.74866	−.58774	−.42502	−.26092	−.09606	+.06919
X			+.24253	+.55979	+.80839	+.95876	+.99431	+.91268	+.72515	+.45474
y			−2.7982	−2.82070	−2.8335	−2.83830	−2.8341	−2.8210	−2.7988	−2.7671
Y			−.8741	−.74304	−.5208	−.23528	+.0786	+.3833	+.6436	+.8306
z			−1.6983	−1.71370	−1.72380	−1.72900	−1.7288	−1.7231	−1.7118	−1.6948
Z			−.3793	−.32239	−.22599	−.10209	+.0341	+.1663	+.2793	+.3604
lg Δ cos δ cos α			9.91425n	9.64126n	8.77612	9.56940	9.75533	9.81402	9.79871	9.71927
lg Δ cos δ sin α			0.56506n	.55180	.52560	.48765	.44020	.38698	.33349	.28702
log tg α			.65081	1.01045	1.74941	.91825	0.68487	0.57289	.53478	.56775
α			87 24 14	84 25 35	88 58 47	83 7 2	78 19 37	75 01 52	73 43 41	74 51 40
α			257 24 14	264 25 35	271 01 13	276 52 58	281 40 23	284 58 08	286 16 19	285 08 20
A.R. —			17 9 37	17 37 42	18 4 5	18 27 32	18 46 49	18 59 52	19 05 05	19 00 33
lg Δ cos δ			.57564	.55396	.52567	.49079	.44928	~~.38511~~ .40197	.35125	.30238
lg Δ sin δ			.21756	.30880	.28999	.26271	.22909	.19223	.15603	.12529
log tg δ			9.74192n	9.75484n	9.76432n	9.77192	9.77981	9.79026	9.80478	9.82295
δ			−28 54 22	−29 37 28	−30 9 54	−30 36 8	−31 03 38	−31 40 24	32 32 9	33 37 50
log Δ			.63338	.61480	.58886	~~.55845~~	.51649	.47201	.42539	.38191

1877

Jun 13	July 3	July 23	Aug 12	Sept. 1	Sept. 21	Oct 11	Oct 31	Nov 20	Dec 10	Dec 30
~~279 26 04~~	~~288 20 41~~	~~297 15 18~~	~~306 09 55~~	~~315 04 32~~						
243 47 32	248 14 50	252 42 08	257 9 26	261 36 44	266 04 02	270 31 20	274 58 38	279 25 56	283 53 14	288 20 32
230 34 28	234 20 38	238 09 54	242 2 34	245 58 57	249 59 20	254 04 06	258 13 33	262 28 06	266 48 10	271 14 06
115 14 14	117 10 19	119 04 57	121 1 17	122 59 28	124 59 40	127 02 03	129 06 46	131 14 03	133 24 05	135 37 03
9.95625	9.94921	9.94147	9.93297	9.92364	9.91339	9.90215	9.88981	9.87623	9.86127	9.84476
9.63059n	9.65960	9.68669n	9.71211	9.73601n	9.75853n	9.77980n	9.79993	9.81898	9.83702	9.85412
.22829	.22125	.21351	.20501n	.19568	.18543	.17419	.16185	.14827	.13331	.11680
9.76885	9.79786	9.82495	9.85037	9.87427	9.89679	9.91806	9.93819	9.95724	9.97528	9.99238
.45944	.42339	.38856	.35464	.32141	.28864	.25613	.22366	.19103	.15803	.12442
109 08 46	110 40 05	112 13 53	113 50 32	115 30 17	117 13 27	119 0 23	120 51 30	122 47 11	124 47 54	126 54 09
218 17 32	221 20 10	224 27 46	227 41 04	231 00 34	234 26 54	238 00 46	241 43 00	245 34 22	249 35 48	253 48 18
269 15 52	272 18 30	275 26 06	278 39 24	281 58 54	285 25 14	288 59 06	292 41 20	296 32 42	300 34 08	304 46 38
9.99997n		9.99804n		9.99043		9.98408		9.95162		9.91454
.50600	50028	.49412	48750	48042	47284	.46480	45628	.44726	43776	42780
8.10848n		8.97643n		9.31722		9.42472		9.65021		9.75617
.50597n		.49216n		.47085n		.44888		.39888		.34234
8.61448n		9.47055		9.79764		9.88952		.09747		.28395
9.79216n		9.84537n		9.89056n		9.92848		9.95927n		9.98242
9.89479		9.85352n		9.79878n		9.72406n		9.61651n		9.44546n
80283n 9.~~88787~~n		9.72220n		9.60961n		9.43853n		9.11752n		8.38351
−.78487		−.71371		−.62919		−.52974		−.41354		−.27891
−.63509		−.52749		−.40702		−.27449		−.13108		+.02156
−1.41996		−1.24120		−1.03621		−.80423		−.54462		−.25735
.15229n		.09382n								
.24689		.25208								
29816		33949								
.54505n		.59157n								
4 11 24	7 14 2	10 21 38	13 34 56	16 54 26	20 20 46	23 54 38	27 36 52	31 28 14	35 29 40	39 42 10
~~5 09 44~~	~~8 12 22~~	~~11 19 58~~	~~14 33 16~~	~~17 52 46~~	~~21 19 06~~	~~24 52 58~~	~~28 35 12~~	~~32 26 34~~	~~36 28 00~~	~~40 40 30~~
274 36 57	277 39 35	280 47 11	284 00 29	287 19 59	290 46 19	294 20 11	298 02 25	301 53 47	305 55 13	310 07 43
273 03 14	276 05 52	279 13 28	282 26 46	285 46 16	289 12 36	292 46 28	296 28 42	300 20 04	304 21 30	308 34 00
8.86370	9.10009 ~~9.99653~~	9.25489	9.37077	9.46363	9.54119	9.60779	9.66607	9.71772	9.76390	9.80537
50597	50025	49409	48747	48039	.47281	46477	45625	44723	43773	42777
9.99859n	9.99611n	9.99226n	9.98669n	9.97982n	9.97081	9.95959	~~9.94748~~	9.92891	9.90840	9.88343
.43691	.43119	.42503	.41841	.41133	.40375	.39571	.38719 9.94577	.37817	.36867	.35881
9.99938n	9.99754n	9.99435n	9.98967n	9.98334	9.97512n	9.96475n	9.95187n	9.93606n	9.91673	9.89314n
.22382	.21816	.21194	.20532	.19834	.19066	.18262	.17410	.16508	.15338	.14562
+.23425	+.39042	+.56103	+.72151	+.87907	+1.03280	+1.1818	+1.32253	+1.4620	+1.5909	+1.7106
+.13306	−.20352	−.51745	−.77343	−.94203	−1.00290	−.9475	−.7802	−.5193	−.1954	+.1524
−.27259	−.26749	−.26139	−.25427	−.24612	−.23690	−.22662	−.21526	−.20281	−.18927	−.17466
+.9240	+.9139	+.8018	+.6001	+.3307	+.0235	−.2863	−.5621	−.7705	−.8881	−.8911
−.16718	−.16430	−.16080	−.15667	−.15191	−.14648	−.14040	−.13365	−.12622	−.11812	−.10933
+.4009	+.3965	+.3479	+.2604	+.1435	+.0102	−.1242	−.2439	−.3343	−.3840	−.3866
9.56503	28981 9.~~2959~~	8.63929	8.71533	8.79906	8.47567	9.36977	9.73648	9.97437	0.14473	0.27021
0.25573	.24576	.25818	.28838	.32848	.37024	40697	.43372	.44654	44370	.42123
0.69070	0.95555	1.61889	1.57305	1.52942	1.89457	1.03720	.69724	.47269	.29897	.15702
78 28 42	83 41 04	88 37 20	88 28 9	88 18 26	89 16 11	84 45 20	78 38 46	71 23 4	63 19 35	54 46 2
281 31 18	276 18 56	271 22 40	~~271 31 07~~	~~271 41 34~~	~~271 43 49~~	~~285 14 40~~	~~281 21 54~~	~~288 36 56~~	~~296 40 25~~	~~305 13 58~~
184605	182516	180531	265 28 9	268 18 26	269 16 [illegible]	264 45 20	258 38 46	251 23 4	243 19 35	234 46 2
			175352	175313	175705	17 39 1	171435	164532	161318	15 39 4
.26457	24840	25831	.28854	32867	37028	.40879	44230	49028	.49257	.50911
10411n	09569	10040	11604	13849	16274	18418	19877	2037	19457	17023
9.83954n	9.84729n	9.84209n	9.82750	9.80982	9.79246	9.77539	9.75646	9.73284	9.70200n	9.66112n
−34 38 50	−35 07 4	34 48 22	33 54 33	32 50 16	−31 48 11	−30 48 12	29 43 01	−28 23 49	−26 43 32	24 37 14
.34929	.33571	34392	36950	.40428	44094	47484	.50354	52597	.54163	.55050

L. June 28

1877 1877 1878 X X X

~~July 13.5 Sept 1 Oct 11 Nov 20 Dec 30 Jan 19. Feb 8 Feb 28 Mar 20 Mar 20 Aug.~~

~~251 33 10 255 59 44 260 26 18 264 52 52 269 19 26 273 46 00 278 12 34 282 39 38 287 5 42 291 32 16 295 58 50~~

	237 15 45	~~Sept 1~~	~~Oct 11~~	Nov 20	Dec 30.	Jan 19	Feb 8	Feb 28	Mar 20	Apr 9	Apr 29
M	251 33 10	260 26 18	269 19 26	278 12 34	287 5 42	291 32 16	295 58 50	300 25 24	304 51 58	309 18 32	313 45 6
E	237 15 45	245 2 13	253 4 17	261 24 39	270 6 23	274 36 13	279 12 40	283 56 3	288 46 56	293 45 37	298 52 29
sin E	9.92488	9.98741	9.98076	9.99570	10.00000	9.99860	9.99436	9.98703	9.97624	9.96183	9.94234
log e sin E	4.71134	4.74387	4.76722	4.78156	4.78646	4.78506	4.78082	4.77349	4.76270	4.74799	4.72880
	-51445	-55446	-58509	-60473	-61159	-60963	-60770	-59360	-57903	-55975	-53555
	-14 17 25	-15 24 6	-16 15 9	-16 47 53	-16 59 19	-16 56 3	-16 46 10	-16 29 20	-16 5 3	-15 32 55	14 52 35
E	237 15 45	245 2 12	253 4 17	261 24 41	270 6 23	274 36 13	279 12 40	283 56 04	288 46 55	293 45 37	298 52 31
½E	118 37 52	122 31 06	126 32 08	130 42 20	135 3 12	137 18 6	139 36 20	141 58 02	144 23 27	146 52 48	149 26 15
log sin ½E	9.94336	9.92594	9.90498	9.87991	9.84908	9.83132	9.81161	9.78966	9.76511	9.73757	9.70627
log cos ½E	9.68049n	9.73063n	9.77475n	9.81436n	9.84989n	9.86625n	9.88173	9.89634n	9.91009	9.92300	9.93504
log tan ½v	.26287	~~.19531~~	.13023	.06535	~~9.99919~~	9.96507	~~9.92988~~	~~9.89332~~	9.85502	~~9.81457~~	~~9.77123~~
	.21544	.19802	.17706	.15179	.12116	.10340	.08369	.06174	.03719	.00959	9.97835
	~~118 38 57~~ ~~9.87751~~	9.86995	9.91407	9.95368	9.98921	0.00557	.02105	.03566	.04941	.06232	.07436
	~~237 15 42~~	.32807	.26299	.19811	.13195	.09783	.06264	.02608	9.98778	9.94727	9.90399
~~log tan~~ ½v	0.35563 -68 5 36	-64 50 6	-61 22 33	-57 38 14	-53 34 24	-51 28 59	49 07 05	-46 43 10	-44 11 40	-41 31 50	-38 43 5
½v	111 54 24	115 9 54	118 37 27	122 21 46	126 25 36	128 36 01	130 52 55	133 16 50	135 48 20	138 28 10	141 16 55
v	223 48 48	230 19 48	237 14 54	244 43 32	252 51 12	257 12 2	261 45 50	266 33 40	271 36 40	276 56 20	282 33 50
log √r	.24795	.24133	.23367	.22510	.21557	.21046	.20513	.19961	.19390	.18807	.18214
u = v+ω	275 49 12	282 20 12	289 15 18	296 43 56	304 51 36	309 12 26	313 46 14	318 34 04	323 37 04	328 56 44	334 34 14
log sin u	9.99776n	9.98985n	9.97500n	9.95091n	9.91411n	9.88923n X	9.85861n	X	9.77318n	X	9.63286n
log r	.49598	.48266	.46734	.45020	.43114	.42092	.41026	.39922	.38780	.37614	.36428
log cos u	9.00605	9.32971	9.51822	9.65304	9.75689	9.80080	9.83996		9.90584		9.95574
log r sin u	.49374n	.47251n	.44234n	.40111n	.34525n		.26887n		.16098n		9.99714n
log r cos u	9.50203	9.81237	9.98556	.10324	.18803		.25022		.29364		.32002
log r	49598	48266	46734	45020	43114		.41026		38780		36428
log sin v	9.84030n	9.88634n	9.92481n	9.95630n	9.98025n		9.99550n		9.99983n		9.98947n
log cos v	9.85829n	9.80507n	9.73320n	9.63039n	9.46955n		9.15611n		8.44895		9.33752
log cos E	9.73303n	9.62535n	9.46416n	9.17417n	7.26877		9.20432		9.50781		9.68386
cos v	-72159	-63887	-54101	-42697	-29482		-14326		+02812		+21753
cos E	-54079	-42204	-29118	-14934	+00186		+16007		+32197		+48291
cos v + cos E	-1.26238	-1.06141	-.83219	-.57631	-.29296		+01681		+35009		+70044
log (cos v + cos E)	0.10120n	0.02588n	9.92022n	9.76066n	9.46681n		8.22557		9.54418		9.84537
log (e/2 + 1)	25188	25780	26472	27263	28164		29172 ~~28608~~		30285 ~~29172~~		31481 ~~30265~~
log 2 sin v	.33628	.36900n	.39215n	.40650n	.41139n		.40576n		.38763n		.35375n
log (e/2 + 1) 2 sin v	.58816n	.62680n	.65687n	.67913n	.69303n		.69748n		.69048n		.66856n
u+A+ω'	10 20 14	16 51 14	23 46 20	31 14 58	38 22 38	43 42 28	48 17 16	53 5 6	58 8 6	63 27 46	69 5 16
u+B+ω'					309 46 5	314 6 55	318 40 43	323 28 33	328 31 33	333 51 13	339 28 43
u+ω'					308 20 7	312 40 57	317 14 45	322 2 35	327 5 35	332 25 15	338 2 45

These constants are computed for B. M. 1/2 h instead of 0h

	Dec 30	Jan 19	Feb 8	Feb 28	Mar 20	Apr 9	Apr 29
log sin (u+A+ω')	.43111	42089	41023	39919	38777	37611	.36425
log r a	9.80238	9.83960	9.87303	9.90283	9.92906	9.95165	9.97041
log sin (u+B+ω')	9.88572n	9.85609n	9.81973n	9.77464n	9.71777n	9.64411n	9.54476n
log 2 b	.36202	.35180	.34114	.33010	.31868	.30702	.29516
log sin (u+ω')	9.89453n	9.86636n	9.83178n	9.78892n	9.73502n	9.66556n	9.57271n
log 2 c	.14981	.13879	.12813	.11709	.10567	.09401	.08215
x	+1.7119	+1.8218	+1.9198	+2.0246	+2.0741	+2.1270	+2.1610
X	+.15242	+ 4893	+ 7574	+ 9331	+ 9966	+ 9422	+7781
y	-1.7690	-1.6140	-1.4484	-1.2728	-1.0876	-8936	-6917
Y	-.8911	-7832	-5805	-3070	+0036	+3138	+5876
z	-1.1055	-1.0119	-9118	-8054	-6929	-5749	-4517
Z	-3866	-3358	-2519	-1332	+0015	+1362	+2550
log Δ cos δ cos α	27057	36382	42768	46795	48724	48703	.46821
log Δ cos δ sin α	.42490	.37970	.30726	.19860	.03503	9.76328	9.01745n
log tan α	.15438n	.01588	9.87958n	9.73065n	9.54777n	9.27625n	8.54924n
α	-54 58 33	-46 2 52	-37 9 24	-28 16 23	-19 26 38	-10 41 51	-2 1 43
α	305 01 27	313 57 08	322 50 36	331 43 37	340 33 22	349 18 9	357 58 17
log Δ cos δ	51167	.52242	.52623	.52312	.51274	.49464	.46848
log Δ sin δ	.17380	13088	06584	9.97248	9.83973	9.64217	9.29425
log tan δ	9.66213n	9.60846n	9.53961n	9.44936n	9.32699n	9.14753n	8.82577n
δ	-24 40 16	-22 5 39	-19 6 27	-15 43 5	-11 59 14	-7 59 42	-3 45 49
log Δ	.55325	.55554	.54984	.53967	.52181	.49888	.46945
α =	h m s 20 20 4	20 55 48	21 31 23	22 6 55	22 42 13	23 17 12	23 57 53

		X		X		X		X		X		X	1878
.	~~Apr 29~~	~~May 19~~	~~June 8~~	~~June 28~~	~~July 18~~	~~Aug 7~~	~~Aug 27~~	~~Sept 16~~	~~Oct 6~~	~~Oct 26~~	~~Nov 15~~	~~Dec 5~~	~~Dec 25~~
-50	300 25 24	304 51 58	~~309 18 32~~	313 45 6	317 18 40	322 36 14	327 4 45	331 31 22	335 57 56	340 24 30	344 57 04	349 17 38	353 44 12
9	May 19	June 8	June 28	July 18	Aug 7	Aug 27	Sept 16	Oct 6	~~Oct 26~~	Nov 15	Dec 5	Dec 25	~~Dec 45~~
5-6	318 11 40	322 38 14	327 4 48	331 31 22	335 57 56	340 24 30	344 51 4	349 17 38	353 44 12	358 10 46	2 37 20	7 3 54	11 30 28
29	304 7 55	309 32 9	315 5 12	320 46 52	326 37 4	332 35 14	338 40 29	344 51 24	351 6 54	357 24 39	3 43 33	10 1 20	16 16 01
34	9.91790	9.88718	9.84883	9.80091	9.74054	9.66814	9.56073	9.41703	9.18879	8.65489	8.81279	9.24062	9.44733
80	4.70436	4.67364	4.63529	4.58737	4.52700	4.44960	4.34719	4.20349	3.97525	3.44185	3.59925	4.02708	4.23379
5-	-50625	-47167	-43181	-38670	-33651	-28158	-22243	-15977	-9446	-2763	+3974	+10644	+17131
35-	-14 34 5	18 6 7	11 59 41	10 44 30	9 20 51	7 49 18	6 10 43	4 26 17	2 37 26	0 46 3	+1 6 14	+2 57 24	+4 45 31
31	304 7 55	309 32 7	315 5 7	320 46 52	326 37 5	332 35 12	338 40 21	344 51 21	351 6 46	357 24 48	3 43 34	+10 1 18	16 15 59
15	152 3 57	154 46 3	157 32 33	160 23 26	163 18 32	166 17 36	169 20 10	172 25 40	175 33 23	178 42 22	1 51 47	5 0 39	8 8 0
27	9.67067	9.62971	9.58206	9.52583	9.45820	9.37466	9.26728	9.11984	8.88918	8.35374	8.51203	8.94123	9.15069
04	9.94620	9.95645	9.96575	9.97405	9.98131	9.98745	9.99243	9.99620	9.99869	9.99989	9.99977	9.99834	9.99561
23	~~9.72447~~	~~9.67326~~	~~9.61631~~	~~9.55178~~	~~9.47689~~	~~9.38721~~	~~9.27485~~	~~9.12364~~	~~8.89046~~	~~8.35385~~	~~8.51226~~	~~8.94288~~	~~9.15508~~
-35	9.94275	9.90179	9.85414	9.79791	9.73028	9.64674	9.53936	9.39192	9.16126	8.62582	8.78411	9.21331	9.42279
36	.08552	.09577	.10507	.11337	.12063	.12677	.13175	.13552	.13801	.13921	.13909	.13766	.13493
99	9.85723	9.80602	9.74907	9.68454	9.60965	9.51997	9.40761	9.25640	9.02325	8.48661	8.64502	9.07565	9.28784
35-	-35 44 57	~~+8 6 43~~ -32 36 35	-29 17 55	-25 48 41	-22 8 57	-18 19 13	-14 20 22	-10 13 48	-6 1 21	-1 45 23	+2 31 42	+6 47 17	10 58 48
56	144 15 9	147 23 25	150 42 5	154 11 19	157 51 3	161 40 47	165 39 38	169 46 12	173 58 39	178 14 37			
50	288 30 18	294 46 50	301 24 10	308 22 38	315 42 6	323 21 34	331 19 16	339 32 24	347 57 18	356 29 14	5 03 24	13 34 34	21 57 36
14	.17618	.17027	.16451	.15902	.15392	.14936	.14550	.14248	.14041	.13941	.13951	.14072	.14295
414	340 30 42	346 47 14	353 24 34	~~360~~ 0 23 02	7 42 30	15 21 58	23 19 40	31 32 48	39 57 42	48 29 38	57 3 48	65 34 58	73 58 00
86	X	9.35902n	X	7.82608	X	9.42323		9.71866	X	9.87442	X	9.95931	
28	.35236	.34054	.32902	.31804	.30784	.29872	.29100	.28496	.28082	.27882	.27902	.28144	28590
74		9.98835		10.00000		9.98419		9.93055		9.82132		9.61635	
14		9.69956		8.14412		9.72195		0.00362		.15324		.24075	
02		.32889		.31804		.28291		.21551		.10014		9.89779	
8		.34054		.31804		.29872		.28496		.27882		.28144	
7n		9.95805n		9.89428		9.77582n		9.54351		8.78726		9.37058	
b		9.62236		9.79298n		9.80439		9.97170n		9.99518n		9.98769	
3		9.80383		9.~~80091~~ 88915		~~9.88389~~ 9.94827 ~~.66314~~ 88915		~~9.66314~~ 9.9465 ~~41505~~		~~8.65470~~ 9.99556		~~9.99332~~ 9.99382	
91		+.41914		+.62085		+.80240		+.43692		+.99812		+.97206	
44		+.63655		~~+.63229~~ +.99473		~~+.46022~~ +.88851		~~+.24125~~ .90528		+.99900		+.98474	
3		+1.05569		+1.39558		+1.69011		~~+1.89249~~ 1.90220		+1.99712		+1.95680	
		0.02354		0.14476		0.22791		0.27926		0.30040		0.29155	
		32722 ~~31461~~		33927 ~~32722~~		34986 ~~33927~~		35752 ~~34986~~		36103 ~~35752~~		35949	
		.29852n		.21232n		.07484		9.82847n		9.06608n		9.65202	
		.62581n		.55159n		.42440n		.18599n		9.42711n		0.01151	
16	75 1 44	8 18 16 ~~75 1 44~~	87 55 36	94 54 4	102 13 32	109 53 00	117 50 42	126 3 50	134 28 44	143 00 40	151 34 50	160 6 0	168 29 2
43	34 25 11	351 41 43	358 19 3	5 17 31	12 36 59	20 16 27	28 14 9	36 27 17	44 52 11	53 24 7	61 58 17	70 29 27	78 52 25
45	343 59 13	350 15 45	356 53 5	3 51 33	11 11 1	18 50 29	26 48 11	35 1 19	43 26 13	51 58 9	60 32 19	69 3 29	77 26 31
5	35233	34051	32899	31801	.30781	29869	29097	.28493	.28079	.27879	27899	.28141	28587
1	9.98500	9.99498	9.99972	9.99841	9.99004	9.97331	9.94656	9.90761	9.85340	9.77935	9.67754	9.53196	9.30026
bn	9.40095n	9.22823n	8.46777n	8.96488	9.33930	9.58972	9.67495	9.77392	9.84850	9.90463	9.94582	9.97432	9.99176
6	.28324	.27142	.25976	.24892	.23872	.22960	.22188	.21584	.21170	.20970	.20990	.21232	.21678
7n	9.44068n	9.15968n	8.73516n	8.82804	9.28770	9.50913	9.65410	9.75883	9.83731	9.89635	9.93986	9.97082	9.98948
5	.07023	.05841	.04689	.03591	.02571	.01659	.00887	.00283	9.99869	9.99669	9.99689	9.99931	.00377
	+2.1744	+2.1652	+2.1316	+2.0722	+1.9854	+1.8707	+1.7280	+1.5579	+1.3621	+1.1433	+.9045	+.6507	+.3856
	+5248	+2120	-1245	-4471	-7197	-9113	-9990	-9711	-8292	-5882	-2760	+0700	+4556
	-4833	-2698	-0534	+1636	+3785	+5879	+7886	+9767	+1.1487	+1.3012	+1.4313	+1.5376	+1.6164
	+7941	+9110	+9257	+8371	+6549	+3991	+0978	-2147	-5018	-7288	-8675	-8998	-7852
	-3243	-1935	-0605	+0731	+2053	+3355	+4603	+5777	+6855	+7817	+8645	+9325	+9846
	+3445	+3952	+4016	+3632	+2842	+1731	+0424	-0931	-2177	-3162	-3764	-3904	-3405
	.43124	37607	30257	.21058	.10233	9.98200	9.86273	9.76849	9.72665	9.74437	9.79831	9.85775	9.94012
	9.49248	9.80699	9.94066	0.00030	.01427	9.99432	9.94763	9.88195	9.81084	9.75770	75113	.80468	9.91974
	9.06124	9.43092	9.63809	9.78942	9.91194	0.01232	0.08490	0.11346	0.08419	0.01333	9.95282	9.94693	9.97957
	+6 34 6	+15 4 42	+23 29 24	31 37 26	39 13 51	45 48 46	50 33 55	52 24 04	50 31 10	45 52 45	41 53 39	41 30 30	43 39 15
48	.43410	.39129	.34014	.28069	.21325	.13876	.05981	9.98306	9.92331	9.90165	9.92652	9.98035	.06067
25	8.30535	9.30471	9.53288	9.63979	9.68975	9.70638	9.70217	9.68538	9.67006	9.66752	9.68851	9.73408	9.80882
7n	7.87125	8.91342	9.19274	9.35910	9.47650	9.56762	9.64236	9.70232	9.74675	9.76627	9.76199	9.75073	9.72815
49	+0 25 34	+4 41 1	+8 51 32	+12 52 39	+16 40 36	+20 16 47	+23 41 48	+26 44 33	+29 10 5	+30 16 37	+30 1 54	+29 23 32	+25 8 9
45	434 10	.39274	.34535	.29175	.23191	.16655	.09806	.03219	9.98220	9.96534	9.98913	.04319	.1352
753	0 2616	1.019	1 3357	2 629	2.3655	3 315	3 2215	3.2936	3 225	3 2331	2 4734	2 462	

D about Nov 10

25437

4

$\Omega + \Omega' = 175°53'4.3''$ I = 8° 14' 5'' l sin I 9.15671
l cos I 9.99548

	1869 Oct. 13	Nov 22	1870 Jan. 1	Feb. ~~Jan~~ 10	Mar 22 ~~Feb 10~~	May 1	June 10	July 20	Aug 29	Oct 8
L'	43 30 24	47 12 21	50 48 35	54 29 4	57 58 44	61 32 30	65 05 21	68 37 14	72 08 06	75 37 57
L' − (Ω' + ω')	227 42 41	231 19 38	234 55 52	238 31 21	242 6 1	245 39 47	249 12 38	9.96974	248 01 49	251 31 40
l cos u'	9.86909n	9.89250n	9.91300n	9.93087n	9.94634n	9.95958n	9.97076n	[illegible]	9.98735n	9.99302n
l tang u'	.04017	.09671	.15366	.21306	.27616	.34458	.42061	58727	61103	74218
l tang γ'	.03666	.09219	.14914	.20854	.27164	.34006	41609	50675	.61057	74166
γ'	227 24 53	231 2 10	234 39 00	238 15 22	241 57 10	245 26 18	249 0 42	252 42 22	256 13 26	259 43 31
v + ω'	202 22 37	218 40 11	235 47 31	253 5 47	269 52 55	285 31 49	299 56 7	312 52 43	324 24 43	334 44 45
λ' − (v + ω')	~~214 07 ..~~ 250 12 16	221 59	358 57 29	345 9 35	331 57 15	319 50 29	309 4 35	299 49 39	291 48 43	284 58 46
log sin β'	9.02580n	9.04921n	9.06971n	9.08745n	9.10305n	9.11629n	9.12747n	9.13666n	9.14406n	9.14971n
log r'	69735	69800	.69877	69957	70043	70135	.70231	.70333	70438	.70547
log cos β'	9.99754	9.99726	9.99699	9.99673	9.99648	9.99626	9.99606	9.99589	9.99574	9.99563
log z' = log r' sin β'	9.72315n	9.74724n	9.76848n	9.78715n	9.80348n	9.81764n	9.82978n	9.83999	9.84844	9.85518
log sin (λ' − (v + ω'))	9.62056	9.33074	8.29950n	9.40845n	9.67202n	9.80947n	9.89003n	9.93828n	9.96774n	9.98499n
log r' cos β'	.69489	.69526	.69576	.69630	.69691	.69761	.69837	.69922	.70019	.70110
log cos (λ' − (v + ω'))	9.95714	9.80980	9.99991	9.98527	9.94582	9.88326	9.79959	9.69670	9.58003	9.41241
log cos γ' =	9.75468	9.98706	9.99690	9.98200	9.94230	9.87952	9.79565	9.69259	9.56577	9.40804
log sin γ'	9.63749	9.38115	9.07574	9.45027	9.68400	9.81464	9.89259	9.93961	9.96840	9.98579
log r' cos γ'	.65203	.68509	.69567	.68153	.64293	.58087	.49796			
− r' cos γ'	− 2.4878	− 4.8428	− 4.9622	− 4.8032	− 4.3927	− 3.8095	− 3.1475	− 24884	− 18620	− 1.2987
r	+ 1.9823	1.9169	1.8873	1.8971	1.9449	2.0251	2.1297	2.2500	2.3794	2.5110
r − r' cos γ'	− 2.5055	2.9259	− 3.0749	− 2.9061	− 2.4478	− 1.7844	− 1.0178	− 0.2384	+ 0.5176	+ 1.2123
log r' sin γ' = log Q sin l	.33484	.07918	9.77451	.14984	.38443	.51599	.59490	70114	70662	70893
log Q cos l'	.39830n	.46626n	.48763	.46334n	.38873n	.25149n	.00766n	9.37731n	9.71357	0.08361
log tang l'	9.93594n	.61292n	9.28668n	9.68668n	9.99566n	.26450n	.58724n	1.26563n	.95922	.60715
log Q	.51973	50002	.49571	51[illegible]	.53718	.57226	60896	.64358	67539	70863
	9.48036	9.49998	9.50499	9.49006	9.46287	9.42774	9.39104	9.35642	9.32461	9.29637
	8.44108	8.49994	8.51257	8.47201	8.38861	8.28322	8.17312	8.06926	7.97383	7.88411
	.027611	.031619	.032558	.029649	.024469	.019197	.014898	.0117290	.0094152	.0077466
	.008040	.008052	.008011	[illegible]	.007920	.007869	.007818	.0077627	.0077066	.0076488
	.019521	.023567	.024541	.021682	.016559	.011328	.007080	+.0039663	+.0017086	+.0000978
log a	8.29050	8.37230	8.38189	8.33610	8.21877	8.05415	7.85003	7.59839	7.23264	5.99064
log z'	9.72315n	9.74724n	9.76848n	9.78715n	9.80848n	9.81764n	9.82978n	9.83999n	9.84844n	9.85518n
log W₀	9.95065	0.05554n	0.09537n	0.06025n	9.95928n	9.80877n	9.61681n	9.37538n	9.01808n	7.78252n
log a	8.27950	8.37230	8.38989	8.33610	8.21877	8.05413	7.85003			
log y'	.32045	.01603	8.99526n	0.10475n	.36893n	.50708n	.58840n			
log S₀	.54892	.32538	9.32213n	.37785n	.52470n	.49821n	.37543n	.17289n	9.83757n	8.61343n
log x'	.65203	.67509	.69567	.68157	.64273	.58087n	.49796			
4x'	+ 0.87695	.11153	.12178	.10418	.072685	.043134	.022284	+.009890	+.0031826	+.0001270
$\frac{2}{a^3}$	− .054772	.06061	− .06143	− .05625	− .047388	− .038874	− .031728	− .027908	− .0236410	− .020318
$4x' - \frac{2}{a^3}$	+ .032873	.05092	+ .06035	+ .04790	+ .025107	+ .004260	− .009444	− .018038	− .0204584	− .020191
$\log(4x' - \frac{2}{a^3})$	8.51684	8.70689	8.78068	8.68033	8.39979	7.63144	7.97516n	8.25619n	8.31086n	8.30516n
log K₀	.45384	.64389	.71768	.61733	.33679	9.56844	9.91216n	0.19319n	0.24786n	0.24216n

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	Oct. 13	Nov 22	Jan. 1	Feb. 10	Mar 22	May 1	June 10	July 20	Aug 29	Oct 8
L'	257 48 16	259 00 37	260 12 55	261 25 12	262 37 27	263 49 40	265 01 52	266 14 03	267 26 12	268 38 21
u'	87 50 57	89 3 12	90 15 30	91 27 47	92 40 2	93 52 15	95 4 27	96 16 38	97 28 47	98 40 56
l sin u'	9.99969	9.99994	9.99999	9.99986	9.99953	9.99901	9.99829	9.99739	9.99629	9.99499
l tang u'	1.42497	1.78189	2.34594	1.59277n	1.33175n	1.17966n	1.15762n	0.93861n	0.88176n	81615n
	1.411[illegible]n	9.4047[illegible]n	9.193[illegible]n							

	Oct. 13	Nov 22	Jan. 1	Feb. 10	Mar 22	May 1	June 10
T'	87 49 12	89 02 28	90 15 40	91 28 54	92 42 04	93 55 12	95 08 19
v + ω'	208 23 32	224 41 06	241 48 26	259 0 42	275 53 50	291 36 44	305 57 02
λ' − (v + ω')	239 25 40	224 21 22	208 27 04	192 22 12	176 48 14	162 18 28	149 11 17
l sin β'	9.19946	9.19971	9.19976	9.19963	9.19930	9.19878	9.19806
log r'	1.00152	1.00164	1.00175	1.00184	1.00193	1.00201	1.00207
l cos β'	9.99449	9.99448	9.99448	9.99449	9.99449	9.99451	9.99462
l z'	.20078	.20135	.20157	.20147	.20123	.20079	.20013
l sin (λ' − …)	9.93570n	9.84455n	9.67723n	9.33088n	8.74627	9.48274	9.70946
l r' cos β'	.99601	.99612	.99623n	.99633	.99642	.99652	.99659
l cos (λ' − …)	9.70640n	9.85431n	9.94408n	9.98980n	9.99932n	9.97896n	9.93392n
log cos γ' = l r' cos β'	9.70089n	9.84879n	9.93858n	9.98429n	9.99381n	9.97347n	9.92844n
l sin γ'	9.93686	9.85018	9.69[illegible]	9.42190	9.22437	9.53036	9.72416
l r' cos γ'	.70241n	.85048	.94033	.98613	.99574n	.97548n	.93037n
− r' cos γ'	+ 5.0398	+ 7.0865	+ 8.7163	+ 9.6857	+ 9.9024	+ 9.4511	+ 8.5214
r	+ 1.9823	+ 1.9169	+ 1.8873	+ 1.8971	+ 1.9449	+ 2.0251	+ 2.1297
r − cos γ'	7.0221	9.0034	10.6036	11.5828	11.8473	11.4762	10.6511
log sin l'	.93840	.81782	.69754	.42374	.22630	.53237	.72623
log cos l'	~~.98334~~	~~.93031~~	1.02545 ~~.84353~~	1.06332 ~~.62615~~	1.07362	1.05979	1.02739
log tang l'	.91193	9.89741	9.67209	9.35992	9.15268	9.47258	9.69884
log ρ	[illegible]	8.94037	8.93121	8.92506	8.92204	8.92174	8.92418
log ρ	1.04779	1.05963	1.06877	1.07992	1.07796	1.07818	1.07582
log ρ³ =	6.85663	6.82111	6.79368	6.77529	6.76612	6.76561	6.77234
$\frac{1}{\rho^3}$	+.0007188	+.0006624	+.0006218	+.0005760	+.0005836	+.0005829	+.0005923
$\frac{1}{r^3}$	−.0009876	−.0009887	−.0009880	−.0009874	−.0009868	−.0009862	−.0009858
$\frac{1}{\rho^3} - \frac{1}{r^3} = \Delta$	−.0002706	−.0003263	−.0003662	−.0003914	−.0004032	−.0004033	−.0003933
log Δ =	6.43265n	6.51362n	6.56372n	6.59263n	6.60552n	6.60563n	6.59494n
log z' =	.20098	.20135	.20157	.20147	.20123	.20079	.20013
log W₀ =	8.04667n	8.12801n	8.17827n	8.20714n	8.21979n	8.21946n	8.20811n
log S₀	8.77670	8.76533	8.65099	8.33288	8.76125n	8.49793n	8.71403n
4x'	+.0013648	+.0023124	+.0031919	+.0037911	+.0039527	+.0038117	+.0033609
$\frac{2}{a^3}$	+.0014249	+.0010642	+.0011735	+.0011306	+.0011351	+.0011805	+.0012614
$4x' - \frac{2}{a^3}$	−.0000598	+.0010427	+.0020184	+.0026605	.0028576	+.0026312	+.0020997
log K₀	7.15974n	8.41828	8.71805	8.83800	8.86504	8.83319	8.73516

July 20	Aug 29	Oct 8
.95309n	.87624n	.81063n
96 21 25	97 34 27	98 47 29
137 27 47	127 [illegible]8 49	118 1 40
9.19716	9.19606	9.19476
1.00213	1.00217	1.00220
9.99455	9.99458	9.99461
.19929	.19823	.19696
9.82999	9.90155	9.94582
.99668	.99675	.99681
9.86737n	9.78094n	9.67201n
9.86192n	9.77532n	9.66662n
9.83629	9.90456	9.94782
.86401n	.77764n	.66882n
+ 7.3123	+ 5.9930	+ 4.6647
+ 2.2604	+ 2.3794	+ 2.5110
+ 9.5627	+ 8.3724	+ 7.1757
.83842	.90673	.94952
.98018	.92285	.84586
9.85784	9.98388	.19376
1.07145	1.09170	1.01821
8.92853	8.93455	8.94179
6.78565	6.80365	6.82587
+.0006104	+.0006363	+.0006689
−.0009854	−.0009857	−.0009849
−.0008750	−.0103488	−.0103640
6.57403n	6.54258n	6.49969n
.19927	.19823	.19696
8.18694n	8.15385n	8.10982n
8.81374n	8.83388n	8.85549n
.86401n	.77769n	.66882n
7.43808	7.32027	7.16864
+.002742	+.00[illegible]	+.001[illegible]
−.0013750	−.0015140	−.0016496
+.0011006	+.000[illegible]	−.0002085
8.43467	[illegible]	7.72501n

3160

8.44820

1870 1871 | 1871 1872

Nov 17	Dec 27	Feb 5	Mar 17	Apr 26	June 5	July 15	Aug 24	Oct 3	Nov 12	Dec 22
79 06 42	82 34 23	86 00 57	89 26 23	92 50 41	96 13 51	99 35 52	102 56 45	106 16 30	109 35 07	112 52 37
255 00 25	258 28 06	261 54 40	265 20 06	268 44 24	272 07 34	275 29 35	287 03 02	290 22 47	293 41 24	296 58 59
9.99695	9.99927	10.00000	9.99917	9.99680	9.99290	9.98746	9.98048n	9.97193n	9.96177n	9.94096n
.92464	1.23621	2.67653	1.20812	.91412	.73905	.61393	.51331	.43004	0.35757	9.29817
.92412	1.23569	2.67641	1.20750	.91350	.73853	.61341	.50879	.42552n	.35315	0.29317 288605
263 12 31	266 40 24	270 07 16	273 32 58	276 57 28	280 20 51	283 41 16	287 13 03	290 34 32	293 54 37	297 13 26
344 03 03	352 29 52	0 13 51	7 22 29	14 01 59	20 17 43	26 13 59	31 52 23	37 20 23	42 38 47	47 49 37
279 09 28	274 10 32	269 53 23	266 10 29	262 55 29	260 03 08	257 27 14	255 20 40	253 14 09	251 15 50	249 23 49
9.15366n	9.15598n	9.15671n	9.15588n	9.15351n	9.14961n	9.14417n	9.13719n	9.12864n	9.11848n	9.10667n
70660	70775	70893	71012	71133	71255	71378	71501	71623	71745	71866
9.99555	9.99550	9.99549	9.99550	9.99555	9.99563	9.99574	9.99588	9.99604	9.99622	9.99642
9.86026	9.86373	9.86564	9.86600n	9.86484	9.86216	9.85795	9.85220	9.84487	9.83593	9.82533
9.99493n	9.99885n	10.00000n	9.99903n	9.99668n	9.99342n	9.98957n	9.98563n	9.98174n	9.97635n	9.97130n
.70215	.70325	.70442	.70562	.70688	.71818	.70952	.71085	.71227	.71367	.71508
9.20183	8.86221	7.28436n	8.82422n	9.09052	9.23742	9.33688	9.40313	9.46004n	9.50679n	9.54640
9.19738	8.85771	7.27985	8.81972	9.08607	9.23305	9.33262n	9.39501n	9.45608	9.50301n	9.54282n
9.99454	9.99887	10.00000n	9.99905	9.99675	9.99355	9.98977	9.98591n	9.98149	9.97678	9.97180
−0.80165	−36767	+.00974	+33872	+62720	+88227	+111278	+130024	+148700	+166138	+182592
2.64100	2.76620	2.88440	2.99410	3.09420	3.18420	3.26330	3.33120	+3.38800	+3.42340	+3.46750
+1.83935	+2.39853	+2.87464	+~~2.65538~~	+~~2.46702~~	+~~2.30933~~	+2.15052	+4.63144	+4.87500	5.09478	5.28342
~~.70917~~	~~.70808~~	~~.70610~~	3.33282	3.72140	4.06680	4.37608				
.70114	.70662	.70893	0.70917	.70808	.70610	.70399	.70092	.69772	.69423	.69046
.26466	.37994	.46157	.52285	.57071	.60919	.64109	.66571	.68797	.70712	.72374
.43648	.32668	.24742	.18656	.13737	.09691	.06240	.03521	.00975	9.98711	9.96672
72845	75019	76922	78592	80060	81352	82504	83455	84340	85128	85826
9.27155	9.24981	9.23078	9.21408	9.19940	9.18648	9.17496	9.16545	9.15660	9.14872	9.14174
781465	774943	769234	764224	759820	755944	752488	749635	746950	744616	742522
.0065261	.0056161	.0049243	.0043876	.0039647	.0036261	.0033488	.0031358	.0029499	+.0027936	+.0026621
.0275893	.0275293	.0274681	.0274070	.0273455	.0272837	.0272221	71610	71009	70413	.0269827
−.0010632	−.0019132	−.0025438	−.0030194	−.0033808	−.0036576	−.0038733	−.0040252	.0041510	.0042477	.0043206
7.02662	7.28176n	7.40548	7.47991	7.52902n	7.56820	7.58808	7.60479n	7.61815	7.62815	7.63554
9.86026n	9.86373n	9.86564n	9.86600n	9.86484	9.86216n	9.85795	9.85220n	9.84487n	9.83593	9.82533n
8.82388	9.08245	9.20812	9.2				[illegible]	9.40002	9.40108	9.39787
9.66020	9.92084	.04690	.1					24856	25517	25892
				27177		13909				
−.0008523	−.0007034	+.0000248	+				38	+.0061725	.0070569	.0078890
−.0180520	−.0161990	−.0147435	−.0135765	−.0126245	−.0118330	−.0112280	−.0104460	−.0099632	−.0095914	−.0092309
−.0189043	−.0169024	−.0147683	~~−.0145992~~ −.0125538	−.0105040	−.0086308	−.0066180	−.0052122	−.0038207	−.0025345	−.0013415
8.27655n	8.22794	8.16932n	8.09878	8.02135n	7.93099n	7.82073	7.71702n	7.58214n	7.40389	7.12772n
0.21355n	0.16494n	0.10632n	0.03578n	9.95835n	9.86799n	9.75773n	9.65402n	9.51914n	9.34085n	9.06472n
269 50 29	271 02 37	272 14 45	273 26 53	274 39 01	275 51 10	277 03 20	278 15 30	279 27 42	280 39 56	281 52 11
99 53 4	101 5 12	102 17 20	103 29 28	104 41 36	105 53 45	107 5 55	108 18 5	109 30 17	110 42 31	111 54 46
9.99310	9.99182	9.98943	9.98785	9.98532	9.98307	9.98037	9.97746	9.97433	9.97099	9.96743
.71583n	.70785n	(.66188n)	.61994n	.58133n	.54549n	.51199n	.48017n	.45074n	.42247n	.39530n
.73331n	.69775n	.65636n	.61442n	.57581n	.53997n	.50647n	.47499n	.44522n	.41695n	.38998n
100 0 30	101 13 20	102 26 29	103 39 26	104 52 23	106 5 19	107 18 16	108 31 10	109 44 6	110 57 1	112 9 57
109 56 32	102 49 32	96 11 42	90 16 2	84 49 29	79 46 41	75 3 22	70 36 12	66 21 8	62 15 39	58 17 45
9.19327	9.19159	9.18970	9.18762	9.18533	9.18284	9.18014	9.17723	9.17410	9.17076	9.16720
1.00223	1.00224	1.00224	1.00223	1.00221	1.00218	1.00214	1.00208	1.00202	1.00195	1.00186
9.99464	9.99469	9.99473	9.99478	9.99484	9.99490	9.99496	9.99503	9.99510	9.99518	9.99526
.19550	.19363	.19194	.18985	.18754	.18502	.18228	.17931	.17612	.17271	.16906
9.97314	9.98922	9.99746	9.99999	9.99823	9.99305	9.98506	9.97462	9.96191	9.94698	9.92981
.99687	.99693	.99697	.99701	.99705	.99708	.99710	.99711	.99712	.99713	.99712
9.53285n	9.34[illegible]n	9.03[illegible]n	7.66875n	8.91322	9.24910	9.41141	9.52128	9.60327	9.66787	9.72010
9.52749n	9.33708n	9.02880n	7.66353n	8.91006	9.24400	9.40637	9.51631	9.59822	9.66305	9.71586
9.97384	9.98940	9.99712	9.99999	9.99827	9.99322	9.98541	9.97523	9.96281	9.94829	9.93160
.52972n	.33942n	.03004n	8.66576n	9.95227	.24618	.40857	.51839	.60024	.66500	.71772
+3.3863	+3.1849	+1.0766	+.0463	−.8959	−1.7627	−2.5616	−3.2991	−3.9833	−4.6238	−5.2206
+2.6410	+2.7662	+2.8844	+2.9941	+3.0942	+3.1842	+3.2633	+3.3312	+3.3880	+3.4334	+3.4675
+6.0273	+4.9511	+3.9560	+3.0404	+2.1968	+1.4215	+0.7017	+0.0321	−0.5953	−1.1904	−1.7531
.97607	.99173	.99976	1.00222	1.00048	.99530	.98755	.97731	.96483	.95024	.93346
.78012	.69470	.59726	.48293	.34209	.15275	9.84615	8.50650	9.77474n	.07169n	.24381n
.19395	.29703	.40250	.51929	.65839	.84265	1.14140	2.47081	1.19009n	.87413n	.68965n
1.05000	1.04099	1.03137	1.02123	1.01070	.99984	.98867	.97714	.96574	.95408	.94234
8.95000	8.95901	8.96863	8.97877	8.98930	9.00016	9.01133	9.02286	9.03426	9.04592	9.05766
6.85000	6.87703	6.90589	6.93631	6.96790	7.00048	7.03399	7.06838	7.10278	7.13776	7.17298
+.0007079	+.0007534	+.0008052	+.0008636	+.0009288	+.0010011	+.0010814	+.0011698	+.0012670	+.0013733	+.0014893
−.0009847	−.0009846	−.0009846	−.0009847	−.0009848	−.0009851	−.0009853	−.0009857	−.0009862	−.0009866	−.0009872
−.0002768	−.0002312	−.0001794	−.0001211	−.0000560	+.0000160	+.0000961	+.0001844	+.0002809	+.0003867	+.0005021
6.44217n	6.36399n	6.25382n	6.08314n	5.74819n	5.20683	5.98272	6.26505	6.44855	6.58737	6.70079
.19550	.19383	.19194	.18985	.18754	.18502	.18228	.17931	.17612	.17271	.16906
8.05071n	7.97086n	7.85880n	7.68603n	7.34877n	6.80499	7.57804	7.85740	8.03771	8.17312	8.28265
8.82522n	8.76928n	8.66129n	8.49318n	8.15661n	7.61000	8.37782	8.64982	8.82062	8.94452	9.04076
.52972n	.33942n	.03004n	8.66576n	9.95227	.24618	.40851	.51839	.60039	.66500	.71722
6.97189	6.70341	6.28386	4.74890	5.70046n	5.45301	6.39123	6.78344	7.04894	7.25237	7.41801
+.0009373	+.0005051	+.0001922	+.0000562	+.0000502	+.0000284	+.0002461	+.0006074	+.0011193	+.0017880	+.0026183
−.0018697	−.0020840	−.0023225	−.0025857	−.0028737	−.0031874	−.0035240	−.0039010	−.0042926	−.0047140	−.0051642
−.0009324	−.0015788	−.0021303	−.0025[illegible]	−.0028239	−.0031590	−.0032829	−.0032936	−.0031733	−.0029270	−.0025359
8.38264n	8.61137n	8.74148n	8.82468n	8.87388	8.91219n	8.92930n	8.93071n	8.91413n	8.87946n	8.81888n

1870 1871 1871 1872

Nov 17	Dec 27	Feb 5	Mar 17	Apr 26	June 5	July 15	Aug 24	Oct 3	Nov 12	Dec 22
79 06 42	82 34 23	86 00 57	89 26 23	92 50 41	96 13 51	99 35 52	102 56 45	106 16 30	109 35 07	112 52 37
255 00 25	258 28 06	261 54 40	265 20 06	268 44 24	272 07 34	275 29 35	287 03 02	290 22 47	293 41 24	296 58 59
9.99695	9.99927	10.00000	9.99917	9.99680	9.99290	9.98746	9.98048n	9.97193	9.96177n	9.94096n
.92464	1.23621	2.67653	1.20842	.91412	.73905	.61393	.51331	.43004	0.35777	9.29817
.92412	1.23569	2.67641	1.20750	.91350	.73853	.61341	.50875	.42552	.35325	0.29317 288605
263 12 31	266 40 24	270 07 46	273 32 58	276 57 28	280 20 51	283 41 16	287 13 03	290 34 32	293 54 37	297 13 26
344 03 03	352 29 52	0 13 51	7 22 29	14 01 59	20 17 43	26 13 59	31 52 23	37 20 23	42 38 47	47 49 37
279 09 28	274 10 32	269 53 23	266 10 29	262 55 29	260 03 08	257 27 14	255 20 40	253 14 09	251 15 50	249 23 49
9.15366n	9.15598n	9.15671n	9.15588n	9.15351n	9.14961n	9.14417n	9.13719n	9.12864n	9.11848n	9.10667n
70660	70775	70893	71012	71133	71255	71378	71501	71623	71745	71866
9.99555	9.99550	9.99549	9.99550	9.99555	9.99563	9.99574	9.99588	9.99604	9.99622	9.99642
9.86026	9.86373	9.86564	9.86600n	9.86484	9.86216	9.85795	9.85220	9.84487	9.83593	9.82533
9.99453	9.99885n	10.00000n	9.99903n	9.99668n	9.99342n	9.98957n	9.98563n	9.98114n	9.97635n	9.97130n
.70215	.70325	.70442	.70562	.70688	.71818	.70952	.71085	.71227	.71367	.71508
9.20183	8.86221n	7.28436n	8.82422n	9.09052	9.23742n	9.33688	9.40313n	9.46004n	9.50679n	9.54640
9.19738	8.85771	7.27985	8.81972	9.08607	9.23305n	9.33262n	9.35901	9.45608	9.50301n	9.54282n
9.99454	9.99887	10.00000	9.99905	9.99675	9.99355	9.98977	9.98591	9.98149	9.97678	9.97180
−0.80165	−.36767	+.00974	+.33872	+.62720	+.88227	+1.11278	+1.30024	+1.48700	+1.66138	+1.82592
2.64100	2.76620	2.88440	2.99410	3.09420	3.18420	3.26330	3.33120	+3.38800	+3.43340	+3.46750
+1.83935	+2.39853	+2.87404	+~~2.65539~~	+~~2.46702~~	+~~2.30933~~	+~~2.15052~~				
~~.70917~~	~~.70808~~	~~.70610~~	3.33282	3.72140	4.06660	9.37608	+4.63144	+4.87500	5.09478	5.25342
.70114	.70662	.70893	0.70917	.70808	.70610	.70399	.70092	.69772	.69423	.69046
.26466	.37994	.46157	.52286	.57071	.60919	.64109	.66571	.68797	.70712	.72374
.43648	.32668	.24742	.18656	.13737	.09691	.06240	.03521	.00975	9.98711	9.96672
72845	75019	76922	78552	80060	81352	82504	83455	84340	85128	85826
9.27155	9.24981	9.23078	9.21408	9.19940	9.18648	9.17496	9.16545	9.15660	9.14872	9.14174
781465	774943	769234	764224	759820	755944	752488	749635	746980	744616	742522
.0065261	.0056161	.0049243	.0043876	.0039647	.0036261	.0033488	.0031358	.0029494	+.0027936	+.0026621
.0275893	.0275293	.0274681	.0274070	.0273455	.0272837	.0272221	71610	71009	70413	.0069827
−.0010632	−.0019132	−.0025438	−.0030154	−.0033808	−.0036576	−.0038733	−.0040252	.0041510	.0042477	.0043206
7.02662	7.28146n	7.40548	7.47991n	7.52902n	7.56820n	7.58808	7.60479n	7.61815	7.62815	7.63554
9.86026n	9.86373n	9.86564n	9.86600n	9.86484n	9.86216n	9.85791n	9.85220n	9.84487n	9.83593	9.82533n
8.82388	9.08249	9.20812	9.28291	9.33086	9.36236	9.38303	9.39399	9.40002	9.40108	9.39787
9.66020	9.92084	.04690	.12156	.16958	.21180	.22411	23831	24856	25517	25892
−.0008523	−.0007034	+.0000248	+.0011029	+.0021205	+.0033022	+.0043100	+.0052338	+.0061725	.0070569	.0078890
−.0180520	−.0161990	−.0147435	−.0135766	−.0126245	−.0118330	−.0112280	−.0104460	−.0099832	−.0095914	−.0092309
−.0189043	−.0169024	−.0147683	−~~.0145992~~ −.0125538	−.0105040	−.0088308	−.0066180	−.0052122	−.0038207	−.0025345	−.0013415
8.27655n	8.22794	8.16932n	8.09878	8.02135n	7.93099n	7.82073	7.71702	7.58214n	7.40389	7.12772n
0.21355n	0.16494n	0.10632n	0.03578n	9.95835n	9.86799n	9.75773n	9.65402n	9.51914n	9.34089n	9.06472n
269 50 29	271 02 37	272 14 45	273 26 53	274 39 01	275 51 10	277 03 20	278 15 30	279 27 42	280 39 56	281 52 11
99 53 4	101 5 12	102 17 20	103 29 28	104 41 36	105 53 45	107 5 55	108 18 5	109 30 17	110 42 31	111 54 46
9.99350	9.99162	9.98943	9.98785	9.98532	9.98307	9.98037	9.97746	9.97433	9.97099	9.96743
.75553n	.70785n	(.66188n)	.61994n	.58133n	.54549n	.51199n	.48017n	.45074n	.42247n	.39530n
.75331n	.69775n	.65636n	.61442n	.57581n	.53997n	.50647n	.47495n	.44522n	.41695n	.38998n
100 0 30	101 13 20	102 26 24	103 39 26	104 52 23	106 5 19	107 18 16	108 31 10	109 44 6	110 57 1	112 9 57
109 56 32	102 42 32	96 11 42	90 16 2	84 49 29	79 46 41	75 3 22	70 36 12	66 21 8	62 15 39	58 17 45
9.19327	9.19159	9.18970	9.18762	9.18533	9.18284	9.18014	9.17723	9.17410	9.17076	9.16720
1.00223	1.00224	1.00224	1.00223	1.00221	1.00218	1.00214	1.00208	1.00202	1.00195	1.00186
9.99464	9.99469	9.99473	9.99478	9.99484	9.99490	9.99496	9.99503	9.99510	9.99518	9.99526
.19550	.19363	.19194	.18985	.18754	.18502	.18228	.17931	.17612	.17271	.16906
9.97314	9.98922	9.99746	9.99999	9.99823	9.99302	9.98506	9.97462	9.96191	9.94698	9.92981
.99687	.99693	.99697	.99701	.99705	.99708	.99710	.99711	.99712	.99713	.99712
9.53285n	9.34282n	9.03307n	7.66875n	8.95322	9.24910	9.41141	9.52128	9.60327	9.66787	9.72010
9.52749n	9.33708n	9.02770n	7.66353n	8.95006	9.24400	9.40637	9.51631	9.59822	9.66305	9.71586
9.97384	9.98949	9.99752	9.99999	9.99827	9.99322	9.98541	9.97523	9.96281	9.94829	9.93160
.52972n	.33942n	.03004n	8.66576n	9.95227	.24618	.40857	.51839	.60024	.66500	.71772
+3.3863	+~~2.2045~~ 2.1849	+1.0766	+.0463	−.8959	−1.7627	−2.5616	−3.2991	−3.9833	−4.6238	−5.2206
+2.6410	+2.7662	+2.8844	+2.9941	+3.0942	+3.1842	+3.2633	+3.3312	+3.3880	+3.4334	+3.4675
+6.0273	+4.9811	+3.9560	+3.0404	+2.1968	+1.4215	+0.7017	+0.0321	−0.5963	−1.1904	−1.7531
.97607	.99173	.99976	1.00222	1.00048	.99540	.98755	.97731	.96483	.95024	.93346
.78012	.69470	.59726	.48293	.34209	.15275	9.84615	8.50650	9.77474n	.07169n	.24381n
.19395	.29703	.40250	.51929	.65839	.84265	1.14140	2.47081	1.19009n	.87453n	.68965n
1.05000	1.04099	1.03137	1.02123	1.01070	.99984	.98867	.97714	.96574	.95408	.94234
8.95000	8.95901	8.96863	8.97877	8.98930	9.00016	9.01133	9.02286	9.03426	9.04592	9.05766
6.85000	6.87703	6.90589	6.93631	6.96790	7.00048	7.03399	7.06838	7.10278	7.13776	7.17298
+.0007079	+.0007534	+.0008052	+.0008636	+.0009288	+.0010014	+.0010814	+.0011698	+.0012670	+.0013733	+.0014893
−.0009847	−.0009846	−.0009846	−.0009847	−.0009848	−.0009851	−.0009853	−.0009857	−.0009862	−.0009866	−.0009872
−.0002768	−.0002312	−.0001794	−.0001211	−.0000560	+.0000160	+.0000961	+.0001844	+.0002809	+.0003867	+.0005021
6.44217n	6.36399n	6.25382n	6.08314n	5.74819n	5.20683	5.98272	6.26505	6.44835	6.58737	6.70079
.19550	.19383	.19194	.18985	.18754	.18502	.18228	.17931	.17612	.17271	.16906
8.05074n	7.97086n	7.85880n	7.68603n	7.34877n	6.80489	7.57804	7.85740	8.03771	8.17312	8.28269
8.82522n	8.76928n	8.66129n	8.49318n	8.15661n	7.61000	8.37782	8.64982	8.82062	8.94432	9.04076
.52972n	.33942n	.03004n	8.66576n	9.95227	.24618	.40851	.51839	.60039	.66500	.71722
6.97189	6.70341	6.28386	4.74890	5.70046n	5.45301	6.39123	6.78344	7.04894	7.25237	7.41801
+.0009373	+.0005051	+.0001922	+.0000162	+.0000502	+.0000284	+.0002461	+.0006074	+.0011193	+.0017880	+.0026183
−.0018697	−.0020840	−.0023225	−.0025857	−.0028737	−.0031874	−.0035240	−.0039010	−.0042926	−.0047150	−.0051642
−.0009324	−.0015788	−.0021303	−.0025801	−.0029239	−.0031590	−.0032829	−.0032936	−.0031733	−.0029270	−.0025459
8.38264n	8.61197n	8.74148n	8.82468n	~~8.86388~~ 8.87988	8.91219n	8.92290n	8.93071n	8.91453n	8.87946n	8.81888n

	1878 Jan 31	Mar 11	Apr 20	May 30	July 9	Aug 18	Sept 27	175 51 21 Nov 6	1878 Dec 16	1879 Jan 25
L'	116 09 03	119 24 74	122 38 43	125 52 00	129 04 18	132 15 39	135 26 03	138 35 35	141 44 16	144 52 07
u'	300 15 20	303 30 41	306 45 00	309 58 17	313 10 35	316 21 56	319 32 20	322 44 14	325 52.55	329 00 46
sin u'	9.93641n	9.92106n	9.90377n	9.88463	9.86287n	9.83888	9.81220	9.78209n	9.74889n	9.71168n
log tang u'	0.23410	.17902n	.12683	.07663n	0.02770	9.97929n	9.93090n	9.88125n	9.83097n	9.77865n
tang λ'	0.22958	.17450	.12231	.07211	.02318	9.97477	9.92638	9.87674	9.82644n	9.77402
λ'	300 30 55	303 47 12	306 02 10	310 15 52	313 28 18	316 39 47	319 50 05	323 01 25	326 9 26	329 16 33
v+ω'	52 55 33	57 58 37	63 00 41	68 03 17	73 10 23	78 22 05	83 41 21	89 12 29	94 54 55	100 53 31
λ'-(v+ω')	247 35 22	245 48 35	244 01 29	242 11 55	240 17 55	238 17 42	236 08 39	233 48 56	231 14 31	228 23 02
log sin β'	9.09312n	9.07797n	9.06048n	9.04114n	9.01958n	8.99559n	8.96891	8.93863n	8.90543	8.86822
log r'	.71988	.72103	.72218	.72331	.72441	.72547	.72651	.72751	.72847	.72938
cos β'	9.99664	9.99687	9.99711	9.99736	9.99761	9.99786	9.99811	9.99836	9.99859	9.99881
	9.81257	9.79880	9.78266	9.76445	9.74395	9.72106	9.69542	9.66614n	9.63390n	9.59760n
	9.96558n	9.96005n	9.95375	9.94675n	9.93853n	9.92981n	9.91931	9.90694n	9.89198n	9.87368n
r' cos β'	.71649	.71790	.71929	.72067	.72202	.72333	.72462	.72587	.72706	.72819
	9.58128	9.61253n	9.64145n	9.66876n	9.69502n	9.72061	9.74593	9.77114n	9.79660	9.82226
	9.57784n	9.60940n	9.63856n	9.66612	9.69263	9.71847n	9.74404n	9.76950n	9.79519n	9.82167
log cos z'	9.96646	9.96070	9.95444	9.94747	9.93960	9.93062	9.92016	9.90780	9.89288	9.87461
2r' cos z'	+1.92470	+2.14010	+2.29450	+2.45150	2.61240	+2.77930	+2.95500	+31406	+33393	+35518
-r' cos z'	+3.45000	+3.50078	+3.50010	+3.48790	+3.46460	+3.42870	+3.38190	+3.3234	+3.2540	+3.1722
n - r'² cos² z'	+54747	+564088	579490	593940	607640	620800	+623690	+6.4640	+6.5933	+6.7240
log sin l'	68631	68173	67662	67078	66401	65609	64665	63531	62135	60397
log cos l'	.73836	.75134	.76305	.77374	.78365	.79295	.80188	81050	81910	82763
l tang l'	9.94795	9.93039	9.91357	9.89704	9.88036	9.86314	9.84475	9.82481	9.80226	9.77634
log ρ	.86441	.86553	.87462	.87883	.88298	.88565	.88837	.89063	.89252	.89392
log 1/ρ	9.13559	9.13017	9.12538	9.12117	9.11752	9.11435	9.11163	9.10937	9.10748	9.10608
log 1/ρ³	7.40677	7.39051	7.37614	7.36351	7.35256	7.34305	7.33489	7.32811	7.32244	7.31824
1/ρ³	+.0025514	.0024576	+.0023776	+.0023095	.0022520	+.0022032	.0021622	+.0021287	+.0021011	+.0020809
-1/a³	-.0069255	68693	-68150	67623	-67108	-66618	.0066141	-6.5686	65252	64843
Δ	-.0043741	-.0044117	-.0044374	-.0044524	-.0044588	-.0044586	.0044519	-.0044399	-.0044221	-.0044034
log Δ	7.64089	7.64461	7.64713	7.64859n	7.64922	7.64920	7.64855	7.64737n	7.64563n	7.64379n
log z'	9.81299n	9.79880n	9.78266	9.76445	9.74397n	9.72106	9.69574	9.66614n	9.63390n	9.59760n
log R	9.39086	9.38041	9.36679	9.35004	9.33021	9.30726	9.28097	9.25038	9.21640	9.17826
log S₀	26027	25959	25717	25299	24707	23534	22948	21705	20154	18253
	+.0086813	+.0094415	+.0101830	+.0109150	+.0116483	+.0123920	+.0131555	+.013944	+.014767	+.015640
-r/a³	-.0089042	-.0086034	-.0083219	-.0080551	-.0078009	-.0075539	-.0073123	-.007074	-.006837	-.006604
	-.0002229	+.0008381	~~.0268640~~ +.0018611	+.0028595	+.0038474	+.0048381	+.0058432	+.006870	+.007930	+.009036
R	6.34811n	6.92330	7.26977	7.45635	7.58517	7.68467	7.76661	7.83696	7.89927	7.95598
R₁	8.2851	8.86030	9.20677	9.39335	9.52217	9.62167	9.70836	9.77383	9.83614	9.89285

	Jan 31	Mar 11	Apr 20	May 30	July 9	Aug 18	Sept 27	Nov 6	Dec 16	Jan 25
L'	283 04 28	284 16 48	285 29 10	286 41 34	287 54 07	289 06 31	290 19 05	291 31 41	292 44 22	293 57 07
u'	113 07 3	114 19 23	115 31 45	116 44 9	117 56 36	119 9 6	120 21 40	121 37 0	122 49 41	124 2 26
log sin u'	9.96365	9.95963	9.95538	9.95090	9.94616	9.94118	9.93594	9.93022	9.92443	9.91837
log tang u'	.36968n	.34486n	.32094n	.29780n	.27536n	.25314n	.23226n	.21070n	.19034n	.17035n
log tang λ'	.36416n	.33934n	.31542n	.29228n	.26984n	.24802n	.22674n	.20518n	.18482n	.16483n
λ'	113 22 59	114 35 27	115 48 47	117 1 46	118 14 45	119 27 45	120 40 47	121 56 33	123 9 38	124 22 44
λ'-(v+ω')	57 24 45	50 34 39	46 45 31	42 55 14	39 1 47	35 3 5	30 56 41	26 45 2	22 15 41	17 30 11
log sin β'	9.16342	9.15440	9.15515	9.15067	9.14593	9.14095	9.13571	9.12992	9.12413	9.11807
log r'	1.00177	1.00166	1.00155	1.00142	1.00128	1.00114	1.00098	1.00081	1.00063	1.00044
l cos β'	9.99534	9.99543	9.99552	9.99561	9.99571	9.99580	9.99590	9.99601	9.99612	9.99623
lz = lr sin β'	~~.99711~~ .16519	~~.99709~~ .16106	~~.99707~~ .15670	~~.99703~~ .15209	~~.99699~~ .14721	~~.99694~~ .14209	.99688 .13669	0.13073	0.12476	.11851
sin(λ'-(v+ω'))	9.91022	9.88769	9.86241	9.83314	9.79915	9.75915	9.71101	9.65332	9.57845	9.47822
l r' cos β'	.99711	.99709	.99707	.99703	.99699	.99694	.99688	0.99682	.99675	.99667
l cos(λ'-(v+ω'))	9.76488	9.80250	9.83574	9.86469	9.89032	9.91309	9.93336	9.95084	9.96636	9.97941
l cos γ'	9.76022	9.79823	9.83126	9.86030	9.88603	9.90889	9.92926	9.94685	9.96248	9.97564
l sin γ'	9.91256	9.89092	9.86680	9.83810	9.80552	9.76744	9.73042	9.66833	9.60023	9.51285
l r' cos γ'	.76199	.79989	.83281	.86172	.88731	.91003	.93024			
- r' cos γ'	-5.7809	-6.3080	-6.8047	-7.2731	-7.7146	-8.1290	-8.5161	-88647	-91857	-94642
r	+3.4500	+3.5008	+3.5001	+3.4879	+3.4640	+3.4286	+3.3819	+3.3234	+3.2540	+3.1722
r - r' cos γ'	-2.3309	-2.8072	-3.3046	-3.7852	-4.2506	-4.7004	-5.1342	-5.5413	-5.9317	-6.2920
log r' Δ r' = S sin l'	.91433	.89268	.86785	.83913	.80680	.76859	.73[illegible]	66914	60086	.51329
l r = r' cos γ' = S cos l'	.36001n	.44827n	.51912n	.57809n	.62845n	.67213n	.71047n	.74361	.77318	.79879n
l tan l'	.55432n	.44401n	.34873	.26144n	.17835n	.09645n	.02508n	9.92553	9.82768	9.71450
log S	.98061	.91806	.90[illegible]	.89650	.88196	.87618	.87386	.86007	.85420	.85044
l 1/S	9.06939	9.08108	9.09[illegible]	9.10350	9.11404	9.12382	9.13246	9.13993	9.14580	9.14956
l 1/S³	7.20817	7.24308	7.27729	7.31050	7.34212	7.37146	7.39738	7.41979	7.43740	7.44868
1/S³	+.0016150	+.0017502	+.0018880	+.0020441	+.0021986	+.0023521	+.0025002	+.0026290	+.0027378	+.0028099
-1/a³	-.0009878	-.0009886	-.0009893	-.0009902	-.0009912	-.0009922	-.0009933	-.0009945	-.0009957	-.0009970
Δ	+.0006272	+.0007616	+.0008987	+.0010539	+.0012073	+.0013599	+.0015069	+.0016345	+.0017421	+.0018125
log Δ	6.79741	6.88173	6.95622	7.02280	7.08182	7.13357	7.17808	7.21338	7.24080	7.25837
l S'	.16379	.16106	.15670	.15209	.14721	.14209	.13669	13073	12476	11851
l W₀	8.37564	8.45583	8.52596	8.58793	8.64207	8.68864	8.72981	8.75691	8.77836	8.78968
l Δ	6.79741	6.88173	6.95622	7.02280	7.08182	7.13357	7.17808	7.21338	7.24080	7.25837
log γ'	.90733	88498	85948	83017	.79601	.75609	70789	65014	57520	47489
log S₀	9.11978	9.17975	9.22874	9.26601	9.29087	9.30264	9.29901	9.27632	9.22880	9.14606
log r'	.76199	.79989	.83281	.86172	.88731	.91003	.93024			
l Δ r'	7.55940	7.68162	7.78903	7.88452	7.96913	8.04354	8.10832	~~88647~~	~~91857~~	~~94642~~
- r/S³	+.0036258	+.0048042	+.0061522	+.0076652	+.0093139	+.0110546	+.0128328	+.0144890	+.0159925	+.0[illegible]575
Δ r' - r/S³	-.0056383	-.0061257	-.0066278	-.0071295	-.0076156	-.0080646	-.0084536	-.0087372	-.0089090	-.0089175
log R₀	-.0020125	-.0013215	-.0004756	+.0005357	+.0016983	+.0029400	+.0043777	+.0057518	+.0070835	+.0082400
	8.71634n	8.53411n	8.09028n	8.14156	8.64888	8.8887	9.03424	9.17260	9.26305	9.32873

								1873	1874			
	Mar 6	Apr 15	May 25	July 4	Aug 13	Sept 22	Nov 1	Dec 11	Jan 20	Mar 1	Apr 10	May 20
Sin I	147 59 12	151 05 34	154 11 14	157 16 16	160 20 42	163 24 35	166 27 59	169 30 55	172 33 26	175 35 36	178 37 29	181 39 06
9.15654	332 07 57	335 14 13	338 19 53	341 24 55	344 29 21	347 33 14	350 36 38	353 39 34	356 42 34	359 44 44	2 46 37	5 48 14
	9.66984	9.62208n	9.56731	9.50339	9.42719	9.33349n	9.21257n	9.04312n	8.75891	7.64769n	8.68527	9.00485
cos I	9.72328n	9.66897n	9.57913n	9.52684n	9.44331n	9.34382n	8.71844n	9.04578	8.75962n	7.64747n	~~9.99949~~ 8.68574n	9.00709
9.99549	9.71877	9.65946	9.59462	9.52213	9.43880	9.33931	9.20383	9.04127	8.75511	7.64296	8.68123	9.00258
	332 22 33	335 27 47	338 32 05	341 35 40	344 38 29	347 40 42	350 42 11	353 43 28	356 44 36	359 44 54	2 44 53	5 44 40
	107 11 59	113 54 47	[illegible] 07 23	128 55 57	137 28 17	146 53 01	157 20 21	169 00 41	182 00 08	196 27 22	212 15 11	229 04 00
	225 10 34	221 32 57	217 24 42	212 39 43	207 10 12	200 [illegible] 41	193 22 00	184 42 47	174 44 28	163 17 32	150 25 42	136 40 40
	8.82628n	8.77862n	8.72385n	8.65993n	8.58373n	8.49003n	8.36911n	8.19966n	7.91551n	6.80429n	7.84187	8.16145
	~~295 09 56~~ .73025	~~296 22 49~~ .73107	~~297 35 46~~ .73185	~~29~~ .73257	73325	73387	73443	73493	73539	73578	73611	.73639
	9.99029	9.99522	9.99989	9.99955	9.99968	9.99979	9.99988	9.99995	9.99999	0.00000	9.99999	9.99995
	9.55653	9.50969	9.45570	9.39250	9.31698	9.22390	9.10354	8.93459	8.65090n	7.55007n	8.57798	8.89784
	9.85082n	9.82169n	9.78857n	9.73214n	9.65957n	9.55025n	9.36395n	8.91469n	8.96216n	9.45862n	9.69241n	9.83639n
	.72927	.73029	.73124	.73212	.73293	.73366	.73431	.73488	.73538	.73578	.73610	.73634
	9.84815n	9.87413n	9.89998n	9.92524n	9.94922n	9.97075	9.98807n	9.99853	9.99817n	9.98127n	9.93965n	9.86184n
	9.84717n	9.87335n	9.89937n	9.92479n	9.94890n	9.97054n	9.98795n	9.99858n	9.99816n	9.98127n	9.93967n	9.86179n
	9.85477	9.82266	9.78459	9.73324	9.66080	9.55163	9.36359	8.90626	8.96250	9.45854	9.69242	9.83644
	+37794	+40218	+42778	+45432	+48100	+50631	+52769	+54139	.73355n	.71705n	.67178n	.59818n
	+3.0828	+2.9818	+2.8713	+2.7525	+2.6269	+2.4968	+2.3656	+2.2377	+5.4144	+5.2166	+4.7440	+3.9644
									+2.1204	+2.0186	+1.9418	+1.8978
	+6.8622	+7.0036	+7.1491	+7.2957	+7.4335	+7.5599	+7.6425	+7.6516	+7.5348	+7.2312	+6.6858	+5.8622
	.58202	.55373	.51644	.46581	.38409	.28550	.09842	9.64119	9.69980	.19437n	.42858	.57283
	.83646	.84532	.85425	.86307	.87187	.87852	.88324	.88375	.87707	.85921	.82515	.76806
	9.74556	9.70841	9.66219	9.60274	9.52[illegible]	9.40698	9.21518	8.75744	8.82082	9.33574	9.60338	9.80477
	.89507	.89570	.89583	.89539	.89425	.89223	.88901	.88446	.87802	.86914	.85756	.84220
	9.10493	9.10430	9.10417	9.10461	9.10575	9.10777	9.11099	9.11554	9.12198	9.13086	9.14244	9.15780
	7.31479	7.31290	7.31251	7.31383	7.31725	7.32331	7.33257	7.34662	7.36594	7.39258	7.42732	7.47340
	+.0020644	+.0020554	+.0020536	+.0020598	+.0020761	+.0021053	+.0021526	+.0022214	+.0023224	+.0024694	+.0026850	+.0029[illegible]
	64454	64090	63746	63430	63133	62862	62620	62404	-.0062206	-.0062039	-.0061858	-.00617[illegible]
	-.0043810	-.0043536	-.0043210	-.0042832	-.0042372	-.0041809	-.0041094	-.0040190	-.0038982	-.0037345	-.0035148	-.00[illegible]
	7.64157n	7.63885n	7.63558n	7.63177n	7.62708n	7.62127n	7.61378n	7.60412	7.59086	7.57223n	7.54590n	7.505[illegible]
	9.55653	9.50969n	9.45570n	9.39250n	9.31698n	9.22390n	9.10354n	8.93459	8.65090n	7.55007n	8.57798	8.89784
	9.13497	9.08541	9.02815	8.96114	8.88093	8.78204	8.65419	8.47858	8.17852	7.05906	7.06064	8.34021
	15853	12770	08726	03290	9.95646	9.84205	9.64891	9.19056	9.22516n	9.70339n	9.91117n	.01570n
	+.016558	+.017509	+.018484	+.019459	+.020381	+.021165	+.021685	+.021754	+.0211060	+.0194665	+.0166605	+.0126[illegible]
	-.006364	-.006129	-.005897	-.005670	-.005454	-.005257	-.005092	-.004977	-.0049240	-.0049845	-.0051943	-.0056450
	+.010194	+.011380	+.012587	+.013789	+.014927	+.015911	+.016593	+.016783	+.0161815	+.0144820	+.0114662	+.0070577
	8.00834	8.05614	8.09992	8.13953	8.17397	8.20170	8.21992	8.22487	8.20901	8.16083	8.05941	7.86656
	9.94521	9.99301	.03679	.07640	.11084	.13857	.15679	.16174	.14577	.09759	9.99617	9.80332
	295 09 56	296 22 49	297 35 46	298 48 48	300 01 56	301 15 08	302 28 26	303 41 50	304 55 19	306 08 54	307 22 36	308 36 29
	125 13 13	126 28 8	127 41 5	128 54 7	130 7 15	131 20 27	132 33 45	133 47 9	135 0 38	136 14 13	137 27 53	138 41 46
	9.91201	9.90135	9.89839	9.89110	9.88348	9.87552	9.86720	9.85830	~~9.87040~~ 9.84940	9.83993	9.82997	9.81958
	.15068n	.13128n	.11212n	.09315n	.07433n	.05562n	.03700n	0.01841n	9.99984n	9.98128n	9.96235n	9.94381n
	.14376n	.12576n	.10660n	.08763n	.06881n	.05010n	.03148n	.01289n	9.99432n	9.97576n	9.95706n	9.93829n
	125 35 53	126 49 4	128 2 16	129 15 30	130 28 47	131 42 9	132 55 21	134 8 59	135 22 28	136 35 53	137 49 40	139 3 25
	12 24 52	6 55 15	0 55 51	354 20 31	347 1 28	338 50 6	329 36 8	319 9 16	307 21 41	294 7 52	279 33 50	263 58 46
	9.11171	9.10505	9.09809	9.09080	9.08318	9.07522	9.06690	9.05820	9.04910	9.03963	9.02967	9.01928
	1.00024	1.00003	9.99981	9.99958	9.99934	9.99910	9.99884	9.99857	9.99829	9.99800	9.99770	9.99740
	9.99635	9.99645	9.99656	9.99668	9.99679	9.99691	9.99702	9.99714	9.99726	9.99738	9.99750	9.99761
	.11195	.10508	.09790	.09038	.08252	.07432	.06574	.05677	.04739	.03763	.02737	.01668
	9.33240	9.08098	8.21073	8.99383n	9.35128n	9.55757n	9.70415n	9.81559n	9.90027n	9.61154n	9.22049	9.99760
	.99659	.99648	.99637	.99626	.99613	.99601	.99586	.99571	.99555	.99538	.99520	.99501
	9.88973	9.99682	9.99994	9.99788	9.98877	9.96967	9.93578	9.87879	9.78307	9.96029n	9.99392	0.02071
	9.98608	9.99327	9.99650	9.99456	9.98556	9.96658	9.93280	9.87593	9.78033	~~9.98[illegible]~~ 9.60892	~~9.99[illegible]~~ 9.21899	9.01832
	9.39644	9.24210	9.10162	9.19652	9.40414	9.57711	9.71256	9.81936	9.90186	9.96981	9.99399	9.99762
	-96900	-98470	-99154	-98660	-96584	-92402	-85436	-74904	-60065	-40454	-16432	+10369
	+3.0828	+2.9818	+2.8713	+2.7525	+2.6269	+2.4968	+2.3656	+2.2377	+2.1204	+2.0186	+1.9418	+1.8978
	-6.6072	-6.8652	-7.0441	-7.1135	-7.0315	-6.7434	-6.1780	-5.2527	-3.8861	-2.0263	+0.2984	+2.9347
	39668	24213	19143	19610	40348	57621	71140	81793	90015	55881	99169	99502
	82002	83665	84783	85208	84705	82888	79085	72038	58951	30690	9.47509	46756
	9.57666n	40548n	9.25360n	9.34482n	9.55643n	9.74733	9.92055	.09755	.31064	.65211	1.57660	52746
	.84892	.85027	.85470	.86242	.87353	.88791	.90526	.92511	.94692	.96933	~~.91385~~ .99189	~~[illegible]~~ 1.01336
	9.15108	9.14973	9.14530	9.13758	9.12647	9.11209	9.09474	9.07489	9.05308	9.03067	9.00811	8.98664
	7.45324	7.44919	7.43590	7.41374	7.37941	7.33627	7.28422	7.22467	7.15924	7.09201	7.02433	6.95992
	+.0028395	+.0028131	+.0027284	+.0025926	+.0023956	+.0021691	+.0019241	+.0017[illegible]	+.0014479	+.0012360	+.0010516	+.0009118
	-.0009983	-.0009998	-.0010013	-.0010029	-.0010045	-.0010063	-.0010084	-.0010099	-.0010119	-.0010139	-.0010161	-.0010182
	+.0018412	+.0018133	+.0017271	+.0015897	+.0013911	+.0011628	+.0009157	+.0007067	+.0004360	+.0002221	+.0000415	+.0008936
	7.26508	7.25842	7.23732	7.20132	7.14336	7.06550	6.96194	6.6676 6.82452	6.63448	6.34655	5.61805	6.02694
	11195	10508	09790	09038	08252	07432	06574	05677	04739	03763	02737	01668
	8.78983	8.77630	8.74802	8.70450	8.63868	8.55262	8.44048	8.29405	8.09467	7.79698	7.15822	7.45642
	7.26508	7.25842	7.23732	7.20132	7.14336	7.06550	6.96194	6.82452	6.63448	6.34655	5.61805	6.02694n
	32899	07746	9.20710	9.99009n	34741n	55358n	70001n	81139n	89582n	95567n	98912n	99261n
	9.00687	8.74868	7.85722	8.60421n	8.90357n	9.03188n	9.07475n	9.04862n	8.94310n	8.71502n	8.01997n	8.33235
	~~96900~~	~~98470~~	~~99154~~	~~98660~~	~~96583~~	~~92402~~	~~85435~~	~~74904~~	~~60065~~	~~40454~~	~~+16432~~	~~-10377~~
	+.0178400	+.0178530	+.0171250	+.0156840	+.0134360	+.0107440	+.0078260	+.0050007	+.0025888	+.0005884	+.0000682	+.0001103
	-.0087530	-.0083883	-.0078322	-.0071361	-.0062930	-.005[illegible]	-.0045576	-.0037538	-.0030596	-.0024949	-.0020537	-.0017305
	+.0090865	+.0094647	+.0092928	+.0085479	+.0071430	+.0053283	+.0032952	+.0012469	-.0004708	-.0015965	-.0019855	-.0016202
	9.37120	9.38891	9.38095	9.34466	9.26668	9.13939	8.92804	8.50863	8.08564n	8.65897n	8.71070n	8.62237

♃ 1874	Jan ~~May~~ 29	Aug 8	Sept. 17	Oct 27	1834 Dec 6	1875 Jan 15	May 1880 Feb 24	Apr 5	May 15	Jun 24
l' 9.15860	184 40 31	187 41 48	190 42 57	193 44 05	196 45 12	199 46 23	202 56 2			
i' 9.99549	8 49 39	11 50 56	14 52 5	17 53 13	20 54 20	23 55 31	26 56 37			
log sin u	9.18600	9.31246	9.40925	9.48734	9.55246	9.60807				
log tang u'	9.19117	~~9.99065~~ 9.32181	~~9.48521~~ 9.42404	9.50885	9.58203	9.64706				
log tang λ'	9.18666	9.31730	9.41553	9.50434	9.57752	9.64255				
λ'	8 44 16	11 43 48	14 48 17	17 42 44	20 42 29	23 42 27	26 42 15			
v+ω'	246 17 37	263 20 12	279 28 26	294 20 08	307 46 16	319 48 47	330 33 36			
λ'−(v+ω')	122 24 39	108 23 36	95 14 51	83 22 36	72 56 13	63 53 34	56 08 39			
log sin β'	8.34260	8.46906	8.56585	8.64394	8.70906	8.76464	8.81281			
log r'	.73660	.73675	.73684	.73686	.73683	.73673	.73657			
l cos β'	9.99989	9.99981	9.99971	9.99958	9.99943	9.99926	9.99908			
l z' = l r' sin β'	9.07920	9.20581	9.30269	9.38080	9.44589	9.50137	9.54938			
l sin(λ'−(v+ω'))	9.92646	9.97723	9.99818	9.99709	9.98045	9.95326	9.91931			
l r' cos β'	.73649	.73656	.73655	.73644	.73626	.73599	.73565			
log cos(λ'−(v+ω'))	9.72913n	9.49903n	8.96122n	9.06199	9.46750	9.64380	9.74594			
log cos γ'	9.72904n	9.49886n	8.96093n	9.06157	9.46693	9.64276	9.74502			
log sin γ'	9.92650	9.97725	9.99818	9.99710	9.98050	9.95344	9.91972			
log r' cos γ'	.46564n	.23561n	9.69777n	9.79843	.20376	.37949	.48159			
−r' cos γ'	+2.9217	+1.7203	+.4986	−.6287	−1.5987	−2.3960	−3.0310			
r	+1.8921	+1.9253	+1.9933	+2.0888	+2.2034	+2.3292	+2.4605			
r − r' cos γ'	+4.8138	+3.6456	+2.4919	+1.4601	+0.6047	−.0668	−0.5705			
log r' sin γ' = l ρ sin l'	.66310	.71398	.73502	.73396	.71733	.69017	.65529			
l log ρ cos l'	~~.47694~~ .68249	.56177	.39653	.16438	9.78154	8.82478	9.75626			
l tan l'	9.98066	.15224	.33849	.56958	.93579	1.86539	.90003			
log ρ	.82353	.80140	.77648	.74918	.72023	.69021	.65870			
log 1/ρ	9.17647	~~9.19860~~ 9.19854	9.22352	9.25082	9.27977	9.30979	~~9.34130~~ 9.34030			
log 1/ρ³	7.52941	7.59562	7.67056	7.75246	7.83931	7.92937	8.02090			
1/ρ³	+.0033839	+.0039412	+.0046834	+.0056554	+.0069074	+.0084991	+.010493			
−1/r'³	−.0061688	−.0061624	−.0061586	−.0061578	−.0061550	−.0061633	−.006172			
Δ	−.0027849	−.0022212	−.0014752	−.0005024	+.0007484	+.0023358	+.004321			
log Δ	7.44481n	7.34659n	7.16885n	6.70105n	6.87413	7.36844	7.63558			
log z'	9.07920	9.20581	9.30269	9.38080	9.44589	9.50137	9.54938			
log W₀	8.46077	8.48916n	8.40830n	8.01861n	8.25678n	8.80657	9.12172			
log y'	~~.04462~~						65486			
log S₀	.04462n	9.99714n	9.84034n	9.37134n	9.52760	9.99445	.22730			
log Δx'										
Δx'	+.0081370	+.0038213	+.0007356	−.0003159	+.0011964	+.0055967	+.013097			
−x/ρ³	−.0064026	−.0075879	−.0093356	−.0118130	−.0152200	−.0197960	~~−.057210~~ −.025818			
Δx − x/ρ³	+.0017344	−.0037666	−.0086000	−.0121289	−.0140236	−.0142003	~~−.04113~~ −.012721	8.10452n		
log (Δx − x/ρ³)	7.23915	7.57595n	7.93450n	8.08382n	8.14687n	8.15229n		0.04128n		
log R₀	9.17591	9.51271n	9.87126n	0.02058n	.08363n	0.08805n	~~0.10700~~ 171 7 n	λ'−(v+ω')		
♄ L'	309 50 19	311 04 20	312 18 29	313 32 44	314 47 8	316 00 31	317 24 40	318 39 26	319 54 21	321 09 24
u'	139 55 38	141 9 39	142 23 28	143 38 3	144 52 27	146 13 20	147 21 44	148 36 30	~~149 51 25~~	~~151 06 28~~
log sin u'	9.80857	9.79736	9.78552	9.77301	9.75995	9.74468	9.73185			
log tang u'	9.92493n	9.90587n	9.88669n	9.86708n	9.84726n	9.82480n	9.80649n			
log tang λ'	9.91941n	9.90035n	9.88117n	9.86156n	9.84174n	9.81928n	9.80098n			
λ'	140 17 8	141 30 59	142 44 33	143 58 12	145 12 57	146 31 28	147 41 29			
λ'−(v+ω')	247 56 52	232 18 7	217 15 28	203 38 5	191 26 2	180 46 2	~~141 24 52~~			
log sin β'	9.00827	8.99706	8.98522	8.97271	8.95965	8.94438	8.93139			
log r'	.99708	.99676	.99642	.99608	.99573	.99537	.99500	99462	99424	99385
log cos β'	9.99773	9.99785	9.99796	9.99808	9.99819	9.99831	9.99842			
log z' = z' sin β'	.00535	9.99382	9.98164	9.96879	9.95538	9.93975	9.92639			
l sin(λ'−v+ω')	9.96701n	9.89753n	9.78204n	9.60347n	9.29719n	8.12679n	9.18871			
l r' cos β'	.99481	.99461	.99438	.99416	.99392	.99368	.99342			
l cos(λ'−v+ω')	9.57455n	9.78770n	9.90087n	9.96195n	9.99129n	9.99996n	9.99476n			
l cos γ'	~~9.99591~~	9.78555	9.89883	9.96003	9.98548	9.99827	9.99318			
l sin γ'	9.57228n	9.89881	~~9.88881~~	9.61279n	9.33729n	8.94901	9.24508			
l r' cos γ'	9.567		9.78552				0.98818n			
−r' cos γ'	+.37099	+.60578	+.78569	+.90388	+.96652	+.98547	+.97316			
r	+1.8921	+1.9253	+1.9933	+2.0888	+2.2934	+2.3292	+2.4605			
r−r' cos γ'	+.56020	+.98831	+.98502	+11.1276	+11.8686	+12.1839	+12.1921			
l ρ sin l'	.96446	.89557	.78194	.60887	.33302	9.94438	.24008			
l ρ cos l'	.74834	.90217	.99344	1.04639	1.07438	1.08579	1.08608			
l tang l'	.21612	9.99340	9.78850	9.56248	9.25864	8.85859	9.15400			
log ρ	1.03276	1.04941	1.06300	1.07350	1.08141	1.08692	1.09045			
l 1/ρ	8.96724	8.95059	8.93700	8.92643	8.91859	8.91308	8.90955			
l 1/ρ³	6.90172	6.85177	6.81100	6.77929	6.75577	6.73924	6.72865			
1/ρ³	.0007975	.0007108	.0006472	.0006016	.0005696	.0005486	+.0005354			
−1/r'³	−.0010204	−.0010226	−.0010250	−.0010275	−.0010299	−.0010325	−.0010352			
A	−.0002229	−.0003118	−.0003778	−.0004259	−.0004600	−.0004839	−.0004998			
log A	6.34811n	6.49388n	6.57726n	6.62931n	6.66276n	6.68476n	6.69880n			
log z'	.00535	9.99382n	9.98164n	9.96879n	9.95538n	9.93975n	9.92639			
log W₀	7.76626n	7.88050n	7.97170n	8.01090n	8.03094	8.03731	8.03799n			
log A	6.34811n	6.49388n	6.57726n	6.62931n	6.66276n	6.68476n	6.88093n			
log y'	.96182n	.89214n	.77642n	.59763n	.29111n	9.12047n				
log S₀	8.72273	8.79882	8.76648	8.63974	8.36667n	7.21803	8.29373n			
Ax	+.0008270	+.0018888	+.0029683	+.0038496	+.0044461	+.0047687	+.0048639			
−z/ρ³	−.0015089	−.0013686	−.0012900	−.0012566	−.0012557	−.0012777	−.0013173			
Ax − z/ρ³	−.0006819	+.0005202	+.0016783	+.0025930	+.00319	+.0034910	+.0035466			
log (Ax − z/ρ³)	6.83372n	6.71617	7.22487	7.41380	7.50385	7.54295	7.54980			
log R₀	8.24652n	8.12897	8.63767	8.82660	8.91665	8.95575	8.96260			

	×Aug 3	Sept 12	Oct 22	1875 Dec 1	× 1876 Jan 10	Feb 19	Mar 30	×× May 9	June 18	July 28	Sep 16	Oct 16
	215 03 17				227 16 16			236 31 41	239 38 8	242 45 20	245 53 18	249 02 06
								60 32 16	63 38 43	66 45 55	69 53 53	73 02 41
								9.93986	9.95234	9.96327	9.97270	9.98070
								.24803	30503	.36722	43654	51587
								9.99535	9.94783	9.95876	9.96815	9.97615
								[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								~~9.44463~~	~~9.46763~~	~~9.52382~~	~~9.56334~~	~~9.67224~~
	38 46 27				50 59 26			60 16 58	63 24 30	66 32 56	69 42 20	72 52 41
	42 33 4				29 30 30			45 40 02	50 48 10	55 52 36	60 55 20	65 57 22
λ+ω+σ'	134 22 53				21 28 56			14 36 56	12 36 20	10 40 20	8 47 00	6 54 19
B'	8.95607				9.04882			9.09646	9.10854	9.11987	9.12930	9.13730
r'	.73534 -				.73317 -			.73097	.73013	.72925	.72833	.72436
cos B'	9.99822				9.99726			9.99659	9.99638	9.99620	9.99603	9.99587
	9.69141				9.78199			9.82743	9.83907	9.84912	9.85763	9.86466
	9.75182				9.56373			9.40197	9.33893	9.26762	9.18383	9.08001
	.73356				.73043			.72756	.72651	.72545	.72436	.72323
	9.91661				9.96873			9.98571	9.98944	9.99242	9.99488	9.99684
	9.91483				9.96599			9.98230	9.98578	9.98862	9.99094	9.99271
	9.75557				9.58061			9.44675	9.40093	9.35371	9.30627	9.25884
	.65017				.69916			.71327	.71591	.71787	.71924	.72007
	-44686				-50022			-51674	-51989	-52224	-52389	-52489
	+2.9511				+3.3040			+3.4535	+3.4807	+3.4961	+3.5000	+3.4924
	-15176				-16982			-17139	-17182	-17263	-17389	-17565
	.49091				.31378			.17772	.13166	.08316	.03460	9.98626
	.18113				.23999			23398	23507	23712	24002	.24465
	.30978				.08778			9.94373	9.89559	9.84604	9.79464	9.74161
	.53765				~~.429720~~ .42642			.35819	.33975	.32403	.31148	.30233
	~~161295~~				~~127926~~			~~107457~~	~~101925~~	~~97909~~	~~[illegible]~~	~~90699~~
	9.46235				9.57358			9.64181	9.66025	9.67599	9.68452	9.69767
	8.38705				8.72074			8.92543	8.98075	9.02791	9.06856	9.09301
	.024381				.052571			.084223	.095665	.106638	.116996	.123884
	-.006223				.006317			.006413	.006457	.006490	.006532	.006575
	+.018158				+.046254			+.077810	+.089214	+.100148	+.109763	+.117309
	8.25907				8.66515			8.89104	8.95043	9.00065	9.04045	9.06933
	9.69141				9.78199			9.82743	9.83907	9.84912	9.85763	9.86466
	9.88724				0.38390			0.65523	0.72626	0.78653	0.83454	0.87075
	48538				.29416			.12953	.06544	9.99307	9.[illegible]	9.96324
	.68121				.59607			.95733	.95263	.93048	.88590	.80933
	+.081142	.071950			+.23137			+.40208	+.46381	+.52303	+.57503	+.61575
	-.~~132555~~				-.~~25439~~			-.~~45332~~	-.~~51391~~	-.57170	-.62215	-.66126
	~~.051413~~	+.009192	7.96341		~~-.05302~~	+.05768	8.76102	~~-.05124~~	~~-.05010~~	~~-.04867~~	~~-.04623~~	~~-.04551~~
			9.90017			0.69778		0.98309	1.05350	1.11349	1.16207	1.19945
	142 15 04				122 07 56			109 44 34	105 52 5	102 32 6	98 16 38	94 29 42
	322 24 36	323 39 57	324 55 26	326 11 04	327 26 52	328 42 48	329 58 55	331 15 11	332 31 37	333 48 13	335 05 00	336 21 07
	152 21 40				157 23 56			161 12 15	162 28 41	163 45 14	165 02 04	166 19 01
	9.66642				9.58469			9.50812	9.47867	9.44677	9.41202	9.37393
	9.71904				9.61939n			9.53192n	9.49930	9.46447	9.42702	9.38644
	9.71353n				9.61388			9.52641	9.49379	9.45896	9.42151	9.38093
	152 39 31				157 39 19			161 25 29	162 41 8	163 56 55	165 12 57	166 28 50
	~~175 14 50~~				~~200 21 46~~			~~216 31 18~~	~~221 38 20~~	~~226 43 52~~	~~231 46 36~~	~~234 45 36~~
	8.86596				8.78420			8.70766	8.67821	8.64631	8.61156	8.57348
	.99345	.99304	99262	99220	.99177	99133	.99089	.99044	.98999	.98952	.98905	.98858
	9.99883				9.99919			9.99944	9.99951	9.99957	9.99904	9.99870
	9.85941				9.77600			9.69810	9.66820	9.63583	9.60061	9.56205
	9.78689				9.92779			9.97369	9.98313	9.99031	9.99548	9.99866
	.99228				.99092			.98988	.98950	.98909	.98865	.98828
	9.89801n				9.72581n			9.52865	9.43684	9.31991n	9.15824	8.89416
	9.89684				9.72500n			9.52809	9.43635	9.31948	9.15788	8.89386
	9.78883				9.92811			9.97376	9.98317	9.99033	9.99546	9.99866
	9.89022n				9.71677n			~~0.96420~~	~~.97316~~	~~.97985~~	~~.98451~~	~~.98724~~
	+7.7677				+5.2093			+33001	+26690	+20371	+14026	.7629
	+2.9511				+3.3040			+3.4535	+3.4807	+3.4961	+3.5000	+3.4924
	+10.7188				+8.5133			+6.7536	+6.1497	+5.5332	+4.9026	+4.2553
	.78228				.91988			.96420	.97316	.97985	.98451	.98724
	1.03015				0.93010			0.82954	0.78885	0.74298	0.69043	0.62893
	9.75213				9.98978			.15466	.18431	.23687	.29408	.35831
	1.09033				1.07557			1.05766	1.05051	1.04274	1.03437	1.02539
	8.98967				8.92443			8.94234	8.94949	8.95726	8.96563	8.97461
	0.72901				0.77329			0.82702	0.84847	0.87188	0.89689	0.92383
	+.0005358				+.0005933			+.0006715	+.0007055	+.0007444	+.0007887	+.0008352
	-.0010463				-.0010585			-.0010683	-.0010716	-.0010751	-.0010786	-.0010821
	-.0005105				-.0004652			-.0003968	-.0003661	-.0003307	-.0002899	-.0002429
	6.70800n				6.66764n			6.59857n	6.56360n	6.51943	6.46225	6.38543
	9.85941				9.77600			9.69810	9.66820	9.63583	9.60061	9.56205
	7.98021n				7.85644n			7.70947n	7.64460n	7.56806n	7.47566n	7.36028n
	7.49717n				7.58639n			7.56214n	7.53623n	7.49883n	7.44639n	7.38257n
	8.90997				8.99919			8.97494	8.94903	8.91163	8.85919	8.78518
	+.0039654				+.0024233			+.0013095	+.0009771	+.0006736	+.0004066	+.0001883
	-.0018812				-.0019603			-.0023189	-.0024554	-.0026023	-.0027603	-.0029306
	+.0023842				+.0004630			-.0010094	-.0014783	-.0019287	-.0023537	-.0027453
	7.37734				6.66558			7.00406n	7.16976n	7.28526n	7.37775n	7.43859n
	8.79014				8.07838			8.41686	8.58256n	8.69806n	8.78455	8.85732

1876	Nov 25	1877 Jan 4	Feb 13	Mar 25	May 4	June 13	July 23	Sept 1	Oct 11	Nov 20
L'	252 11 46	255 22 20	258 33 48	261 46 16	264 59 43	268 14 12	271 29 44	274 46 22	278 04 05	281 22 55
u'	76 12 21	79 22 55	82 34 23	85 46 51	89 00 18	92 14 47	95 30 19	98 46 57	102 04 40	105 23 30
log sin u'	9.98729	9.99250	9.99634	9.99882	9.99993	9.99967	9.99799	9		
log tang u'	.60992	.92706	.88487	1.13211	1.76026	1.40642	8.98400			
log tang λ'	.60541	.72255	.88036	1.12760	1.75575	1.40191	~~8.97949~~ 1.41149			
λ'	76 04 03	79 16 25	82 29 47	85 44 13	88 59 41	92 16 11	95 33 23			
ν+ω'	71 3 44	76 13 34	81 29 58	86 55 26	92 32 34	98 24 36	104 34 50			
λ'−ν+ω'	5 00 19	3 02 51	+0 59 49	358 48 47	356 27 07	353 51 35	350 58 33			
log sin β'	9.14389	9.14910	9.15294	9.15542	9.15653	9.15627	9.15459			
log r'	.72635	.72530	.72422	.72311	.72197	.72081	.71962	0.71842	.71720	.71597.
log cos β'	9.99575	9.99564	9.99556	9.99551	9.99549	9.99549	9.99553			
log z' = log r' sin β'	9.87024	9.87440	9.87716	9.87853	9.87850	9.87708	9.87421			
log tang (λ'−ν+ω')	~~.72210~~ 8.94075	~~.72094~~ 8.72562	~~.71978~~ 8.24053	~~.71862~~ 8.31628n	~~.71746~~ 8.79159	~~.71630~~ 9.02923	~~.71515~~ 9.19549			
log r' cos β'	.72210	.72094	.71978	.71862	.71746	.71630	.71515			
log cos (λ'−ν+ω')	9.99834	9.99939	9.99993	9.99991	9.99917	9.99750	9.99459			
log cos γ'	9.99409	9.99503	9.99549	9.99542	9.99466	9.99299	9.99012			
log sin γ'	9.21426	9.19712	9.15622	9.15953	9.19248	9.25076	9.32402			
log r' cos γ'	.72044	.72033	.71972	.71853	.71663	.71380	.70974			
−r' cos γ'	−5.2534	−5.2521	−5.2447	−5.2304	−5.2075	−5.1737	−5.1256			
r	+3.4731	+3.4424	+3.4002	+3.3469	+3.2822	+3.2063	+3.1198			
r − r' cos γ'	−1.7803	−1.8097	−1.8445	−1.8835	−1.9253	−1.9674	−2.0058			
log r' sin γ' = log Q sin l'	9.94061	9.90242	9.88045	9.88264	9.91445	9.97157	.04364			
log Q cos l'	.25049	.25761	.26588	.27497	.28450	.29389	.30229			
log tang l'	9.69012	9.64481	9.61457	9.60767	9.62995	9.67768	9.74135			
log Q	.29711	.29626	.29988	.30808	.32080	.33825	.35591			
log Q³	~~.89163~~	~~.88878~~	~~.89964~~	~~.92394~~	~~.96240~~	~~1.01475~~	~~1.07973~~			
log 1/Q	9.70289	9.70374	9.70012	9.69192	9.67920	9.66175	9.64009			
log 1/Q³	9.10867	9.11122	9.10036	9.07576	9.03760	8.98525	8.92027			
1/Q³	.128435	.129189	.125997	.119[illegible]	.109045	.096661	.083230			
−1/r³	−.006621	−.006690	−.006720	−.006771	.006825	.006880	−.006937			
A	+.121814	+.122519	+.119277	+.112289	+.102220	+.089781	+.076293			
log A	9.08570	9.08821	9.07657	9.05034	9.00954	8.95318	8.88248			
log z'	9.87024	9.87440	9.87716	9.87853	9.87850	9.87708	9.87421			
log W₀	.89270	.89937	.89049	.86564	.82480	.76702	.69345			
log S₀	.68591	.47153	9.97364	.02200n	.45535n	.63549n	.72988n			
Az	+.63995	+.64345	+.62558	+.58734	+.53232	+.46449	+.39104			
−z/r³	~~−.68348~~ +.19369	~~−.68631~~ +.19879	~~−.66770~~ +.19717	~~−.62976~~ +.18926	~~−.57488~~ +.17442	~~−.50823~~ +.15457	~~−.43641~~ +.13139			
log R₀	1.22501	1.23511	1.23160	1.21285	1.17836	1.12589	1.05532			
λ'−(ν+ω')	90 40 38	86 47 10	82 48 08	78 38 34	74 18 19	69 43 22	64 50 22			
L'	337 39 04	338 56 21	340 13 49	341 31 28	342 49 18	344 07 20	345 25 32	346 43 56	348 02 31	349 21 17
u'	167 36 08	168 53 25	170 10 43	171 28 32	172 46 22	174 04 24	175 22 36	176 41 00	177 59 35	
log sin u'	9.33182	9.28486	9.23192	9.17194	9.09968	9.01391	8.90636			
log tang u'	9.34296n	9.29307n	9.23759n	9.17576n	9.10316n	9.01624n	8.90778n			
log tang λ'	9.33655n	9.28756	9.23208	9.17025	9.09765	9.01073	8.90227			
λ'	167 45 15	169 01 37	170 18 59	171 34 03	172 51 46	174 08 51	175 26 05			
λ'−ν+ω'	~~241 55 00~~	~~247 04 50~~	~~252 21 14~~	~~257 46 42~~	~~263 28 50~~	~~269 15 52~~	~~275 26 06~~			
log sin β'	8.53136	8.48440	8.43146	8.37148	8.29922	8.21345	8.10590			
log r'	.98810	.98761	.98712	.98662	.98612	.98562	.98511	.98460	.98408	.98356
log cos β'	9.99975	9.99980	9.99984	9.99988	9.99991	9.99994	9.99996			
log z' = log r' sin β'	9.51946	9.47201	9.41858	9.35810	9.28534	9.19907	9.09101			
log cos (λ'−ν+ω')	9.99997	9.99932	9.99656	9.99141	9.98350	9.97222	9.95671			
log r' cos β'	.98785	.98741	.98696	.98650	.98603	.98556	.98507			
log cot (λ'−ν+ω')	8.07260	8.74868	9.09793	9.29430	9.43219	9.53978	9.62855			
log cos γ'	8.07235	8.74848	9.09777	9.29418	9.43210	9.53972	9.62851			
log sin γ'	9.99997n	9.99932	9.99657	9.99142	9.98350	9.97222	9.95671			
r' cos γ'	9.06045n	9.73609	.08489	.28080	.41822	.52534	.61362			
−r' cos γ'	+.1149	+.5446	+1.2159	−1.9090	−2.6195	−3.3523	−4.1079			
r	+3.4731	+3.4424	+3.4002	+3.3469	+3.2822	+3.2063	+3.1198			
r − r' cos γ'	+3.5880	+2.8978	+2.1823	+1.4379	+0.6627	−0.1460	−0.9881			
log r' sin γ' = log Q sin l'	.98807	.98693	.98369	.97804	.96962	.95784	.94182			
log Q cos l'	0.55485	0.46207	0.33891	0.15773	9.82132	9.16435	9.99480			
log tang l'	0.43322	.52486	0.64478	0.82031	1.14830	1.79349	0.94702			
log Q	1.01576	1.00548	.99456	.98295	.97071	.95790	.94457			
log 1/Q	8.98424	8.99452	9.00544	9.01705	9.02929	9.04210	9.05543			
log 1/Q³	6.95272	6.98356	7.01632	7.05115	7.08787	7.12630	7.16629			
1/Q³	+.0008969	+.0009629	+.0010383	+.0011250	+.0012243	+.0013375	+.0014665			
−1/r³	−.0010857	−.0010894	−.0010930	−.0010968	−.0011006	−.0011044	−.0011083			
A	−.0001888	−.0001265	−.0000547	+.0000282	+.0001237	+.0002331	+.0003582			
log A	6.27600n	6.10209n	5.73799n	5.45029	6.09237	6.36754	6.55413			
log z'	9.51946	9.47201	9.41858	9.35810	9.28534	9.19907	9.09101			
log W₀	7.20826n	6.98690n	6.56937n	6.22119	6.79061	6.97941	7.05794			
log Ay	7.26382n	7.08882n	6.72151n	6.42826	7.06190	7.32532	7.49591			
log x	8.67662n	8.50162n	8.13431n	7.84106	8.47470	8.73812	8.90871			
Ax	+.0000219	−.0000689	−.0000665	+.0000838	+.0003240	+.0007814	+.0014715			
−x/r³	−.0031149	−.0033145	−.0035304	−.0037602	−.0040182	−.0042885	−.0045752			
	−.0030932	−.0033834	−.0035969	−.0037114	−.0036942	−.0035071	−.0031037			
log (Ax − x/r³)	7.49041n	7.52935n	7.55593n	7.56954n	7.56752n	7.54495n	7.49188n			
R₀	8.90324n	8.94215	8.96873	8.98234n	8.98032	8.95775	8.90468			

(47) Dec 30 1878 Feb 8 Mar 20 Apr 29 June 8 July 18 Aug 27 Oct 6 Nov 15

2844252

.71473

350 40 15

.98303

4 1869. [illegible] * 12.694 1870

1869	Oct. 13	Nov 22	Jan 1	Feb. 10	Mar 22	May	June 10	July 20	Aug 29	Oct 8
$di = r\cos u W_0$	-1722	-1.500	-1.614	0.957	-0.285	+0.146	+0.313	+0.297	+0.176	+.013
$d\Omega = (2)\, r\sin u W_0$	-2.892	-7.684	-12.207	-13.983	-12.481	-9.252	-5.884	-3.172	-1.247	-.0.061
(3) $R_0 \sin v$	-4485	-4160	-1037	+3373	+2762	+0.677	-1813	-3.828	-4.526	-4.476
(3) $S_0(\cos v + \cos E)$	+15.201	+10.284	-1077	-12035	-15.458	-12391	-7.341	-3.243	-0.868	-016
$d\varphi$	+10.716	+6.124	-2.114	-9.662	-12.696	-11.714	-9.154	-7.071	-5.394	-4.492
-(4) $R_0 \cos v$	-18340	-33460	-42511	-32992	-15414	-2124	+3366	+3799	+1464	-1125
+(5) $(\frac{p}{r}+1)\sin v\, S_0$	-32.080	-11.309	+0.235	-7.704	-24.259	-33.461	-31.283	-22.261	-11.014	[illegible].678
(6) $W_0\, r\sin u$	-028	-076	-120	-138	-123	-091	-058	-031	-012	-020
$d\pi$	-50.448	-44.845	-42.396	-40834	-39.796	-35.676	~~-2[illegible]~~ 27.975	-18.493	-9.562	-1.803
+(7) $R_0 \sin v$	+6585	+6108	+1523	-3484	-4056	-0994	+2263	+.5622	+6641	+6572
+(8) $\frac{1}{2} S_0$	-5.5057	-3.4022	+.3430	+3.8797	+5.3069	+4.7950	+8.4366	+2.0401	+.8915	+.0504
$d\mu$	-4.8472	-2.7914	+0.4953	+3.5313	+4.9013	+4.6956	+3.7029	+2.6023	+1.5556	+0.7076
-(9) $R_0 \cos v$	-0846	-1543	-1961	-1522	-711	-.098	+155	+175	+067	-052
+(10) $R_0\, r$	-10.753	-16107	-18.795	-14994	8058	-1430	+3319	+6698	+8032	+8366
+(11) $S_0(\frac{p}{r}+1)\, r\sin v$	-1.480	-.522	+.011	-6.355	-1.119	-1.543	-1.443	-1.027	-.508	-.031
(6) $W_0\, r\sin u$	-028	-076	-120	-138	-123	-091	-058	-031	-012	-022
dL	-13.107	-18.248	-20.865	-17.009	-10.011	-3.162	+1.973	+5.815	+7.579	+8.283
(12) $\cos v\, R_0$								-3.624	-1.396	+1.073
+(10) $R_0\, r$	-10.753	-16.107	-18.795	-14.994	-8.058	-1.430	+3.319	+6.698	+8.032	+8.366
-(13) $S_0(\frac{p}{r}+1)\, r\sin v$	+17.494	+31.916	+40.550	+31.470	+14.704	+2026	-3210	+21.234	+10.507	+0.645
	+30.600	+10.787	-0224	+7348	+23.140	+31.917	+29.840			
dM	+37.341	+26.596	+21.531	+23.524	+29.786	+32.513	+29.949	+24.308	+17.143	+10.084

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$di = r\cos u W_0$	+.02149	-.0224	-.0195	-.0134	-.0252	+.0038	+.0122	+.0192	+.0241	+.0267
$d\Omega = (2)\, r\sin u W_0$	+.0361	-.0927	-.1477	-.1967	-.2274	-.2382	-.2296	-.2053	-.1704	-.1305
(3) $R_0 \sin v$	+.0024	-.0245	-.0104	+.0394	+.0942	+.1246	+.1206	+.0700	+.0382	-.0136
(3) $S_0(\cos v+\cos E)$	+.2568	+.2846	+.2296	+.1085	-.0265	-.1238	-.1601	-.1418	-.0901	-.0272
$d\varphi$	+.2592	+.2601	+.2192	+.1479	+.0677	+.0008	-.0395	-.0718	-.0519	-.0408
-(4) $R_0 \cos v$	+.0100	-.1967	-.4255	-.5484	-.5250	-.3908	-.2239	-.0694	-.0123	-.0034
+(5) $(\frac{p}{r}+1)\, r\sin v\, S_0$	-.5419	+.3129	-.0502	+.0695	-.0418	-.3344	-.6822	-.9736	-1.1436	-1.1816
+(6) $W_0\, r\sin u$	-.0004	-.0009	-.0015	-.0019	-.0022	-.0023	-.0023	-.0020	-.0017	-.0013
$d\pi$	-.5323	-.5105	-.4770	~~.6195~~ -.4808	-.5690	-.7275	-.9084	-1.0450	-1.1576	-1.1863
-(7) $R_0 \sin v$	-.0004	+.0036	+.0015	-.0057	-.0138	-.0183	-.0177	-.00103	-.00056	+.00019
-(8) $\frac{1}{2} S_0$	-.00430	-.0941	-.0731	-.0350	+.0091	+.0479	+.0750	+.0892	+.0926	+.0880
$d\mu$	-.0434	-.0905	-.0716	-.0408	-.0047	+.0296	+.0573	+.0789	+.0870	+.0899
-(9) $R_0 \cos v$	+.0005	-.0091	-.0196	-.0253	-.0242	-.0160	-.0103	-.0032	-.0006	-.0002
-(10) $R_0\, r$	+.0059	-.0947	-.1881	-.2492	-.2745	-.2631	-.2208	-.1223	-.0677	+.0254
+(11) $S_0(\frac{p}{r}+1)\, r\sin v$	-.0250	-.0143	-.0023	+.0032	-.0019	-.0154	-.0315	-.0449	-.0527	-.0545
+(6) $W_0\, r\sin u$	-.0004	-.0009	-.0016	-.0019	-.0022	-.0023	-.0023	-.0020	-.0017	-.0013
dL	-.0190	-.1190	-.2115	-.2732	-.3028	-.2988	-.2649	-.1724	-.1227	-.0306
+(12) $R_0 \cos v$	-.0095	+.1676	+.4058	+.5231	+.5008	+.3728	+.2185	+.0662	+.0118	+.0033
-(10) $R_0\, r$	+.0059	-.0947	-.1881	-.2492	-.2745	-.2631	-.2208	-.1223	-.0677	+.0254
-(13) $S_0(\frac{p}{r}+1)\, r\sin v$	+.5770	+.2965	+.0477	-.0663	+.0399	+.3189	+.6307	+.9287	+1.0908	+1.1270
dM	+.5734	+.3914	+.2654	+.2076	+.2662	+.4286	+.6284	+.8726	+1.0350	+1.1557

1870		1871				1871				
Nov 17	Dec 27	Feb 5	Mar 17	Apr 26	June	July 15	Aug 24	Oct 3	Nov 12	Dec 22
+.000	−0.320	−460	−574	−660	−720	−753	−761	−750	−721	−677
+.533	+.684	+.515	+.127	−.403	−1.013	−1.654	−2.277	−2.872	−3.408	−3.869
−4082	−3478	−2844	−2225	−1685	−1218	−823	−550	−330	±170	−064
−.204	−1.003	−2.106	−3.316	−4.510	−5.749	−6.604	−7.427	−8.112	−8645	−9025
−4.286	−4.481	−4.950	−5.541	−6.195	−6.967	7.427	−7.977	−8.442	−8.815	−9.089
−3192	−4526	−5218	−5356	−5137	−4622	−3877	−3241	−2487	−1707	−926
+7.533	+13.404	+17.148	+19.130	+19.700	+19.624	+17.831	+15821	+13.394	+10.639	+7.668
+.005	+.006	+.005	+.001	−.004	−.010	−.016	−.022	−.028	−.034	−.038
+4.346	+8.884	+11.935	+13.775	+14.559	+14.992	+13.938	+12.558	+10.879	+8.898	+6.704
+5993	+5107	+4170	+.3247	+2475	+1788	+.1208	+.0807	+.0485	+.0250	+.0094
+.5339	−.9289	−1.1909	−1.3625	−1.4725	−1.5770	−1.5830	−1.6023	−16130	−1.6161	−1.6087
+.0654	−.4182	−.7734	−1.0358	−1.2250	−1.3982	−1.4622	−1.5216	−1.5645	−1.5911	−1.5993
−147	−209	−241	−247	−.237	−213	−.179	−149	−.115	−079	−043
+8238	+7.715	+7.029	+6.203	+5.363	+4.482	+3.564	+2.865	+2136	+1.436	+.768
+.347	+.618	+.791	+.882	+.909	+.905	+.822	+.730	+.618	+0.491	+0.354
+.005	+.006	+.005	+.001	−.004	−.010	−.016	−.022	−.028	−.034	−.038
+8.443	+8.130	+7.584	+6.839	+6.031	+5.164	+4.191	+3.424	+2.611	+1.814	+1.041
+3.044	+4.318	+4.977	+5.119	+4.809	+4.409	+3.668	+2.865	+2.136	+1.436	+.768
+5.238	+7.715	+7.029	+6.203	+5.363	+4.482	+3.564	+3.092	+2.373	+1.629	+.883
−7.186	−12.796	−16.358	−18.247	−18.791	−18.718	−17.008	−15.091	−12.776	−10.148	−7.314
+4.096	−0.763 ✓	−4.352	−6.934	−8.528	−9.827	−9.746	−9.134	−8.267	−7.083	−5.663
+.0269	+.0248	+.0206	+.0145	+.0069	−.0020	−.0118	−.0221	−.0326	−.0427	−.0519
−.0899	−.0329	−.0231	−.0032	+.0042	−.0028	−.0259	−.0662	−.1247	−.2016	−.2969
−.0602	−.0972	−.1228	−.1368	−.1404	−.1349	−.1221	−.1040	−.0820	−.0584	−.0363
+.0298	+.0698	+.0867	+.0780	+.0438	−.0144	−.0941	−.1516	−.3028	−.4228	−.5461
−.0304	−.0274	−.0361	−.0588	−.0966	−.1493	−.2162	−.2956	−.3848	−.4815	−.5824
−.0471	−.1265	−.2257								
−.0471	−.1265	−.2262	−.3294	−.4279	−.5721	−.5755	−.6130	−.6182	−.5900	−.5258
+1.1015	−.9325	−.7057	−.4103	−.1912	+.0404	+.2541	+.4081	+.5000	+.5203	+.4649
−.0009	−.0005	−.0002	+.0000	+.0000	−.0000	−.0008	−.0006	−.00120	−.0029	−.0049
−1.1495	−1.0595	−.9311	−.7845	−.6191	−.4688	−.3217	−.2055	−.1194	−.0717	−.0647
+.0088	+.0148	+.0180	+.0201	+.0206	+.0198	+.0179	+.0153	+.0120	+.0086	+.0013
+.0781	+.1646	+.0490	+.0321	+.0143	−.0089	−.0226	−.0~~692~~ 413	−.0~~770~~ 692	−.0~~944~~ 790	~~−.1115~~ .0977
+.0869	+.0789	+.0670	+.0522	+.0349	+.0159	−.0047	−.0260	−.0572	−.0704	−.0924
−.0022	−.0058	−.0104	−.0152	−.0197	−.0236	−.0265	−.0283	−.0285	−.0272	−.0243
+.1216	+.2157	+.3034	+.3815	+.4467	+.4987	+.5290	+.5418	+.5309	+.4963	+.4359
−.0508	−.0430	−.0325	−.0208	−.0088	+.0023	+.0117	+.0158	+.0231	+.0240	+.0~~116~~ 214
−.0009	−.0005	−.0002	+.0000	+.0000	−.0000	−.0003	−.0006	−.0012	−.0020	−.0029
+.0677	+.1664	+.2603	+.3455	+.4182	+.4760	+.5139	+.5317	+.5243	+.4911	+.4201
+.0449	+.1206	+.2148	+.3142	+.4082	+.4885	+.5489	+.5747	+.5897	+.5628	+.5016
+.1216	+.2157	+.3034	+.3815	+.4467	+.4987	+.5290	+.5418	+.5309	+.4963	+.4359
+1.0507	+.8895	+.6731	+.4293	+.1824	−.0468	−.2424	−.3893	−.4769	−.4963	−.4426
+1.2172	+1.2258	+1.1913	+1.1250	+1.0373	+.9390	+.8350	+.7372	+.6437	+.5628	+.4948

4.

	1872 Jan 3	Mar 11	Apr 20	May 30	Jul 9	Aug 18	Sep 27	Nov 6	Dec 16	1873 Jan 25
$di = r\cos u\,W_0$	-.620	-.553	-.480	-.403	-.325	-.247	-.172	-.102	-.040	+.015
$d\Omega = (2)\,r\sin u\,W_0$	-4.241	-4.519	-4.698	-4.777	-4.757	-4.645	-4.445	-4.163	-3.817	-3.417
(3) $R_0 \sin v$	-.006	+.007	-.020	-.087	-.192	-.336	-.518	-.740	-1.004	-1.310
(3) $S_0(\cos v + \cos E')$	-9.254	-9.337	-9.279	-9.082	-8.753	-8.294	-7.711	-6.394	-6.199	-5.294
$d\varphi$	-9.260	-9.330	-9.259	-9.169	-8.945	-8.630	-8.229	-7.134	-7.203	-6.604
-(4) $R_0 \cos v$	-.156	+.592	+1.313	+2.061	+2.649	+3.248	+3.786	+4.260	+4.622	+4.836
+(5) $(\frac{p}{r}+1)\, r\sin v\, S_0$	+4.562	+1.397	-1.760	-4.851	-7.816	-10.609	-13.141	-15.422	-17.266	-18.658
(6) $W_0\, r \sin w$	-.042	-.045	-.046	-.047	-.047	-.046	-.044	-.041	-.038	-.033
$d\pi$	+4.364	+1.944	-0.495	-2.897	-5.214	-7.398	-9.399	-11.203	-12.682	-13.833
-(7) $R_0 \sin v$	+.0009	-.0011	+.0030	+.0128	+.0282	+.0493	+.0761	+.1084	+.1469	+.1997
-(8) $\frac{1}{2} S_0$	+1.6087	+1.6012	+1.5926	+1.5829	+1.5722	+1.5604	+1.5465	-1.5302	-1.5080	-1.4800
dw	~~+1.6096~~	~~+1.6023~~	~~+1.5956~~	~~+1.5957~~	~~+1.6004~~	~~+1.6097~~	~~+1.6226~~	-1.4218	-1.3611	-1.2883
	-1.6078	-1.6001	-1.5896	-1.5701	-1.5440	-1.5111	-1.4704			
-(9) $R_0 \cos v$	-.097	+.027	+.061	+.092	+.122	+.150	+.175	+.195	+.212	+.223
+(10) $R_0\, r$	+0.128	-.488	-1.075	-1.646	-2.199	-2.737	-3.261	-3.768	-4.258	-4.732
(11) $S_0(\frac{p}{r}+1)\, r \sin v$	.210	+.064	-.081	-.224	-.361	-.489	-.606	-.707	-.791	-.855
(6) $W_0\, r \sin w$	-.042	-.045	-.046	-.047	-.047	-.046	-.044	-.041	-.038	-.033
dL	+0.289	-0.438	-1.141	-1.825	-2.485	-3.122	-3.736	-4.321	-4.875	-5.397
(12) $\cos v\, R_0$	+.149	+.565	-1.253	-1.909	-2.527	-3.098	-3.612	-4.065	-4.410	-4.636
+(10) R_2	+0.128	-0.481	-1.075	-1.646	-2.199	-2.737	-3.261	-3.768	-4.258	-4.732
+(13) $S_0(\frac{p}{r}+1)\, r \sin v$	-4.351	-1.332	+1.679	+4.628	+7.456	+10.012	+12.535	+14.715	+16.475	+17.803
dM	-4.074	-2.881	-0.649	+1.073	+2.730	+4.277	+5.662	+6.882	+7.807	+8.435

h										
$di = r\cos u\,W_0$	-.0598	-.0638	-.0693	-.0697	-.0665	-.0594	-.0482	-.033	-.014	+.006
$d\Omega = (2)\,r \sin u\,W_0$	-.4093	-.5376	-.6777	-.8260	-.9754	-1.1178	-1.2438	-1.336	-1.392	-1.396
(3) $R_0 \sin v$	-.0169	-.0034	+.0016	-.0049	-.0258	-.0620	-.1161	-.1855	-.2683	-.3574
(3) $S_0(\cos v + \cos E')$	-.6666	-.7769	-.8691	-.9359	-.9762	-.9596	-.9050	-.894	-.660	-.487
$d\varphi$	-.6835	-.7803	-.8675	-.9408	-1.0015	-1.0216	-1.0211	-.989	-.928	-.844
-(4) $R_0 \cos v$	-.4216	-.2792	-.1004	+.1122	+.3459	+.6006	+.8489	+1.068	+1.237	+1.327
+(5) $(\frac{p}{r}+1)\, r \sin v\, S_0$	+.3286	+.1162	-.1649	-.4498	-.8646	-1.2264	-1.5422	-1.769	-1.840	-1.717
+(6) $W_0\, r \sin w$	-.0040	-.0053	-.0081	-.0046	-.0710	-.0110	-.0123	-.013	-.014	-.014
$d\pi$	-.0970	-.1683	-.2720	-.3437 ~~-.3201~~	-.5243	-.6368	-.7056	-.714	-.617	-.404
-(7) $R_0 \sin v$	+.0025	+.0005	-.0002	+.0007	+.0037	+.0091	+.0170	+.0271	+.0392	+.0523
-(8) $\frac{1}{2} S_0$	-.1158	-.1332	-.1492	-.1631	-.1739	-.1805	-.1815	-.1755	-.1606	-.1361
$d\psi$	-.1133	-.1327	-.1494	-.1625	.1702	-.1714	-.1645	-.1484	-.1214	-.0838
-(9) $R_0 \cos v$	-.0194	-.0129	-.0046	+.0052	+.0161	+.0277	+.0392	+.049	+.057	+.061
+(10) $R_0\, r$	+.3463	+.2284	+.0822	-.1923	-.2903	-.5062	-.7310	-.944	-1.138	-1.291
+(11) $S_0(\frac{p}{r}+1)\, r \sin v$	+.0058	+.0053	-.0076	-.0231	-.0344	-.0566	-.0711	-.081	-.084	-.078
+(6) $W_0\, r \sin w$	-.0040	-.0053	-.0067	-.0081	-.0096	-.0110	-.0123	-.013	-.014	-.014
$d\alpha$	+.3387	+.2155	+.0633	-.1183	-.3239	-.5461	-.7752	-.989	-1.179	-1.322
+(12) $R_0 \cos v$	+.4022	+.2663	+.0958	-.1070	-.3337	-.5724	-.8096	-1.020	-1.180	-1.267
-(10) $R_0\, r$	+.3463	+.2284	+.0822	-.0923	-.2903	-.5062	-.7310	-.944	-1.138	-1.291
-(13) $S_0(\frac{p}{r}+1)\, r \sin v$	-.3134	-.1108	+.1573	+.4757	+.8247	+1.1648	+1.4710	+1.686	+1.756	+1.639
dM	+.9353	+.8834	+.3353	+.2764	+.2003	+.0984	-.0896	-.226	-.562	-.919

								1874			
Mar 6	Apr 15	May 25	July 4	Aug 13	Sept 22	Nov 1	Dec 11	Jan 20	Mar 1	Apr 10	May 20
+.059	+.093	+115	+125	+124	+112	+.0[illegible]	+.063	+.032	+.002	-.002	-.032
-2976	-2508	-2030	-1561	-1119	-.726	-.402	-.1647	-.029	+.0012	-.008	-.190
-1657	-2039	-2445	-2857	-3237	-3532	-3661	-3533	-3058	-2226	-1195	-0315
-4310	-3196	-2216	-1205	-318	+334	+.610	+0353	-536	-2030	-3813	-5250
-5967	-5235	-4661	-4062	-3555	-3198	-3051	-3180	-3594	-4256	-5008	-5565
+4930	+4777	+4339	+3548	+2335	+656	-1459	-3833	-6054	-7427	-7190	-5722
-19485	-19640	-19008	-17485	-14978	-11479	-7120	-2301	+1012	+2357	+2480	+2908
-029	-028	-020	-015	-011	-007	-004	-002	.000	.000	.000	-.002
-14.584	-14.891	-14.689	-13.952	-12.654	-10.830	-8.583	-6.136	-5.042	-5.070	-4.710	-2.216
+2425	+2984	+3579	+4181	+4738	+5769	+5358	+5170	+4468	+3253	+1746	+0461
-14417	-13884	-13136	-12091	-10624	-8589	-5811	-2138	+2444	+7723	+12954	+16837
-11992	-10900	-9557	-7910	-5886	-3420	-.0453	+.3032	+6912	+10976	+14700	+17298
+.226	+219	+199	+163	+107	+030	-067	-175	-277	-340	-329	-234
-5186	-5600	-5964	-6263	-6471	-6556	-6477	-6197	-5661	-4823	-3673	-2303
-.883	-900	-871	-801	-686	-526	-326	-105	+046	+108	+113	+133
-029	-025	-020	-015	-011	-007	-004	-002	+.000	+.000	+.000	-.002
-5882	-6.306	-6.656	-6.916	-7.061	-7.059	-6.874	-6.479	-5.892	-5.055	-3.889	-2.404
-4.704	-4.557	-4.140	-3.386	-2.228	-0.626	+1.392	+3.658	+5.777	+7.087	+6.861	+4.888
-5.186	-5.600	-5.964	-6.263	-6.471	-6.556	-6.477	-6.197	-5.661	-4.823	-3.673	-2.303
+18.592	+18.740	+18.137	+16.683	+14.292	+10.953	+6.723	+2.196	-.966	-2.250	-2.368	-2.775
+8.702	+8.583	+8.033	+7.034	+5.593	+3.771	+1.708	-0.343	-.850	+.014	+.820	-.190

+.027	+.045	+.060	+.069	+.071	+.066	+.055	+.041	+.026	+.013	+.002	-.004
-1344	-1237	-1065	-864	-641	-428	-246	-108	-023	+.011	+.048	-.025
-4421	-507	-540	-530	-463	-354	-216	-079	+027	+079	+062	+021
-304	-137	-008	+045	+028	±.052	-163	-256	-289	-209	-048	+109
-.746	-.644	-.553	-.485	-.435	-.406	-.399	-.335	-.253	-.136	+.014	+.130
-1.375	-.821	-1128	+.652	+1.327	+1.779	+1.900	+1.661	+1.143	+.537	+.072	+.060
+1.337	+1.190	+.960	+.659	+.335	+.066	-.086	-.085	+.053	+.245	+.373	+.338
-013	-012	-010	-009	-006	-004	-002	-001	-.000	+.000	+.000	-.009
-.051	+.357	+.838	+1.303	+1.656	+1.841	+1.812	+1.575	+1.196	+.782	+.445	+.[illegible]
+0646	+0742	+0790	+0775	+0678	+0517	+0316	+0115	+0039	-0107	-0090	-0030
-1017	-0580	-0077	+0451	+0941	+1330	+1550	+1543	+1277	+0793	+0166	-0350
-0371	~~0338~~ +0162	+0713	+1226	+1619	+1847	+1866	+1658	+1238	+0686	+0076	-0380
+060	+054	+044	+030	+015	+003	-004	-004	+.002	+011	+017	+015
-1383	-1394	-1317	-1162	-.926	-.657	-.383	-.138	-.049	+.159	+190	+.152
-.063	-.038	-.005	+.030	+.061	+.081	+.087	+.076	+.052	+.025	+.003	-.003
-013	-012	-010	-008	-006	-004	-002	-001	-.000	+.000	+.000	+.000
-1.399	-1.390	-1.288	-1.110	-.856	-.577	-302	-067	+005	+195	+210	+.164
-1.256	-1.136	-916	-.629	-319	-.063	+.082	+081	-.050	-234	-.356	-.322
-1.383	-1.394	-1.317	-1.162	-926	-657	-383	-138	-049	+159	+190	+152
+1.312	+.784	+.107	±.622	-1.267	-1.697	-1.813	-1.585	-1.091	-.512	-.069	+.058
-1.327	-1.746	-2.126	-2.463	-2.512	-2.417	-2.114	-1.642	-1.190	-.587	-.235	-112

1874.

	Jan 29	Aug 8	Sep 17	Oct 27	Dec 6	1875 Jan 15	Feb 24	Apr 5	May 15	June 24
$de = -2\cos u\, W_0$	−.030	−.046	+.000	+.005	+.019	+.097	−.255	−.521 −2.268	−.925 −7.497	−1.499 −12.547
$d\varpi = \frac{2}{e}\sin u\, W_0$	−.328	−.408	−.364	−.150	+.250	+.508	+1.450	+2.054	+2.425	+2.302
(3) $R_0 \sin 2$	+.041	+.329	−.1211	−.2186	−.2883	−.3106	−.2828	−		
(3) S_0 (cos u + cos E)	+.5676	+.4792	+.2931	−0.810	+.860	+1.612	+1.232			
$d\varphi$	~~+10.717~~ −8.635	~~+10.121~~ −5.023	~~+1.720~~ ±4.142	~~−2.996~~ −2.996	~~−2.023~~ −2.023	~~−1.494~~ −1.494	−.596	−2.388	−3.929	−6.207
(4) $R_0 \cos 2$	−1.224	+.2458	+.4724	+.5042	+.3796	+1.815	−.0070			
(5) $(p+1)\,2\sin 2\, S_0$	−1.723	−5.721	−6.522	−2.886	+4.853	+15.539	+27.777			
(6) $W_0\, 2\sin w$	−.003	−.004	−.004	−.002	+.002	+.008	+.014			
$d\pi$	−2.950	−3.267	−1.802	+2.144	+8.651	+17.362	+27.721	+39.216	+51.322	+63.550
(7) $R_0 \sin 2$	−.0061	+.0481	+.1770	+.3195	+.4213	+.4539	+.4129	−		
(8) $\frac{1}{2} S_0$	+1.8077	+1.5925	+1.0720	+.3474	−.4720	−1.3082	−2.1171			
du	+1.8016	+1.6406	+1.2490	+0.6669	−.0507	−.8543	−1.7042	−2.5863	−3.4830	−4.3800
(9) $R_0 \cos 2$	−.056	+.112	+.216	+.231	+.174	+.083	−.003	+		
(10) $R_0\, 2$	−.541	+1.197	+2.828	+4.180	+5.099	+5.457	+5.165			
(11) $S_0 (p+1) \sin 2$	−.079	−.262	−.298	−.132	+.222	+.711	+1.268			
(6) $W_0\, 2\sin w$	−.008	−.004	−.004	−.002	+.002	+.008	+.414			
$d\psi$	−0.680	+1.043	+2.742	+4.277	+5.497	+6.259	+6.444	+5.917	+4.578	+2.319
(12) $R_0 \cos 2$	+1.168	−2.346	−4.608	−4.812	−3.622	−1.732	+.066			
(10) R_0	−0.541	+1.197	+2.828	+4.180	+5.099	+5.457	+5.165			
(13) $R_0 (\frac{p}{2}+1) \sin 2$	+1.643	+5.460	+6.224	+2.764	−4.631	−14.828	−26.509			
dW	+2.270	+4.311	+4.544	+2.132	−3.154	−11.103	−21.278	−33.302	−46.757	−61.260

	Jan 29	Aug 8	Sep 17	Oct 27	Dec 6	Jan 15	Feb 24	Apr 5	May 15	June 24
di results	−.006	−.003	+.000	+.006	+.011	+.016	+.021	+.024	+.027	+.028
$d\Omega = \frac{2}{\sin i}$ results	−.066	−.084	−.133	−.148	−.148	−.138	−.120	~~−.017~~ −.046	~~+.059~~ −.069	~~+.075~~ −.043
(3) $R_0 \sin 2$	−.005	+.014	+.071	+.140	+.196	+.229	+.336			
(3) S_0 (cos u + cos E)	+ ~~.109~~ .271	+ ~~.303~~ .298	+ ~~.303~~ .247	+ ~~.247~~ .150	+ ~~.094~~ .059	+.002	−.014			
$d\varphi$	+.266	+.317	+.318	+.290	+.255	+.231	+.222	+.228	+.250	+.280
(4) $R_0 \cos 2$	+.144	−.102	+.276	+.323	+.252	+.134	+.006			
(5) $(\frac{p}{2}+1)\, 2\sin 2\, S_0$	+.082	+.362	+.550	+.537	+.335	+.026	−.324			
(6) $2\sin u\, W_0$	−.001	−.001	−.004	−.004	−.001	−.001	+.001			
$d\pi$	+.225	~~+.465~~ +.259	~~+.825~~ +.273	~~+.859~~ +.213	~~+.586~~ +.082	~~+.159~~ +.109	−.317	−.515	−.684	−.812
(7) $R_0 \sin 2$	+.0007	−.0020	−.0103	−.0204	−.0286	−.0334	−.0335			
(8) $\frac{1}{2} S_0$	−.0862	−.1010	−.0904	−.0645	−.0326	−.0022	+.0247			
du	−.0855	−.1030	−.1007	−.0849	−.0612	−.0356	−.0088	+.0125	+.0327	+.0497
(9) $R_0 \cos 2$	+.006	−.005	−.013	−.015	−.012	−.006	+.000			
(10) $R_0\, 2$	+.064	−.049	−.165	−.267	−.347	−.401	−.432			
(11) $S_0 (\frac{p}{2}+1) \sin 2$	+.004	+.017	+.025	+.025	+.015	+.001	−.015			
$d\psi$	+.074	−.037	−.153	−.257	−.344	−.406	−.447	−.461	−.456	−.429
(12) $R_0 \cos 2$	+.138	+.097	+.263	+.308	+.246	+.127	−.005			
(10) R_0	+.064	−.049	−.165	−.267	−.347	−.401	−.432			
(13) $R_0 (\frac{p}{2}+1) \sin 2$ dW	−.078	−.345	−.525	−.512	−.329	−.024	+.309			
	~~+.124~~ −.152	−.297	−.427	−.471	−.431	−.298	−.128	+.057	+.231	+.286

1876

Aug 3	Sept 12	Oct 22	Dec 1	Jan 10	Feb 19	Mar 30	May 9	June 18	July 28	Sept 6	Oct 16
-2,268	-3,254	-4,463	5,890	-7,497	-9,219	-10,948	-12,547	-13,846	-14661	-14805	-14790
+1,347	-0.840	-4,758	10,932	-19,873	-32,011	-47,571	-66,355	-87,963	-111,175	-134,239	-155,018
+1689				+6531			+6173	+4709	+2470	-0.524	-4,153
~~+10,878~~				-32,742			-44,544	-45,262	-43,662	-39,505	-32,917
-9,189	-12,811	-16.954	-21,486	-26,211	-30,821	-34,993	-38,371	-40,553	-41,192	-40,029	-37,090
~~+3,678~~				+							
+3,678				+35,274			+76,555	+91,443	+106,450	+118,360	+129,427
+71,791				+77,288			+44,749	+28,844	+12,556	-2,150	-13,126
+ ,013				- ,196			- 654	- ,867	-1,095	-1,322	-1,328
+75,482				+112,366			+120,650	+119,720	+117,911	+115,888	+114,773
- ~~2466~~	+86,723	96,855	+105,585		+117,189	+119,883					
- 2466				- 9534			-9013	-6875	-3606	+0767	+6063
-50200				-73536			-81011	-79514	-75228	-67735	-56975
-5,2666	-6,1281	-6,9420	-7,6839	-8,3070	-8,7730	-9,0224	-9,0024	-8,6389	-7,8834	-6,6968	-5,0912
+ 017				+1610			+3494	+4187	+9858	+5447	+5907
-4476				-31,446			-63,400	-75,745	-86,659	-97,022	-105,575
+3,276				+3,527			+2,042	+1,316	+0,543	- ,098	- ,599
+ ,013				- 196			- 654	- 867	-1,095	-1,322	-1,528
-1,170	-5,455	-11,197	-18,229	-26,505	-36,131	-46,896	-58,518	-70,509	-82,323	-92,995	-101,735
-3,510				-33,664			-73,060	-87,556	-101,590	-118,915	-123,515
-4,476				-31,446			-63,400	-75,745	-86,659	-97,022	-105,515
-68,514				-73,760			-42,706	~~-11,983~~	+2052	~~+12527~~	+17,426
								-27,529	-11,983	+2,052	+12,527
-76,500	-92,210	-108,069	123,820	-138,870	-153,297	-166,731	-179,166	-190,230	-200,232	~~-212,989~~	~~-241,550~~
										-208885	-216,506

+,028	+027	+026	+024	+,022	+020	+017	+,014	+,011	+,009	+006	+004
~~+,073~~	~~+067~~	~~+059~~	~~+048~~	~~+035~~	~~+022~~	~~+009~~	~~-004~~	+073	+067	+059	+048
-017	-007	+028	+046	+059	+068	+074	+070				
+131				+016			-017	-016	+009	+002	+019
+184				+415			+464	+449	+418	+372	+311
+315	+349	+381	+409	+431	+445	+446	+447	+433	+409	+370	+330
+285				+085			-208	-310	-409	-501	-581
-1216				-980			-466	-286	-120	+020	+124
+002				+001			+001	+007	+001	+000	+003
-929	-950	-961	-941	-894	-829	-756	-673	-595	-528	-481	-457
-0191				+,0023			+,0024	+,0024	+,0014	-0023	-0027
+0850				+0932			+0844	+0789	+0720	+0638	+0539
+0659	+0748	+0822	+0878	+,0909	+0917	+0903	+0868	+0813	+0734	+0635	+0512
+013				+024			-009	-014	-019	-023	-027
-347				-075			+172	+254	+333	+407	+473
-055				-,045			-021	-013	-005	+001	+006
-389	-,335	-270	-195	-,116	+029	+056	+142	+227	+309	+383	+440
-,272				-081			+198	+296	+390	+478	+554
-347				-075			+172	+254	+333	+407	+473
+1160				+935			+445	+278	+115	+019	-118
+541	+617	+694	+747	+779	+800	+811	+815	+823	+838	+866	+909

	1876 Nov. 25	1877 Jan 4	Feb 13	Mar 25	May 4	June 13	July 23	1877 Aug 23 ~~Sept 1~~	Sept 1 ~~Oct 11~~	Oct 11 ~~Nov 20~~
di = 2 cos i W₀	~~-12770~~ -12770	-10.636	-8010	-5200	-2521	-0.241	+1.459	+1.589	+2652	+3.119
dΩ = (2)/2 sin i W₀	-170.920	-179.590	-179.820	-171.430	-155.540	-133.895	-109.492	-111.960	-87.077	-64.130
(3) R₀ sin i	-8198	-12263	-15,984	-18936	-20796	-21,298	-20.464	-20.552	-18602	-15714
(3) S₀ (cos i + cos E)	-24,282	-14,892	-4,375	+4606	+11547	+15.779	+17.149	+17.667	+16.546	+13.349
dφ	-32480	-26655	-20.369	-14330	-9.249	-5.519	-3.324	-2.885	-2.056	-2.367
(-4) R₀ cos i	+135480	+135690	+130460	+119760	+104615	+86.203	+66632	+68.997	+49691	+32.559
(8) (l+1) e S₀	-18.259	-16.226	-6.726	+9218	+29390	+50.744	+70.192	+70.984	+86.330	+98.190
(6)	-1.684	-1769	-1.772	-1689	-1532	-1.319	-1.099	-1091	-848	-625
dπ	+115.587	+117.685	+121962	+127.289	+132.473	+135.628	+135.745	+138.810	+135.123	+127.124
-(7) R₀ sin i	+11970	+17903	+23336	+27646	+30361	+31094	+29876	+29685	+26868	+22698
-(8) ½ S₀	-43059	-26555	-8843	+9901	+26833	+9.1587	+5.3117	+5.3588	+6.1551	+6.5601
d²u	-3.1089	-0.8652	+1.4993	+3.7347	+5.7194	+7.2681	+8.2953	+8.3273	+8.8419	+8.8299
-(9) R₀ cos i	+6183	+6.192	+5984	+5466	+4774	+3939	+3041	+3103	+2235	+1484
-(10) R₀	-111295	-112905	-111,365	-105948	-97137	-88.364	-71889	-68.893	-54.389	-40.594
+(11) S₀ (l+1)	-.833	-.741	-.307	+.421	+1.341	+2.316	+3.203	+3.188	+3.882	+4.281
(6)	-1,684	-1.769	-1.772	-1,689	-1.532	-1.319	-1,079	-1.091	-848	-625
dL	-107.629	-109.223	-107490	-101.750	-92.554	-80.433	-66.724	-63.693	-49.120	-35.479
(12) R₀ cos i	-129300	-129.500	-124505	-114.297	-99840	-82268	-63.591	-65.900	-47.456	-31.095
-(10) R₀	-111.295	-112905	-111.365	-105948	-97137	-85.364	-71.889	-68.893	-54.389	-40594
+(13) S₀ (l+1)	+17.426	+15.485	+6.419	-8.795	-28048	-48428	-66.990	-67.716	-82.448	-90.910
dM	-223.169	-226.920	-229.451	-229.040	-225.025	-216.060	202470	-202.609	-184.293	-162.599

di = 2 cos i W₀	+.003	+.001	+.000	-.000	-.000	-.000	-.000	+.000	+.001	+.001
dΩ	+.035	+.022	+.009	-.004	-.014	-.022	-.025	-.023	-.021	-.014
1	+.039	+.062	+.087	+.111	+.132	+.148	+.148	+.144	+.126	+.083
2	+.238	+.154	+.063	-.030	-.121	-.200	-.259	-.263	-.294	-.283
dφ	~~+.239~~ +.277	~~+.156~~ +.216	~~+.046~~ +.150	~~-.079~~ +.081	~~-.116~~ +.011	~~-.199~~ -.055	~~-.282~~ -.119	-.119	-.168	-.200
1	-.646	-.691	-.712	-.704	-.663	-.585	-.462	-.484	-.338	-.173
2	+.179	+.174	+.097	+.061	-.307	-.642	-1.059	-1.057	-1.533	-2020
3	0	0	0	0	0	0	0			
dπ	~~+.754~~ -.467	~~+.147~~ -.517	~~+.070~~ -.615	~~-.088~~ -.765	~~-.333~~ -.970	~~-.665~~ -1.227	~~-1.077~~ -1.521	-1.541	-1.871	-2193
1	-.0057	-.0091	-.0127	-.0163	-.0192	-.0211	-.0211	-.0208	-.0182	-.0120
2	+.0422	+.0285	+.0124	-.0064	-.0281	-.0526	-.0802	-.0799	-.1093	-.1392
du	+.0365	+.0194	-.0003	-.0227	-.0473	-.0737	-.1013	-.1007	-.1275	-.1512
1	-.029	-.032	-.032	-.032	-.030	-.027	-.021	-.022	-.015	-.008
2	+.530	+.575	+.604	+.613	+.599	+.555	+.478	+.484	+.369	+.215
3	+.008	+.008	+.004	+.003	-.014	-.029	-.048	-.048	-.069	-.091
dL	+.509	+.551	+.576	+.578	+.555	+.499	+.409	+.414	+.286	+.116
1	+.616	+.660	+.680	+.672	+.633	+.557	+.449	+.462	+.322	+.165
2	+.530	+.575	+.604	+.613	+.599	+.555	+.478	+.484	+.369	+.215
3	-.171	-.166	-.093	+.058	+.293	+.613	+1.011	+1.010	+1.464	+1.930
dM	+.975	+1.069	+1.191	+1.343	+1.525	+1.727	+1.938	+1.956	+2.155	+2.310

Nov. 20 ~~Dec 30~~	Dec 30	1878 Feb 8	Mar 20	Apr 29	June 8	July 18	Aug 27	Oct 6	Nov 15	Dec 25
+3122	+2800	+2295	+1720	+1167	+.687	+315	+060	+.083	-129	-133
-44522	-28877	-17207	-9103	-3984	-1159	+015	+118	+.365	+1044	-1661
-12221	-8488	-4868	-1686	+750	+2217	+2605	+2049	+0.997	+106	-079
+8.973	+4204	+0.211	-3639	-5.600	-5786	-4180	+1180	+2353	+5235	+6628
-3248	-4284	-5079	-6325	-4850	-3569	-1.575	+0.869	+3.350	+5341	+6549
+18585	+8435	+2270	-.153	+538	+3296	+6645	+8876	+8604	+5581	+1052
+97.270	+92.560	+81.917	+66660	+48.745	+30.281	+13.951	+2.427	-2.482	-0.917	+4.549
-434	-281	-168	-089	-039	-011	+000	+.001	-004	-010	-016
+115.421	+100.414	+84019	+66.418	+49.244	+32.566	+20.596	+11.304	+6.118	+4.654	+5.585
+17652	+12260	+7031	+2436	-1083	-3202	-3763	-2960	-1439	-0154	+0114
+66248	+63794	+58635	+51063	+41469	+30016	+17278	+4211	+7352	-16550	-21257
+83900	+76054	+65666	+53499	+40386	+26814	+1.3515	+1257	-8791	-16704	-21143
+0.836	+.379	+102	-.007	+024	+148	+299	+399	+387	-257	+047
-28.225	-17.755	-9310	-3052	+1316	+3961	+5119	+5060	+4070	+2444	[illegible]
+4374	+4.162	+3684	+2998	+2192	+1362	+.627	+.109	-.112	-.041	+.204
-434	-281	-168	-089	-039	-011	+000	+001	-004	-010	-016
-23.449	-13.495	-5.752	-0.150	+3.493	+5.460	+6.045	+5.569	+4.341	+2.644	+0.711
-17.750	-8056	-2168	+.146	-.574	-3148	-6346	-8477	-8217	-5330	-1.005
-28.225	-17.755	-9.310	-3052	+1.316	+3.961	+5.119	+5.060	+4.070	+2.444	+[illegible]
-92.895	-88.398	-78.233	-63.662	-46.554	-28.920	-13.322	-2317	+2371	+.876	-4.344
-138,870	-114.209	~~-86.318~~ -89.771	~~-45.752~~ ~~-60.756~~ 66.568	~~-28.107~~ -45.752	~~-14.549~~ -28.107	~~-5.734~~ -14.549	~~-1.776~~ -5.734	~~-2.011~~ -1.776	~~-0.596~~ -2.011	-4.873
+.000	-.001	-.003	-.006	-.009	-.012	-.013	-.012	-.009	-.005	-.002
-.002	+.012	+.028	+.034	+.033	+.021	-.004	-.024	-.038	.038	-.024
+.009	-.095	-.224	-.352	-.440	-.444	-.347	-.187	-.048	+.001	-.029
-.226	-.123	+.007	+.121	+.159	+.068	-.150	-.401	-.540	-.476	-.257
-.217	-.218	-.218	-.231	-.281	-.378	-.497	-.588	-.578	-.475	-.280
-.015	+.095	+.104	+.040	-.316	-.660	-.885	-.808	-.419	+.067	+.386
-.2445	-.2699	-.2657	-.2217	-.1387	-.316	+.501	+.625	+.570	+.083	-.176
-2.460	-2.604	-2.553	-2.257	-1.703	-1.016	-.384	+.017	+.151	+.150	+.210
-.0014	+.0138	+.0324	+.0508	+.0635	+.0641	+.0501	+.0270	+.0070	-.0002	+.0042
-.1665	-.1860	-.1902	-.1698	-.1179	-.0353	+.0620	+.1431	+.1766	+.1506	+.0824
-.1679	-.1722	-.1578	-.1190	-.0544	+.0288	+.1121	+.1701	+.1836	+.1504	+.0866
-.001	+.004	+.005	-.002	-.074	-.030	-.040	-.036	-.019	+.003	+.017
+.022	-.200	-.431	-.637	-.774	-.793	-.682	-.461	-.199	+.030	+.174
-.010	-.121	-.119	-.099	-.062	-.016	+.022	+.037	+.026	+.004	+.008
-.089	-.317	-.540	-.738	-.850	-.839	-.700	-.460	-.192	+.037	+.18
+.014	+.090	+.098	+.088	+.302	+.631	+.845	+.912	+.400	-.065	-.368
+.022	-.200	-.431	-.637	-.774	-.793	-.682	-.461	-.199	+.030	+.174
+.2335	+.2577	+.2537	+.2117	+.1324	+.340	-.478	-.788	-.544	-.080	+.168
+2.371	+2.287	+2.408	+1.518	+.852	+.178	-.315	-.477	-.343	-.115	-.026

1869	$\omega^2\frac{dr}{dt}$	e ′f	e ″f	$\frac{di}{dt}$	′f	$\frac{d\Omega}{dt}$	′f	$\frac{d\varphi}{dt}$	′f	$\frac{d\pi}{dt}$	′f
Oct 13	-4.8472		-.2020	-1.722		-2.892		+10.716		-50.448	
		-.0856	~~-20~~		+.007		+.199		+.191		-.233
Nov 22	-2.7914		-.2876	-1.900		-7.684		+6.124		-44.845	
		-2.8770			-1.893		-7.485		+6.315		-45.078
1870 Jan 1	+0.4953		-3.1646	-1.614		-12.207		-2.114		-42.396	
		-2.3817			-3.507		-19.692		+4.201		-87.474
Feb 10	+3.5313		-5.5463	-0.957		-13.983		-9.662		-40.834	
		+1.1496			-4.464		-33.675		-5.461		-128.308
Mar 22	+4.9013		-4.3967	-0.285		-12.481		-12.696		-39.796	
		+6.0509			-4.749		-46.156		-18.157		-168.104
May 1	+4.6956		+1.6542	+0.146		-9.252		-11.714		-35.696	
		+10.7465			-4.603		-55.408		-29.871		-203.780
June 10	+3.7029		+12.4007	+0.313		-5.884		-9.154		-27.975	
		+14.4494			-4.290		-61.292		-39.025		-231.755
July 20	+2.6023		+26.8501	+0.297		-3.172		-7.071		-18.493	
		+17.0517			-3.993		-64.464		-46.096		-250.248
Aug 29	+1.5556		+43.9024	+0.176		-1.247		-5.394		-9.562	
		+18.6073			-3.817		-65.711		-51.490		-259.810
Oct 8	+0.7076		+62.5097	+0.013		-0.061		-4.492		-7.803	
		+19.3149			-3.804		-65.772		-55.982		-267.613
Nov 17	+0.0654		+81.8246	+.000		+0.533		-4.286		+4.346	
		+19.3803			-3.804		-65.239		-60.268		-263.267
Dec 27	-0.4182		+101.2049	-.320		+.684		-4.481		+8.884	
		+18.9621			-4.124		-64.555		-64.749		-254.383
1871 Feb 5	-0.7734		+120.1670	-.460		+.515		-4.950		+11.935	
		+18.1887			-4.584		-64.040		-69.699		-242.448
Mar 17	-1.0358		+138.3557	-.574		+.127		-5.541		+13.775	
		+17.1529			-5.158		-63.913		-75.240		-228.673
Apr 26	-1.2250		+155.5086	-.660		-.403		-6.195		+14.559	
		+15.9279			-5.818		-64.316		-81.435		-214.114
June 5	-1.3982		+171.4365	-.720		-1.073		-6.967		+14.992	
		+14.5297			-6.538		-65.329		-88.402		-199.122
July 15	-1.4622		+185.9662	-.753		-1.654		-7.427		+13.938	
		+13.0675			-7.291		-66.983		-95.829		-185.184
Aug 24	-1.5216		+199.0337	-.761		-2.277		-7.977		+12.558	
		+11.5459			-8.052		-69.260		-103.806		-172.626
Oct 3	-1.5645		+210.5796	-.750		-2.872		-8.442		+10.879	
		+9.9814			-8.802		-72.132		-112.248		-155.747
Nov 12	-1.5911		+220.5610	-.721		-3.408		-8.815		+8.898	
		+8.3903			-9.523		-75.540		-121.063		-146.849
Dec 22	-1.5993		+228.9513	-.677		-3.869		-9.089		+6.704	
		+6.7910			-10.200		-79.409		-130.152		-140.145
1872 Jan 31	-1.6078		+235.7423	-.620		-4.241		-9.260		+4.364	
		+5.1832			-10.820		-83.650		-139.412		-135.781
Mar 11	-1.6001		+240.9255	-.553		-4.519		-9.330		+1.944	
		+3.5831			-11.373		-88.169		-148.742		-133.837
Apr 20	-1.5896		+244.5086	-.480		-4.698		-9.299		-0.495	
		+1.9935			-11.853		-92.867		-158.041		-134.332
May 30	-1.5701		+246.5021	-.403		-4.777		-9.169		-2.897	
		+0.4234			-12.256		-97.644		-167.210		-137.229
July 9	-1.5440		+246.9255	-.325		-4.757		-8.945		-5.214	
		-1.1206			-12.581		-102.401		-176.155		-142.443
Aug 18	-1.5111		+245.8049	-.247		-4.645		-8.630		-7.398	
		-2.6317			-12.828		-107.046		-184.785		-149.841
Sept 27	-1.4704		+243.1732	-.172		-4.445		-8.229		-9.399	
		-4.1021			-13.000		-111.491		-193.014		-159.240
Nov 6	-1.4218		+239.0711	-.102		-4.163		-7.134		-11.203	
		-5.5239			-13.102		-115.654		-200.148		-170.443
Dec 16	-1.3611		+233.5472	-.040		-3.817		-7.203		-12.682	
		-6.8850			-13.142		-119.471		-207.351		-183.125
1873 Jan 25	-1.2883		+226.6622	+.015		-3.417		-6.604		-13.832	
		-8.1733			-13.127		-122.888		-213.955		-196.957
Mar 6	-1.1992		+218.4889	+.059		-2.976		-5.967		-14.584	
		-9.3725			-13.068		-125.864		-219.922		-211.541
Apr 15	-1.0900		+209.1164	+.093		-2.508		-5.235		-14.888	
		-10.4625			-12.975		-128.372		-225.157		-226.429
May 25	-.9557		+198.6539	+.115		-2.030		-4.661		-14.689	
		-11.4182			-12.860		-130.402		-229.818		-241.118
July 4	-.7910		+187.2357	+.125		-1.561		-4.062		-13.952	
		-12.2092			-12.735		-131.963		-233.880		-255.070
Aug 13	-.5886		+175.0265	+.124		-1.119		-3.555		-12.654	
		-12.7978			-12.611		-133.082		-237.435		-267.724
Sept 22	-.3420		+162.2287	+.112		-0.726		-3.198		-10.830	
		-13.1398			-12.499		-133.808		-240.633		-278.554
Nov 1	-.0453		+149.0889	+.091		-0.402		-3.051		-8.583	
		-13.1851			-12.408		-134.210		-243.684		-287.137
Dec 11	+.3032		+135.9038	+.063		-.164		-3.180		-6.136	
		-12.8819			-12.345		-134.374		-246.864		-293.273
1874 Jan 20	+.6912		+123.0219	+.032		-.029		-3.594		-5[illegible]	
		-12.1907	~~+110.8312~~		-12.313		-134.403		-250.458		-298.315
	1.457		+110.83								

$\frac{dL}{dt}$	'f	$\frac{dM}{dt}$	'f
−13.107	+.214	+37.341	+.448
−18.248	−18.034	+26.596	+27.044
−20.865	−38.899	+21.531	+48.575
−17.009	−55.908	+23.824	+72.399
−10.011	−65.919	+29.786	+102.185
−3.162	−69.081	+32.513	+134.698
+1.973	−67.108	+29.949	+164.647
+5.815	−61.293	+24.308	+188.955
+7.579	−53.714	+17.143	+206.098
+8.283	−45.431	+10.084	+216.182
+8.443	−36.988	+4.096	+220.278
+8.120	−28.868	−0.763	+219.515
+7.584	−21.284	−4.352	+215.163
+6.839	−14.445	−6.534	+208.229
+6.031	−8.414	−8.528	+199.701
+5.164	−3.250	−9.827	+189.874
+4.191	+0.941	−9.746	+180.128
+3.424	+4.365	−9.134	+170.994
+2.611	+6.976	−8.267	+162.727
+1.814	+8.790	−7.083	+155.644
+1.041	+9.831	−5.663	+149.981
+0.289	+10.120	−4.074	+145.907
−0.438	+9.682	−2.381	+143.526
−1.141	+8.541	−0.649	+142.877
−1.825	+6.716	+1.073	+143.950
−2.485	+4.231	+2.730	+146.680
−3.122	+1.109	+4.277	+150.957
−3.736	−2.627	+5.662	+156.619
−4.321	−6.948	+6.882	+163.501
4.875	−11.823	+7.807	+171.308
−5.397	−17.220	+8.435	+179.743
−5.882	−23.102	+8.702	+188.445
−6.306	−29.408	+8.583	+197.028
−6.656	−36.064	+8.033	+205.061
−6.916	−42.980	+7.034	+212.095
−7.061	−50.041	+5.593	+217.688
−7.059	−57.100	+3.771	+221.459
−6.874	−63.974	+1.708	+223.167
−6.479	−70.453	−0.343	+222.824
−5.892	−76.345	−0.850	+221.974

t (+) 15	$\omega^2\frac{da}{dt^2}$	∫	"∫	$\frac{di}{dt}$	'∫	$\frac{d\Omega'}{dt}$	'∫	$\frac{d\varphi}{dt}$	∫	$\frac{d\pi}{dt}$	∫
		−12.1907			−12.313		−134.403		−250.458		−298.315
Mar 1	+1.0976		+110.8812	+.002		+.002		−4.256		−5.070	
		−11.0931			−12.311		−134.401		−254.714		−303.385
Apr 10	+1.4700		+95.7381	−.002		−.008		−5.008		−4.710	
		−9.6231			−12.313		−134.409		−259.722		−308.095
May 20	+1.7298		+90.1150	−.032		−.190		−5.565		−2.216	
		−7.8933			−12.345		−134.599		−265.287		−310.311
June 29	+1.8016		+82.2217	−.030		−.328		−5.635		−2.950	
		−6.0917			−12.375		−134.927		−270.922		−313.261
Aug 8	+1.6406		+76.1300	−.016		−.408		−5.121		−3.267	
		−4.4511			−12.391		−135.335		−276.043		−316.528
Sept 17	+1.2490		+71.6789	+.020		−.364		−4.142		−1.802	
		−3.2021			−12.371		−135.699		−280.185		−318.330
Oct 27	+.6669		+68.4768	+.005		−.150		−2.996		+2.144	
		−2.5352			−12.386		−135.849		−283.181		−316.186
Dec 6	−.0507		+65.9416	−.019		+.250		−2.023		+8.051	
		−2.5859			−12.405		−135.599		−285.204		−308.135
1875 Jan 15	−.8543		+63.3557	−.097		+.808		−1.499		+17.362	
		−3.4402			−12.502		−134.791		−286.698		−290.773
Feb 24	−1.7042		+59.9155	−.255		+1.459		−1.596		+27.721	
		−5.1444			−12.757		−133.341		−288.294		−262.452
Apr 5	−2.3863		+54.7711	−.521		+2.054		−2.393		+39.216	
		−7.7307			−13.278		−131.287		−290.687		−223.236
May 15	−3.4830		+47.0404	−.925		2.425		−3.929		+51.322	
		−11.2137			−14.203		−128.862		−294.616		−171.914
June 25	−4.3800		+35.8267	−1.499		2.302		−6.207		+63.550	
		−15.5937			−15.702		−126.560		−300.823		−108.364
Aug 3	−5.2666		+20.2330	−2.268		+1.347		−9.189		+75.482	
		−20.8603			−17.970		−125.213		−310.012		−32.882
Sept 12	−6.1281		−0.6273	−3.254		−0.840		−12.811		+86.723	
		−26.9884			−21.224		−126.053		−322.823		+53.841
Oct 22	−6.9420		−27.6157	−4.463		−4.758		−16.954		+96.855	
		−33.9304			−25.687		−130.811		−339.777		+150.696
Dec 1	−7.6839		−61.5461	−5.890		−10.932		−21.486		+105.585	
		−41.6143			−31.577		−141.743		−361.263		+256.281
1876 Jan 10	−8.3070		−103.1604	−7.497		−19.873		−26.211		+112.366	
		−49.9213			−39.074		−161.616		−387.474		+368.647
Feb 19	−8.7730		−153.0817	−9.219		−32.011		−30.821		+117.187	
		−58.6943			−48.293		−193.627		−418.295		+485.834
Mar 30	−9.0224		−211.7760	−10.948		−47.571		−34.993		+119.883	
		−67.7167			−59.241		−241.198		−453.288		+605.717
May 9	−9.0024		−279.4927	−12.547		−66.355		−38.371		+120.650	
		−76.7191			−71.788		−307.553		−491.659		+726.367
June 18	−8.6389		−356.21[illegible]	−[illegible].846		−87.963		−40.553		+119.720	
		−85.3580			−85.634		−395.516		−532.212		+846.087
July 28	−7.8834		[illegible]	−14.661		−111.175		−41.192		+117.911	
		−93.2414			−100.295		−506.691		−573.404		+963.998
Sept 6	−6.6968		−534.8112	−14.805		−134.239		−40.029		+115.888	
		−99.938[illegible]			−115.100		−640.930		−613.433		+1079.886
Oct 16	−5.0912		−634.7494	−14.150		−155.018		−37.070		+114.773	
		−105.0294			−129.290		−795.948		−650.503		+1194.659
Nov 25	−3.1089		−739.7788	−12.770		−170.920		−32.480		+115.537	
		−108.1383			−142.060		−966.868		−682.983		+1310.196
1877 Jan 4	−0.8652		−847.9171	−10.636		−179.590		−26.655		+117.685	
		−109.0035			−152.696		−1146.458		−709.638		+1427.881
Feb 13	+1.4793		−956.9206	−8.010		−179.820		−20.359		+121.962	
		−107.5242			−160.706		−1326.278		−729.997		+1549.853
Mar 25	+3.7347		−1064.4448	−5.200		−171.430		−14.330		+127.289	
		−103.7895			−165.906		−1497.708		−744.327		+1677.142
May 4	+5.7194		−1168.2343	−2.571		−155.540		−9.249		+132.473	
		−98.0701			−168.427		−1653.248		−753.576		+1809.625
June 13	+7.2681		−1266.3044	−0.241		−133.885		−5.519		+135.628	
		−90.8020			−168.668		−1787.143		−759.095		+1945.253
July 23	+8.2993		−1357.1064	+1.459		−109.492		−3.324		+135.745	
		−82.5027			−167.209		−1896.635		−762.419		+2080.998
Sept 1			−1439.6091								
Oct 11											
Nov 20											
Dec 30											

$\frac{dL}{dT}$	$\int$	$\frac{dM}{dT}$	$\int$
	−76.345		+221.974
−5.055		+.014	
	−~~71~~ 81.400		+221.988
−3.889		+.820	
	−~~80~~ 85.289		+222.808
−2.404		−.190	
	−~~82~~ 87.693		+222.618
−.680		+2.270	
	−88.373		+224.888
+1.043		+4.311	
	−~~82~~ 87.330		+229.199
+2.742		+4.544	
	−~~79~~ 84.588		+233.743
+4.277		+2.132	
	−~~75~~ 80.311		+235.875
+5.497		−3.154	
	−~~69~~ 74.814		+232.721
+6.259		−11.103	
	−~~63~~ 68.555		+221.618
+6.444		−21.278	
	−62.111		+200.340
+5.917		−33.302	
	−56.194		+167.038
+4.578		−46.757	
	−51.616		+120.281
+2.319		−61.260	
	−49.297		+59.021
−1.170		−76.500	
	−50.467		−17.479
−5.455		−92.210	
	−55.922		−109.689
−11.197		−108.069	
	−67.119		−217.758
−18.229		−123.820	
	−85.348		−341.578
−26.505		−138.870	
	−111.853		−480.448
−36.131		−153.297	
	−147.984		−633.745
−46.896		−166.731	
	−194.880		−800.476
−58.518		−179.166	
	−253.398		−979.642
−70.509		−190.230	
	−323.907		−1169.872
−82.323		−200.232	
	−406.230		−1370.104
−92.995		−208.885	
	−499.225		−1578.989
−101.735		−216.506	
	−600.960		−1795.495
−107.629		−223.169	
	−708.589		−2018.664
−109.223		−226.920	
	−817.812		−2245.584
−107.490		−229.451	
	−925.302		−2475.035
−101.750		−229.040	
	−1027.052		−2704.075
−92.554		−225.025	
	−1119.606		−2929.100
−80.433		−216.060	
	−1200.039		−3145.160
−66.724		−202.470	
	−1266.763		−3347.630

	t	$\omega^2\frac{du}{d\tau^2}$	'g	''f	$\frac{dc}{d\tau}$	'f	$\frac{d\Omega}{d\tau}$	'f	$\frac{d\varphi}{d\tau}$	'f	$\frac{d\pi}{d\tau}$	'f
			−90.8020	−1266.3044		−168.168		−1787.148		−759.095		+1945.253
1877	Jul 23	+8.3273		−1357.1064	+1.589		−111.960		−2.885		+138.810	
			−82.4747			−167.079		−1899.103		−761.980		+2084.063
	Sept 1	+8.8419		−1439.5811	+2.652		−87.077		−2.056		+135.173	
			−73.6328			−164.427		−1986.180		−764.036		+2219.236
	Oct 11	+8.8299		−1513.2139	+3.119		−64.130		−2.367		+127.124	
			−64.8029			−161.308		−2050.310		−766.403		+2346.360
	Nov 20	+8.3900		−1578.0168	+3.122		−44.522		−3.248		+115.421	
			−56.4129			−158.186		−2094.832		−769.651		+2461.781
	Dec 30	+7.6054		−1634.4297	+2.800		−28.877		−4.284		+100.714	
			−48.8075			−155.386		−2123.709		−773.935		+2562.495
1878	Feb 8	+6.5666		−1683.2372	+2.295		−17.207		−5.079		+84.019	
			−42.2409			−153.091		−2140.916		−779.014		+2646.514
	Mar 20	+5.3499		−1725.4781	+1.720		−9.103		−5.325		+66.418	
			−36.8910			−151.371		−2150.019		−784.339		+2712.932
	Apr 29	+4.0386		−1762.3691	+1.167		−3.984		−4.850		+49.244	
			−32.8524			−150.204		−2154.003		−789.189		+2762.176
	June 8	+2.6814		−1795.2215	+.687		−1.159		−3.569		+33.566	
			−30.1710			−149.517		−2155.162		−792.758		+2795.742
	Jul 18	+1.3515		−1825.3925	+.315		+.015		−1.575		+20.596	
			−28.8195			−149.202		−2155.147		−794.333		+2816.338
	Aug 27	+.1251		−1854.2120	+.060		+.118		+.869		+11.304	
			−28.6946			−149.142		−2155.029		−793.464		+2827.642
	Oct 6	−.8791		−1882.9066	−.083		−.365		+3.350		+6.118	
			−29.5737			−149.225		−2155.394		−790.114		+2833.760
	Nov 15	−1.6704		−1912.4803	−.129		−1.044		+5.341		+4.654	
			−31.2441			−149.354		−2156.438		−784.773		+2838.414
	Dec 25	−2.1143		−1943.7244	−.133		−1.661		+6.549		+5.585	
			−33.3584			−149.487		−2158.099		−778.224		+2843.999
1879	Feb 3	−2.2610		−1977.0828	−.040		−2.054		+6.918		+7.198	
			−35.6194			−149.527		−2160.153		−771.306		+2851.197
	Mar 15	−2.1787		−2012.7022	+.041		−2.204		+6.689		+8.456	
			−37.7981			−149.486		−2162.357		−764.517		+2859.653
	Apr 24	−1.9510		−2050.5003	+.119		−2.121		+6.172		+8.727	
			−39.7491			−149.367		−2164.478		−758.345		+2868.380
	June 3	−1.6504		−2090.2494	+.180		−1.862		+5.628		+8.067	
			−41.3995			−149.187		−2166.340		−752.717		+2876.447
	July 13	−1.3300		−2131.6489	+.218		−1.889		+5.220		+6.822	
			−42.7295			−148.969		−2168.229		−747.497		+2883.269
	Aug 22	−1.0186		−2174.3784	+.232		−1.101		+5.002		+5.365	
			−43.7481			−148.737		−2169.330		−742.495		+2888.634
	Oct 1	−.7093		−2218.1265	+.236		−.758		+4.972		+3.699	
			−44.4574			−148.501		−2170.088		−737.523		~~+2891.540~~ 2892.333
	Nov 10	−.4688		−2262.5839	+.190		−.382		+5.100		+2.898	
			−44.9262			−148.311		−2170.470		−732.423		~~+2894.438~~ 2895.231
	Dec 20	−.2353		−2307.5101	+.141		−.140		+5.339		+2.189	
			−45.1615			−148.170		−2170.610		−727.084		~~+2896.627~~ 2897.420
1880	Jan 29	−.0306		−2352.6716	+.078		−.008		+5.641		+1.934	
			−45.1921			−148.092		−2170.618		−721.443		~~+2898.561~~ 2899.354
	Mar. 9	+.1558		−2397.8637	+.007		+.005		+5.979		+2.075	
			−45.0363			−148.085		−2170.613		−715.464		~~+2900.636~~ 2901.429
	Apr. 18	+.3241		−2442.9000	−.069		−.108		+6.311		+2.617	
			−44.7122			−148.154		−2170.721		−709.153		~~+2903.253~~ 2904.046
	May 28	+.4759		−2487.6122	−.146		−.343		+6.618		+3.498	
			−44.2363	2531.8485		−148.300		−2171.064		−702.535		~~+2906.751~~ +2907.544

	$\frac{d\mathcal{L}}{dt}$	∫	$\frac{dM}{dt}$	∫
		-1200.039		-3145.160
	-63.653		-202.509	
		-1263.732		-3347.669
	-49.120		-184.293	
		-1312.852		-3531.962
	-35.474		-162.599	
		-1348.326		-3694.561
	-23.449		-138.870	
		-1371.775		-3833.431
	-13.495		-114.209	
		~~-1385.270~~ 1385.270		-3947.640
	-5.752		-89.771	
		~~-1387.564~~ 1391.022		~~-3943.953~~ -4037.411
	-150		-66.568	
		~~-1387.714~~ -1391.172		~~-4010.521~~ -4103.979
	+3.493		-45.752	
		~~-1384.221~~ -1387.679		~~-4056.273~~ -4149.731
	+5.460		-28.107	
		~~-1378.761~~ -1382.219		~~-4084.380~~ -4177.838
	+6.045		-14.549	
		~~-1372.716~~ -1376.174		~~-4098.929~~ -4192.387
	+5.569		-5.734	
		~~-1367.147~~ -1370.605		~~-4104.663~~ -4198.121
	+4.341		-1.776	
		~~-1362.806~~ -1366.264		~~-4106.439~~ -4199.897
	+2.644		-2.011	
		~~-1360.162~~ -1363.620		~~-4108.430~~ -4201.908
	+0.711		-4.873	
		~~-1355.168~~ -1362.909		~~-4109.040~~ ~~-4106.781~~ -4206.781
	-1.247		-8.445	
		-1364.156		-4215.226
	-3.163		-11.618	
		-1367.319		-4226.844
	-4.922		-13.647	
		-1372.241		-4240.491
	-6.476		-14.544	
		-1378.717		-4255.035
	-7.814		-14.636	
		-1386.531		-4269.671
	-8.936		-14.301	
		-1395.467		-4283.972
	-9.859		-13.857	
x		-1405.326		-4297.829
	-10.610		-13.509	
		-1415.936		-4311.338
	-11.204		-13.393	
+		-1427.140		-4324.731
	-11.655		-13.590	
		-1438.795		-4338.321
	-11.989		-14.065	
−		-1450.784		-4352.386
	-12.218		-14.835	
		-1463.002		-4367.221
	-12.308		-15.806	
		-1475.310		-4383.027

Integration from Mar 29.5 1880

	09:31.5 1869	δ_1	δ	Prec.	
M	344° 03′ 23.35″	−1° 12′ 32.41″	−40′ 20.39″	+12.32″ −22.55″	125° 3′ 17.98″
☊	4 56 8.09	− 36 10.62		−19.30	+4′ 4.39″
π	55 56 27.52	+ 48 21.45		−26.29	+ 9 12.64
i	8 2 54.06	− 2 28.08		+0.41	+ 5.06
φ	17 27 35.51	− 11 55.45		−10.05	
μ	822.06102	−1.12573		−.02286	

Epoch Mar 29.5 1882

M	109 13 36.30 56 53 35.72	166.07	14.02
☊	4 28 42.56	~~173 42~~	~~20.86~~
π	56 53 35.72		
i	8 0 31.45		
φ	17 15 30.01		
μ	800.90243		
log μ	2.9035797		

3.5500006

0.6464269
.2154756
.4309512

	∫ φ' du/dt	c ′∫	′c ″∫	di/dt	′∫	dΩ/dt	″∫	dφ/dt	′∫	dπ/dt	∫′
Oct13	-.0534		-.0039	-.021		+.036		+.259		-.332	
		-.0001			.000		+.002		.000	~~.574~~	-.001
>Nov 22	-.0905		-.0040	-.022		-.093		+.260		.571	
1870		-.0906			-.022		-.091		+.260	~~.481~~	.372
Jan 1	-.0716		-.0946	-.020		-.146		+.219		.499	
		-.1622			-.042		-.239		+.470		.989
Feb 10	-.0408		-.2568	-.013		-.196		+.148		.481	
		-.2030			-.033		-.435		+.618		1.470
Mar 22	-.0044		-.4598	-.005		-.224		+.068		.569	
		-.2077			-.060		-.662		+.686		2.039
May 1	+.0296		-.6675	+.004		-.238		+.001		.728	
		-.1781			-.056		-.900		+.687		2.767
Jan 10	+.0573		-.8456	+.012		-.230		-.040		-.908	
		-.1208			-.044		-1.130		+.647		-3.675
July 20	+.0789		-.9664	+.019		-.200		-.072		-1.045	
		-.0419			-.025		-1.335		+.575		-4.720
Aug 29	+.0870		-1.0083	+.024		-.170		-.052		-1.158	
		+.0451			-.001		-1.505		+.523		-5.878
Oct 8	+.0899		-.9632	+.027		-.130		-.041		-1.186	
		+.1350			+.026		-1.635		+.482		-7.064
Nov 17	+.0869		-.8282	+.027		-.090		-.030		-1.149	
		+.2219			+.053		-1.725		+.452		-8.213
Dec 27	+.0789		-.6063	+.025		-.053		-.027		-1.059	
1871		+.3008			+.078		-1.778		+.425		-9.272
Feb 5	+.0670		-.3055	+.021		-.023		-.036		-.931	
		+.3678			+.095		-1.801		+.389		-10.203
Mar 17	+.0522		+.0623	+.014		-.003		-.059		-.774	
		+.4200			+.113		-1.804		+.330		-10.977
Apr 26	+.0349		+.4823	+.007		+.004		-.097		-.619	
		+.4549			+.120		-1.800		+.233		-11.596
Jan 5	+.0159		+.9372	-.002		-.003		-.149		-.463	
		+.4708			+.118		-1.803		+.084		-12.059
July 15	-.047		+1.4080	-.012		-.026		-.216		-.322	
		+.4661			+.106		-1.829		-.132		-12.381
Aug 24	-.0260		+1.8741	-.022		-.066		-.296		-.205	
		+.4401			+.084		-1.895		-.428		-12.586
Oct 3	-.0572		+2.3142	-.033		-.125		-.385		-.119	
		+.3829			+.051		-2.020		-.813		-12.705
Nov 12	-.0704		+2.6971	-.043		-.202		-.481		-.072	
		+.3125			+.008		-2.222		-1.294		-12.777
Dec 22	-.0924		+3.0096	-.052		-.297		-.582		-.065	
1872		+.2201			-.044		-2.519		-1.876		-12.842
Jan 31	-.1133		+3.2297	-.060		-.409		-.683		-.097	
		+.1068			-.104		-2.928		-2.559		-12.939
Mar 11	-.1327		+3.3365	-.066		-.538		-.780		-.168	
		-.0259			-.170		-3.466		-3.339		-13.107
Apr 20	-.1494		+3.3106	-.069		-.678		-.867		-.272	
		-.1753			-.239		-4.144		-4.206		-13.379
May 30	-.1625		+3.1353	-.070		-.826		-.941		-.346	
		-.3378			-.309		-4.970		-5.147		-13.725
July 9	-.1702		+2.9975	-.066		-.975		-1.001		-.524	
		-.5080			-.375		-5.945		-6.148		-14.249
Aug 18	-.1714		+2.2895	-.059		-1.118		-1.022		-.637	
		-.6794			-.434		-7.063		-7.168		-14.886
Sept 27	-.1645		+1.6101	-.048		-1.244		-1.021		-.706	
		-.8439			-.482		-8.307		-8.189		-15.592
Nov 6	-.1484		+0.7662	-.033		-1.336		-.989		-.714	
		-.9923			-.515		-9.643		-9.178		-16.306
Dec 16	-.1214		-.2261	-.014		-1.392		-.928		-.617	
1873		-1.1137			-.529		-11.035		-10.106		-16.923
Jan 24	-.0838		-1.3398	+.006		-1.396		-.844		-.404	
		-1.1975			-.523		-12.431		-10.950		-17.327
Mar 6	-371		-2.5373	+.027		-1.344		-.746		-.071	
		-1.2346			-.496		-13.775		-11.696		-17.398
Apr 15	+162		-3.7719	+.045		-1.231		-.644		+.357	
		-1.2184			-.451		-15.006		-12.340		-17.041
May 23	+413		-4.9903	+.060		-1.065		-.553		+.838	
		-1.1471			-.391		-16.071		-12.893		-16.203
July 4	+1226		-6.1374	+.069		-.864		-.485		+1303	
		-1.0245			-.322		-16.935		-13.378		-14.900
Aug 13	+1619		-7.1619	+.071		-.641		-.435		+1656	
		-.8626			-.251		-17.576		-13.813		-13.244
Sept 22	+1847		-8.0245	+.066		-.428		-.406		+1.841	
		-.6779			-.185		-18.004		-14.219		-11.403
Nov 1	+1866		-8.7024	+.055		-.246		-.379		+1.812	
		-.4913			-.130		-18.250		-14.598		-9.551
Dec 11	+1658		-9.1937	+.041		-.108		-.335		+1.575	
1874		-.3255			-.089		-18.358		-14.933		-8.016
Jan 20	+1238		-9.5192	+.026		-.023		-.253		+1196	
		-.2017	-9.9209		-.063		-18.381		-15.186		-6.820

$\frac{dL}{dt}$	'f	$\frac{dM}{dt}$	'f
-.019		+.313	
	+.004		+.005
-.119		.391	
	-.115		+.396
-.212		.265	
	-.327		+.661
-.273		.208	
	-.600		+.869
-.303		266	
	-.903		+1.135
-.299		.429	
	-1.202		+1.564
-.265		.643	
	-1.467		+2.207
-.172		+.873	
	-1.639		+3.080
-.123		+1.035	
	-1.762		+4.115
-.031		+1.156	
	-1.793		+5.271
+.068		+1.217	
	-1.725		+6.488
+.166		+1.226	
	-1.555 ~~-1.[illegible]~~		+7.714
+.260		+1.191	
	-1.299 ~~-1.[illegible]~~		+8.905
+.345		+1.125	
	-.954		+10.030
+.418		+1.037	
	-.536		+11.067
+.476		+.939	
	-.060		+12.006
+.514		+.836	
	+.454		+12.842
+.532		+.737	
	+.986		+13.579
+.524		+.644	
	+1.510		+14.223
+.491		+.563	
	+2.001		+14.786
+.430		+.495	
	+2.431		+15.281
+.339		+.435	
	+2.770		+15.716
+.215		+.384	
	+2.985		+16.100
+.063		+.335	
	+3.048		+16.435
-.118		+.276	
	+2.930		+16.711
-.324		+.200	
	+2.606		+16.911
-.546		+.091	
	+2.060		+17.002
-.775		-.070	
	+1.285		+16.932
-.989		-.276	
	+.296		+16.656
-1.179		-.562	
	-.883		+16.094
-1.322		-.919	
	-2.205		+15.175
-1.399		-1.327	
	-3.604		+13.848
-1.390		-1.746	
	-4.994		+12.102
-1.288		-2.126	
	-6.282		+9.976
-1.110		-2.413	
	-7.392		+7.563
-.856		-2.512	
	-8.248		+5.051
-.577		-2.417	
	-8.825		+2.634
-.302		-2.114	
	-9.127		+0.520
-.067		-1.642	
	-9.194		-1.122
+.005		-1.190	
	-9.189		-2.312

1874	ω²dydt/dt	y	'/	di/dt	'/	dΩ/dt	'/	dφ/dt	'/	dπ/dt	'/
		-.2017			-.063		-18381		-15.186		-6.820
Mar 1	+0686		-9.7209	+013		+.011		-135		+782	
		-1331			-.050		-18.370		-15321		-6.038
Apr. 10	+ 76		-9.8540	+002		+008		+014		+445	
		-.1255			-.048		-18.362		-15.307		-5.593
May 20	-380		-9.9795	-004		-025		+130		+278	
		-.1635			-.052		-18.387		-15.177		~~-5.871~~ .315
June 29	-855		-10.1430	+006		-066		+266		+225	
		-.2490			-.046		-18.453		-14.911		~~-5.646~~ -5.090
Aug 8	-1030		-10.3920	-003		-084		+317		+259	
		-.3520			-049		-18.537		-14.594		~~-5.387~~ -4.831
Sept. 17	-1007		-10.7440	-000		-133		+318		+273	
		-.4527			-049		-18.670		-14.276		~~-5.114~~ -4.558
Oct. 27	-0849		-11.1967	+006		-148		+290		+213	
		-.5376			-043		-18.818		-13.986		~~-4.901~~ -4.345
Dec 6	-0612		-11.7343	+011		-148		+255		+ 82	
1875		-.5988			-.032		-18.966		-13.731		~~-4.819~~ -4.263
Jan 15	-0356		-12.3331	+016		-138		+231		-109	
		-.6344			-.016		-19.104		-13.500		~~-4.928~~ 4.372
Feb 24	-0088		-12.9675	+.021		-.120		+222		-.317	
		-.6432			+.005		-19.224		-13.278		-4.689
Apr 5	+0126		-13.6107	+024		-096		+228		-515	
		-6306			+029		-19.320		-13.050		-5.204
May 15	+.0327		-14.2413	+027		-069		+250		-684	
		-.5979			+.056		-19.389		-12.800		-5.888
June 24	+.0497		-14.8392	+028		-043		+280		-812	
		-.5482			+084		-19.432		-12.520		-6.700
Aug 3	+.0659		-15.3874	+028		-017		+315		-929	
		-.4823			+.112		-19.449		-12.206		-7.629
Sept. 12	+.0743		-15.8697	+027		-007		+349		-950	
		-.4080			+.139		-19.456		-11.856		-8.579
Oct. 22	+0822		-16.2777	+026		+028		+381		-961	
		-.3258			+.165		-19.428		-11.475		-9.540
Dec 1	+0878		-16.6035	+024		+046		+409		941	
1876		-2380			+.189		-19.384		-11.066		-10.481
Jan 10	+0909		-16.8415	+022		+059		+431		-894	
		-1471			+.211		-19.325		-10.635		-11.375
Feb. 19	+0917		-16.9886	+020		+068		+445		-829	
		-0554			+.231		-19.250		-10.190		-12.204
Mar 30	+0903		-17.0440	+017		+074		+446		-756	
		+0349			+.248		-19.183		-9.744		-12.960
May 9	+0868		-17.0091	+014		+075		+447		-673	
		+.1217			+.262		-19.108		-9.297		-13.633
June 18	+0813		-16.8874	+011		+073		+433		-595	
		+.2030			+.273		-19.035		-8.864		-14.228
July 28	+0734		-16.6844	+009		+067		+409		-528	
		+.2764			+.282		-18.968		-8.455		-14.756
Sept 6	+0635		-16.4080	+006		+059		+370		-481	
		+.3399			+.288		-18.909		-8.085		-15.237
Oct. 16	+0.512		-16.0681	+004		+048		+330		-457	
		+.3911			+.292		-18.861		-7.755		-15.694
Nov 25	+0365		-15.6770	+003		+035		+277		-467	
1877		+.4276			+.295		-18.826		-7.478		-16.161
Jan 4	+0194		-15.2494	+001		+022		+216		-517	
		+.4470			+.296		-18.804		-7.262		-16.678
Feb 13	-0003		-14.8024	+000		+009		+150		-615	
		+.4467			~~+296~~ 296		-18.795		-7.112		-17.293
Mar 25	-0227		-14.3557	+000		-004		+081		-765	
		+.4240			~~+296~~ 296		-18.799		-7.031		-18.058
May 4	-0473		-13.9317	+000		-014		+011		-970	
		+.3767			~~+296~~ +296		-18.813		-7.020		-19.028
June 13	-0737		-13.5550	+000		-022		-050		-1.227	
		+.3030			~~+296~~ 296		-18.835		-7.075		-20.255
July 23	-1.013		-13.2520	+000		-025		-114		-1.521	
		+.2017			~~+296~~ .296		-18.860		-7.189		-21.776
			-13.0503								

dL/dt	'/	dM/dt	'/
	-9,189		-2,312
+.195		-,587	
	-8,994		-2,899
+210		-235	
	-8,784		-3,134
+164		-,112	
	-8,620		-3,246
+074		-,152	
	-8,546		-3,398
-037		-297	
	-8,583		-3,695
-153		-,427	
	-8,736		-4,122
-257		-471	
	-8,993		-4,593
-344		-431	
	-9,337		-5,024
-406		-,258	
	-9,743		-5,322
-447		-,128	
	-10,190		-5,449
- 461		+057	
	-10,651		-5,392
- 456		+231	
	-11,107		-5,161
- 429		+386	
	-11,536		-4,775
- 381		+541	
	-11,917		-4,234
-335		+617	
	-12,252		-3,617
- 270		+694	
	-12,522		-2,923
- 195		+747	
	-12,718		-2,176
- 116		+779	
	-12,833		-1,397
+.029		+800	
	-12,804		-0,597
+ 056		+811	
	-12,748		+0,214
+ 142		+815	
	-12,606		+1,029
+ 227		+823	
	-12,379		+1,832
+ 309		+838	
	-12,070		+2,670
+ 383		+866	
	-11,687		+3,536
+ 440		+909	
	-11,247		+4,445
+ 509		+975	
	-10,738		+5,420
+ 551		+1,069	
	-10,187		+6,489
+ 576		+1,191	
	-9,611		+7,680
+578		+1,343	
	-9,033		+9,023
+555		+1,525	
	-8,478		+10,548
+499		+1.727	
	-7,979		+12,275
+ 409		+1.938	
	-7,570		+14,213

1878..		$\omega^2\frac{du}{dt^2}$	f	''f −13.5550	$\frac{di}{dt}$	'f	$\frac{d\Omega}{dt}$	'f	$\frac{d\varpi}{dt}$	'f
			+.3030			+.296		−18.835		−7.075
	July 23	−1007		−13.2520	+.000		−.023		−.119	
			+2023			+.296		−18.858		−7.194
	Sept 1	−.1275		−13.0497	+.001		−.021		−.168	
			+.0748			+.297		−18.879		−7.360
	Oct 11	−.1512		−12.9749	+.001		−.014		−.200	
			−.0764			+.298		−18.893		−7.560
	Nov 20	−.1679		−13.0513	+.000		−.002		−.217	
			−.2443			+.298		−18.895		−7.777
	Dec 30	−.1722		−13.2956	−.001		+.012		−.218	
			−.4165			+.297		−18.883		−7.995
1878	Feb 8	−.1578		−13.7121	−.003		+.025		−.217	
			−.5743			+.294		−18.858		−8.212
	Mar 20	−1190		−14.2864	−.006		+.034		−.231	
			−.6933			+.288		−18.824		−8.443
	Apr 29	−0544		−14.9797	−.009		+.033		−.281	
			−.7477			+.279		−18.791		−8.724
	June 8	+.0288		−15.7274	−.012		+.021		−.378	
			−.7189			+.267		−18.770		−9.102
	July 18	+.1121		−16.4463	−.013		−.001		−.497	
			−.6068			+.254		−18.772		−9.599
	Aug 27	+.1701		−17.0529	−.012		−.024		−.588	
			−.4367			+.242		−18.796		−10.187
	Oct 6	+.1836		−17.4896	−.009		−.038		−.588	
			−.2531			+.233		−18.834		−10.775
	Nov 15	+.1504		−17.7427	−.005		−.038		−.475	
			−.1027			+.228		−18.872		−11.250
	Dec 25	+.0866		−17.8454	−.002		−.024		−.280	
			−.0161			+.226		−18.896		−11.530
1879	Feb. 3	+.0167		−17.8615	+.000		+.002		−.093	
			+.0006			+.226		−18.894		−11.623
	Mar. 15	−.0445		−17.8609	.000		−.024		+.060	
			−.0439			+.226		−18.918		−11.563
	Apr. 24	−.0875		−17.9048	+.003		−.047		+.150	
			−.1314			+.229		−18.965		−11.413
	June 3	−.1124		−18.0362	+.006		−.064		+.187	
			−.2438			+.235		−19.029		−11.226
	July 13	−.1224		−18.2800	+.011		−.073		+.191	
			−.3662			+.246		−19.102		−11.035
	Aug 22	−.1218		−18.6462	+.016		−.074		+.180	
			−.4880			+.262		−19.176		−10.855
	Oct. 1	−.1140		−19.1342	+.021		−.067		+.165	
			−.6020			+.283		−19.243		−10.690
	Nov 10	−.1018		−19.7362	+.026		−.052		+.154	
			−.7038			+.309		−19.295		−10.536
	Dec 20	−.0867		−20.4400	+.031		−.030		+.151	
			−.7905			+.340 5		−19.325		−10.385
1880	Jan 29	−.0707		−21.2305	+.035		−.003		+.158	
			−.8612			+.375		−19.328		−10.227
	Mar 9	−.0538		−22.0917	+.039		+.029		+.172	
			−.9150			+.414		−19.299		−10.055
–	Apr. 18	−.0367		−23.0067	+.042		+.065		+.195	
			−.9517			+.456		−19.234		−9.860
	May 28	−.0199		−23.9584	+.044		+.103		+.223	
			−.9716			+.500		−19.131		−9.637
				−24.9300						

$\frac{d\pi}{dt}$	$\int$	$\frac{d\mathcal{L}}{dt}$	$\int$	$\frac{dM}{dt}$	$\int$
	-20.255		-7.979		+12.275
-1,541	-21.796	+0.414	-7.565	+1.956	+14.231
-1,871	-23.667	+.286	-7.279	+2.155	+16.386
-2,193	-25.860	+116	-7.168	+2.310	+18.696
-2,460	-28.320	-.089	-7.257	+2.371	+21.067
-2,604	-30.924	-.317	-7.574	+2.287	+23.354
-2,553	-33.477	-.545	-8.119	+2.008	+25.362
-2,257	-35.734	-.738	-8.857	+1.518	+26.880
-1,703	-37.437	-.850	-9.707	+.852	+27.732
-1,016	-38.453	-.839	-10.546	+.178	+27.910
-0.384	-38.837	-.700	-11.246	-.315	+27.595
+.017	-38.820	-.460	-11.706	-.477	+27.118
+.151	-38.669	-.192	-11.898	-.343	+26.775
+.150	-38.519	+.037	-11.862	-.115	+26.660
+.210	-38.309	+.183	-11.679	-.026	+26.634
+.401	-37.908	+.240	-11.439	-.161	+26.473
+.691	-37.217	+.221	-11.218	-.471	+26.002
+.988	-36.229	+.146	-11.072	-.842	+25.160
+1.220	-35.009	+.038	-11.034	-1.182	+23.978
+1.358	-33.651	-.085	-11.119	-1.443	+22.535
+1.404	-32.247	-.211	-11.330 ~~-10.738~~	-1.615	+20.920
+1.378	-30.869	-.334	-11.664 ~~-10.404~~	-1.712	+19.208
+1.303	-29.566	-.446	-12.110 ~~-9.958~~	-1.748	+17.460
+1.202	-28.364	-.543	-12.653 ~~-9.415~~	-1.745	+15.715
+1.094	-27.270	-.626	-13.279 ~~-8.789~~	-1.720	+13.995
+0.985	-26.285	-.694	-13.973 ~~-8.095~~	-1.679	+12.316
+.892	-25.393	-.745	-14.718 ~~-7.350~~	-1.637	+10.679
+.816	-24.577	-.781	-15.499 ~~-6.569~~	-1.597	+9.082

Correction of Elements by Perturba

For Oct 31 1869
B.M.T.

New Elements	M	π	Ω	i	φ	μ
Date	~~37 49 23~~ ~~243 54 08~~	56° 1' 44"	4 56 45	8° 2' 58"	17 28 10	802.00077
Integration df ♃ ♄	+ 3' 4"	− 3 52	− 1 7	− 4	− 39	+ .36123
Jan 30 1870	37 52 27	55 57 52	4 55 44	8 2 54	17 27 31	802.36200
	126 56 03					
Aug 4 1871 df ♃ ♄	+ 6 12	− 2 59	− 1 7	− 7	− 1 36	+ .32668
	127 02 15	55 58 47	4 55 38	8 2 51	17 26 34	802.32745
	~~224 57 24~~					
Oct 17 1872 df ♃	+ 6 37	− 2 39	− 0 51	− 0 13	− 3 13	−.10250
♄	+ 0 30	− 0 16	− 8	− 0	− 8	−.00260
	+ 7 07	− 2 55	− 0 59	− 0 13	− 3 21	−.10510
	224 57 24					
	225 04 31	55 58 49	4 54 46	8 2 45	17 24 49	802.09567
Dec 31 1873 ♃	+ 5 52	− 4 53	− 2 14	− 12	− 4 7	− 32205
♄	+ 9	− 9	− 18	0	− 14	+ 0935
	+ 6 01	− 5 02	− 2 32	− 12	− 4 21	− 31270
	343 4 41					
	343 10 42	55 56 42	4 54 13	8 02 46	17 23 49	801.68807
	339 54 03					
	323 04 45					

For ~~Jan 31~~ Feb. 4.5 1875
~~Oct~~ 25 1869

	B.M.T.	♃	For Feb. 24.5 (interlunid) ♄	Precession (1980d)	Elements for ~~Jan 31.0~~ Feb 4.5 24.5 1875
M	344 28 04.15	+1' 16.8 + 3' 41".29 + 59.77 + 3 31.89	+0' 12".65 − 0' 5".32 − 12.97 − 5.39	+67° 44' 01".48 4, 27 28.01	52° 16' 30".66 +56 43 38.97
Ω	4 56 5.99	− 2 14.77 − 2 14.11	− 19.10 − 19.16	+ 4 56.90	4 58 29.06 + 4 58 24.62
π	56 00 54.45	− 4 44.81 − 4 37.20	− 4.36 − 4.51	+ 5 1.44	56 01 1.72 + 56 1 14.15
i	8 2 58.43	− 12.51 − 12.61	− 0.02 − .01	+ 2.46	8 2 48.66 + 8 2 48.56
φ	17 28 9.73	− 4 46.68 − 4 47.45	− 13.50 − 13.39		17 23 9.55 + 23 8.87
μ	802.00077	− .086925 − .10555	− .01583 − .01594		801.88802 + 801.87928

M. eq. 1869.0

m. eq. 1875

Integration for ~~Oct~~ 17.5 1871 B.M.T.

				(3224)	
M	344 28 4.18	+3' 31".86 + 2' 18".27	+ 9".43 + .06	111° 23' 20".38	95 53 24.18
Ω	4 56 5.99	− 1 39.3	− 1.80	+ 1 38.98	4 56 39.24
π (1869.0)	56 00 54.45	− 3 44.67	− 10.60	+ 1 40.45	55 58 34.66
i	8 2 58.43	− 4.86	+ 0.10	+ 0.92	8 2 54.59
φ	17 28 9.73	− 1 12.42	+ 0.36		17 26 57.67
μ	802.00077	+.44224	+ .00988		802.45289

Iris	1870	1871	1872	1873
	° ′ ″			
φ	17 27 31	17 26 34	17 24 49	17 23 49
l sin φ = lg e	9.47715	9.47676	9.47606	9.47566
e	.30002	.29975	.29927	.29899
1+e	1.30002	~~1138~~	1.29927	1.29899
1−ε	.69998	.70025	.70073	.70101
lg(1+ε)	.11394	.11386	.11370	.11361
~~lg 1+a~~		~~.21822~~		
lg(1−ε)	9.84509	9.84525	9.84555	9.84572
lg √a(1+ε)	.27218	~~2708~~ .27215	27211	27213
lg √a(1−ε)	.13775	.13784	13804	13819
½φ	8 43 45	8 43 17	8 42 24	8 41 54
45°−½φ	36 16 15	36 16 43	36 17 36	36 18 06
l tg(45−½φ)	9.86557	9.86570	9.86593	9.86606
lg cos φ	9.97952	9.97956	9.97963	9.97967
lg cos² φ	9.95904	9.95912	9.95926	9.95934
lg a	43042	43044	43052	43066
log p	.38946	.38956	.38978	.39000
log μ	2.90437	2.90435	2.90423	2.90401
	3.55001	3.55001	3.55001	3.55001
	.64564	.64566	.64578	0.64600
	21521	21522	21526	21533
log a	43042	.43044	43052	.43066
log e	9.47715	9.47676	9.47606	9.47566
log b	5.31443	5.31443	5.31443	5.31443
log e″	4.79158	4.79119	4.79049	4.79009

Integration for Jan 21.5 1870

″ ♄ ″		″ ♃ ″		Sum	
−4.43	+4.866	−0.17	+0.66	17 49 20.06	2° 11′ 8.96″
−19.76		−0.24	+	49.48	4 56 35.48
−1′ 27.41″		+0.59	+	52.24	56 0 10.29
−3.48		−0.04	+	0.46	8 2 55.37
+3.89		+0.47			17 28 14.09
−0.5638		−0.0402			801.9403

Integration for Aug 13.5 1873 BM ~~14.0~~ 13804

+2′ 54.96″	+3′ 34.40″	+6.30″	−7.17″	807 26 1.06	292 00 34.23
					~~40 24.08~~
−2 12.56		−17.27	+3 17.86		4 56 34.12
−4 21.52		−14.09	+3′ 20.46″		55 59 39.80
−12.67		−0.28	+ 1.81		8 2 47.29
−3 6.569		−13.59			17 24 04.5
−.31305		−.02366			801.66406

	1869 Oct 31.0 Mm	W.M.T. 1870 Jan 26.0	W.M.T. 1871 Mar 24.0	W.M.T. 1873 Aug 17.0	B.M.T. 1875 Apr 24.5
Ω	4° 56 5.99	4 56 35.48	4 56 39.24	4 56 54.12	4° 58 29.62
Ω−ν	184 56 5.99	184 56 35.48	184 56 39.24	184 56 54.12	~~56 1 14.18~~
½(Ω−ν)	92 28 3.00	92 28 17.74	92 28 19.62	92 28 27.06	92 29 14.81
	8 2 58.43	8 2 55.31	8 2 54.59	8 2 47.29	8 2 48.56
	23 27 22.16	23 27 21.70	23 [illegible] 21.23	23 27 20.31	23 27 19.93
i′+ε	31 30 20.59	31 30 19.07	31 [illegible] 15.82	31 30 07.60	31 30 8.49
i′−ε	−15 24 23.73	−15 24 26.33	−15 24 26.64	−15 24 33.02	−15 24 31.37
½(i′+ε)	15 45 10.30	15 45 8.53	15 45 7.91	15 45 3.80	15 45 4.24
½(i′−ε)	−7 42 11.86	−7 42 13.16	−7 42 13.32	−7 42 16.57	−7 42 15.68
sin ½(Ω−ν)	9.9995970	9.9995958	9.9995956	9.9995950	9.9995906
sin ½(i′+ε)	9.4337514	9.4337383	9.4337336	9.4337029	9.4337062
	9.4333484	9.4333341	9.4333292	9.4332979	9.4332968
	7.7597262	7.7617848	7.7620789	7.7624912	7.7647989
tan ½(Ω′+A)	1.6714490	1.6713478	1.6712503	1.6708067	1.6684979
½(Ω′+A)	88 46 45.21	88 46 44.68	88 46 43.48	88 46 38.99	88 46 15.54
½(Ω′−A)	92 32 26.03	92 32 41.16	92 32 43.09	92 32 50.68	92 33 9.85
Ω′	181 19 18.18	181 19 25.64	181 19 26.57	181 19 29.67	181 19 55.39
A	356 14 26.12	356 14 03.32	356 14 0.39	356 13 48.31	356 12 35.61
ω	51 4 48.46	51 3 40.81	51 1 55.42	51 2 45.68	51 02 44.56
ω′	54 50 21.34	54 49 37.49	54 47 55.03	54 48 57.37	54 50 8.87
cos ½(Ω−ν)	8.6340003	8.6347199	8.6348115	8.6351742	8.6374948
cos ½(i′−ε)	9.9960630	9.9960625	9.9960625	9.9960616	9.9960618
sin ½(Ω−ν)	9.9995970	9.9995958	9.9995956	9.9995950	9.9995906
cos ½(i′+ε)	9.9833744	9.9833755	9.9833758	9.9833283	9.9833780
	9.9829704	9.9829713	9.9829714	9.9829733	9.9829686
	8.6300633	8.6307824	8.6308740	8.6312358	8.6335506
tan ½(Ω′−A)	1.3522081	1.3521889	1.3520974	1.3517375	1.3494120
½(Ω′−A)	−87 27 33.57	−87 27 18.84	−87 27 16.91	−87 27 9.32	87 26 50.15
	92 32 26.03	92 32 41.16	92 32 43.09	92 32 50.68	92 33 9.85
cos ½(Ω−ν)	8.6340003	8.6347199	8.6348115	8.6351742	8.6374948
sin ½(i′−ε)	9.1272447	9.1272647	9.1272674	9.1273170	9.1273496 3041
sin ½ i″					
½ i″	15 44 29.48	15 44 27.69	15 44 26.95	15 44 22.80	15 44 22.79
i″	31 28 58.98	31 28 55.28	31 28 53.90	31 28 45.60	31 28 45.58
sin Ω′	8.3629772	8.3636575	8.3637422	8.3640244	8.3663596
cos i″	9.9308445	9.9308492	9.9308510	9.9308617	9.9308617
cos Ω′	9.9998873	9.9998841	9.9998841	9.9998839	9.9998826
sin i″	9.7178753	9.7178626	9.7178580	9.7178293	9.7178292
cos Ω′	9.9998873	9.9998841	9.9998841	9.9998839	9.9998826
cos i″ sin Ω′	8.2938217	8.2945067	8.2945932	8.2948861	8.2972213
tan A	1.7060656	1.7053774	1.7052909	1.7049978	1.7026613
A	88 52 22.08	88 52 15.65	88 52 14.84	88 52 12.03	88 51 50.16
sin Ω′	8.3629772	8.3636057	8.3637422	8.3640244	8.3663596
cos i″ cos Ω′	9.9307318	9.9307333	9.9307352	9.9307456	9.9307443
tan B	8.4322454	8.4329224	8.4330070	8.4332788	8.4356153
B	+1 32 59.15	+1 33 7.81	+1 33 8.89	+1 33 12.39	+1 33 42.54
A	91 07 37.52	91 07 44.35	91 07 45.16	91 07 47.92	91 08 9.84
A+ω′	145 57 59.54	145 57 21.84	145 55 40.19	145 56 44.44	145 58 18.71
B+ω′	56 23 21.49	56 22 45.30	56 21 39.2	56 22 9.76	56 23 51.41
ω′	54 50 21.34	54 49 37.49	54 47 55.03	54 48 57.37	54 50 8.87
log a	9.9999713	9.9999684	9.9999684	9.9999684	9.9999680
log b	9.9308907	9.9308927	9.9308947	9.9309053	9.9309056
log c	9.7178753	9.7178626	9.7178580	9.7178293	9.7178292
φ	17 28 9.73	17 28 14.09	17 26 57.67	17 24 0.45	17 23 8.89
log e	9.4774048	9.4774339	9.4765229	9.4757335	9.4753869
e	.3001968	.3002161	.2998627	.2990429	.2988044
log(1+e)	.1140188	.1140156	.1138974	.1136235	.1135437
log(1−e)	9.8449764	9.8449639	9.8451832	9.8456914	9.8458392
log √(1+e)	.0570044	.0570078	.0569487	.0568117	.0567718
log √(1−e)	.2152773	.2152882	.2151958	.2153381	.2152992
log √(a(1+e))	9.9224882	9.9224818	9.9225916	9.9228457	9.9229196
	.2722816	.2722960	.2721446	.2721498	.2720710
log √(a(1−e))	.1377661	.1377700	.1377874	.1381838	.1382188
½φ	8 44 48.6	8 44 7.04	8 43 28.83	8 42 0.22	8 41 39.44
45−½φ	36 15 55.14	36 15 52.96	36 16 31.17	36 17 59.78	36 18 25.56
tan(45−½φ)	9.8654839	9.8654742	9.8606429	8660340	9.8661478
	~~9.9431797~~	~~9.9433128~~	~~9.9433751~~	~~9.9437515~~	~~9.9438185~~
	~~9.8654887~~				
log e	9.4774048	9.4774339	9.4769224	9.4757335	9.4753869
log const	5.3144251	4.7918550	4.7913475	4.7901586	4.7898120
log e″	4.7918299				
log 10	2.9041748	2.9041421	2.9044193	2.9039924	2.9041090
log const	3.5502060				
log √a	2152773	2152882	2151958	2153381	2152992
log a	4305546	4305764	.4303916	.4306762	.4305984

	Wash. M.T. 1869 Oct 31.0	W.M.T. 1870 Jan 26.0	W.M.T. 1871 Mar 24	W.M.T. 1873 Aug 17.0	B.M.T. 1875 Feb. 24.5
M	343° 58′ 0″.68	3° 21′ 39″.17	97° 27′ 41″.76	272 50 44.47	56 43 38.97
E	337 20 25.86	4 48 1.22	113 14 51.08	275 47 55.06	73 06 32.96
½E	168 40 12.93	2 24 0.61	56 37 25.54	137 53 57.55	36 33 16.48
sin ½E	9.2932634	8.6219922	9.9217261	9.8268566	9.7749461
cos ½E	9.9914583	9.9996188	9.7404689	9.8703606	9.9048723
	9.5655450	8.8942882	.1938706	.0986087	.0470171
	.1292194	.1373888	9.8782563	.0085621	.0430911
log tan ½v	9.4363256	8.7568994	.3156143	.0899385n	.0039260
½v	−15 16 30.44	3 16 12.06	64 11 48.45	−50 53 26.70	45 15 32.30
½v	164 43 29.56			129 06 33.30	
v	329 26 59.12	6 32 24.12	128 23 36.90	258 13 06.60	90 31 4.60
log r	.2896796	.2761930	.4789722	.4173320	.3911560
v+A+ω′	115 24 58.66	152 29 45.96	274 19 17.09	44 09 51.04	236 29 23.31
v+B+ω′	25 50 20.61	62 55 9.42	184 44 40.82	314 35 16.36	146 54 56.04
v+ω′	24 17 21.46	61 22 1.61	183 11 31.93	313 02 03.97	145 21 13.47
l sin(v+A+ω′)	9.9557903	9.6644624	9.9987636n	9.8480563	9.9210555n
log r a	.2896509	.2761614	.4789406	.4173204	.3911240
log a sin(v+B+ω′)	9.6393318	9.9495685	8.9175871n	9.8525864	9.7370927
log r b	.2205703	.2090857	.4098665	.3482573	.3220616
log a sin(v+ω′)	9.6142052	9.9433501	8.7458432n	9.8638840n	9.7547367
log r c	.0075549	9.9940558	.1168302	.1357813	.1059852
x	+1.7597105	+.8722154	−3.0040297	+1.8212799	−2.0520100
X	−.7789980	+.5875197	+.9956787	−.8267729	+.9044730
y	+.7242776	+1.4343470	−.2125465	+1.5879458	+1.1459201
Y	−.5644970	−.7251686	+.0580250	+.5352033	−.3697742
z	+.4185623	+.8654716	−.0876140	−.9978500	+.7306710
Z	−.2449340	−.3146502	+.0251744	+.2322217	−.1604417
log ρ cos δ cos α	9.9919401	0.1642747	.3028397n	9.9976078	0.0597667n
log ρ cos δ sin α	9.2039107	9.8507555	9.1889889n	0.0223345n	9.8899434
log tan α	9.~~2114274~~ 9.2115706	9.6864808	8.8861492	0.0247267n	9.8301767n
α		25 54 42.09	−4 23 58.40	−46 37 48.71	−34 04 21.99
α₀	9° 14′ 41″.56	25 54 42.09	184 23 58.70	313 22 11.29	145 55 38.01
Δα	+24.80	−8.98	−5.37	+23.37	+6.06
α(C)	+9 15 6.36	+25 54 33.11	184 23 53.33	313 22 34.66	145 55 44.07
α(O)	9 15 4.00	+25 54 34.50	184 19 32.60	313 22 16.00	145 53 36.04
log ρ cos δ	9.9976182	.2102887	.3041214n	.1608379n	.1415651
log ρ sin δ	9.~~7412473~~ 2396205	9.7412472	8.~~5441897~~ 7954607	9.8840180n	9.7560495
log tan δ	9.2420023	9.5309586	8.~~2400683~~ 8.4913388n	9.7231801	9.6144844
δ₀	+9° 54′ 11″.05	18 45 25.64	−~~9 51 35.75~~ 1 46 31.83	−27 51 49.74	+22 22 20.95
Δδ	+9.40	−5.73	+2.34	+0.95	+9.05
δ(C)	+9 54 20.45	+18 45 19.91	−~~9 51 33.40~~ 1 46 29.49	−27 51 48.79	+22 22 30.00
δ(O)	+9 54 21.80	+18 45 17.60	−1 43 50.40	−27 51 58.30	+22 23 18.00
Δα(C−O)	+2.36	−1.39	+4′ 20″.73 = +260.7	+18″.66	+2′ 08″.13 +128.1
Δδ(C−O)	−1.35	+2.31	−2 39.09 −159″.1	+9.51	−1′ 48″.00 − 48″.0
l sin N	9.93192	9.94421	9.93107	9.97154	9.95667
l cos δ	9.99347	9.97631	9.99980	9.94650	9.96596
l Δα	0.37291	0.14301n	2.41614	1.27091	2.10755
log I	0.29830	0.06353n	2.34701	1.18895	2.03018
log cos N	9.71498	9.67761	9.71727	9.54456	9.62884n
log Δδ	0.13033n	0.36361	2.20167n	0.97818	1.68124n
log II	9.84531n	0.04122	1.91894	0.52274	1.81008n
I	+1.99	−1.16	+222.34	+15.45	+107.20
II	−0.70	+1.10	+82.97	+3.33	+20.43
[illegible]	+1.29	−.06	+305.31	+18.78	+127.63
log cos N	9.71498	9.67761	9.71727	9.54456	9.62884
l cos δ	9.99347n	9.97631n	9.99980	9.94650n	9.96596
l Δα	37291	14301n	2.41614	1.27091	2.10755
log I	0.08136n	9.79693	2.13371	0.76197n	1.70235
l sin N	9.93192	9.94421	9.93107	9.97154	9.95667
log Δδ	13033	36361	2.20167n	97818	1.68124n
log II	.06225n	.30782	2.13274n	.94972	1.63791n
I	−1.21	+0.63	+136.05	−5.78	+50.39
II	−1.15	+2.03	−135.75	+8.91	+43.44

Normal Equations of Condition

-1.4		1869 ~~1870~~	0 = ~~+2.4~~ +1.3	+.000di	+.000dΩ	+3.349dL	+0.375dl	-2.439dφ	-14.636 $\frac{d\chi}{10}$	-13.651
-0.5		1870	~~-1.4~~ -0.1			+1.863	-.399"	-.509	-9.187	-8.232
+0.8	dλ cos θ	1871	~~+260.7~~ +305.3			+1.139	-3.405"	+2.226	+3.560	+3.520
-0.2		1873	~~+18.7~~ +18.7			+1.580	-12.361"	-3.116	+0.351	-13.576
+0.2		1875	~~+128.1~~ +127.6			+1.931	-21.757"	+3.420	-2.985	-19.391
5.1		1869	~~-1.3~~ -2.4	+.792"	-.916	+.089	-0.144"	+.124	-.576	-.629
+2.9		1870	~~+2.1~~ +2.4	+.967	-.275	+.072	-0.102"	+.098	-.833	+.427
+0.0	dθ	1871	~~-159.1~~ +0.3	-.082	+.780	-.020	-0.029"	-.048	+.198	+.799
-0.6		1873	~~+9.5~~ +8.1	-1.166	-.569	-.038	+0.400	+.038	+.281	-1.054
-1.0		1875	~~-48.0~~ +7.0	+.933	+.705	-.016	+0.107	+.016	+.240	+1.985

nn na nb nc nd ne nf ns

+8.0376
+.9000
-6.5736
-35.1264

-32.7624

5.76 +8.0376 +0.9000 ~~-6.5736~~ -3

5 ~~5.76~~ 000 000 +8.0376 +0.9000 -6.5736 -35.1264 -32.7624

5.76							
1.96			-2.6082	+.5586	+.7126	+12.8615	+11.5248
67964.49			+296.9373	-887.6835	+580.3182	+928.0920	+917.6640
349.69			+28.9850	-231.1507	-58.2692	+6.5637	-253.8712
16409.61			+247.3611	-2787.0717	+438.1020	-382.8780	-2483.9871
1.69	-1.0296	+1.1908	-0.1154	+0.1892	-.1652	+.4462	+.8177
4.41	+2.0307	-.5775	+.1512	-.2142	+.2058	-.6993	+.8967
25312.81	+18.0462	+124.0980	+3.1820	+46.139	+7.6368	-31.5018	-127.1209
90.25	-11.0770	-8.4055	-.3610	+3.8000	+.3610	+2.6695	-10.0130
2304.00	-44.7840	-33.8400	+.4680	-5.1360	-.7660	-11.5200	-95.2800
112444.67	-41.81	-162.73	+582.34	-3901.19	+961.57	+489.71	-2072.11

(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(as)
+1.846	-.392	-.096	-.091	-.200	+.612	+1.680
+.870	+.658	-.015	+.100	+.015	+.224	+1.851
+2.716	+.266	-.111	+.009	-.185	+.836	+3.531

(bb)	(bc)	(bd)	(be)	(bf)	(bs)
+2.927	+.185	-.679	+.153	-1.119	+1.075
+.497	-.011	+.075	+.011	+.169	+1.399
+3.424	+.174	-.604	+.164	-.950	+2.474

(cc)	(cd)	(ce)	(cf)	(cs)
+18.401	-22.558	-12.398	-61.623	-78.089
+3.729	-42.015	+6.604	-5.768	-37.476
+22.130	-64.573	-5.794	-67.391	-115.565

(dd)	(de)	(df)	(ds)
+164.876	+30.101	-18.054	+153.595
+473.380	-74.407	+64.969	+422.102
+638.256	-44.306	+46.915	+575.697

(ee)	(ef)	(es)
+22.453	+51.492	+91.601
+11.696	-10.205	-66.286
+34.149	+41.287	+25.318

(ff)	(fs)
+311.965	+283.277
+8.968	+58.256
+320.933	+341.680

	a	b	c	d	e	f	g	n Wrong.	
(aa)	+2.716	+.0266	−.111	+.009	−.185	+.836	+3.531	−41.81	+7.40
log(aa)	0.4339298	9.4248816	9.0453230n	7.9542425	9.2671717n	9.9222063	0.5478977	1.6212802n	0.8692317
(bb)		+3.424	+.179	−.604	+.164	−.950	+2.474	−16.273	+0.46 =
(ab)(ab)		+.026	−.011	+.001	+.018	+.082	+.346	−.409	+0.72
(bb1)		+3.398	+.185	−.605	+.182	−1.032	+2.128	−15.864	−0.26
log(bb1)		0.5312234	9.2671717	9.7817554n	9.2600714	0.0136797n	0.3279716	2.2004127n	9.4149733n
(cc)			+22.130	−64.573	−5.794	−67.391	−115.565	+582.34	+627.46
ac ac			+.005	−.000	+.008	−.034	−.144	+1.71	−.30
cc1			+22.125	−64.573	−5.802	−67.357	−115.421	+580.63	+627.76
bc1 bc1			+.010	−.033	+.010	−.056	+.116	−8.64	−.01
cc2			+22.115	−64.540	−5.812	−67.301	−115.538	+589.27	+627.77
log cc2			1.3446869	1.8098290n	0.7643256n	1.8280215n	2.0627250n	2.7703143	2.7978006
dd				+638.256	−44.306	+46.915	+575.697	−3901.19	−4045.00
ad ad				+.000	−.001	+.003	+.012	−.14	+.02
dd1				+638.256	−44.305	+46.912	+575.685	−3901.05	−4045.02
bd1 bd1				+.108	−.032	+.184	−.379	+28.25	+.05
dd2				+638.148	−44.273	+46.728	+576.064	−3929.30	−4045.07
cd2 cd2				+188.352	+16.961	+196.413	+337.185	−1719.71	−1836.07
dd3				+449.796	−61.234	−149.685	+238.879	−2209.59	−2209.00
log dd3				2.6530156	1.7869926n	2.1751783n	2.3781743	3.3443118n	~~3.3830888~~ 3.3441814n
ee					+34.149	+41.287	+25.315	+961.57	+1055.00
ae ae					+.013	−.057	−.241	+2.85	+.50
ee1					+34.136	+41.344	+25.556	+958.72	+1054.50
be1 be1					+.010	−.055	+.114	−8.50	−.01
ee2					+34.126	+41.399	+25.442	+967.22	+1054.51
ce2 ce2					+1.527	+17.687	+30.364	−154.86	−164.99
ee3					+32.599	+23.712	−4.922	+1122.08	~~888.50~~ +1220.50
de3 de3					+8.336	+20.348	−32.520	+300.80	+301.27
ee4					+24.263	~~18.0644~~ +3.364	+27.598	+821.28	+918.28
log ee4					1.3849445	0.5229656	1.4408619	2.9144912	~~2.9602567~~ 2.9634242
ff						+320.933	+341.630	+489.71	+694.77
af af						+.257	+1.087	−12.87	+2.27
ff1						+320.676	+340.543	+502.58	+692.50
bf1 bf1						+.314	−.646	+48.20	+.08
ff2						+320.362	+341.189	+454.38	+692.42
cf2 cf2						+204.812	+351.609	−1993.28	−1910.45
ff3						+115.550	−10.420	+2247.66	+2602.87
df3 df3						+49.813	−79.494	+735.31	~~736.45~~ +866.42
ff4						+65.737	+69.074	+1512.35	~~1852.54~~ +1866.42
ef4 ef4						+.458	+3.792	+112.85	~~125.40~~ +126.31
ff5						+65.279	+65.282	+1399.50	~~1727.14~~ +1740.11
log ff5						1.81477		3.14597	~~3.2373275~~ 3.24058

	ng	nn
an ag an / aa	−2072.11	+1124447
	−54.38	+6436
gn1 nn1	−2017.73	+1118011
bn1 bg1 bn1	−99.35	+74063
bb1 gn2 nn2	−1918.38	+1043948
cn2 cg2 cn2 / cc2 gn3 nn3	−3078.69	+187015
	+1160.21	+856933
dn3 dg3 dn3 / dd3 gn4 nn4	−1178.41	+106544
	+2338.62	+750389
en4 eg4 en4 / ee4 gn5 nn5	+934.12	+278996
	+1399.50	+500393
fn5 fn5 / ff5 nn6		300040
	−1659.92	+1099128
	+9.62	20.2
	−1669.54	+1098927
	+ .16	.0
	−1669.70	+1098927
	−3279.73	+17820.3
	+1610.03	+920724
	−1197.42	+113022
	+2807.45	+807702
	+1037.94	343213
	+1769.51	
		+464489 45688

nn na . na . nb . nb . nc . nc . nd . nd . ne . ne . nf . nf . ng . ng .

169 | + ~~4.3537~~ ~~+.4875~~ −3.4 ~~−3.5607~~ ~~−19.0268~~

.00 +4.3537 ~~+.4875~~ +.4875 −3.5607 −19.0268 −127.463

93208.09 −.1863 +.0399 +.0509 +.9187 +.8232

34469 +347.367 −1035.5465+1895.978 +1016.8680 +1014.6560

16281.76 +28.8850 −231.1507 −58.2652+6.5637 −253.8712

5.76 + ~~246.3856 −2776.1932 +436.392~~

7.29 +246.8856 −2776.1532+436.3920 ~~350.8860~~ −380.8860 −2474.2916

.01

9.61 +1.9008 −2.1984 + .2136 −.3456 + .2976 −1.3776 −1.5056

49.02 +2.6109 −.7425 + .1944 −.2754 + .2646 −.8551 +1.1522 + ~~1.1520~~

91290 −.0246 +.2340 −.0060 −.0087 ~~−.0052~~ −.0144 + .0594 ~~−.0144~~ + .2399

−3.6146 −1.7639 −.1178 +1.2400 + .1178 + .8711 −3.2674

+6.5310 — +4.9350 — — −.1120 +.7490 — + .1120 +1.6800 — +3.8950 —

+7.4035 +0.4642 +627.4569 −4045.0037 +1054.9914 +694.7714 −1659.9212

+7.40 + .46 +627.46 −4045.00 +1055.00 +694.77 −1659.92

~~−1659.92~~ +1098129
+9.62 + 20.2
−1669.54 +1098927
+ .16 + .8
−1669.70 +1098924
−3279.73 + 17820.3
+1610.03 +920721
+1175.28 +108880
+2785.31 +811841
+1045.14 +348260
+1739.97 +463581
+463865

log fns 3.24058
log ff₅ 1.81477
log dχ/dυ 1.42581n
dχ/dυ −26.657
dχ −266.57

dχ efy −889
Tem4 +919.23
δ +81034
log s 2.95920
−log e ly 1.38494n
log dφ 1.57426n
dφ −37.52

dχ dβ3 +39902
Tw dγ de3 +22975
dw −22130
δ +40747
log s 3.61010
−log dδs 2.65302
log dlog a 0.95708n
dlog a −9.06

dχ cf2 +17940
Tw γ ke2 +2181
dlog a cd2 +584.7
Ten2 +627.8
δ +32246
log s 3.50848
−log dℒ 1.34469n
log dℒ' 2.16379n
dℒ' −145.81

dχ bf1 +27.51
Tw γ be1 −6.83
dlog ab1 +5.48
dℒ' ε1 −26.58
bn1 − .26
δ −1.08
log s 0.08342n
−log bb1 .53122n
log dΩ' 9.50220
dΩ' + 0.32

dχ ab −2229
Tw dγ ae + 16.94
dlog ad − .08
dℒ ae +16.19
dΩ ab + .08
an + 7.40
δ +8.24
log s .91593
−log aa 43393n
log di' .48200n
di' − 3.04

−8887
+919.23
+83036
2.91927
1.38494n
1.53433n
dφ −34.22

+39902
+20957
22130
+38729
3.58804
2.65302
.93502n
dlog a − 8.61

+17940
+198.9
+555.7
+627.8
+3176.4
3.50184
1.34469n
2.15725n
dℒ' −143.63

+ 27.57
− 6.23
+ 3.21
− 26.57
− .26
− 0.34
9.53148n
.53122n
9.00022
dΩ' + 0.10

− 2229
+ 6.33
− 0.08
+ 15.94
+ .03
+ 7.40
+ 7.33
0.86510
43393n
.43117
di' − 2.70

log(1−cos i') 9.16791
l dΩ' 9.00022
log dΩ'(1−cos i') 8.16813
dΩ'(1−cos i') + 0.02
dψ −4 26.57
dπ' −4 26.55
dΩ' + 1.0
dϖ' −4 26.65

log cos i' 9.93084
l dΩ' 9.00022
8.93106
−dΩ' cos i' − 0.09
dψ −4 26.57
dϖ' −4 26.66

dℒ' −2′ 23.63″
+ .02
dℒ' −2 23.61
dπ −4 26.65
dM + 2′ 03.04″

log b 7.76609n
log dlog μ 9.35022n
log dμ 8.70111n
dμ + .05025
802.00077
+802.05102
log μ 2.9042020
3.5500066
log a 4305364

log dM 4.32335
l dlog a 9.3502
5.25837n
log a 0.4305546
Δlog a − .0000182
log a 0.4305364

lo	1869 WMT Oct 31.0	1870 WMT Jan 20.0	1871 WMT Mar 24	1873 WMT Aug 17.0	1875 Feb 24.5 BMT
M₀	343° 58′ 0.68″	3° 21′ 34.17″	97 27 41.76	292 50 41.47	56 43 38.97
dM	+ 2 3.04	+ 2 3.04	+ 2 3.04	+ 2 3.04	+ 2 3.04
Tdμ	(Ω) + 0.00 (87)	+ 4.37 (569)	+ 0 25.58 (1386)	+ 1 9.64 (1542)	+ 1 37.58
M	344 00 3.72	3 23 47.18	97 30 10.38	292 53 54.15	56 47 19.54
Ω′₀	181 19 18.18	181 19 25.64	181 19 26.57	181 19 29.67	181 19 55.39
dΩ′	+ 0.10				
Ω′	181 19 18.28	181 19 25.74	181 19 26.67	181 19 29.77	181 19 55.49
ϖ₀	54 50 22.36	54 49 37.49	54 47 55.03	54 48 57.37	54 50 8.87
dϖ′ ω	54 45 55.68	54 45 10.83	54 43 28.37	54 44 30.71	54 45 42.21
i′₀	31 28 55.88	31 28 55.28	31 28 53.80	31 28 45.60	31 28 45.58
di′ i′	31 28 56.28	31 28 52.58	31 28 51.20	31 28 42.90	31 28 42.88
φ	17 28 9.73	17 28 14.09	17 26 57.67	17 24 0.45	17 23 8.89
dφ φ	17 27 35.51	17 27 39.87	17 26 23.45	17 23 26.23	17 22 34.67
μ₀	802.00077	801.94037	802.45289	801.66406	801.87928
dμ	.05025	801.99062	802.50314	801.71431	801.92953
μ	802.05102				
log a₀	.4305546	.4305764	.4303916	.4306762	.4305984
l sin Ω′	8.3629864n	8.3636665n	8.3637513n	8.3640336n	8.3663687n
cos i′	9.9308478	9.9308527	9.9308545	9.9308652	9.9308652
cos Ω′	9.9998844n	9.9998841n	9.9998840n	9.9998839n	9.9998826n
sin i′	9.7178661	9.7178534	9.7178486	9.7178201	9.7178200
−log cos Ω′	9.9998844	9.9998841	9.9998840	9.9998839	9.9998826
cos i′ tan Ω′	8.2938342	8.2945192	8.2946058	8.2948988	8.2972389
l tan A	1.7060502	1.7053649	1.7052782	1.7049857	1.7026487
−log tan Ω′	8.3629864	8.3636665	8.3637513	8.3640336	8.3663687
l cos i′ cos Ω′	9.9307322	9.9307368	9.9307385	9.9307491	9.9307478
l tan B	8.4322542	8.4329297	8.4330128	8.4332845	8.4356209
A	91 07 38.06	91 07 44.47	91 7 45.29	91 7 48.03	91 8 9.96
B	1 32 59.22	1 33 7.90	1 33 8.97	1 33 12.46	1 33 42.62
A+ω′	145 53 33.74	145 52 55.30	145 51 13.66	145 52 18.74	145 53 52.17
B+ω′	56 18 54.90	56 18 18.73	55 16 37.34	56 17 43.17	56 19 24.83
ω′	54 45 55.68	54 45 10.83	54 43 28.37	54 44 30.71	54 45 42.21
log a	9.9999685	9.9999684	9.9999684	9.9999684	9.9999680
l b	9.9308911	9.9308962	9.9308980	9.9309088	9.9309092
log c	9.7178661	9.7178534	9.7178486	9.7178201	9.7178200
log e	9.4771757	9.4772049	9.4766931	9.4755035	9.4751567
e++	.3000376	.3000548	.2997044	.2988846	.2986460
log(b′+e)	.1139559	.1139627	.1138447	.1135705	.1134907
log b′(1−e)	9.8450447	9.8450622	9.8452812	9.8457895	9.8459373
	.2722462	.2722604	.2721090	.2721142	.2720354
~~log e~~ ″	.1378055	.1378102	.1378273	.1382287	.1382587
log e r	4.7916005	4.7916300	4.7861182	4.7899286	4.7895818
log a	.4305364	.4305582	.4303734	.4306580	.4305802

Wash. M IV. B M IV.

	Oct 31.0 1869.	Jan 26.0 1870.	Mai 24.0 1871.	Aug 17.0 1873.	Feb 24.5 1875.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
M	344 0 08.72	3 23 47.18	97 30 10.38	292 53 54.15	56 47 19.59
E	337 23 33.40	4 50 59.60	113 16 37.14	275 51 47.28	73 10 0.26
½E	168 41 46.70	2 25 29.95	56 38 18.57	137 55 53.64	36 35 0.13
sin ½E	9.2922768	8.6264569	9.9217996	9.8260864n	9.7752403
cos ½E	9.9914928n	9.9996109	9.7402993	9.8706058	9.9047104
	9.8645230	8.8887173	.1938086	.0982006	.0472757
	.1292983	.1374211	9.8781266	.0088255	.0429691
log tg ½v	9.4352247	8.7612962	.3157820	.0893711	.0043066
½v	−15 14 17.71	3 18 12.59	64 12 19.65	−50 51 14.84	45 17 2.47
½v	164 45 42.29			129 08 45.16	
v	329 31 24.58	6 36 23.18	~~128 29 6.48~~ 128 24 39.30	258 17 30.32	90 34 5.34
log r	.2896846	.2762866	~~.4891496~~ .4785846	.4171916	.3912958
v+ω+Ω′	115 24 58.32	152 29 18.48	274 15 52.96	44 9 49.06	236 27 57.51
v+B+Ω′	25 50 19.48	62 54 41.91	184 41 16.64	314 35 13.49	146 53 30.17
v+Ω′	24 17 20.21	61 21 34.01	183 08 7.67	313 02 1.03	145 19 47.55
log sin (v+ω+Ω′)	9.9557907	9.6645735	9.9987958	9.8430519	9.9209358
log r a	.2896531	.2762552	.4789530	.4171602	.3912638
sin (v+B+Ω′)	9.6393269	9.9495390	8.9123761	9.8525924	9.7378700
log r b	.2205737	.2071828	.4098826	.3481004	.3222050
sin (v+Ω′)	9.6141995	9.9433184	8.7379625	9.8638896	9.7549984
log r c	.0075507	9.9941400	.1968332	.1350117	.1091158
x	+1.7597210	+.8726266	−3.0043379	+1.8205899	−2.0521519
X	−.7789980	+.5875179	+.9256787	−.8267729	+.9044730
y	+.7242735	+1.4345702	−.2100190	−1.5874232	+1.1470307
Y	−.5644970	−.7251686	+.0580250	+.5352033	−.3697742
z	+.4185528	+.8658814	.0860598	−.9974734	+.7313513
Z	−.2448840	−.3146502	+.0257744	+.2322217	−.1604417
log Δ cos δ cos α	9.9919447	9.4550105	0.3029063	9.9973064	.0598200
log Δ cos δ sin α	9.7242735	9.9512994	9.2100090	.0221065n	9.8805643
log tg α	~~9.9523397~~ 9.7323288	~~9.4779754~~ 9.7401189	~~9.7308601n~~ 8.9071127n	.0248001n	9.8307443
α			−46 38 6.12		−34 6 27.11
α			313 21 53.88		145 53 32.89
Δα			+23.37		+6.06
α(C)			313 22 17.25		145 53 38.95
α(O)			313 22 16.00		145 53 36.04
Δα(C−O)	+2.18	+1.52	+0.27	+1.25	+2.90″

log Δ cos δ	9.9976227	2104128 7413337	.3041461	.1605753	.1417967
log Δ sin δ	9.2395967	9.7415502	8.7840060	9.8838042	9.7565521
log tg δ	9.2419740	~~9.6558814~~ 9.6554686 9.5309205	~~8.4809032~~ 8.4803598	9.7232288	9.6147554
δ				−27 51 59.31	+22 23 6.27
Δδ	+9 54 8.77	+18 45 20.19	−1 43 52.36	+0.95	+4.05
	+9.40	−5.73	+2.34	−27 51 58.36	+22 23 10.32
δ(C)	+9 54 18.17	+18 45 14.46	−1 43 50.02	−27 51 58.30	+22 23 13.00
δ(O)	9 54 23.30	18 45 17.60	−1 43 50.40	−0.06	−2.68
Δδ(C−O)	−5.13	−3.14	+0.38	−0.06	−2.68

	9.9919447	0.1643958	0.3029063
	9.2035128	9.8508922	9.1818264
	9.2115681	0.4038817	8.8789201
		9.6864964	184 19 38.24
α	9 14 41.38	25 54 45.00	184 19 38.24
	+24.80	−8.98	−5.37
α(C)	9 15 6.18	25 54 36.02	184 19 32.87
α(O)	9 15 4.00	25 54 34.50	184 19 32.60
Δα(C−O)	+2.181	+1.52	+0.27

° ′ ″

~~9 54 23.30~~

~~18 45 17.60~~

° ′ ″	h m s
9 15 4.00	0 37 0.27
25 54 34.50	1 43 38.30
184 19 32.60	12 17 18.17
313 22 16.00	20 53 29.07
145 53 36.04	9 43 34.40

To be checked.

	°	′	″
Ω'	181	19	18.28
$\tfrac{1}{2}\Omega'$	90	39	39.14
i''	31	28	56.28
ε	23	27	22.53
$i''+\varepsilon$	54	56	18.81
$i''-\varepsilon$	-8	01	33.75
$\tfrac{1}{2}(i''+\varepsilon)$	27	28	9.40
$\tfrac{1}{2}(i''-\varepsilon)$	-4	00	46.87

$\sin\tfrac{1}{2}\Omega'$ 9.9999717
$\cos\tfrac{1}{2}(i''-\varepsilon)$ 9.9989339
9.9989050
8.0100354
1.5888696 n
8.9244388
90 38 16.12
94 20 51.97
$180+\Omega$ 184 56 8.09

Ω = 4 56 8.09
4 356 14 24.15
ω' 54 45 58.68
ω 51 00 19.83

$\cos\tfrac{1}{2}\Omega'$ 8.0619853
$\cos\tfrac{1}{2}(i''+\varepsilon)$ 9.9480501
8.0100354

$\sin\tfrac{1}{2}\Omega'$ 9.9999717
$\sin\tfrac{1}{2}(i''-\varepsilon)$ 8.8449935
8.8449646 n
7.7259432
1.1190214 n
~~85~~ 39 8.03
94 20 51.97

$\cos\tfrac{1}{2}\Omega'$, 8.0618853
$\sin\tfrac{1}{2}(i''+\varepsilon)$ 9.6639579
7.7258432

$\log\sin\tfrac{1}{2}i'$ 8.8462162

$\tfrac{1}{2}i'$ 4 1 27.03
i' 8 02 54.06

New Elements

Epoch – Oct. 31.0 1869 W.M.T.

M = 344° 0′ 8″.72

Mn Eq 1869 {
Ω = 4 56 8.09 +49.48
ω 51 00 19.83
π 55 56 27.52 +50.245
}

φ 17 27 35.51
i 8 2 54.06 + 0.46

~~φ = 17° 22′ 34″.67~~

μ 802.05102
$\log a$ .4305346

Perturbations Mean Eq. 1880.

(1869.0)	π	Ω	i'	ω
	55 56 28	4 56 8	8 2 54	51 00 20
Perturbations	+9 13	+ 9 4	+ 5	+ 9
Eq 1880	56 05 41	5 05 12	8 2 59	51 00 29
	– 4 Perturbations 42	= – 2 33	– 1 2	– 4 42
	56 00 59	Ω' = 99 11 31	i'' 1 18 33	~~50 55 47~~
		Ω' = 112 34 41	i' 2 29 19	

= for h_1
= for h

51 00 29
2 9
50 58 20

~~π~~ = 56° 00′ 59″

Elements Feb. 24 1876 M.Eq. 1880

π = 56 5 41
Ω 5 5 12
$\pi-\Omega$ 50 00 29

56 0 59
5 2 39
50 58 20

i	8	2	47
i''	1	18	33
$i'+i''$	9	21	20
$i'-i''$	6	44	14
$\tfrac{1}{2}(i''+\varepsilon)$	4	40	40
$\tfrac{1}{2}(i''-i)$	-3	22	07

Ω' 99 11 31
Ω 5 2 39
$\Omega'-\Omega$ 94 08 52
$\tfrac{1}{2}(\Omega'-\Omega)$ 47 04 26
} h_1

i	8	2	47
i'	2	29	19
$i'+\varepsilon$	10	32	06
$i'-\varepsilon$	5	33	28
$\tfrac{1}{2}(i''+i')$	5	16	03
$\tfrac{1}{2}(i''-i')$	2	46	44

Ω' 112 34 41
Ω 5 2 39
$\Omega'-\Omega$ 107 32 02
$\tfrac{1}{2}(\Omega'-\Omega)$ 53 46 01

$\sin\tfrac{1}{2}(\Omega'-\Omega)$
$\sin\tfrac{1}{2}(i'+i')$
$\sin\tfrac{1}{2}I\sin\tfrac{1}{2}(N+N')$
$\sin\tfrac{1}{2}I\cos\tfrac{1}{2}(N+N')$
$\tan\tfrac{1}{2}(N+N')$
$\tfrac{1}{2}(N+N')$
$\tfrac{1}{2}(N+N')$
$\tfrac{1}{2}(N-N')$
N
ω
ω'
N'
Ω'
$N'+\Omega'$

$\cos\tfrac{1}{2}(\Omega'-\Omega)$
$\sin\tfrac{1}{2}(i''-i')$

$\sin\tfrac{1}{2}(\Omega'-\Omega)$
$\cos\tfrac{1}{2}(i''+i')$

$\cos\tfrac{1}{2}(\Omega'-\Omega)$
$\cos\tfrac{1}{2}(i''+i')$

	h_1	h
ω' =	~~240 11 20~~	~~246~~ 12 13
$N+\Omega'$	~~175 59 25~~	~~170 02 56~~
I	8 14 44	9 6 34
N	170 57 16	164 50 23
ω	50 58 20	50 58 20
ω'	240 07 04	246 07 57
N'	76 47 54	57 28 15
Ω'	99 11 31	112 34 41
$N'+\Omega'$	175 59 25	170 02 56

$\sqrt{a(1+e)}$ .27204
$\sqrt{a(1-e)}$ .13826
$\log c''$ 4.78958

Integration for Jan 13, 18~~8~~77 B.M.T.

New Elements. Oct 31.0 1869 B.M.T.	° ′ ″	Perturbations ♃	♄	Precession M Eq 1877.0	Epoch Jan 30 1877
M	~~344 0 37.2~~ 343 56 42.32	−50′ 38.07″ −21 5.71	+11.39 −13.56	259° 48′ 25.94″ ~~+ 6 35.92~~	242° 33′ 22.31″
Eq 1869 Ω	4 56 8.09	−28 42.11	−18.82	+ 6 35.92	4 33 43.08
π	55 56 27.92	+31 17.31	−19.62	+ 6 41.92	56 34 7.53
i	8 2 54.06	−2 48.71	+2.96	+ 3.68	8 0 11.99
φ	17 27 35.51	−12 36.58	−7.05		17 14 51.88
μ	802.05102	−2.36359	+.00855		799.69600″

	°	′	″
Ω	4	33	43.08
~~Ω − ω~~	~~178~~	~~26~~	~~16.92~~
~~½(Ω − ω)~~	~~87~~	~~43~~	~~8.46~~
	92	16	51.54
i	8	2	48.30
ε	23	27	18.98
i + ε	31	30	7.28
i − ε	−15	24	30.68
½(i + ε)	15	45	3.64
½(i − ε)	−7	42	15.34

sin ½(Ω − ω) 9.9996557 cos ½ Ω − ω. 8.5998846
sin ½(i + ε) 9.4337017 sin ½(i − ε) 9.1272989n
sin ½ i′ sin ½(Ω′ + a) 9.4333574 — 7.7271835n
cos ½ i′ cos ½(Ω′ + a) 7.7271835
tan ½(Ω′ + a) 1.7061739
½(Ω′ + a) 88 52 23.91
½(Ω′ − a) 92 20 54.61
Ω′ 181 13 18.52 sin ½ i′ 9.4334414 cos ½ i′ 9.9833990
a 52 0 24.45 ½ i′ +15 44 28.77
ω 356 31 29.30 i′ 31 28 57.54
ω′ 55 28 53.15

sin ½(Ω − ω) 9.9996557 cos ½(Ω − ω) 8.5998846n
cos ½(i + ε) 9.9833784 cos ½(i − ε) 9.9960619
cos ½ i′ sin ½(Ω′ − a) 9.9830341 8.5959465n
cos ½ i′ cos ½(Ω′ − a) 8.5959465n
tg ½(Ω′ − a) 1.3870876n
½(Ω′ − a) − 87 39 5.39
½(Ω′ − a) 92 20 54.61

sin Ω′ 8.3288475n − cos Ω′ 9.9999012 − sin Ω′ 8.3288475 A + ω′ 146° 31′ 26.35″ log μ 2.9029249
cos i′ 9.9308465n cos i′ sin Ω′ 8.2596940 − cos i′ cos Ω′ 9.9307477 B + ω′ 56 54 52.59 log Const 3.5500066
cos Ω′ 9.9999012 tang A 1.7402072n Tang B 8.3980998 ω′ 55 28 55.15 ~~3.4529315~~
sin i′ 9.7178905n A − 88 57 28.80 B 1 25 57.44 .6470817
log a 9.9999730 log b 9.9308835 log a 9.9999730 log √a .2156939
A 91 02 31.20 log b 9.9308835 log a .4313878
log c 9.7178705

log e = sin φ = 9.4720305
e .2965040
1 + ε 1.2965040
1 − ε .7034960
log(1 + ε) 0.1127739
log(1 − ε) 9.8472616

log √(1+ε) 0.0563869
log √a .2156939
log √(1−ε) 9.9236308

log √a(1+ε) 0.2720808
log √a(1−ε) 0.1393247

φ 17 14 51.88
½ φ 8 37 25.94
(45 − ½ φ) 36 22 34.06
tang(45 − ½ φ) ~~9.9449160~~
~~9.8830353~~
9.8672439

l sin φ 9.4720305
log ℓ 5.3144251
log e″ 4.7864556

log cos φ 9.9800 2
cos² φ 9.96004
log a .43139
log p .39143

Opposition Ephemeris of (109) for 1877

1877

			July 15.5	July 19.5		Jan 5.5	Jan 9.5
Ε			235 44 8.20	236 29 53.23			
M	° ′ ″	° ′ ″	249 46 32.40	250 39 51.18	° ′ ″	° ′ ″	~~242° 40′ 21.6″~~
M	236 26 50.70	237 20 44.8	~~238 13 28.26~~	~~239 06 47.04~~	~~240 0 25.82~~	240 53 24.60	241 46 43.38
E	224 31 ~~54.08~~	~~225 16 2.65~~	226 0 12.14	~~226 44 27.67~~	~~227 28 49.38~~	228 13 17.28	228 57 51.00
			117 52 4.10	118 14 56.61		114 06 38.64	114 28 55.80
			9.9464662	9.9449259		9.9603556	9.9590845
			9.6697195n	9.6751413		9.6111936n	9.6174302n
			.2185470	.2170065		.2329364	.2311653
			9.8090442	9.8144660		9.7505183	9.7567549
			.4095028	.4025407		.4819181	.4744104
			−68 43 10.357	−68 24 25.51		−71 45 14.63	−71 27 26.97
			111 16 49.65	111 35 34.49		108 14 45.37	108 32 33.03
			222 33 39.30	223 11 8.98		216 29 30.74	217 05 6.06
			.4984346	.4972138		.5096802	.5086332
			9 05 5.65	9 42 35.33		3 00 57.09	3 36 32.41
			279 28 31.89	280 06 1.57		273 24 23.33	273 59 58.65
			278 02 34.45	278 40 4.13		271 58 25.89	272 34 1.21
			9.1983762	9.2270075		8.7210877	8.7989774
			.4984076	.4971808		.5096532	.5086002
			9.9949337	9.9932165		9.9992320n	9.9989410n
			.4293181	.4280973		.4405637	.4395167
			9.9957070	9.9959113		9.9997422n	9.9995640n
			.2163051	.2150843		.2275507	.2265037
						~~+2755101~~	
x			+.4974853	+.5298005		+0.1201139	+.2030409
X			−.4047617	−.4657818		+.2575101	+.1915282
y			−2.6506463	−2.6382370		−2.7529333	−2.7444652
Y			+.8552664	+.8283934		+.8007712	+.9149540
z			−1.6293412	−1.6221672		−1.6876907	−1.6829364
Z			+.3710854	+.3594242		+.3808828	+.3969881
log a cos δ cos α			8.5672090	8.8069848		9.6310621 ~~9.6489686~~	9.5961231
log a cos δ sin α			.2541563	.2576411		0.2676780	.2623351
log tan α			1.2869473	1.4506563		~~.6187107~~ .6366169	.6662120
α			−87 2 36.31	−87 58 15.55		−76 59 58.02	−77 49 46.12
			272 57 23.69	272 01 44.45		283 00 1.98	282 10 13.88
			+42.74	+43.52		+ 34.23	+35.13
			272 58 6.43	272 2 27.97		283 0 36.21	282 10 49.01
log a cos δ			.2547348	.2579134		.2789560	.2722074
log a sin δ			.0997689n	.1018150		.1128923n	.1092235
log tg δ			9.8450341n	9.8434016n		9.8339363n	9.8370161n
δ			−34 59 17.00	−34 53 13.00		−34 18 11.96	−34 29 33.80
			−7.10	−7.37		−5.17	−5.24
			−34 59 24.10	−84 53 20.37		−84 18 17.13	−84 29 39.04
log Δ			.3413069	.3439501		.3619419	.3561760
q			331 1			324 45	
α			272 57			283 0	
q+α			243 58			247 45	
log δ			9.8450n			9.8339n	
sin (q+α)			9.9535n			9.9666n	
log q			1.2088			1.1350n	
cos (q+α)			9.6424n			9.5782n	
fay(a′−a)I						+8.62	
f			+10.17			+25.61	
			32.57			34.23	35.13
a′−a			42.74	43.52			
δ′−δ			−7.10	7.37		−5.17	−5.24

X

Jun 13.5	17.5	21.5	25.5	29.5	July 3.5	7.5	11.5
° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
~~242 40 2.16~~							
242 40 2.16	243 33 20.94	244 26 39.72	245 19 58.50	246 13 17.28	247 06 36.06	247 59 54.84	248 53 13.62
229 42 32.43	230 27 19.86	231 12 14.06	231 57 15.24	232 42 23.27	233 27 38.49	234 13 0.97	234 58 30.82
114 51 16.21	115 13 39.94	115 36 7.04	115 58 37.62	116 21 11.63	116 43 49.24	117 06 30.48	117 29 15.41
9.9577883	9.9564665	9.9551188	9.9537448	9.9523441	9.9509163	9.9494919	9.9479978
9.6235753n	9.6296314n	9.6356009	9.6414862	9.6472890	9.6530118	9.6585562	9.6642252
.2298691	.2285473	.2271996	.2258256	.2244249	.2229971	.2215918	.2200586
9.7629000n	9.7689561	9.7749256	9.7808109	9.7866137	9.7923365	9.7979812	9.8035499
0.4669691n	.4595912	.4522740	.4450147	.4378112	.4306606	.4233603	.4165087
-71 09 34.12	-70 51 35.94	-70 33 32.39	-70 15 23.18	-69 57 8.43	-69 38 47.88	-69 20 21.42	-69 01 48.97
108 50 25.88	109 08 24.06	109 26 27.66	109 44 36.82	110 02 51.57	110 21 12.12	110 39 38.58	110 58 11.03
217 40 51.76	218 16 48.12	218 52 55.32	219 29 13.64	220 05 43.14	220 42 24.24	221 19 17.16	221 56 22.06
.5075694	.5064882	.5053900	.5042746	.5031414	.5019910	.5008232	.4996376
						7 50 43.57	8 27 48.41
4 12 18.11	4 48 14.47	5 24 21.67	6 00 35.99	6 37 9.49	7 13 50.59	~~7 11 4.93~~	
274 35 44.35	275 11 40.71	275 47 47.91	276 24 6.23	277 00 35.73	277 37 16.83	278 14 9.75	278 57 14.65
273 09 46.91	273 45 43.27	274 21 50.47	274 58 8.79	275 34 38.29	276 11 19.39	276 48 12.31	277 25 17.21
8.8652566	8.9229732	8.9741104	9.0200349	9.0617231	9.0999055	9.1351356	9.1678439
.5075424	.5064612	.5053630	.5042476	.5031144	.5019640	.5007962	.4996168
9.9986015n	9.9982127n	9.9977736	9.9972835	9.9967415	9.9961465	9.9954976	9.9947937
.4384529	.4373717	.4362735	.4351581	.4340249	.4328745	.4317067	.4305211
9.9993379n	9.9990632	9.9987391	9.9983646	9.9979391	9.9974616	9.9969311	9.9968465
.2254399	.2243587	.2232605	.2221451	.2210119	.2198615	.2186937	.2175081
	032						
+0.2359386	+.2688[illegible]32	+.3016292	+.3344125	+.3671449	+.3998246	+.4324459	+.4650016
+.1246673	+.0592552	-.0103891	-.0771693	-.1452069	-.2117975	-.2774638	-.3418905
-2.7356113	-2.7263675	-2.7167338	-2.7067094	-2.6962885	-2.6854741	-2.6742642	-2.6626546
+.9249828	+.9308159	+.9324483	+.9298940	+.9231719	+.9123047	+.8973253	+.8782839
-1.6779452	-1.6727143	-1.6672456	-1.6615359	-1.6555832	-1.6493850	-1.6428519	-1.6362679
+.4013383	+.4038663	+.4045725	+.4034640	+.4005498	+.3958368	+.3893386	+.3810755
9.5570328	9.5132955	9.4642511	9.4089912	9.3462434	9.2742204	9.1902816	9.0902971
0.2578293n	.2541979	.2514644	~~.2397536~~ .2496623	.2487375	.2487502	.2496725	.2514860
0.7007965n	.7409024	.7872133	.8406511	.9024941	.9745298	1.0593909	1.1611887
-78 44 10.75	-79 42 27.64	-80 43 46.73	-81 47 14.49	-82 51 55.09	-83 56 49.09	-85 00 55.29	-86 3 11.49
281 15 49.25	280 17 32.36	279 16 13.27	278 12 45.51	277 08 4.91	276 03 10.91	274 59 4.71	273 56 48.51
+36.03	+36.91	+37.80	+38.65	+39.50	+40.72	+41.14	+41.94
281 16 25.28	280 18 9.27	279 16 51.07	278 13 24.16	277 08 44.41	276 03 51.63	274 59 45.85	273 57 30.45
	103 4097	101 2909	098 [illegible]053	098 6553			
.2662760	.2612430	.2571740	.2541190	.2521134	.2511783	.2513181	.2525162
0.1060572n	~~.1060572~~	~~.1034097~~	~~.1012909~~	~~.0996921~~	.0981425	.0981636	.0987103
9.8397812n	~~9.8448142~~n	~~9.8462357~~n	~~9.8471719~~n	9.847~~5788~~	9.8469642n	9.8468455n	9.8461947n
	9.8421664n	9.8441169n	9.8455803n	9.8465419n			
-34 39 47.44	~~-34 58 27.95~~	~~-35 3 45.72~~	~~-35 7 14.38~~	~~-35 8 45.~~33	-35 6 27.96	-35 06 1.44	-35 3 35.93
-5.35	34 48 37.98	-34 55 52.44	-35 01 20.25	-35 4 53.62	-6.31	-6.56	-6.83
-34 39 52.79	-5.49	-5.66	-5.85	-6.07			
	-34 48 43.47	-34 55 58.10	-35 1 26.10	-35 4 59.69	-35 6 34.27	-35 6 8.00	-35 3 42.76
.3511349	~~.3477428~~ .3468765	~~.3441419~~ .3434449	~~.3413964~~ .3406628	~~.3395255~~ .3391824	.3383869	.3384874	.3394704
326 26		327 54		329 9		330 11	
281 16		279 16		277 9		274 59	
247 42		247 10		246 18		245 10	
9.8398n		9.8441n		9.8465n		9.8468n	
9.9662n		9.9646n		9.9617n		9.9579n	
1.1491		1.1639		1.1790		1.1940	
9.5792n		9.5889n		9.6042n		9.6232n	
+9.02		9.39		9.71		9.97	
27.01		28.41		29.80		31.17	
36.03	36.91	37.80	38.65	39.50	40.72	41.14	41.94
-5.35	-5.49	-5.66	5.85	-6.07	6.31	6.56	6.83

$\delta^2 f_x = \frac{1}{16}\left(\Delta^2 f_x - \frac{5}{64}\Delta^4 f_x\right.$

$\delta f(x_0 - \frac{1}{2}h) = \frac{1}{4}\Delta f x_0 - \frac{1}{2}\delta^2 f(x_0 + h)$

$\delta f x_0 + \frac{1}{2}h = \frac{1}{4}\Delta f x_0 + \frac{1}{2}\delta^2 f(x_0 - h)$

(109)

	h		$\delta^2 f_{x\alpha}$		$\delta f x$		. $\delta^2_{fx}\delta$					
	12											
June 5	5											
	6											
6	7											
	8			''		° ' ''	''		° ' ''	' ''	' ''	
+ 7	9		~~277~~	−17.32		282 10 49.01	+4.27		−34 29 39.04	29 39.0		
	10			−16.66	−13 11.64	281 57 37.37	4.56	−2 40.49	32 19.53	32 19.5	−2 40.5	
8	11	X		−15.98	−13 28.30	281 44 9.09	+4.76	−2 35.93	34 55.46	34 55.5	2 36.0	
	12			−15.26	13 44.26	281 30 24.81	+4.98	−2 31.16	37 26.62	37 26.6	2 31.1	
9	13		~~3.70~~	−14.55	13 59.52	281 16 25.28	+5.20	−2 26.18	−34 39 52.79	39 52.8	2 26.2	
	14			−13.80	14 14.09	281 02 11.19	+5.42	−2 20.90	42 13.69	42 13.7	2 20.9	
10	15	X		−13.03	14 27.19	280 47 43.30	+5.62	−2 15.48	44 29.17	44 29.2	2 15.5	
	16			−12.22	14 40.90	280 33 02.40	+5.82	−2 9.96	46 39.13	46 39.2	2 10.0	
11	17		−~~3.3~~4	−11.40	14 53.12	280 18 49.29	+6.01	−2 4.14	−34 48 43.47	48 43.5	2 4.9	
	18			−10.58	15 4.52	280 3 4.75	+6.19	−1 58.11	50 41.58	50 41.6	1 58.1	
12	19	X		9.75	15 15.10	279 49 49.65	+6.36	−1 51.92	(33.50 19.25) 52 33.50	52 33.5	1 51.9	
	20			8.91	15 24.84	279 32 24.81	+6.53	−1 45.75	54 19.25	54 19.0	1 45.5	
13	21		−~~3.5~~2	−8.06	15 33.75	279 16 51.07	+6.68	−1 39.22	−34 55 58.10	55 58.1	1 39.1	
	22			7.19	15 41.82	279 1 9.25	+6.82	−1 32.44	34 57 30.54	57 30.5	1 32.4	
14	23	X		6.32	15 49.01	278 45 20.24	+6.94	−1 25.52	34 58 56.06	58 56.1	1 25.6	
	24			5.44	15 55.32	278 29 24.92	+7.05	−1 18.59	35 0 14.65	0 14.6	1 18.5	
15	25		−~~3.64~~	−4.56	16 00.76	278 13 24.16	+7.16	−1 11.54	−35 1 26.10	1 26.1	1 11.5	
	26			3.66	16 5.36	277 57 18.80	+7.24	−1 4.33	35 2 30.43	2 30.4	1 4.3	
16	27	X		2.76	16 9.02	277 41 5.78	+7.32	−0 57.09	3 27.52	3 27.5	0 57.1	
	28			1.83	10 11.77	277 24 58.01	+7.39	−0 49.78	4 17.30	4 17.3	0 49.8	
17	29		−~~3.75~~	−0.82	16 13.60	277 08 44.41	+7.45	−0 42.39	−35 4 59.69	4 59.7	0 42.4	7.5
	30			+0.13	16 14.31	276 52 30.10	+7.49	−0 34.90	5 34.59	5 34.6	0 34.9	7.5
18 July	1	X		+1.03	16 14.18	276 36 15.92	+7.53	−0 27.41	6 2.00	6 2.0	27.4	7.5
	2			+1.98	16 13.12	276 20 2.80	+7.55	−0 19.90	6 21.90	6 21.9	19.9	7.5
19	3		−~~3.84~~	+2.93	16 11.14	276 3 51.63	+7.57	−0 12.35	−35 6 34.27	6 34.3	12.4	7.7
	4			3.89	16 8.20	275 47 43.36	+7.55	−0 4.75	6 39.02	6 39.0	−4.7	7.5
20	5	X		+4.85	16 4.38	275 31 38.98	+7.53	+0 2.83	6 36.19	6 36.2	+2.8	7.6
	6			5.86	15 59.50	275 15 39.48	+7.49	+0 10.34	6 25.85	6 25.8	10.4	7.4
21	7		−~~3.81~~	+6.87	15 53.64	274 59 45.85 x	+7.45	+0 17.83	−35 6 8.00	6 8.0	17.8	7.5
	8			+7.84	15 46.88	274 43 58.98	+7.39	+0 25.32	5 42.68	5 42.7	25.3	7.4
22	9	X		+8.80	15 ~~34.40~~ 38.72	274 28 20.26	+7.30	+0 32.71	5 9.97	5 10.0	32.7	7.3
	10			+9.74	15 ~~28.78~~ 29.90	274 12 50.33	+7.20	+0 40.00	4 29.97	4 30.0	40.0	7.2
23	11		−−3.36	+10.68	15 20.19	273 57 30.65	+7.10	+0 47.20	−35 3 42.76	3 42.8	47.2	7.2
	12			11.55	15 9.16	273 42 21.29	+6.99	+0 54.31	2 2 48.45	2 48.4	54.4	6.5
24	13	X		+12.41	(14 58.61	273 27 23.68	+6.87	+1 1.30	1 47.15	1 47.2	1 1.2	7.0
	14			+13.23	14 45.25)	273 12 38.48	+6.74	+1 8.17	0 38.98	0 39.0	1 8.2	6.7
25	15			+14.04	14 32.02	272 58 6.43	+6.59	+1 14.91	−34 59 24.10	59 24.1	1 14.9	
	16											
26	17	X										
	18											
27	19											

	λ	Δ1	Δ2	Δ3	Δ4	β	Δ1	Δ2	Δ3	Δ4
	° ′ ″	′ ″	′ ″	″		° ′ ″	′ ″	′ ″	″	″
Jan 5.5	~~272 58 6.43~~ 283 0 36.21					−84 18 17.13				
		−49 47.20					−11 21.91			
x 9.5	282 10 49.01		−4 36.53			84 29 39.04		+1 8.16		
		54 23.73		+44.25			10 13.75		+14.91	
y 13.5	281 16 25.28		−3 52.28		+5.89	84 39 52.79		1 23.07		1.93
		58 16.01		50.09			8 50.68		+12.98	
17.5	280 18 9.27		−3 2.19		+3.38	34 48 43.47		1 36.05		−2.40
		1 01 18.20		53.48			7 14.63		+10.58	
21.5	279 16 51.07		−2 8.71		+2.39	84 55 58.10		1 46.63		−2.80
		1 3 26.91		56.87			5 28.00		+7.78	
25.5	278 13 24.16		−1 12.84		+3.94	35 01 26.10		1 54.41		−3.18
X		1 4 39.76		59.81			3 33.59		+4.60	
29.5	277 8 44.41		− 13.03		+0.22	35 4 59.69		1 59.01		−2.76
		1 4 52.78		60.03			−1 34.58		+1.84	
Jul 3.5	276 3 51.63		+ 47.00		+3.35	35 6 34.27		2 0.85		−2.72
		1 4 5.78		63.38			+0 26.27		−0.88	
7.5	274 59 45.85		+1 50.38		−2.38	35 6 8.00		1 58.97		−4.67
		1 2 15.40		61.00			2 25.24		−5.55	
11.5	273 57 30.45		+2 51.38		−6.82	35 3 42.76		1 53.42		+2.80
		59 24.02		+54.18			4 18.66		−8.35	
15.5	272 58 6.43		+3 45.56			84 59 24.10		+1 45.07		
		55 38.46					6 3.73			
19.5	272 2 27.97					84 53 20.37				

☍ Jan 27

~~3418069~~

~~3439501~~

λ

	h	m	s			Δ1	Δ2	Δ3	Δ4
5	18	48	43.27	9	3619419				
6	18	47	50.49	10		−57659			
7	18	46	56.60	11 —	3561760		+7248		
8	18	46	1.65	12		50411		+579	
9	18	45	5.69	13	3511349		7827		−138
10	18	44	8.75	14		42584		441	
11	18	43	10.89	15	3468765		8268		−115
12	18	42	12.16	16		34316		327	
13	18	41	12.62	17	3434449		8595		−105
14	18	40	12.32	18		25721		222	
15	18	39	11.31	19	3408728		8817		−90
16	18	38	9.65	20		16904		132	
17	18	37	7.30	21	3391824		8949		−121
18	18	36	4.62	22		−7955		+11	
19	18	35	1.35	23	3383869		8960		−46
24	18	33	57.66	24		+1005		−35	
	18	32	53.61	25	3384874		8825		−255
	18	31	49.25	26		9830		290	
	18	30	44.65	27	3394704		8535		−278
	18	29	39.87	28		18365		468	
	18	28	34.96	29	3413069		8067		
	18	27	30.01	30		26432			
	18	26	25.06	1	8439501				
	18	25	20.19	2					
	18	24	15.44	3					
	18	23	10.89						
	18	22	6.60						
	18	21	2.63						
	18	19	59.06						
	18	18	55.94						
	18	17	53.35						
	18	16	51.36						
	18	15	50.03						
	18	14	49.42						
	18	13	49.58						
	18	12	50.56						
	18	11	52.43						

9.5

					m s
★1809	+453		3561760	18	50
1849	462	13305	3548455	18	47
+1880	472	−12843	3535612 +	18	44
1923	481	−12372	3523240	18	41
1954	488	−11897	3511349	18	38
1989	497	−11398	3499951	18	35
X 2014	503	−10901	3489050	18	32
2041	510	−10398	3478652	18	29
2065	516	−9888	3468765	18	27
2088	522	−9367	3458898	18	24
x 2109	527	−8845	3449553	18	22
2129	532	−8318	3441235	18	20
2147	537	−7786	3434449	x 18	18
2163	541	−7244	3427205	18	16
x 2177	544	−6703	3420502	18	14
2189	547	−6159	3414343	18	12
2202	550	−5612	3408728	18	11
2213	553	−5057	3403671	18	10
x 2222	555	−4504	3399167	18	09
2229	557	−3950	3395217	18	8
2235	559	−3393	3391824	18	7
2239	560	−2829	3388995	18	6
x 2241	560	−2269	3386726	18	06
2241	560	−1709	3385017	18	6
2239	560	−1149	3383869	18	6
2233	558	−0584	3383285	18	6
x 2225	556	−026	3383259	18	06
2215	554	+530	3383789	18	6
−2202	551	+1084	3384874	18	6
2187	547	+1631	3386505	18	6
x 2170	542	+2178	3388683	18	06
2150	538	+2720	3391413	18	7
−2128	532	+3268	3394704	18	8
2102	525	+3811	3398515	18	9
x 2074	518	+4336	3402851	18	10
2044	511	+4854	3407705	18	11
+2010	502	+5365	3413069	18	13

log 2 = 503.14 lg 2² 1.00628

log 9 = 33918 lg [illegible]² .67836

lg 2²a² 1.58464

lg a([illegible]) 1.31944

lg I 9.63480

I 0.43

° ′ ″
175 31 12
I = 8 12 42
9.15482
9.99852

1877 1878

	July 23.5	Sept 1	Oct 11	Nov 20	Dec 30	Feb 8	Mar 20	Apr 29	June 8	July 18	Aug 27
l'	271 29 44	274 46 22	278 4 5	281 22 55	284 42 52	288 3 59	291 26 15	294 49 41	298 14 14	301 39 56	305 6 47
u'	95 58 32	99 15 10	102 32 53	105 51 43	109 11 40	112 32 47	115 55 3	119 18 29	122 43 02	126 08 44	129 35 35
log sin u'	9.99763	9.99431	9.98950	9.98314	9.97516	9.96547	9.95396	9.94052	9.92498	9.90715	9.88682
log tang u'	.98915n	0.78806n	65252n	54647n	.45827n	38178n	31340n	25076n	19218n	13642n	08246n
log tang λ'	~~.13467~~	~~9.94288~~	~~9.80734~~	~~9.70129~~	.45379	.37730	.30892	.24628	.18770	.13194	.07798
	.97567	.78358	.64804	.54199							
λ'	96 2 14	99 20 49	102 40 26	106 4 04	109 22 41	112 45 23	116 9 3	119 33 39	122 59 12	126 25 39	129 53 0
ν+ω'	104 59 45	111 30 45	118 25 51	125 54 29	134 2 9	142 56 47	152 47 37	163 44 47	175 57 47	189 33 35	204 32 31
λ'−ν+ω'	351 2 29	347 50 04	344 14 35	340 06 35	335 20 32	329 48 36	323 21 26	315 48 52	307 1 25	296 52 4	285 20 29
log sin β'	9.15245	9.14512	9.14432	9.13796	9.12998	9.12029	9.10878	9.09534	9.07980	9.06197	9.04164
log r'	71762	71842	.71720	71597	71473	71349	71226	.71103	70981	70861	70743
log cos β'	9.99557	9.99564	9.99574	9.99586	9.99601	9.99619	9.99639	9.99661	9.99684	9.99709	9.99735
log r'' = log r' cos β'	9.87207	9.86755	9.86152	9.85393	9.84471	9.83378	9.82104	9.80630	9.78961	9.77058	9.74907
log sin (λ'−ν+ω')	9.19235n	9.32374n	9.43386	9.53176n	9.62034n	9.70145n	9.77585n	9.84322n	9.90221n	9.95039n	9.98424n
log cos γ'	9.99024	9.98578	9.97911	9.96915	9.95449	9.93289	9.90067	9.85218	9.77654	9.65217	9.41989
log sin γ'	9.32148	9.40094	9.48120	9.56098	9.63831	9.71232	9.78238	9.84675	9.90399	9.95113	9.98444
log r' cos γ'	.70986	.70420	.69631	.68512	.66922	.64638	.61293	.56321	.48635	.36078	.12732
− r' cos γ'	−51270	−50606	−49695	−48431	−46690	−44298	−41014	−36577	−30644	−22950	−13407
2	+3.1332	+3.0385	+2.9332	+2.8197	+2.6986	+2.5719	+2.4423	+2.3136	+2.1905	+2.0799	+1.9894
2 − r' cos γ'	−1.9938	−2.0221	−2.0363	−2.0234	−1.9704	−1.8579	−1.6591	−1.3441	−0.8739	−0.2151	+0.6487
log r' sin γ' = log Q sin l'	0.29968	0.30580	0.30884	.30608	.29455	.26902	.21987	.12843	9.94146	9.33264	9.81204
log Q cos l'	.04110	.11936	.19840	.27695	.35304	.42581	.49464	.55778	.61380	.65974	.69187
log tang l'	~~.25858~~	~~.18644~~	~~.11044~~	~~.02913~~	~~9.94151~~	~~9.84321~~	~~9.72523~~	~~9.57065~~	~~9.32766~~	~~8.67290~~	~~9.12017~~
	9.74142	9.81356	9.88956	9.97087	0.05849	.15679	.27477	.42935	.67234	1.32710	.87983
log Q	.35732	.38252	.41108	.44252	.47627	.51178	.54861	.58594	.62340	.66022	.69561
log 1/Q³	8.92804	8.85244	8.76676	8.67244	8.57119	8.46466	8.35417	8.24218	8.12980	8.01934	7.91317
1/Q³	+.084731	+.071194	+.058449	+.047038	+.037266	+.029152	+.022604	+.017465	+.013483	+.010456	+.008188
− 1/2³	− .006937	− 6994	− 7054	− 7114	− 7175	− 7237	− 7298	− 7361	− 7423	− 7485	− 7546
A	+.077794	+.064200	+.051393	+.039924	+.030081	+.021915	+.015306	+.010104	+.006060	+.002971	+.000642
log A	8.89095	8.80754	8.71090	8.60123	8.47829	8.34074	8.18486	8.00449	7.78248	7.47290	6.80754
log r''	9.87207	9.86755	9.86152	9.85393	9.84471	9.83378	9.82104	9.80637	9.78961	9.77058	9.74907
log 300 =	8.76302	8.67509	8.57242	8.45516	8.32300	8.17452	8.00590	7.81086	7.57209	7.24348	6.55661
	~~0.69907~~	~~0.61114~~	~~0.50847~~	~~0.39121~~	~~0.25905~~	~~0.11057~~	~~9.94195~~	~~9.74691~~	~~9.50814~~	~~9.17953~~	~~8.49266~~
log δ₀	0.73454n	0.78139	0.79875	0.78087	0.74542	0.68792	0.60541	0.49140	0.32759	0.06504	9.43261
Ax	+0.39885	+0.32490	+0.25539	+.19335	+0.14045	+.09708	+.06278	+.03696	+.01857	+.00682	+.00086
− 2/Q³	− ~~.00658~~	~~−.00457~~	~~−.00300~~	~~−.00188~~	~~−.00112~~	~~.00064~~	~~−.00035~~	~~−.00018~~	~~−.00008~~	~~−.00003~~	−.00008
	+.~~39227~~	+32033	+.25239	+.19147	~~+13933~~	~~+09644~~	~~+06243~~	~~+03678~~	~~+01849~~	+00679	+00085
log k₀	~~9.59359~~	~~9.50560~~	~~9.40207~~	~~9.28010~~	9.14404	~~8.98426~~	~~8.79539~~	~~8.56561~~	~~8.26694~~	~~7.83187~~	6.92942
=	[illegible]	0.97180	.86007	.71938	.53713	.28044	9.81572	9.47387n	9.97626n	0.11011n	0.12442n

♄	July 23.5	Sept 1	Oct 11	Nov 20	Dec 30	Feb 8	Mar 20	Apr 29	June 8	July 18	Aug 27
l' 169 36 8	345 25 32	346 43 56	348 02 31	349 21 17	350 40 15	351 59 26	353 18 47	354 38 21	355 58 6	357 18 3	358 38 13
u'	175 49 24	177 07 48	178 26 23	179 45 9	181 4 7	182 23 18	183 42 39	185 02 13	186 21 58	187 41 55	189 2 5
log sin u'	8.86232	8.69958	8.43503	7.63545	8.27067n	8.61985n	8.81105n	8.94349n	9.04486n	9.12658n	9.19599n
log tang u'	8.86348n	8.70012n	8.43519n	7.63545n	8.27075n	~~9.9962~~ 8.62022n	8.81196n	8.94517n	9.04754n	9.13091n	9.20141n
log tang λ'	8.85800n	8.69464n	8.42971n	7.62997n	8.26527	8.61474	8.80648	8.93969	9.04206	9.12543	9.19573
λ'	175 52 32	177 9 58	178 27 33	179 45 20	181 3 44	182 21 30	183 39 52	184 58 25	186 17 13	187 36 11	188 55 24
ν+ω'	[illegible] 59 8	117 30 8	124 25 14	131 53 52	140 1 32	148 56 10	158 47 00	169 44 10	181 57 10	195 32 58	210 31 54
λ'−ν+ω'	64 53 24	59 39 50	54 02 19	47 51 28	41 01 42	33 25 20	24 52 52	15 14 17	4 20 03	352 03 13	338 23 30
log sin β'	9.04573	8.88248	8.61741	7.81731	8.45200n	8.80066n	8.99133n	9.12322n	9.22406n	9.30365n	9.37413
log r'	98511	98460	98408	98356	98303	98251	98198	98144	98090	98037	97984
log cos β'	9.99777	9.99999	10.00000	10.00000	10.00000	9.99999	9.99998	9.99996	9.99993	9.99990	9.99987
log z'	8.06062	7.89788	7.63333	6.83375	7.46897n	7.81815	8.00935	8.14179	8.24316	8.32528	8.39425
log sin (λ'−ν+ω')	9.95689	9.93605	9.90817	9.87010	9.81719n	9.74100n	9.62401n	9.41968n	8.87837n	9.14065n	9.56616n
log r' cos β'	.98508	.98459	.98408	.98356	.98303	.98250	.98196	.98140	.98083	.98027	.97971
log cos (λ'−ν+ω')	9.62773	9.70335	9.76882	9.82671	9.87759	9.92150	9.95769	9.98446	9.99876	9.99581	9.96835
log cos γ'	9.62770	9.70334	9.76882	9.82671	9.87759	9.92149	9.95767	9.98442	9.99869	9.99571	9.96832
log sin γ'	9.95689	9.93605	9.90817	9.87009	9.81719	9.74100	9.62411	9.42012	8.88880	9.14562	9.56699
log r' cos γ'	~~0.94200~~	~~.92065~~	~~0.89225~~	~~.85365~~	~~.80022~~	~~.72357~~	~~.60609~~	~~.40156~~	~~9.86970~~	~~.12599~~	~~.54683~~
− r' cos γ'	~~−87500~~	~~−83301~~	~~−78028~~	~~−71393~~	~~−63128~~	~~−52907~~	~~−40373~~	~~−25209~~	~~−7408~~		
	−4.1003	−4.8747	−.56612	−.64606	−.72548	−.80168	−.87024	−.92440	−.95410	−.94641	−.88428
2	+3.1332	+3.0385	+2.9332	+2.8197	+2.6986	+2.5719	+2.4423	+2.3136	+2.1905	+2.0799	+1.9894
2 − r' cos γ'	−0.9671	−1.8362	−27280	−36409	−4.5562	−5.4449	−6.2604	−6.9304	−7.3505	−7.3842	−6.8834
log r' sin γ' = log Q sin l'	.94200	.92065	.89225	85365	80022	72351	60609	40156	9.86970	12599	54683
log Q cos l'	9.98547	0.26392	0.43584	0.56121	.65860	0.73599	0.79660	0.84076	0.86632	0.86830	0.83780
log tang l'	.95653n	~~9.34327~~n	.45647n	.29244n	.14162n	9.98752	9.80949n	9.56080n	9.00338n	9.25769n	9.70903n
log Q	.94464n	.65673 .93095	.91729	.90385	.89127	.88036	.87212	.46714	.86857	.87530	.88851
log x³/Q	283382	279285	275187	271155	267381	264108	261636	260322	260553	262590	266493
log 1/Q³	7.16616	7.20715	7.24813	7.28845	7.32619	7.35892	7.38364	7.39678	7.39447	7.37410	7.33507
1/Q³	.001466	.001611	.001771	.001943	.002119	.002285	.002419	.002493	.002480	.002367	.002163
− 1/2³	−.001108	−.001112	−.001116	−.001120	−.001124	−.001128	−.001132	−.001137	−.001141	−.001145	−.001149
A	+.000358	+.000499	+.000655	+.000823	+.000995	+.001157	+.001286	+.001356	+.001339	+.001222	+.001014
log A	6.55388	6.69810	6.81624	6.91540	6.99782	7.06333	7.10924	7.13226	7.12678	7.08707	7.00604
log 300	7.01170	6.99268	6.84574	6.14480	6.86191	7.27608	7.51266	7.66758	[illegible]	[illegible]	[illegible]
log δ₀	8.90794	9.03083	9.12058	9.18115	9.21013	9.16892	9.12730	8.94543	8.39807	8.62008	8.96400
Ax	+.001468	+.002432	+.003708	+.005317	+.007218	+.009275	+.011192	+.012535	+.012775	[illegible]	[illegible]
− 2/Q³	−.004594	−.004896	−.005194	−.005478	−.005719	−.005877	−.005908	−.005769	−.005433	−.004922	−.004203
Ax − 2/Q³	−.003126	−.002464	−.001486	−.000161	+.001499	+.003398	+.005284	+.006766	+.007342	+.006843	+.004694
log (Ax − 2/Q³)	7.49459n	7.39164n	7.17202	6.20683n	7.17580	7.53122	7.72296	7.83033	7.86581	7.82236	7.67154
log R₀	8.90706n	8.80373n	8.58411n	7.61892n	8.58789	8.94331	9.13505	9.24242	9.27790	9.23445	9.08363 9.79226n
	9.9996[illegible]	9.99019	9.98337	9.97329	9.95848	9.93670	9.90428	9.85557	9.77970	9.65508	9.42254

Oct 6	Nov 15	Dec 25
308 34 44	312 3 47	315 33 56
133 03 32	136 32 35	140 02 44
9.86371	9.83747	9.80966
.02945	9.97660n	9.92311n
.02495n	9.97212	9.91863
133 21 13	136 50 15	140 20 11
220 43 21	237 40 11	254 45 31
272 37 52	259 10 4	245 34 40
9.01853	8.99229	8.96248
9.70627	9.70515	9.70405
9.99762	9.99789	9.99817
9.72480	9.69744	9.66653
9.99954	9.99219	9.95929n
8.65948n	9.27192n	9.61462n
9.99955	9.99227	9.95966
9.36575	9.97707n	0.31867n
-0.2321	+0.9986	+2.0829
+1.9274	+1.9003	+1.9118
+1.6953	+2.8489	+3.9947
0.22925	0.45465	.60148
.70582	.69742	.66371
9.52343	~~9.37726~~	~~9.93777~~
.47657	.24274	.06223
.72875	.75885	.78533
7.81375	7.72345	7.64401
+.006512	+.005290	+.004406
-7612	-7666	-7724
-.001100	-.002376	-.003318
7.04139	7.37585	7.52088
9.72480n	9.69744n	9.66653n
6.76619	7.07329	8.18741n
8.70224n	9.00934n	9.12346n
9.68087n	.00713	.11844
.00026	+.00225	+.00691
~~+.00001~~	~~+.00001~~	~~+.00001~~
~~.00025~~	~~-.00224~~	~~-.00690~~
6.39794	7.35025	7.83885n
.04360n	9.82814n	9.11503n
359 58 34	1 19 7	2 39 54
190 22 26	191 42 59	193 03 46
9.25544n	9.30764n	9.35414n
9.26260	9.31678n	9.36553n
9.25712n	9.31130	9.36005
180 14 48	191 34 24	192 54 17
226 42 44	243 39 34	260 44 52
323 32 04	307 54 50	292 09 23
9.43303n	9.48469n	9.53063n
9.97929	9.97875	9.97819
9.99982	9.99598	9.99972
8.45374	8.50594	8.55244
9.77463n	9.89704n	9.96668n
.97911	.97858	.97791n
9.90537	9.78851	9.57650
9.90519	9.78829	9.57627
9.77436	9.89717	9.96673
~~.75365~~	~~.87592~~	~~.94452~~
-.76645	-.58485	-.35844
+1.9274	+1.9003	+1.9118
-.57371	-.39482	-1.6726
.75365	.87592	.94492
0.75869	0.59640	.22339
9.99496	0.27952n	.72153n
.90670	.92885	.95261
2.72010	2.78655	2.85783
7.27950	7.21345	7.14217
.001905	.001635	.001357
-.001154	-.001155	-.001163
+.000751	+.000477	+.000224
6.87564	6.67552	6.35025
[illegible]	~~7.72016~~	~~8.37636~~
9.04147	8.96618n	8.70693n
+.005756	+.002790	+.000803
-.003672	-.003106	-.002652
+.002084	-.000316	-.001849
7.31890	6.49969n	7.26694
8.73099	7.91178	8.67903
7.72076	7.57530n	8.29297n
8.66185	9.27423n	9.21645n

Integration for Nov 15 1878

Zero Elements Oct 31.5 1869 B.M.T.		Perturbations ♃	♅	♄	Precession 330°2'	Elements for Nov. 15.5 1878
M	~~343 56 42.32~~ 349 3 23.35	−31 52.62	−1° 10' 0.78 41 53.40	−17.73 +8.59	+26.72 +15° 39' 33.47	358 1 11.41
Ω	4 56 8.09 +4.949	−35 55.86		−18.85	+ 7 25.41	4 27 18.79
π	55 56 27.52 +0.24	+47 16.11		−38.59	+7 32.16	56 50 37.60
i	8 2 54.06 +0.46	−2 29.29		+0.23	+ 3.96	8 0 28.96
φ	17 27 35.51	−13 7.57		−11.03		17 14 16.91
μ	802.05102	−.75893		−.00435		801.2877 4

m Eq 1869

2. 9037886
3. 5500066
.6462180
log a 4308120

log a

1878 1880

	1878	1880		1878	1880		1878	1880
Ω	4 27 18.79	4 28 42.56	$l\sin\frac{1}{2}(\Omega-n)$	9.9996717	9.9996683	$l\cos\frac{1}{2}(\Omega'-n)$	8.5846068	8.5918683$_n$
Ω ~~n~~	184 27 18.79	184 28 42.56	$l\sin\frac{1}{2}(i'+\varepsilon)$	9.4331795	9.4331852	$l\sin\frac{1}{2}(i''-\varepsilon)$	9.1283781$_n$	9.1283514$_n$
$\frac{1}{2}(\Omega-n)$	92 13 39.39	92 14 21.28	$l\cos\frac{1}{2}i''\sin\frac{1}{2}(\Omega'+a)$	9.4328512	9.4328512		9.7175849	~~7.7175849~~
			$l\sin\frac{1}{2}i''\cos\frac{1}{2}(\Omega'+a)$	~~9.9830916~~ 7.7175845	9.4328530 9.7202197		~~8.5856490~~	9.7202197$_n$
			$l\tan\frac{1}{2}(\Omega'+a)$	~~9.4497556~~ 1.7148663	1.7126338		9.~~+323~~859$_n$	
i	8 0 28.96	8 00 31.45	$\frac{1}{2}(\Omega'+a)$	(~~1 6 17.46~~)				
ε	23 27 18.50	23 27 17.55	$\frac{1}{2}(\Omega'+a)$	88 53 42.54	88 53 22.99	$l\sin\frac{1}{2}i'$	9.4329319	9.4329350
$i+\varepsilon$	31 27 47.46	31 27 49.00	$\frac{1}{2}(\Omega'-a)$	92 17 35.64	92 18 18.77	$\frac{1}{2}i'$	15 43 20.61	15 43 21.03
$i-\varepsilon$	−15 26 49.54	−15 26 46.10	Ω'	181 11 18.18	181 11 41.76	i'	31 26 41.22	31 26 42.08
$\frac{1}{2}(i+\varepsilon)$	15 43 53.73	15 43 54.50	a	356 36 6.90	356 35 42.2			
$\frac{1}{2}(i-\varepsilon)$	−7 43 24.77	−7 43 23.05	ω	52 23 18.81	52 24 53.16			
			ω'	55 47 11.91	55 49 48.94			

	1878	1880		1878	1880
$l\sin\frac{1}{2}(\Omega-n)$	9.9996717	9.9996683	$l\cos\frac{1}{2}(\Omega-n)$	8.5896068	8.5918683
$l\cos\frac{1}{2}(i'+\varepsilon)$	9.9834199	9.9834194	$l\cos\frac{1}{2}(i'-\varepsilon)$	9.4960422$_n$	9.4960426$_n$
$l\cos\frac{1}{2}i'\sin\frac{1}{2}(\Omega'-a)$	9.9830916	9.9830877		8.5856490$_n$	8.5879102
$l\cos\frac{1}{2}i'\cos\frac{1}{2}(\Omega'-a)$	8.5856490$_n$	8.5879109$_n$			
$l\tan\frac{1}{2}(\Omega'-a)$	1.3974426	1.3951766	$l\cos\frac{1}{2}i'$	9.9834396	
$\frac{1}{2}(\Omega'-a)$	−87 42 24.36 92 17 35.64	87 41 41.23 92 18 18.77			

$l\sin\Omega'$ 8.3168028$_n$
$l\cos i'$ 9.9310220
$l\cos\Omega'$ 9.9999066$_n$
$\log e = l\sin i''$ 9.7174013

8.3191896$_n$
9.9310209
9.9999006 1878 1880
9.7174059

$-l\cos\Omega'$ 9.9999066
~~8.3168028~~
$l\cos i''\sin\Omega'$ 8.2478248$_n$
$l\tan A$ 1.7520818
A −88 59 9.96
A 91 00 50.04
$\log a$ 9.9999746

9.9999066
8.3592105$_n$
1.8496951$_n$
−88 58 49.85
96 01 10.15

$-l\sin\Omega'$ 9.3168028
$-l\sin i'\cos\Omega'$ 9.9309286
$l\tan B$ 8.3858742
B 1 23 39.34
$\log b$ 9.9310569

8.3191896
9.9309265
8.3882631
1 24 1.99

	1878	1880
$A+\omega'$	146° 48' 1.95"	146 50 59.09
$B+\omega'$	57 10 46.25	57 13 50.83
ω'	55 47 11.91	55 48 48.94
$\log a$	9.9999746	9.9999743
$\log b$	9.9310569	9.9310563
$\log c$	9.7174013	9.7174043

φ 17 14 16.91 17 15 30.0
$\log e = l\sin\varphi$ 9.4717883 9.4722891
e .2963421 .2966806
$1+e$ 1.2963421
$1-e$ .7036579
$\log(1+e)$ .1127196 .1128330
$\log(1-e)$ 9.8473616 9.8471526
$\log\sqrt{1+e}$ 0.0563598 .0564165
~~$\log\sqrt{1+e}$~~ .2154060 .2154756
$\log\sqrt{1-e}$ 9.9236808 9.9235763
$\log\sqrt{a(1+e)}$ .2717658 ~~.3672349~~ .2718921
$\log\sqrt{a(1-e)}$ .1350868 .1340519

$\log e$ 9.4717933 9.4722891
$\log e''$ 5.3144251 5.3144251
$\log e''$ 4.7862184 4.7867142

$2(A+\omega')$ 293 36 3.90
$2(B+\omega')$ 114 21 32.50
$2\omega'$ 111 34 23.82

$\log\sin 2(A+\omega')$ 9.9620638$_n$
$\log a^2$ 9.9999492
$\log I$ 9.9620130$_n$
I −.9162479

$\log\sin 2(B+\omega')$ 9.9595083
$\log b^2$ 9.8621138
$\log II$ 9.8216221
II +.6631658

$\log\sin 2\omega'$ 9.9684586
$\log c^2$ 9.4348026
$\log III$ 9.4032612
III +.2530820

φ 8 37 45.00
$\frac{1}{2}\varphi$ 8 37 8.40 36 22 15.00
$45-\frac{1}{2}\varphi$ 36 22 51.55
$l\tan(45°-\frac{1}{2}\varphi)$ 9.8673210 9.8671599

Check I + II + III = 0

+.6631658
.2530820
+.9162478

1

Opposition Ephemeris of 109 for 1878

	Oct. 26	Oct. 30	Nov. 3	Nov. 7	Nov. 11	Nov. 15	Nov. 19
M	353° 34′ 5.66″	354 27 30.81	355 20 55.96	356 14 21.11	357 7 46.26	358 1 11.41	358 54 36.56
E	350 52 32.71	352 8 6.71	353 23 46.46	354 39 31.01	355 55 19.46	357 11 10.94	358 27 4.52
$\frac{1}{2}E$	175 26 16.35	176 4 3.35	176 41 53.23	177 19 45.50	177 57 39.23	178 35 35.47	179 13 32.26
$l \sin \frac{1}{2}E$	8.9005858	8.8361944	8.7603993	8.6683443	8.5511953	8.3900704	8.1308139
$l \cos \frac{1}{2}E$	9.9986218n	9.9989763n	9.9992784	9.9995280	9.9997250n	9.9998690n	9.9999603
$l \sqrt{r} \sin \frac{1}{2}v$	9.1723516	9.1079602	9.0321651	8.9401101	8.8229611	8.6618362	8.4025797
$l \sqrt{r} \cos \frac{1}{2}v$	.1377086n	.1380631n	.1383652	.1386148	.1388118	.1389558	.1390471
$l \tan \frac{1}{2}v$	9.0346430n	8.9698971n	8.8937999	8.8014953	8.6841493	8.5228804	8.2635326
$\frac{1}{2}v$	−6 10 52.49	−5 19 49.64	−4 28 38.64	−3 37 21.90	−2 45 59.49	−1 54 32.97	~~−0 15 50.51~~ −1 3 3.24
$\frac{1}{2}v$	173 49 7.51	174 40 10.36	175 31 21.00	176 22 38.10	177 14 0.51	178 05 27.03	178 56 56.36
v	347 38 15.02	349 20 20.72	351 02 42.00	352 45 16.20	354 28 1.02	356 10 54.06	357 53 52.72
log r	.2804816	.2798906	.2793854	.2789670	.2786366	.2783938	.2782484
$v+A+\omega'$	134 26 16.97	136 08 22.97	137 50 44.07	139 33 18.15	141 16 2.97	142 58 56.01	144 41 54.67
$v+B+\omega'$	44 49 1.27	46 31 7.27	48 13 28.37	49 56 2.45	51 38 47.27	53 21 40.31	53 04 38.97
$v+\omega'$	43 25 26.93	45 07 32.93	46 49 54.03	48 32 28.11	50 15 12.93	51 58 05.97	53 41 4.63
$l \sin(v+A+\omega')$	9.8537031	9.8406720	9.8268073	9.8120554	9.7963560	9.7796418	9.7618367
log r a	.2804562	.2798652	.2793600	.2789416	.2786112	.2783684	.2782150
$\log \sin(v+B+\omega')$	9.8480936	9.8606965	9.8726001	9.8838338	9.8944251	9.9043882	9.9137752
log r b	.2115385	.2109475	.2104423	.2100239	.2096935	.2094507	.2092973
$\log \sin(v+\omega')$	9.8372055	9.8504366	9.8629342	9.8747318	9.8858597	9.8963444	9.9062167
log r c	9.9978829	9.9972919	9.9967867	9.9963683	9.9960379	9.9957951	9.9956417
x	+1.3619441	+1.3195899	+1.2769306	1.2330963	+1.1884126	+1.1429056	+1.0966088
X	−.8292506	−.7882284	−.7433942	−.6949689	−.5882523	−.5882523	−.5304308
y	+1.1471815	+1.1793535	+1.2107165	1.2412454	+1.2709210	+1.2997124	+1.3276162
Y	−.5017756	−.5530279	−.6015799	−.6471990	−.7287931	−.7287931	−.7648631
z	+.6840570	+.7042526	+.7239705	+.7431903	+.7618993	+.7800897	+.7977235
Z	−.2177129	−.2399486	−.2610818	−.2808036	~~−.3162085~~ −.2993317	−.3162085	−.3316441
$\log a \cos\delta \cos\alpha$	9.7264774	9.7256352	9.7271640	9.7308851	9.7365831	9.7440266	9.7529531
$\log a \cos\delta \sin\alpha$	9.8098329	9.7968002	9.7847147	9.7738204	9.7643629	9.7565785	9.7507036
$\log \tan\alpha$	0.0833555	0.0711650	.0575507	.0429353	~~9.9722202~~ .0277758	9.9875171 .0125830	9.9977505
α	50 27 54.10	49 41 24.51	~~48 2~~ 48 47 6.81	47 49 39.33	46 49 52.40	45 49 ~~23.93~~ 41.50	44 51 6.89
$\log a \cos\delta$	9.9226455	9.9146351	9.9083554	9.9039272	9.9014819	9.9009006	9.9023485
$\log a \sin\delta$	9.6687010	9.6668024	9.6655423	9.6650053	9.6652691	9.6663983	9.6684599
$\log \tan\delta$	9.7460555	9.7521673	9.7571869	9.7610781	9.7638072	9.7654026	9.7661114
δ	29 7 44.54	29 28 23.39	29 45 27.59	29 58 45.72	+30 8 ~~13.79~~ 18.99	+30 13 56.52	30 16 34.2
log a	9.9813698	9.9748233	9.9697694	9.9663062	9.9645033 ~~+20 8 13.79~~ ~~9.9645266~~	9.9643958 46	9.9650953
l	344° 10′	344 34	344 58	345 23	345 47	346 11	346 34
α	50 28	49 40	48 47	47 50	46 50	45 50	44 51
$l+\alpha$	34 38	34 14	33 45	33 13	32 37	32 01	31 25
log a	1.3430	1.3467	1.3503	1.3542	1.3582	1.3623	1.3668
$\log \sin(l+\alpha)$	9.7546	9.7502	9.7447	9.7386	9.7316	9.7244	9.7141
$\log \tan\delta$	9.7460	9.7522	9.7572	9.7611	9.7638	9.7655	9.7661
$\log(\delta'-\delta)$	.8436	.8491	.8522	.8539	.8536	.8522	.8400
$\delta'-\delta$	48.73	49.21	49.73	50.27	50.83	51.42	52.02
$\alpha'-\alpha$	+ 6.88	7.07	7.12	7.15	7.14	7.12	6.52
log q	1.3430	1.3467	1.3503	1.3542	1.3582	1.3623	1.3668
$\log \cos(l+\alpha)$	9.9152	9.9174	9.9198	9.9225	9.9255	9.9283	9.9312
	1.2582	1.2641	1.2701	1.2767	1.2837	1.2906	1.2980
	18.12	18.40	18.62	18.91	19.22	19.53	19.87
$a'-a$	55.71	56.26	56.85	57.42	57.97	57.54	58.94
	3.71	3.75	3.79	3.83	3.86	3.90	3.93

ttt	. Nov 23	Nov 27 .	Dec 1 .	Dec 5 .
M	359° 48′ 1.71″	0° 41′ 26.86″	1° 34′ 52.01″	2° 28′ 17.16″
E	359 42 59.23	0 58 54.11	2 14 48.31	3 30 40.85
½ E	179 51 29.61	0 29 27.05	1 7 24.15	
	9.8934774	7.9328184	8.2923743	
	9.9999887	9.9999841	9.9999165	
	7.6652432	8.2045842	8.5641401	
	~~.5325642~~			
	.1390855	.1390709	.1390033	
	7.5261577	8.0655133	8.4251368	
	−0 11 32.76	+0 39 58.38	+1 31 28.57	
ν/2	359 48 27.24			
ν	359 36 54.48	+1 19 56.76	+3 02 57.14	
log r	.2781760	.2782006	.2783142	
v+A+ω′	146 24 56.43	148 07 58.71	149 50 59.09	
v+B+ω′	56 47 40.73	58 30 43.01	60 13 43.39	
v+ω′	55 24 6.39	57 07 8.67	58 50 9.05	
log sin(v+A+ω′)	9.7428536	9.7225925	9.7009366	
log r a	.2781506	.2781752	.2782888	
log sin(v+B+ω′)	9.9225767	9.9308213	9.9385270	
log b	.2092329	.2092575	.2093711	
log sin(v+C+ω′)	9.9154811	9.9241762	9.9323156	
log r c	9.9955773	9.9956019	9.9957155	
			−3424135	
x	+1.0495527	+1.0017680	+.9532910	
X	−.4699774	−.4071952	−.3506092	
y	+1.3649953	1.3806347	1.4057177	
Y	−.7961809	−.8240604	−.8478631	
z	+.8148138	+.8313389	.8472880	
Z	−.3454497	−.3575441	−.3678649	
			7359541	
log a cos δ cos α	9.7631099	9.7742058	9.~~7800881~~	
log a cos δ sin α	9.7469567	9.7455232	9.7486528	
	9.9838468	9.9713174	9.9605747	
	43 56 4.98	43 06 33.67	42 ~~55 43.69~~ 24 10.48	
log a cos δ	9.9056985	9.9108529	9.9176501	
log a sin δ	9.6715099	9.6755903	9.6807189	
	9.7658114	9.7647374	9.7630688	
	30 15 1.40	30 11 19.53	30 ~~16 50.74~~ 05 45.40	
	9.9692694	9.9741514	~~9.9779127~~ 9.9805402	
	346 57	347 17	347 40	
	43 56	43 7	42 24	
	30 53	30 26	30 04	
	9.7104	9.7046	9.6988	
	1.3716	1.3760	1.3808	
	9.7658	9.7648	9.7631	
	.8478	0.8454	.8437	
	52.66	53.30	53.97	
	+7.04	+7.00	+6.98	
	59.70	60.30	60.95	
	1.3716	1.3760	1.3808	
	9.9336	9.9356	9.9372	
	1.3052	1.3116	1.3180	
	20.20	20.50	20.80	
	3.98	4.02	4.06	

α

				Δ1	Δ2	Δ3	Δ4
Oct 26.5	50°	27′	54″.10		−7 14		
				−47 29.59		1 26	
30	49	40	24.51		−5 48.11		
				53 17.70		+1 38.33	
Nov 3	48	47	6.11		4 9.78		+12.00
				57 27.48		+1 50.33	
7	47	49	39.33		2 19.45		+5.15
				59 46.93		+1 55.48	
11	46	49	52.40		−0 23.97		+4.78
				60 10.90		+1 60.26	
15	45	49	41.50		+1 36.29		−3.85
				58 34.61		+1 56.41	
19	44	51	6.89		3 20.20		+1.49
				55 1.91		+1 57.90	
23	43	56	4.98		5 30.60		−2.038
				49 31.31		1 37.52	
27	43	6	33.67		7 8.12		
				42 23.19			
Dec 1	42	29	10.48				

δ

Oct 26.	+29°	7′	44″.54		3 16		
				+20 38.85		18	
30	29	28	23.39		−3 34.65		
				17 4.20		+11.42	
Nov 3	29	45	27.59		−3 46.07		+7.43
				13 18.13		+3.95	
7	29	58	45.72		−3 50.06		+7.71
				9 28.07		+3.72	
11	30	8	13.79		−3 46.34		+8.79
				5 41.73		+12.51	
15	30	13	55.52		−3 33.83		+11.40
				+2 7.90		+23.91	
19	30	16	3.42		−3 9.92		+6.16
				−1 2.02		+30.07	
23	30	15	1.40		−2 39.85		+17.52
				3 41.87		+47.59	
27	30	11	19.53		−1 52.26		
				5 34.13			
Dec 1.	30	5	45.40		54	58	

q.	9.9813698		+13646		
		−65465			
	9748233		+14926	1280	
		−50539		+981	
	9697694		15907		−285
		−34632		+696	
	9663062		16603		−357
		−18029		+339	
	9645033		16942		−187
		−1087		+152	
	9643946		17094		−512
		+16007		−360	
	9659953		16734		−295
		+32741		655	
	.9692694		16079		−336
		+48820		991	
	9741514		+15068		
		+63888			
	.9805402				

		fδ₂α		fδ₁α	~~ff′~~ α		fδ₂δ		fδ₁δ		~~ff′~~ δ	√
		″			° ′ ″	h m s			″		° ′ ″	
Oct. 26		+ 27.17			50° 27′ 54.10	3 21 51.61			+12.22		~~129°~~ + 29° 4′ 44.54	444
27		25.88		11 14.91	50 16 35.19	21 6.62	-44.99	-1.78	+12.56	+ 5 28.84	29 13 13.39	134
28	×	24.57		- 11 40.79	50 04 58.40	20 19.90	-46.72	1.64	+12.88	+ 5 16.28	29 18 29.67	297
29		23.22		- 12 5.34	49 52 53.06	19 31.54	-48.36	1.55	+13.14	5 3.43	29 23 33.10	332
30	.	21.80		12 28.56	49 40 24.57	18 41.63	-49.91	1.45	+13.35	4 50.29	29 28 23.39	234
31	:	20.32		12 50.48	49 27 34.03	17 50.27	51.36	1.36	+13.61	4 36.64	29 33 0.03	01
Nov 1	×	18.80		- 13 10.80	49 14 23.23	16 57.55	52.72	1.25	+13.80	4 23.03	29 37 23.06	231
2		17.25		13 29.58	49 00 53.65	16 3.58	53.97	1.16	+13.96	4 9.28	29 41 32.31	324
3		15.66		- 13 46.83	48 47 6.81	15 8.45	55.13	1.04	+14.10	3 55.29	29 45 27.59	276
4		13.96		14 2.66	48 33 4.15	14 12.28	56.10	.94	+14.21	3 40.90	29 49 8.49	85
5	×	12.28		14 16.62	48 18 47.53	13 15.17	57.11	.81	+14.30	3 26.69	29 52 35.15	352
6		10.50		14 28.88	48 04 18.70	12 17.25	57.92	.71	+14.33	3 12.43	29 55 47.58	476
7	.	8.73		14 39.33	47 49 39.33	11 18.62	58.63	.58	+14.31	2 58.10	29 58 45.72	457
8	.	6.95		14 48.11	47 34 51.22	10 19.41	59.21	.46	+14.34	2 43.47	30 01 29.19	292
9		5.17		14 55.06	47 19 56.16	9 19.74	59.67	.34	+14.30	2 29.13	30 3 58.32	583
10	×	3.34	1.82	15 0.20	47 04 55.96	8 19.73	60.01	.23	+14.22	2 14.85	30 6 13.17	132
11	.	- 1.52	1.83	15 3.54	46 49 52.40	7 19.49	60.24	-9	+14.11	2 0.63	30 8 13.79	138
12	.	+ 0.31	1.83	15 5.02	46 34 47.38	6 19.[illegible]	60.33	+ 1	+13.97	1 46.19	30 9 59.98	00
13	+	+ 2.19		15 4.71	46 19 42.67	5 18.84	60.32	15	+13.81	1 32.22	30 11 32.20	322
14	.	+ 3.98	1.84	15 2.57	46 04 40.10	4 18.67	60.17	27	+13.59	1 18.45	30 12 50.65	506
15	.	+ 5.83	1.85	14 58.55	45 49 41.50	3 18.77	59.90	42	+13.32	1 04.86	30 13 55.52	554
16	.	+ 7.71	1.88	14 52.08	45 34 49.42	2 19.29	59.48	53	+13.01	0 51.11	30 14 46.68	466
17	×	9.59	1.88	14 44.37	45 20 5.05	1 20.34	58.95	.63	+12.66	+ 0 38.10	30 15 24.73	247
18		11.44	1.85	14 34.80	45 05 30.25	0 22.12	58.32	.76	+12.31	+ 0 25.45	30 15 50.18	502
19	.	13.29	1.85	14 23.36	44 51 6.89	2 59 24.46	57.56	88	+11.91	+ 0 13.14	30 16 3.42	34
20		15.14	1.85	14 9.59	44 36 56.90	58 27.[illegible]	56.68	1.02	+11.46	+ 0 0.81	30 16 4.28	44
21	×	16.99	1.85	13 54.85	44 23 2.05	57 32.[illegible]	55.66	1.12	+10.96	- 0 10.27	30 15 53.96	540
22	.	18.74	1.75	13 38.[illegible]1	44 09 24.14	56 37.58	54.54	1.29	+10.46	- 0 21.23	30 15 30.73	307
23	.	20.50	1.76	13 19.17	43 56 4.98	55 44.33	53.25	1.42	+9.91	- 0 31.69	30 15 1.40	10
24	.	22.13	1.63	12 57.59	43 43 7.39	54 52.50	51.83	1.46	+9.21	0 42.40	30 14 19.00	190
25	×	23.76	1.63	12 35.46	43 30 31.93	54 2.13	50.37	1.58	+8.45	0 51.61	30 13 27.39	274
26	.	25.26	1.50	12 11.77	43 18 20.16	53 13.34	48.79	1.69	+7.72	1 0.07	30 12 27.32	273
27	.	26.89		11 46.57	43 6 33.67	52 26.24	47.10	1.80	+6.92	1 7.79	30 11 19.53	195
28	.	28.19		11 19.36	42 55 14.31	51 40.95	45.29	1.88	+6.12	1 15.28	30 10 4.25	44
29	×	29.59		10 51.17	42 44 23.14	50 57.54	43.41	1.97	+5.20	1 21.40	30 8 42.85	429
30		30.73		10 21.70	42 34 1.44	50 16.10	41.44	2.04	+4.26	1 26.59	30 7 16.26	163
Dec 1		+ 32.00		9 50.97	42 24 10.48	49 36.70	39.40		+3.27	1 30.85	30 5 45.40	454

Abl. T

2 - δ

·	+ 854		×9.9813698	7	569	7 57
	+ 875	-19699	.9795995		56.0	55
×	+ 896	-16824	.9779175		53.2	53
·	+ 916	-15929	.9763246		51.5	51
·	+ 934	-15013	×9.9748233	7.	498	50
·	951	-14077	.9734156		48.3	49
×	967	-13126	.9721030		46.9	47
	982	-12160	.9708870		45.5	45
·	995	-11178	×9.9697694	7	443	44
	1008	10180	.9687514		43.3	43
×	1019	-9172	.9678342		42.3	42
·	1029	-8154	.9670188		41.5	41
·	1039	-7125	×9.9663062	7.	406	41
·	1045	-6079	.9656983		40.0	40
×	1051	-503.4	.9650[illegible]		39.5	40
	1055	-3982	.9645[illegible]		39.1	39
	1059	-2929	×9.9643033	7	389	39
	1062	-1868	964 3165		38.6	39
×	1066	-806	964 2359		385	39
	1068	+259	964 2618		38.5	39
	1070	+1327	×9.9643946	7	386	39
	1067	+2407	.9646353		38.9	39
×	1062	+3474	.9649827		39.2	39
	1056	+4534	.654361		39.7	40
	1048	+5590	×9.9659953	7	403	40
·	1040	+6636	.9666589		41.0	41
×	1030	+7676	.9674265		41.8	42
·	1019	+8705	9682970		42.8	43
·	1006	+9724	×9.9692694	7	43.8	44
·	992	+10734	.9703428		45.0	45
×	.977	+11726	.9715154		46.2	46
·	958	+12701	9727855		47.6	48
·	943	+13659	×9.9741514	7	490	49
·	925	+14604	9756118		50.6	51
×	904	+15529	9771647		52.3	52
	883	+16434	9788081		54.0	54
+	[illegible]	+1731[illegible]	+9.9[illegible]	7	56.0	[illegible]

29 7

log 2 = 2784 log 2² .5568

log 4 1.8644 log 4² 9.5288

log 2²a² 0.4856

log a²(a-1)² 1.3194

log I 0.8338

I 9.21

.78622
4.~~78622~~
~~4.6737~~

1878 1879 log √a(1+ε) .27177 log √a(1−ε) = .13909

	Dec 45 Jan 14	Feb 3	Feb 23	Mar 15	Apr 4	Apr 24	May 14	Jun 3	Jun 23	Jul 13
M	11 16 33	15 43 54	20 11 15	24 38 36	29 05 57	33 33 18	38 00 39	42 28 00	46 55 21	51 22 42
	15 56 20	+6 23 43	+8 1 39	+9 32 23	+10 55 05	+12 09 14	+13 14 33	+14 11 00	14 58 40	15 37 49
E'	15 56 20	22 07 37	28 12 54	34 10 59	40 01 02	45 42 32	51 15 12	56 39 00	61 54 01	67 00 31
½	7 58 10	11 03 48	14 06 27	17 05 29	20 00 31	22 51 16	25 37 36	28 19 30	30 57 00	33 30 16
l sin ½ E'	9.14190	9.28306	9.38693	9.46819	9.53423	9.58927	9.63599	9.67621	9.71121	9.74194
l cos ½ E'	9.99579	9.99185	9.98670	9.98038	9.97296	9.96449	9.95503	9.94461	9.93329	9.92108
l tan ½ v	9.41367	9.55483	9.65870	9.73996	9.80600	9.86104	9.90776	9.94798	9.98298	0.01371
l sec² ½ v	.13488	0.13094	0.12579	0.11947	0.11205	0.10358	0.09412	0.08370	0.07238	0.06017
tang ½ v	9.27879	~~9.86091~~ 9.42389	9.53291	9.62049	9.69395	9.75746	9.81364	9.86428	9.91060	9.95354
½ v	10 45 32	14 51 48	18 50 09	22 39 10	26 18 04	29 46 24	33 04 05	36 11 23	39 08 39	41 56 29
v	21 31 04	29 43 36	37 40 18	~~30 58 68~~ 45 18 20	52 36 08	59 32 48	66 08 10	72 22 46	78 17 18	83 52 58
log r	.28516	.14572								
r =	28676	29144	29938	30868	31902	33012	34172	35358	36552	37746
v + A + ω'	168 18 06	176 31 38	184 28 20	192 06 22	199 24 10	206 20 50	212 56 12	219 10 48	225 05 20	230 41 00
v + B + ω'	78 41 50	86 54 22	94 51 04	102 29 06	109 46 54	116 43 34	123 18 56	129 33 32	135 28 04	141 03 44
v + ω'	70 18 16	85 30 48	93 27 30	101 05 32	108 23 20	115 20 00	121 55 22	128 09 58	134 04 80	139 40 10
l sin(v+A+ω')	9.30637	8.78229	8.89196n	9.32164n	9.52141n	9.64720n	9.73537n	9.80055n	9.85016n	9.88855n
l r a	.28513	.29141	.29935	.30865	.31899	.33009	.34169	.35355	.36549	.37743
l sin(v+B+ω')	9.99149	9.99937	9.99844	9.98961	9.97358	9.95093	9.92203	9.88704	9.84591	9.79829
l r b	.21622	.22250	.23044	.23974	.25008	.26118	.27278	.28464	.29658	.30852
l sin(v+ω')	9.98925	9.99867	9.99921	9.99181	9.97724	9.95609	9.92879	9.89554	9.85688	9.81104
l r c	.00256	.00884	.01678	.02608	.03642	.04752	.05912	.07098	.08292	.09486
x	+.39040	+.11850	−.15535	−.42690	−.69247	−.94906	−1.19410	−1.42600	−1.64310	−1.84500
X	+.39959	+.68857	+.89346	+.99043	+.96961	+.83542	+.60501	+.30585	−.02767	−.35807
y	+1.61330	+1.64680	+1.69380	+1.69570	+1.67360	+1.62970	+1.56610	+1.48490	+1.38830	+1.27880
Y	−.82456	−.64728	−.39092	−.08727	+.22693	+.51466	+.74321	+.88750	+.93221	+.87276
z	+.98133	+1.01750	+1.03750	+1.04210	+1.03200	+1.00840	+.97255	+.92581	+.86957	+.80520
Z	−.35776	−.28084	−.16961	−.03787	+.09846	+.22330	+.32246	+.38507	+.40446	+.37867
log Δ cos δ cos α	9.89762	9.06981	9.86812	9.75092	9.44270	9.05553	9.77018n	0.04926n	0.22292n	0.34303n
log Δ cos δ sin α	~~9.79489~~ 9.59698	~~9.86727~~ .00839	0.11491	0.20639	0.27887	0.33136n	0.36348	0.37579	0.36538n	0.33276n
log tan α	9.99981	.10148	.24679	0.45547	0.83617	1.27577n	.59330n	.32593n	.14266	9.98973n
α	44 57 20	~~45 00 00~~ 51 35 03	60 28 05	70 41 28	81 42 12	86 57 59 93 2 1	75 41 22 104 18 38	64 43 35 115 16 25	54 14 45 125 45 15	44 19 22 135 40 38
	2 59 49	3 26 32	4 1 52	4 42 46	5 26 49	6 12 8	6 57 15	7 41 6	8 23 1	9 2 43
log a cos δ	.04780	.11404	.17535	.23153	.28384	.33199	.37717	.41889	.45628	.48847
log Δ sin δ	9.79489	9.86727	9.93846	0.00182	0.05327	0.09050	0.11227	0.11757	0.10517	0.07331
tan δ	9.74708	9.75323	9.76311	9.77029	9.76943	9.75851	9.73510	9.69868	9.64889	9.58484
δ	29 11 14	29 32 01	30 05 45	30 30 30	30 27 32	29 49 60	28 31 08	26 33 00	24 00 55	21 01 46
log Δ	.10677	.17449	.23824	.29625	.34834	.39373	.43335	.46729	.49560	.51840

h	m	s							°	'	"						
2	59	49							+29	11	14						
3	26	32	+ 26	43					29	32	1	+ 20	47				
4	1	52	35	20	+ 8	37			30	5	45	+ 33	44	+12	57		
4	42	46	40	54	5	34	− 3	03	30	30	30	+ 24	45	−8	59	2
5	26	49	44	3	3	9	2	25	30	27	32	− 2	58	27	43	
6	12	8	45	19	+ 1	16	1	45	29	50	0	− 0 37	32	34	34	
6	57	15	45	7	− 0	12	1	28	28	31	8	− 1 18	52	41	20	
7	41	6	43	51	1	16	1	4	26	33	0	− 1 58	8	39	16	
8	23	1	41	55	1	56		40	24	6	55	− 2 33	5	34	57	
9	2	43	39	42	2	13		18	21	1	46	− 2 59	9	26	4	
9	40	7	37	24	2	18		5	17	42	50	− 3 18	56	19	46	
10	15	20	35	13	2	11		7	14	11	29	− 3 31	21	−12	25	7
10	48	22	33	8	− 1	5			10	34	39	− 3 37	50	−8	29	7
11	19	37	31	9	+ 2	1			6	58	45	− 3 36	54	+2	06	6
11	48	38	27	1	− 2	8			3	30	0	− 3 26	45	+7	09	8
12	15	25	26	47	− 2	24			+0	14	41	− 3 17	19	11	26	2
12	39	15	23	50	− 2	57			−2	41	2	+ 2 55	48	20	36	9
12	63	16	20	1	− 3	49			−5	12	2	+ 2 31	0	24	43	4
13	14	6	15	50	− 4	21			−7	9	49	+ 1 57	47	33	13	9

Aug 2	Aug 22	Sept 11	Oct 1	Oct 21	Nov 10	Nov 30	Dec 20	Jan 9
55 52 3	60 17 24	64 44 45	69 12 06	73 39 27	78 06 48	82 34 09	87 01 30	91 28 51
+16 8 48	+16 31 56	+16 47 41	+16 56 27	16 58 41	+16 54 57	16 45 18	+16 20 28	+16 10 46
71 58 51	76 49 20	81 32 26	86 08 33	90 38 08	95 01 39	99 19 29	103 31 58	107 39 39
35 59 26	38 24 40	40 46 13	43 04 16	45 19 04	47 30 50	49 39 43	51 45 59	53 49 48
9.76912	9.79330	9.81493	9.83436	9.85188	9.86773	9.88209	9.89514	9.90702
9.90801	9.89408	9.87929	9.86362	9.84706	9.82957	9.81110	9.79160	9.77099
0.04089	0.06507	0.08670	0.10613	0.12365	0.13950	0.15386	0.16691	0.17879
0.04710	0.03317	0.01838	0.00271	9.98615	9.96866	9.95019	9.93069	9.91008
9.99379	0.03190	0.06832	0.10342	0.13750	.17084	.20369	.23622	.26801
44 35 27	47 06 10	49 29 18	51 45 31	53 55 21	55 59 23 6	57 58 06	59 51 59	61 41 31
89 10 54	94 12 20	98 58 36	103 31 02	107 50 42	111 58 46	115 56 12	119 43 58	123 23 02
.38908	.40044	.41146	.42206	.43224	.44196	.45118	.45994	.46820
235 58 56	241 00 22	245 46 38	250 19 04	254 38 44	258 46 48	262 44 14	266 32 00	270 11 04
146 21 40	151 23 06	156 09 22	160 41 48	165 01 28	169 09 32	173 06 58	176 54 44	180 33 48
144 58 06	149 59 32	154 45 48	159 18 14	163 37 54	167 45 58	171 43 24	175 31 10	179 10 14
9.91848n	9.94184n	9.95997n	9.97385n	9.98421n	9.99162n	9.99650n	9.99920n	9.99999n
.38905	.40041	.41143	.42203	.43221	.44193	.45115	.45991	.46817
9.74347	9.68026	9.60665	9.51926	9.41230	9.27436	9.07866	8.73181	7.99263n
.32014	.33150	.34252	.35312	.36330	.37302	.38224	.39100	.39926
9.75893	9.69907	9.62977	9.54828	9.44926	9.32614	9.15822	8.89277	8.16065
.10648	.11784	.12886	.13946	.14964	.15936	.16858	.17734	.18560
-2.03020	-2.19910	-2.35200	-2.48820	-2.60900	-2.71400	-2.80320	-2.87810	-2.93900
-.64851	-.86612	-.98199	-.99113	-.88103	-.66618	-.37087	-.03030	+.31414
+1.15780	+1.02750	+.88955	+.74540	+.59649	+.44400	+.28900	+.18253	-.02465
+.71580	+.47853	+.20243	-.12591	-.42406	-.67160	-.83796	-.90194	-.85489
+.73352	+.65601	+.57363	+.48724	+.39774	+.30585	+.21223	+.11752	+.02219
+.31057	+.20762	+.08783	-.05463	-.18399	-.29139	-.36357	-.39133	-.38092
-0.42792	0.48646	0.52296	0.54149n	0.54282	0.52894	0.50161	0.46365	0.41911
0.27268n	0.17782n	0.03822n	9.79203	9.23661n	9.35714n	9.73954n	9.88616n	9.94425n
9.84476n	9.69136n	9.51594n	9.25054n	8.69579n	8.82823n	9.23793n	9.42251	9.52514n
34 58 16	26 9 57	18 8 28	10 5 44	2 50 30	3 51 8	9 48 45	14 49 6	18 31 29
145 1 44	153 50 3	161 51 52	169 54 16	177 9 30	183 51 8	189 48 45	194 49 6	198 31 29
9 40 7	10 15 20	10 47 28	11 19 37	11 48 38	12 15 25	12 39 15	12 59 16	13 14 6
.51440	.53341	.54509	.54827	.54834	.52956	.50901	.47834	.44321
0.01874	9.93632	9.82050	9.63610	9.32989	8.16017	9.17995	9.43745	9.54249
9.50434	9.40291	9.27541	9.08783	8.78655	7.63061	8.67094n	8.95911n	9.09928n
17 42 50	14 11 29	10 40 39	6 58 45	3 30 00	+0 14 41	-2 41 02	5 12 02	7 9 49
.53550	.54687	.55268	.55150	.54416	.52957	.50949	.48013	.44661

.10677			
.17449		+6772	
.23824		6375	397
.29625		5801	574
.34834		.5209	592
.39373		.4539	670
.43335		.3962	577
.46729		.3394	568
.49560		.2831	563
.51840		.2280	551
.53550		.1710	570
.54687	1137	.1137	573
.55234	+547+	.0591	556
~~5444~~ .55250	- 84	.0998	699
.54416	844	.1034	816
.52957	11459	.1259	325
.50949		.2008	749
.48013		.2936	928
.44661		.3352	.416

Sept 11

-2.35200
+.98535
+.88955
+.18705
+.57363
+.08116

0.52340n
.03205
9.50865
-1.95250
1.62 07 10
~~9.81610~~
1.84828
.54480
9.81610
9.27120
+1.03440

.55234

Ω = 52 23 20
log p = .39089

1880

~~4.56732~~ 4.78622

A+ω' 146 48 02
B+ω' 57 10 46
ω' 55 47 12

log a 9.98897
log b 9.93106
log c 9.71740

	Jan 9	Jan 29	Feb. 18	Mar 9	Mar 29	Apr 18	May 8	May 28	June 17	July 7	July
M	91 23 32	95 50 38	100 17 44	104 44 50	109 11 56	113 39 02	118 06 08	122 33 14	127 00 20	131 27 26	135 54
E	107 34 43	111 37 41	115 36 25	119 31 19	123 22 40	127 10 44	130 55 49	134 38 10	138 18 02	141 55 39	145 3
½ E	53 47 22	55 48 51	57 48 13	59 45 39	61 41 20	63 35 22	65 27 55	67 19 05	69 09 01	70 57 50	72 4
l sin ½ E	9.90679	9.91762	9.92749	9.93648	9.94467	9.95213	9.95890	9.96504	9.97059	9.97558	9.98
l cos ½ E	9.77141	9.74964	9.72658	9.70209	9.67602	9.64816	9.61830	9.58615	9.55135	9.51344	9.47
l √r sin ½ v	.17856	.18939	.19926	.20825	.21644	.22390	.23067	.23681	.24236	.24735	.251
l √r cos ½ v	9.91050	9.88873	9.86567	9.84118	9.81511	9.78725	9.75739	9.72524	9.69044	9.65253	9.61
tang ½ v	.26806	.30066	.33359	.36707	.40133	.43665	.47328	.51157	.55192	.59482	.60
½ v	61° 39' 22"	63 24 56	65 06 51	66 45 30	68 21 09	69 54 11	71 24 45	72 53 09	74 19 34	75 44 15	77 07
v	123 18 44	126 49 52	130 13 42	133 31 00	136 42 18	139 48 22	142 49 30	145 46 18	148 39 18	151 28 30	154 14
log r	.46804	.47584	.48316	.49002	.49640	.50236	.50788	.51296	.51764	.52190	.52
v+(A+ω')	270 06 46	273 37 54	277 01 44	280 19 02	283 30 20	286 36 24	289 37 32	292 34 20	295 27 20	298 16 32	301 02
v+B+ω'	180 29 30	184 00 38	187 24 28	190 41 46	193 53 04	196 59 08	200 00 16	202 57 04	205 50 04	208 39 16	211 25
v+ω'	179 05 56	182 37 04	186 00 54	189 18 12	192 29 30	195 35 34	198 36 42	201 33 30	204 26 30	207 15 42	210 01
l sin(v+A+ω')	9.99999	9.99913n	9.99672n	9.99292n	9.98782n	9.98150n	9.97401	9.96539n	9.95565n	9.94482	9.93
l r a	.46803	.47581	.48313	.48999	.49637	.50233	.50785	.51293	.51761	.52187	.52
l sin(v+B+ω')	7.93354n	8.84473n	9.11035	9.26858	9.38015	9.46558	9.53414	9.59100	9.63926	9.68081	9.717
l r b	.39910	.40690	.41422	.42108	42746	43342	.43894	.44402	.44870	.45296	.456
l sin(v+ω')	8.19664	8.65966	9.02032	9.20861	9.33505	9.42943	9.50400	9.56520	9.61676	9.66092	9.699
l r c	.18544	.19324	20056	.20742	.21380	.21976	.22528	.23036	23504	.23930	.243
x	-.293780	-.298500	-.301890	-.304030	-.304930	-.304670	-.303290	-.300830	-.297350	-.292880	-.28
X	+.31414	+.61969	+.84945	+.97628	+.98646	+.88076	+.67329	+.38907 -1.08400	+.96097 -1.22450	-.27390	-.57
y	-.02151	-.17850	-.33464	-.48940	-.64211	-.79251	-.93990	~~1.22450~~	~~1.36075~~	-1.36075	-149
Y	-.85489	+.70250	+.46407	+.16938	+.14568	+.44378	+.69064	+.85890	+.93058	+.89526	+.76
z	+.02410	-.09127	-.16630	-.26063	-.35388	-.44586	-.53615	-.62454	-.71090	-.79474	-.876
Z	-.37092	+.30480	+.20135	+.07349	+.06320	+.19254	+.29965	+.37266	+.40375	+.38973	+.332
l a cos δ cos α	.41891	.37389n	.33636n	.31471n	.31446n	.33564n	.37284n	.41817n	.46427n	~~.49174~~ 50552n	.538
l a cos δ sin α	9.94276	9.94498n	9.90239n	9.81874n	9.69586n	9.59246	9.39665	9.35238	9.46823	9.66510	9.861
l tang α	9.52375	9.57109	9.56603	9.50403	9.38140	9.20688	9.02381	8.93421	9.00396	9.15958	9.323
α	18 28 16	20 26 44	20 12 42	17 42 07	13 31 53	9 05 48	6 01 48	4 54 44	5 45 45	8 28 41	11 53
	13 13 53	13 21 43	13 20 51	13 10 49	12 54 07	12 36 35	12 24 07	12 19 39	12 23 07	12 32 52	12 47
l a cos δ	44188	40210	36396	33578	32669	34120	37525	41977	46647	51000	547
l a sin δ	9.54010	9.57527	9.56544	9.52390	9.46342	9.40367	9.37383	9.40119	9.48735	9.60747	9.735
l tang δ	9.09822	9.17317	9.20148	9.18812	9.13673	9.06247	8.99858	8.98242	9.02088	9.09746	9.187
δ	7 08 47	8 29 37	9 02 10	8 47 12	7 48 04	6 35 12	5 41 31	5 29 08	5 59 23	7 03 53	8 45
log Δ	44527	.40689	36938	.34091	33073	34408	37740	42176	46885	51337	.552
u = v+ω		179 13 12		185 54 20		192 11 42		198 09 38		203 51 50	
l sin u		8.13396		9.01237n		9.32478n		9.49371n		9.60699n	
l r		.47584		.49002		.50236		.51296		.52190	
l cos u		9.99996n		9.99768n		9.99009n		9.97781n		9.96119n	
log r sin u		8.60980		9.50239n		9.82714n		.00667n		.12889n	
log r cos u		.47580n		.48770n		.49245n		.49077n		.48309n	
l sin v		9.90331		9.86044		9.80981		9.75012		9.67901n	
l r		.47584		.49002		.50236		.51296		.52190	
l cos v		~~9.77776n~~	9.77776n	~~9.83795n~~	9.83795n	~~9.88302n~~	9.88302n	~~9.91740n~~	9.91740n	~~9.94380n~~	9.94380n
l cos E		~~9.96829n~~	9.56653n	~~9.93960n~~	9.69263n	~~9.94010n~~	9.78126n	~~9.85223n~~	9.84671n	~~9.79004n~~	9.89610n
cos v		~~-.59946~~	-.59946	~~-.68857~~	-.68857	~~-.76387~~	-.76387	~~-.82680~~	-.82680	~~-.87862~~	-.87862
cos E		~~+.92959~~	-.36858	~~-.87016~~	-.49275	~~-.79675~~	-.60431	~~-.71159~~	-.70260	~~-.61665~~	-.78723
(cos v + cos E)		-~~1.52905~~	-.96804	-~~1.55873~~	-1.18132	-~~1.56062~~	-1.36818	-~~1.53839~~	-1.52940	-~~1.49527~~	-1.66585
l (cos v + cos E)		~~.18444~~	9.98589n	~~.19276~~	.07236n	~~.19329~~	.13615n	~~.18704~~	.18452n	~~.17476~~	.22162
l (e/2+1)		~~.26062~~	26062	~~.25428~~	25428	~~24886~~	24886	~~24428~~	24428	~~.24042~~	.24042
ω = l (e/2+1)(cos v + cos E) ~~1.677~~		~~.63977~~	.63977	~~.60464~~	.60474	~~56103~~	.56103	~~50733~~	.50736	44133	.44133

	Feb 3	Mar 15	Apr 24	June 3	July 13	Aug 22	Oct 1	Nov	Dec 20
E	22 7 37	34 10 59	45 42 32	56 39 00	67 00 31	76 49 20	86 08 33	95 01 39	103 31 58
v	29 48 36	45 18 20	59 32 48	72 22 46	83 52 58	94 12 20	103 31 02	111 58 46	119 43 58
u = v+ω'	82 06 56	97 41 40	111 56 08	124 46 06	136 16 18	146 35 40	155 54 22	164 22 06	172 07 18
l sin u	9.99588	9.99607	9.96736	9.91459	9.83963n	9.74081	9.61091	9.43048	9.13694
l r	.29144	.30868	.33012	.35358	.37746	.46044	.42206	.44196	.45994
l cos u	9.13728	9.12675n	9.57236n	9.75607n	9.85891n	9.92158	9.96041	9.98363	9.99588
l r sin u	.28732	.30478	.29748	.26817	.21709	.14226	.03297	9.87244	9.59688
l r cos u	9.42872	9.43543n	9.90248n	.10965n	.23637n	.32202n	.38247n	.42559n	.45582
l sin v	9.69536	9.85179	9.93553	9.97913	9.99752	9.99883	9.98786	9.96723	9.93869
l cos v	9.93872	9.84716	9.70487	9.48103	9.02761	8.86531n	9.36873n	9.57319n	9.69544
l cos E	9.96678	9.91764	9.84404	9.74017	9.59172	9.35788	8.82786	8.94267n	9.36922
cos v	+.86840	+.70333	+.50684	+.30271	+.10656	-.07334	-.23374	-.37427	-.49595
cos E	+.92636	+.82726	+.69830	+.54976	+.39059	+.22797	+.06728	-.08763	-.23400
cos v + cos E	+1.79476	+1.53059	+1.20514	+.85247	+.49715	+.15463	-.16646	-.46190	-.72995
l (cos v + cos E)	.25399	.18486	.08102	9.93068	9.69649	9.18929	9.22131n	9.66455n	9.86329n
l (e/2+1)	.35339	.34408	.33248	.32008	.30780	.29627	.28571	.27623	.26788
l r sin v	9.98680	.16047	.26565	.33271	.37498	.39927	.40986	.40919	.39863
l (r sin v)(e/2+1)	.34039	.50435	.59813	.65289	.68278	.69554	.69557	.68542	.66651

Yearly Ephemeris 1880

July27	Aug16	Sept 5	Sept25	Oct 15	Nov 4	Nov24	Dec 14	1881 Dec 34
135 04 32	140 21 38	144 48 44	149 15 50	153 42 56	158 10 02	162 37 08	167 04 14	171 31 20
145 31 16	149 05 03	152 37 14	156 08 01	159 37 36	163 06 08	166 33 55	170 00 58	173 27 25
72 45 38	74 32 32	76 18 37	78 04 01	79 48 48	81 33 04	83 16 58	85 00 28	86 43 43
9.98004	9.98399	9.98748	9.99051	9.99310	9.99526	9.99701	9.99835	9.99929
9.47183	9.42574	9.37413	9.31548	9.24762	9.16710	9.06807	8.93965	8.75637
.25181	.25576	.25925	.26228	.26487	.26703	.26878	.27012	.27106
9.61092	9.56483	9.51322	9.45457	9.38671	9.30619	9.20716	9.07874	8.89546
.64089	.69093	.74603	.80771	.87816	.96084	1.06162	1.19138	1.37560
77 07 21	78 29 04	79 49 34	81 09 00	82 28 36	83 45 17	85 02 27	86 19 03	87 35 19
154 14 42	156 58 08	159 39 18	162 18 00	164 55 02	167 30 34	170 04 54	172 38 06	175 10 38
.52574	.52920	.53228	.53496	.53728	.53924	.54084	.54204	.54288
301 02 44	303 46 10	306 27 20	309 06 02	311 43 04	314 18 36	316 52 56	319 26 08	321 58 40
271 25 28	214 08 54	216 50 04	219 28 46	222 05 48	224 41 20	227 15 40	229 48 52	232 21 24
210 01 54	212 45 20	215 26 30	218 05 12	220 42 14	223 17 46	225 52 06	228 25 18	230 57 50
9.93286	9.91970	9.90543	9.88988	9.87299	9.85465	9.83474	9.81312	9.78956
.52571	.52917	.53225	.53493	.53725	.53921	.54081	.54201	.54285
9.71715	9.74921	9.77779	9.80332	9.82682	9.84711	9.86596	9.88307	9.89863
.45680	.46026	.46334	.46602	.46834	.47030	.47190	.47310	.47394
9.69939	9.73324	9.76333	9.79018	9.81435	9.83618	9.85597	9.87393	9.89028
.24814	.24660	.24968	.25236	.25468	.25664	.25824	.25944	.26028
-287460	-281140	-273960	-265960	-257180	-247660	-237440	-226530	-214990
-.57818	-.81769	-.96466	-1.00097	-.92070	-.73148	-.45426	-.12169	+.22576
-1.49265	-1.61990	-1.74235	-1.85940	-1.97090	-2.07690	-2.17705	-2.27080	-2.35815
+.76563	+.54720	+.26699	-.04375	-.34938	-.61344	-.80359	-.89878	-.87795
-.87606	-.95465	-1.03040	-1.10290	-1.17230	-1.23830	-1.30080	-1.35950	-1.41435
+.33219	+.23742	+.11584	-.01898	-.15137	-.26616	-.34866	-.38865	-.38092
.53817	.55980	.56871	.56355	.54314	.50625	.45159	.37785	.28423
9.86155	.03048	.16891	.27958	.36560	.42950	.47430	.50059	.51002
9.32338	9.47068	9.60020	9.71605	9.82246	9.92355	.02271	.12274	.22579
11 53 17	16 28 01	21 45 45	27 28 33	33 36 07	39 58 58	46 29 51	52 59 27	59 15 55
12 47 33	13 05 52	13 27 03	13 49 54	14 14 24	14 39 56	15 06 00	15 31 58	15 57 04
54759	57799	60082	61553	62555	62189	61376	59829	57575
9.73550	9.85066	9.96121	.04995	.12186	.17799	.21735	.24259	.25414
9.18791	9.27767	9.36039	9.43442	9.49931	9.55550	9.60359	9.64430	9.67839
8 45 45	10 43 54	12 54 51	15 12 29	17 31 20	19 45 55	21 52 16	23 47 27	25 29 40
.55269	.58565	.61195	.63101	.64318	.64816	.64620	.63686	.62024
	209 21 28		214 41 20		219 53 54		225 01 26	
	9.69043		9.75520		9.80715		9.84967	
	52920		53496		53924		54204	
	9.94030		9.91501		9.88490		9.84930	
	.21963		.29016		.34639		.39171	
	.46950		.44997		.42414		.39134	
	9.59243		9.48291		9.33501		9.10785	
	52920		53496		53924		54204	
	~~9.96393~~	9.96393	~~9.97894~~	9.97894	~~9.98960~~	9.98960	~~9.99640~~	9.99640
	~~9.71079~~	9.93345	~~9.60703~~	9.96118	~~9.46339~~	9.98083	~~9.23904~~	9.99837
	~~-.92030~~	-.92030	~~-.95267~~	-.95267	~~-.97634~~	-.97634	~~-.99175~~	-.99175
	~~-.81379~~	-.85793	~~-.40461~~	-.91449	~~-.29066~~	-.95682	~~-.17340~~	-.98485
	~~-1.43409~~	-1.77823	~~-1.35728~~	-1.86716	~~-1.26700~~	-1.93316	~~1.16515~~	-1.97650
	~~.16607~~	.24998	~~.10264~~	.27119	~~9.42651~~	.28628	~~.06636~~	.29590
	~~.23734~~	.23737	~~.23492~~	.23495	~~.23315~~	.23315	~~.23198~~	.23200
	~~.30897~~	.35900	~~.25279~~	.25282	~~.10740~~	.10740	~~9.88188~~	9.88189

13 13 53		
13 21 43	+ 7 50	
13 20 51	- 0 52	-8 42
13 10 49	10 02	-9 50
12 54 07	16 42	-6 40
12 36 34	17 33	-0 51
12 24 07	12 27	+5 6
12 19 89	- 4 28	7 59
12 23 07	+ 3 28	4 56
12 32 52	10 45	5 17
12 47 33	13 38	3 03
13 05 52	18 19	4 41
13 27 03	21 51	2 52
13 49 54	22 51	1 40
14 14 24	24 30	1 39
14 39 56	25 32	1 02
15 06 00	26 4	22
15 31 58	25 55	
15 57 04	25 6	

° ' ''		
-7 68 47		
8 29 37	-1 20 50	
9 02 10	- 32 38	48 17
8 47 12	+ 14 58	47 31
7 48 04	57 6	44 10
6 35 12	1 12 52	+12 44
5 41 31	53 42	-19 10
5 29 08	+12 23	41 15
5 59 23	- 30 15	42 38
7 08 03	1 28 40	38 35
8 45 45	1 37 42	29 02
10 43 54	1 58 5	20 27
12 54 51	2 10 57	12 48
15 12 29	2 17 38	6 41
17 31 20	2 18 51	1 13
19 45 55	2 14 35	4 16
21 52 16	2 6 21	8 14
23 47 27	1 55 11	11 10
-25 29 40	1 42 13	12 58

.44527		
.40689	3838	
.36938	3751	039
.34091	2847	904
.33073	+1018	1829
.34408	-1335	[illegible]
.37740	3332	1597
.42176	4436	1104
.46885	4705	+273
.51337	4452	-257
.55269	3932	520
.58565	3296	636
.61195	2630	666
.63101	1906	724
.64318	1217	689
.64816	- 458	719
.64620	+ 196	654
× .63086	+634	738
.62024	1662	728

4

$N' + \Omega' = 175° 23' 54''$ log sin I 9.15526
$\omega' = 241 33 54$ log cos I 9.99552

	1879 Feb. 3	Mar 15	Apr 24	June 3	July 13	Aug 22	Oct 1	Nov 10	1879 Dec 20	1880 Jan 29
L	319 05 15	322 37 25	326 10 34	329 44 38	333 19 34	336 55 20	340 31 52	344 9 6	347 46 58	351 25 24
$u' = L - (N'+\Omega')$	143 41 21	147 13 31	150 46 40	154 20 44	157 55 40	161 31 26	165 07 58	168 45 12	172 23 04	176 01 30
l sin u'	9.77244	9.73347	9.688~~17~~ 66	9.63~~906~~ 643	9.57493	9.50094	9.43681	9.29011	9.12230	8.84087
l tan u'	9.86621	9.80877	9.74717	9.68~~443~~ 458	9.60798	9.52392	9.45368	9.29853	9.12615	8.84191
l tan λ'	9.86173	9.80429	9.74264	9.68025	9.60350	9.51944	9.44920	9.29405	9.12167	8.83743
λ'	143 58 14	147 29 38	151 ~~83 54~~ 48	154 34 32	158 07 58	161 42 02	165 17 15	168 51 57	172 27 42	176 03 06
h + ω'	271 17 30	286 52 14	301 06 42	313 56 40	325 26 52	335 46 14	345 04 56	353 32 40	1 17 52	8 28 46
λ' − (h + ω')	232 40 44	220 37 24	209 55 06	200 37 56	192 41 06	185 55 48	180 12 19	175 19 17	171 09 50	167 40 10
l sin β'	8.92770	8.88873	8.84386	8.79169	8.73019	8.65620	8.59207	8.44537	8.27756	7.99613
log r'	.70302	.70201	.70105	.70013	.69928	.69848	.69774	.69708	.69658	.69596
log cos β'	9.99844	9.99870	9.99894	9.99917	9.99937	9.99955	9.99967	9.99983	9.99992	9.99998
log z' = log r' sin β'	9.63072	9.59074	9.54491	9.49182	9.42947	9.35468	9.28981	9.14245	8.97414	8.69209
l sin (λ' − h + ω') y	9.20050n	9.81364	9.69790n	9.54696n	9.34161n	9.01416n	7.55422n	8.91151	9.18642n	9.32950
l r' cos β'	.70146	.70070	.69999	.69930	.69865	.69803	.69741	.69691	.69650	.69594
l cos (λ' − h + ω') x	9.78267n	9.88025n	9.93789n	9.97122n	9.98927n	9.99767n	9.99999n	9.99855n	9.99481n	9.98986n
l cos j'	9.78111	9.87895n	9.93683	9.97039	9.98864	9.99722	9.99966	9.99838	9.99473	9.98984n
l sin j'	9.90147	9.81539n	9.70106n	9.55271n	9.35365n	9.05225n	8.59720n	8.93558	9.18990n	9.33001n
l r' cos j'	.48413n	.58096n	.63788n	.67052n	.68792n	.69570n	.69740n	.69546n	.69131n	.68580n
− r' cos j'	+3.0488	+3.8103	+4.3439	+4.6830	+4.8744	+4.9625	+4.9820	+4.9598	+4.9126	+4.8507
z	1.9563	2.0355	2.1385	2.2573	2.3848	2.5144	2.6428	2.7667	2.8836	2.9912
(ch) z − r' cos j'	+5.0051	+5.8458	+6.4824	+6.9403	+7.2592	+7.4769	+7.6248	+7.7265	+7.7962	+7.8419
l q sin l = i sin j	.60443	.51740	.40211	.25284	.05293	9.75073	9.29494	9.63266	9.88648	.02597
l q cos l'	.69941	.76684	.81174	.84138	.86089	.87372	.88223	.88798	.89188	.89442
l tan l'	9.90502	9.75056	9.59037	9.41146	9.19204	8.87701	8.41271	8.74468	8.99460	9.13165
(ch) l q	.80759	.82664	.84239	.85537	.86609	.87495	.88236	.88865	.89389	.89837
l $\frac{1}{q}$	9.19241	9.17336	9.15761	9.14463	9.13391	9.12505	9.11764	9.11135	9.10611	9.10163
l $\frac{1}{q^3}$	7.57723	7.52008	7.47283	7.43389	7.40173	7.37515	7.35292	7.33405	7.31833	7.30489
$\frac{1}{q^3}$	.0037777	.0033119	.0029795	.0027158	.0025219	.0023722	.0022538	.0021580	.0020813	.0020179
$\frac{1}{r_1^3}$	−.0077783	−.0078338	−.0078859	−.0079362	−.0079829	−.0080271	−.0080683	−.0081051	−.0081332	−.0081681
(ch) $\frac{1}{q^3} - \frac{1}{r_1^3} = a$	−.0040016	−.0045219	~~−.0048769~~ .0049172	−.0052204	−.0054610	−.0056549	−.0058145	−.0059471	−.0060577	−.0061502
log a	7.60223	7.65532	7.69172n	7.71770n	7.73727n	7.75242	7.76451n	7.77431	7.78231n	7.78889
log z'	9.63072n	9.59074n	9.54491n	9.49182n	9.42947n	9.35468n	9.28981	9.14245n	8.97414	8.69209n
log (1)	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632
log w_0	9.16927n	9.18238n	9.17295n	9.14584n	9.10306n	9.04342n	8.99064n	8.85308n	8.69277n	8.41730n
log a	7.60223n	7.65532n	7.69172n	7.71770n	7.73727n	7.75242n	7.76451n	7.77431n	7.78231n	7.78889n
log x	.48413n	.58095n	.63788	.67052n	.68792n	.69570n	.69740n	.69546	.69131	.68580n
log ax	8.08636	8.23627	8.32960	8.38822	8.42519	8.44812	8.46191	8.46977	8.47362	8.47469
log z_1	~~7.85567~~									
log Q^3										
l $\frac{z}{Q^3}$										
ax	+.012200	+.017229	+.021360	+.024447	+.026619	+.028062	+.028967	+.029497	+.029759	+.029833
$-\frac{z}{Q^3}$	−.007390	−.006742	−.006353	−.006130	−.006014	−.005965	−.005956	−.005971	−.006002	−.006036
$ax - \frac{z}{Q^3}$	+.004810	+.010487	+.015007	+.018317	+.020605	+.022097	+.023011	+.023526	+.023757	+.023797
$\log(ax - \frac{z}{Q^3})$	7.68215	~~7.90553~~ 8.02065	8.17629	8.26285	8.31397	8.34433	8.36194	8.37153	8.37579	8.37652
log (1)	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632	1.93632
log R_0	9.61847	~~9.84185~~ 9.95697	0.11261	0.19917	0.25029	.28065	.29826	.30785	.31211	.31284
log a	7.60223n	7.65532n	7.69172n	7.71770n	7.73727n	7.75242n	7.76451n	7.77431n	7.78231n	7.78889n
log y	.60196	.51434n	.39789n	.24626	.04026n	9.71219n	8.25163n	9.60842	9.88292	.02544
log (1)	1.93632n	1.93632	1.93632n	1.93632n	1.93632n	1.93632n	1.93632	1.93632	1.93632	1.93632
log S_0	0.14051n	0.10598	0.02593	9.90028	9.71385	9.40093	7.95246	9.31905n	9.60155n	9.75065n

Mar 9	Apr 18	May 28	July 7	Aug 16	Sept 25	Nov 4	Dec 14
355 4 20	358 43 40	2 23 20	6 3 16	9 43 21	13 23 32	17 03 43	20 43 49
179 40 26	183 19 46	186 59 26	190 39 22	194 19 27	197 59 38	201 39 49	205 19 45
7.75524	8.76400	9.08531	9.26697	9.39341	9.48984	9.56721	9.63392
7.75525	8.76474	9.08855	9.27454	9.40713	9.51162	9.59902	9.67841
7.75077	8.76026	9.08407	9.27006	9.40265	9.50714	9.59454	9.67393
179 40 38	183 17 43	186 55 10	190 32 59	194 10 59	197 49 16	201 27 41	205 06 04
15 04 54	21 22 16	27 20 12	33 02 24	38 32 02	43 51 54	49 04 28	54 12 00
164 35 44	161 55 27	159 34 58	157 30 25	155 38 57	153 57 22	152 23 13	150 54 04
6.91905	7.91926	8.24057					
.69557	.69574	.69485	.69464	.69452	.69448	.69452	.69464
9.99999	9.99998	9.99993					

7.61456	8.61440	8.93542
9.42428	9.49175	9.54264
.69550	.69512	.69478
9.98411	9.97803	9.97182
9.98410	9.97800	9.97175
9.42442	9.49193	9.54216
.67961	.67314	.66660
+4.7820	+4.7113	+4.6409
3.0904	3.1795	3.2581
+7.8724	+7.8908	+7.8990

.11993	.18707	.23701
.89611	.89712	.89757
9.22382	9.28995	9.33944
.90211	.90522	.90770
9.09789	9.09478	9.09230
7.29369	7.28434	7.27690
.0019664	.0019246	.0018919
-.0081935	-.0082145	-.0082310
-.0062271	-.0062899	-.0063391

7.79429	7.79864	7.80103
7.61456	8.61440	8.93542
1.93632	1.93632	1.93632
7.34517	8.34936	8.67277

7.79429	7.79864	7.80103
.67961	.67314	.66660
8.47390	8.47178	8.46763

+.029778	+.029633	+.029351
-.006077	-.006119	-.006164

+.023701	+.023514	+.023187
8.37477	8.37133	8.36524
1.93632	1.93632	1.93632

.31109	.30765	.30656

7.79429	7.79864	7.80103
.11978	.18687	.23742
1.93632	1.93632	1.93632
9.85039	9.92183	9.97477

h

~~N′+Ω′ = 175 23 54~~ ~~l sin I 9.15526~~ ~~l cos I 9.99552~~

N′+Ω′ = 169 30 27 log sin I 9.19883

Ω′ = 247 31 45 log cos I 9.99451

	1879 Feb. 3	Mar 15	Apr. 24	June 3	July 13	Aug 22	Oct 1	Nov 10	Dec 20	1880 Jan 29
L	4 0 50	5 22 0	6 43 22	8 4 57	9 26 44	10 48 43	12 10 54	13 33 17	14 55 53	16 19 4
u′ = L − (N′+Ω′)	194 30 23	195 51 33	197 12 55	198 34 30	199 56 17	201 18 16	202 40 27	204 02 50	205 25 26	206 48 37
l sin u′	9.39879$_n$	9.43660$_n$	9.47124$_n$	9.50317$_n$	9.53276$_n$	9.56029$_n$	9.58601$_n$	9.61012$_n$	9.63011$_n$	9.65421$_n$
l tan u′	9.41286	9.45345	9.49114	9.52641	9.55960	9.59103	9.62095	9.64955	9.67374	9.70360
l tan λ′	9.40737	9.44796	9.48565	9.52092	9.55411	9.58554	9.61546	9.64406	9.66825	9.69811
λ′	194 19 55	195 40 11	197 00 42	198 21 27	199 42 25	201 03 37	202 25 04	203 46 45	205 08 40	206 31 11
v+ω′	277 15 21	292 50 05	307 04 33	319 54 31	331 24 43	341 44 05	351 02 47	359 30 31	7 15 43	14 21 37
λ′−(v+ω′)	277 04 34	262 50 06	249 56 09	238 26 56	228 17 42	219 19 32	211 22 17	204 16 15	197 53 27	192 09 34
l sin β′	8.69762	8.63543	8.67007	8.70200	8.73159	8.75912	8.78484	8.80895	8.83160	8.85304
l r′	.97766	.97711	.97657	.97603	.97549	.97494	.97440	.97386	.97332	.97272
log cos β′	9.99966	9.99959	9.99952	9.99945	9.99937	9.99928	9.99919	9.99910	9.99900 ✓	9.99889
log z′ = log r′ sin β′	9.57528	9.61254	9.64664	9.67803	9.70708	9.73406	9.75924	9.78281	9.80492	9.82576
l sin (λ′−v−ω′)	9.99668$_n$	9.99660$_n$	9.97281$_n$	9.93053$_n$	9.87308$_n$	9.80190$_n$	9.71649$_n$	9.61390$_n$	9.48704$_n$	9.32353$_n$
l r′ cos β′	.97732	.97670	.97609	.97548	.97486	.97422	.97359	.97296	.97232	.97161
l cos (λ′−v−ω′)	9.09057	9.09596	9.55399	9.71872	9.82301$_n$	9.88849$_n$	9.93136$_n$	9.95981$_n$	9.97852	9.99015$_n$
l cos γ′	9.09023	9.09555$_n$	9.53491$_n$	9.71817$_n$	9.82238$_n$	9.88777$_n$	9.93055$_n$	9.95891$_n$	9.97752$_n$	9.98904$_n$
l sin γ′ ✓	9.99668	9.99660	9.97287	9.93073	9.87358	9.80297	9.71866	9.61827	9.49638	9.34607
l r′ cos γ′	.06789	.07266$_n$	.51148$_n$	.69420$_n$	.79787$_n$	.86271$_n$	.90495$_n$	.93277$_n$	.95084$_n$	.96176$_n$
− r′ cos γ′	−1.1692	+1.1821	+3.2470	+4.9454	+6.2787	+7.2897	+8.0343	+8.5658	+8.9298	+9.1571
r	1.9563	2.0355	2.1385	2.2573	2.3848	2.5144	2.6428	2.7667	2.8836	2.9912
r − r′ cos γ′	+.7871	+3.2176	+5.3855	+7.2027	+8.6635	+9.8041	+10.6771	+11.3325	+11.8134	+12.1483
log Q sin l′ = r′ sin γ′	.97434	.97371	.94944	.90676	.84907	.77791	.69306	.59213	.46970	.31879
log Q cos l′	9.89603	.50753	.73123	.85750	.93769	.99141	1.02845	1.05434	1.07236	1.08450
log tan l′	1.07831	.46618	.21821	.04926	9.91138	9.78650	9.66461	9.53779	9.39734	9.23429
log Q	.97586	.99771	1.01718	1.03404	1.04838	1.06042	1.07046	1.07876	1.08549	1.09090
log $\frac{1}{Q}$	9.02414	9.00229	8.98282	8.96596	8.95162	8.93958	8.92954	8.92124	8.91451	8.90910
log $\frac{1}{Q^3}$	7.07242	7.00687	6.94846	6.89788	6.85486	6.81874	6.78862	6.76372	6.74353	6.72730
$\frac{1}{Q^3}$	.0011815	.0010159	.00088810	.00079046	.00071591	.00065878	.00061464	.00058039	.00055403	.00053370
$\frac{1}{r'^3}$ ✓	−.0011668	−.0011713	−.0011757	−.0011801	−.0011845	−.0011890	−.0011934	−.0011979	−.0012024	−.0012074
$u = \frac{1}{Q^3} - \frac{1}{r'^3}$	+.0000147	−.0001554	−.00028760	−.00038964	−.00046859	−.00053022	−.00057876	−.00061751	−.00064837	−.00067370
log Δ	5.16732	6.19145$_n$	6.45879$_n$	6.59066$_n$	6.67079$_n$	6.72446$_n$	6.76250$_n$	6.79064$_n$	6.81182$_n$	6.82847$_n$
log z′	9.57528	9.61254	9.64664	9.67803	9.70708	9.73406	9.75924	9.78281	9.80492	9.82576
log (1)	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236
log W$_0$	6.15496	7.21635$_n$	7.51779$_n$	7.68105$_n$	7.79023$_n$	7.87088$_n$	7.93410$_n$	7.98581$_n$	8.02910$_n$	8.06659$_n$
log Δ	5.16732	6.19145$_n$	6.45879$_n$	6.59066$_n$	6.67079$_n$	6.72446$_n$	6.76250$_n$	6.79064$_n$	6.81182$_n$	6.82847$_n$
log x	.06789	.07266$_n$	.51148$_n$	.69420$_n$	.79787$_n$	.86271$_n$	.90495$_n$	.93277$_n$	.95084$_n$	.96176$_n$
log Δx	5.23521	6.26411	6.97027	7.28486	7.46866	7.58717	7.66745	7.72341	7.76266	7.79023
Δx	.0001719	.0001837	.0009338	.0019269	.0029421	.0038652	.0046500	.0052894	.0057898	.0061692
$-\frac{r}{Q^3}$	−.0023113	−.0020680	−.0018992	−.0017843	−.0017073	−.0016565	−.0016244	−.0016058	−.0015976	−.0015964
$\Delta x - \frac{r}{Q^3}$	−.00229411	−.0018843	−.0009654	+.0001426	+.0012348	+.0022087	+.0030256	+.0036836	+.0041922	+.0045728
$\log(\Delta x - \frac{r}{Q^3})$	7.36061$_n$	7.27515$_n$	6.98471$_n$	6.15412	7.09060	7.34412	7.48080	7.56626	7.62244	7.66018
log (1)	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236	1.41236
log R$_0$	8.77297$_n$	8.68751$_n$	8.39707$_n$	7.56648	8.50296	8.75648	8.89316	8.97862	9.03480	9.07254
log Δ	5.16732	6.19145$_n$	6.45879$_n$	6.59066$_n$	6.67079$_n$	6.72446$_n$	6.76250$_n$	6.79064$_n$	6.81182$_n$	6.82847$_n$
log y	.97400$_n$	.97330$_n$	.94890$_n$	.90601$_n$	.84794$_n$	.77612$_n$	.69008$_n$	.58686$_n$	.45936$_n$	.29514$_n$
log (1)	1.41236	1.41236	1.41236	1.41236	1.41226	1.41236	1.41236	1.41236	1.41236	1.41236
log S$_0$	7.55368$_n$	8.57711	8.82005	8.90903	8.93109	8.91244	8.86494	8.78986	8.68354	8.53597

Mar 9	Apr. 18	May 28	July 7	Aug 16	Sept. 25	Nov 4	Dec 14
17 42 4	19 05 17	20 28 41	21 52 18	23 16 7	24 40 07	26 04 20	27 48 44
208 11 37	209 34 50	210 58 14	212 21 51	213 45 40	215 09 40	216 33 53	218 18 17
9.67436n	9.69342n	9.71147n	9.72860n	9.74487n	9.76033n	9.77505n	9.79228n
9.72921	9.75407	9.77827	9.80191	9.82507	9.84782	9.87023	9.89756
9.72372	9.74858	9.77278	9.79642	9.81958	9.84233	9.86474	9.89207
207 53 36	209 16 15	210 39 07	212 02 15	213 25 37	214 49 14	216 13 07	217 57 10
21 02 45	27 20 07	33 18 03	39 00 15	44 29 53	49 49 45	55 02 19	60 09 51
186 50 57	181 56 08	177 21 04	173 02 00	168 55 44	164 59 29	161 10 48	157 47 19
8.87319	8.89225	8.91030	8.92743	8.94370	8.95916	8.97388	8.99111
.97220	.97161	.97114	.97062	.97011	.96959	.96908	.96858
9.99879	9.99867	9.99856	9.99844	9.99832	9.99819	9.99807	9.99791

9.84539	9.86392	9.88144	9.89805	9.91381	9.92875	9.94296	9.95969
9.07638	8.52860n	8.66479n	9.08383	9.28836	9.41824	9.50866	9.57752
.97099	.97034	.96980	.96906	.96843	.96778	.96715	.96649
9.99689	9.99975n	9.99954n	9.99678	9.99182	9.98493	9.97614	9.96652
9.99568n	9.99842n	9.99810n	9.99522	9.99014	9.98312	9.97421	9.96443
9.14721	8.93017	8.97005	9.16894	9.82364	9.43692	9.52458	9.58962
.96788n	.97009n	.96924n ✓					
+9.2871	+9.3345	+9.3162					
3.0984	3.1795	3.2581					
+12.3773	+12.5140	+12.5743					

.11941	9.90184	9.94119
1.09265	1.09740	1.09944
9.02676	8.80444	8.84175
1.09510	1.09827	1.10049
8.90490	8.90173	8.89951
6.71470	6.70519	6.69853
.00051844	.00050721	.00049949
-.00121170	-.0012162	-.0012206
-.00069326	-.00070899	-.00072111

6.84090n	6.85064n	6.85800n
9.84539	9.86392	9.88144
1.41236	1.41236	1.41236
8.09865n	8.12692n	8.15180n

6.84090n	6.85064n	6.85800n
.96788n	.97009n	.96924n
7.80878	8.82073	8.82724

.0064384	.0066181	.0067180
-.0016022	-.0016127	-.0016274

+.0048362	+.0050054	+.0050906
7.68450	7.69944	7.70627
1.41236	1.41236	1.41236

9.09686	9.11180	9.11913

6.84090n	6.85064n	6.85800n
.04737n	9.49894n	9.63449
1.41236	1.41236	1.41236
8.30063	7.76194	7.90685n

h_y	1879 Feb 3	Mar. 15	Apr. 24	June 3	July 13	Aug 22	Oct 1	Nov 10	Dec. 20
$di = 2\cos u\, h_0$ +	−.040	+.041	+.119	+.180	+.218	+.232	+.236	+.190	+.141
$d\Omega = (2)\, 2\sin u\, h_0$	−2.054	−2.204	−2.121	−1.862	−1.889	−1.101	−.758	−.882	−.140
(3) $R \sin v$	+.530	+1.658	+2.877	+3.883	+4.557	+4.902	+4.976	+4.852	+4.588
(3) $\delta_0 (\cos v + \cos E)$	+6.388	+5.031	+3.295	+1.745	+.663	+.100	−.004	+.248	+.751
$d\varphi$	+6.918	+6.689	+6.172	+5.628	+5.220	+5.002	+4.972	+5.100	+5.339
+(4) $R_0 \cos v$	−2.994	−5.287	−5.452	−3.975	−1.574	+1.162	+3.656	+6.312	+8.446
(5) $(\frac{R}{2}+1)\, 2\sin v\, \delta_0$	+10.212	+13.764	+14.200	+12.061	+8.411	+4.214	−.150	−3.410	−6.256
(6) $h_0\, 2\sin \omega$	−.020	−.021	−.021	−.019	−.015	−.011	−.008	−.004	−.001
$d\pi$	+7.198	+8.456	+8.727	+8.067	+6.822	+5.365	+~~2.809~~ +3.661	+2.898	+2.189
+(7) $R_0 \sin v$	−.0767	−.2358	−.4162	−.5616	−.6591	−.7090	−.7158	−.7018	−.6637
+(8) $\delta_0 \frac{1}{2}$	−2.1843	−1.9389	−1.5348	−1.0888	−.6709	−.3096	+.0105	+.2330	+.4284
$d\mu$	−2.2610	−2.1787	−1.9510	−1.6504	−1.3300	−1.0186	−.7093	−.4688	−.2353
+(9) $R_0 \cos v$	−.134	−.238	−.245	−.178	−.071	+.052	+.173	+.284	+.379
+(10) $R_0\, 2$	−1.552	−3.522	−5.294	−6.821	−8.106	−9.166	−10.032	−10.737	−11.301
+(11) $(\frac{R}{2}+1)\, 2\sin v\, \delta_0$	+.459	+.618	+.638	+.542	+.378	+.189	+.007	−.153	−.281
(6) $2\sin u\, h_0$	−.020	−.021	−.021	−.019	−.015	−.011	−.007	−.004	−.001
$d\mathcal{L}$	−1.247	−3.163	−4.922	−6.476	−7.814	−8.936	−9.859	−10.610	−11.204
(12) $R \cos v$	+2.860	+5.050	+5.208	+3.796	+1.503	−1.110	−3.682	−6.028	−8.067
+(10) $R_0\, 2$	−1.552	−3.522	−5.294	−6.821	−8.106	−9.166	−10.032	−10.737	−11.301
+(13) $(\frac{R}{2}+1)\, 2\sin v\, \delta_0$	−9.753	−13.146	−13.561	−11.579	−8.033	−4.025	−.143	+3.256	+5.975
dM	−8.445	−11.618	−13.647	−14.544	−14.636	−14.301	−13.857	−13.509	−13.393

h	1879 Feb 3	1879 Feb 3	Mar. 15	Apr. 24	June 3	July 13	Aug 22	Oct. 1	Nov. 10	Dec 20
$di = 2\cos u\, h_0$	+.000	+.000	+.001	+.003	+.006	+.011	+.016	+.021	+.026	+.031
$d\Omega = (2)\, 2\sin u\, h_0$	+.002	+.002	−.024	−.047	−.064	−.073	−.074	−.067	−.052	−.030
(3) $R \sin v$	−.076	−.076	−.089	−.055	+.009	+.082	+.147	+.196	+.227	+.242
(3) $\delta_0 (\cos v + \cos E)$	−.017	−.017	+.149	+.205	+.178	+.109	+.033	−.031	−.073	−.091
$d\varphi$	−.093	−.093	+.060	+.150	+.187	+.191	+.180	+.165	+.154	+.151
−(4) $R_0 \cos v$	+.427	+.427	+.284	+.105	−.009	−.028	+.035	+.152	+.296	+.446
+(5) $(\frac{R}{2}+1)\, 2\sin v\, \delta_0$	−.026	−.026	+.407	+.884	+1.230	+1.387	+1.370	+1.227	+1.008	+.756
+(6) $R \sin u\, h_0$	.000	.000	−.000	−.001	−.001	−.001	−.001	−.001	−.001	.000
$d\pi$	+.401	+.401	+.691	+.988	+1.220	+1.358	+1.404	+1.378	+1.303	+1.202
−(7) $R_0 \sin v$	+.0110	+.0110	+.0129	+.0080	−.0013	−.0118	−.0212	−.0283	−.0329	−.0350
−(8) $\delta_0 \frac{1}{2}$	+.0057	+.0057	−.0574	−.0955	−.1111	−.1106	−.1006	−.0857	−.0689	−.0517
$d\mu$	+.0167	+.0167	−.0445	−.0875	−.1124	−.1224	−.1218	−.1140	−.1018	−.0867
−(9) $R_0 \cos v$	+.019	+.019	+.013	+.005	−.000	−.001	+.002	+.007	+.013	+.020
−(10) $R_0\, 2$	+.222	+.222	+.190	+.102	−.016	−.145	−.274	−.395	−.503	−.597
+(11) $(\frac{R}{2}+1)\, 2\sin v\, \delta_0$	−.001	−.001	+.018	+.040	+.055	+.062	+.062	+.055	+.045	+.034
+6 $2\sin u\, h_0$	+.000	+.000	−.000	−.001	−.001	−.001	−.001	−.001	−.001	.000
$d\mathcal{L}$	+0.240	+0.240	+.221	+.146	+.038	−.085	−.211	−.334	−.446	−.543
+(12) $R_0 \cos v$	−.408	−.408	−.272	−.100	+.009	+.027	−.083	−.145	−.282	−.426
+(10) $R_0\, 2$	+.222	+.222	+.190	+.102	−.016	−.145	−.274	−.395	−.503	−.597
−(13) $(\frac{R}{2}+1)\, 2\sin v\, \delta_0$	+.025	+.025	−.389	−.844	−1.175	−1.325	−1.308	−1.172	−.963	−.722
dM	−.161	−.161	−.471	−.842	−1.182	−1.443	−1.615	−1.712	−1.848	−1.945

1880

Jan 29	Mar. 9	Apr. 18	May 28
+.078	+.007	−.069	−.146
−.008	+.005	−.108	−.343
+4.237	+3.823	+3.368	+2.901
+1.404	+2.156	+2.943	+3.717
+5.641	+5.979	+6.311	+6.618
+10.226	+11.699	+12.876	+13.742
− 8.292	− 9.624	−10.258	−10.241
.000	.000	− .001	− .003
+1.934	+2.075	+2.617	+3.498
−.6128	−.5531	−.4882	− .4196
+.5822	+.7089	+.8123	+ .8955
−.0306	+.1558	+.3241	+ .4759
+ .459	+ .526	+ .578	+ .617
−11.742	−12.083	−12.334	−12.462
− .372	− .432	− .461	− .460
.000	.000	− .001	− .003
−11.655	−11.989	−12.218	−12.308
− 9.767	−11.173	− 12.298	−13.125
−11.742	−12.083	−12.334	−12.462
+ 7.919	+ 9.191	+ 9.797	+ 9.781
−13.590	−14.065	−14.835	−15.806

1880

Jan. 29	Mar 9	Apr 18	May 28
+.035	+.039	+.042	+.044
−.003	+.029	+.065	+.103
+.244	+.233	+.215	+.191
−.086	−.061	−.020	+.032
+.158	+.172	+.195	+.223
+.588	+.714	+.820	+.903
+.506	+.271	+.071	− .088
−.000	+.000	+.001	+.001
+1.094	+0.985	+.892	+.816
−.0352	−.0338	−.0311	−.0276
−.0355	−.0200	−.0056	+.0077
−.0707	−.0538	−.0367	−.0199
+.026	+.032	+.037	+.041
−.675	−.738	−.786	−.819
+.023	+.012	+.003	−.004
−.000	+.000	+.001	+.001
−.626	−.694	−.745	−.781
−.562	−.682	−.783	−.862
−.675	−.738	−.786	−.819
−.483	−.259	−.068	+.084
−1.720	−1.679	−1.637	−1.597

4.7867142

	° ′ ″
A+Ω′	146 50 59.09
B+Ω′	57 13 50.93
Ω′	55 49 48.94

log a 9.9999792
log b 9.9310563
log c 9.7174043

l √a(1+ε) .2718921
l √a(1−ε) .1390519

	Mar 9.5	13.5	17.5	21.5	25.5	Mar 29.5
M	104 46 40.25	105 40 38.6	106 33 27.47	107 26 51.08	108 20 14.69	109 13 38.30
e sin E	+14 47 7.85	14 40 54.56	14 33 12.89	14 26 29.6	14 18 44.91	14 11 18.96
E	119 33 48.10	120 20 [illegible]	121 06 40.36	121 52 54.04	122 38 59.60	123 24 57.26
½ E	59 46 54.05	60 10 9.20	60 33 20.18	60 56 27.02	61 19 29.80	61 42 28.6
l sin ½ E	9.9365710	9.9382686	9.9399350	9.9413704	9.9431755	9.9447506
l cos ½ E	9.7018237	9.6967408	9.6915930	9.6863792	9.6810979	9.6757472
l √r sin ½ v =	.2084631	.2101604	.2118271	.2134625	.2150676	.2166427
l √r cos ½ v	9.8408756	9.8357927	9.8306449	9.8254311	9.8201498	9.8147991
l tan ½ v	.3675875	.3743680	.3811822	.3880314	.3949178	.4018436
½ v	66°46′58.10	67 06 18.54	67 25 32.08	67 44 38.75	68 03 38.72	68 22 32.15
v	133 33 56.20	134 12 37.18	134 51 4.16	135 29 17.50	136 07 17.44	136 45 4.30
l r	.4902780 ~~.1717867~~ ~~.3435734~~	.4915942 ~~.1745242~~ ~~.3490484~~	~~.1772084~~ ~~.3544168~~ .4928916	~~.1798396~~ ~~.3596792~~ .4941708	.1824192 .3648384 .4954320	~~.1849480~~ ~~.3698960~~ .4966702
v+A+Ω′	280 24 15.29	281 03 36.23	281 42 03.25	282 20 16.59	282 58 16.53	283 36 03.39
v+B+Ω′	190 47 47.13	191 26 28.07	192 04 55.09	192 43 8.43	193 21 8.37	193 58 55.23
v+Ω′	189 23 45.14	190 02 26.08	190 40 53.10	191 19 6.44	191 57 6.38	192 34 53.24
l sin(v+A+Ω′)	9.9922846n	9.9918578n	9.9908801n	9.9898521n	9.9887741n	9.9876471n
l ra	.3435477	.3490231	.3543911	.3596535	.3648127	.3698703
l sin(v+B+Ω′)	9.2725842n	9.2974562n	9.3207918n	9.3427578n	9.3634962n	9.3831279n
l rb	.2746297	.2801051	.2854731	.2907355	.2958947	.3009523
l sin(v+Ω′)	9.2128662n	9.2414110n	9.2679877n	9.2928362n	9.3161555n	9.3381125n
l rc	.0609777	.0664531	.0718211	.0770835	.0822427	.0873003
x	−2.1693635	−2.1922035	−2.2144770	−2.2361742	−2.2572871	−2.2778094
X	+.9779858	+.9889504	+.9951395	+.9965551	+.9932259	+.9851959
y	−.3525445	−.3780605	−.4038917	−.4300245	−.4564476	−.4831480
Y	−.1615894	−.0988902	−.0357246	+.0275921	+.0907591	+.1534929
z	−.1878642	−.2031721	−.2186798	−.2343796	−.2502639	−.2663255
Z	−.0701087	−.0429049	−.0155003	+.0119689	+.0393735	+.0665927
log Δ cos δ cos α	.0760495	.0803570	.0861239	.0932883n	.1017681n	.1114687
log Δ cos δ sin α	9.7110762n	9.6784735n	9.6430737n	9.6046929n	9.5631113n	9.5180598n
log tan α	9.6350267	9.5981165	9.5569498	9.5114046	9.4613432	9.4065911
α	23 20 32.64	21 37 21.35	19 49 34.00	17 59 8.16	16 8 5.90	14 18 25.77
	203 20 32.64	201 37 21.35	199 49 34.00	197 59 8.16	196 8 5.90	194 18 25.77
	+25.00	+25.30	+25.59	+25.89	+26.20	+26.51
	203 20 57.64	201 37 46.65	199 49 59.59	197 59 34.05	196 08 32.10	194 18 52.28
G	346 31		347 03		347 45	
α	203 21		199 50		196 08	
G+α	189 52		186 53		183 53	
log Δ cos δ	.1131343	.1120463	.1126606	.1150465	.1192211	.1251517
log Δ sin δ	9.4115741n	9.3910710n	9.3695500n	9.3471557n	9.3240568n	9.3004494n
log tan δ	9.2984398n	9.2790248n	9.2568894n	9.2321092n	9.2048357n	9.1752977n
δ	−11 14 39.84	−10 45 52.30	−10 14 28.43	−9 41 3.49	−9 6 18.07	−8 30 55.51
	−10.83	−11.02	−11.22	−11.39	−11.56	−11.71
log Δ	.1215519	.1197566	.1196356	.1212799	.1247280	.1299660
δ	−11 14 50.67	−10 46 3.32	−10 14 39.65	−9 41 14.88	−9 6 29.63	−8 31 7.22
log q	1.0416		1.0530		1.0640	
l sin (G+α)	9.2339n		9.0786n		8.8307n	
l tg δ	9.2984n		9.2569n		9.2048n	
I	9.5736		9.3885		9.0095	
	+24.63		+25.35		+26.07	
	+0.37		+.24		+.13	
α′−α	25.00	25.30	25.59	25.89	26.20	26.51
log q	1.0413		1.0530		1.0640	
l cos (G+α)	9.9935n		9.9969n		9.9990n	
log (δ′−δ)	1.0348n		1.0499n		1.0630n	
δ′−δ	−10.83	11.02	−11.22	−11.39	−11.56	11.71

Aug 2.5	6.5	10.5	14.5	18.5	22.5
110 07 191	111 09 25.52	111 53 49.13	112 47 12.74	113 40 36.35	114 33 59.96
14 02 45.15	13 56 3.10	13 48 19.62	13 40 18.13	13 32 14.36	13 24 3.113
124 10 47.06	124 56 29.19	125 42 3.08	126 29 30.87	127 12 50.71	127 58 3.39
62 05 23.53	62 28 14.59	62 51 1.87	63 13 45.43	63 36 25.35	63 59 1.69
9.9462965	9.9478133	9.9493017	9.9507620	9.9521848	9.9536003
9.6708257	9.6648317	9.6592633	9.6536189	9.6478963	9.6420936
.2181886	.2197054	.2211938	.2226541	.2240869	.2254924
9.8093776	9.8038836	9.7983152	9.7926708	9.7869482	9.7811455
.4088110	.4158218	.4228786	.4299833	.4371387	.4443469
68 41 19.18	68 59 59.87	69 18 34.44 √	69 37 2.90	69 55 25.50	70 13 42.29
137 22 38.36	137 59 59.74	138 37 8.78	139 14 5.80	139 50 57.00	140 27 24.58
~~.1874271~~	~~.1898870~~	~~.1922591~~	~~.1945756~~	~~.1968619~~	~~.1991045~~
~~.3748542~~	~~.3797740~~	~~.3844182~~	~~.3891492~~	~~.3937238~~	~~.3982090~~
.4977004	.4981076	.5002972	.5014692	.5026238	.5037604
284 13 37.48	284 50 58.83	285 28 07.87	286 05 04.89	286 41 50.09	287 18 23.67
194 36 29.29	195 13 50.67	195 50 59.71	196 27 56.73	197 04 41.93	197 41 15.51
193 12 27.30	193 49 48.68	194 26 57.72	195 03 54.74	195 40 39.94	196 17 13.52
9.9864714n	9.9852476n	9.9839759n	9.9826571n	9.9812912n	9.9798791n
.3748285	.3796883	.3844521	.3891215	.3936981	.3981833
9.4017567n	9.4194715n	9.4363511n	9.4524646n	9.4678721n	9.4826272n
.3059105	.3107703	.3155341	.3202035	.3247801	.3292653
9.3588477n	9.3784798n	9.3971128n	9.4148866n	9.4317284n	9.4478560n
.0922585	.0971183	.1018821	.1065515	.1111281	.1156133
-2.2977349	-2.3170537	-2.3357586	-2.3538479	-2.3713153	-2.3881544
+.9725085	+.9552164	+.9334013	+.9071867	+.8767268	+.8421957
-.5101139	-.5373309	-.5647877	-.5924723	-.6203720	-.6484739
+.2155186	+.2765483	+.3362822	+.3944262	+.4507048	+.5048656
-.2825571	-.2989496	-.3154968	-.3321912	-.3490249	-.3659901
+.0935067	+.1199882	+.1459053	+.1711307	+.1955462	+.2190436
.1222901n	.1341252n	.1468587n	.1603669n	.1745217n	.1891979n
9.4692258n	9.4162786n	9.3588966n	9.2967663n	9.2295979n	9.1571795n
9.3469357	9.2821534	9.2120379	9.1363994	9.0550762	8.9679816
12 31 58.61	10 50 23.86	9 15 16.78	7 47 42.94	6 28 35.57	5 18 25.66
192 31 58.61	190 50 23.86	189 15 16.78	187 47 42.94	186 28 35.57	185 18 25.66
+26.82	+27.18	+27.54	+27.54	+28.33	28.73
192 32 25.48	190 50 53.04	189 15 44.32	187 48 10.88	186 29 3.90	185 18 54.39
348 37		349 38		350 44	
182 32		189 15		186 29	
181 05		178 53		179 13	
.1327639	.1419453	~~.1477718~~ 1525489	.1643989	.1773023	.1910636
9.2765776n	9.2527594n	9.2294040n	9.2069890n	9.1860481n	9.1671592n
9.1438137n	9.1108141n	9.0~~806322~~n	9.0425901n	9.0087458n	8.9760956
-7 55 40.06	-7 21 15.57	-6 ~~52 52.07~~ 48 23.63	-6 17 40.17	-5 49 33.50	-5 24 23.86
-11.87	-12.02	-12.17	-12.83	-12.49	-12.65
.1369345	.1455327	~~.1509114~~ .1556206	.1690249	.1795513	.1930000
-7 55 51.93	-7 21 27.59	-6 48 35.80	-6 17 52.50	-5 49 45.99	-5 24 36.51
1.0746		1.0855		1.0969	
8.3025n		8.2898		8.6867	
9.1438n		9.1108n		9.0087n	
~~8.3029~~ 8.5799		8.4861		8.7963n	
+26.79		+27.57		+28.39	
+ 03		- 03		- .06	
26.82	27.18	27.54	27.94	28.33	28.73
1.0746		1.0855		1.0969	
9.9979n		9.9999n		9.9995n	
1.0945n		1.0854n		1.0964n	
-11.87	12.02	-12.17	-12.83	-12.49	12.65

$$\delta^2 f_4 = \frac{1}{16}\left(4^2 f_4 - \frac{5}{64} 4^4 f_4\right)$$

1880		4_1	4_2	4_3	4_4
		° ′ ″			
Mar. 9.5	203 20 57.64				
		−1 43 10.99			
13.5	201 37 46.65		−4 36.07		–
		−1 47 47.06		+1 57.59	
17.5	199 49 59.59		−2 38.48		+0 4.48
		−1 50 25.54		+2 2.07	
21.5	197 59 34.05		−0 36.41		−0 3.53
		−1 51 1.95		+1 58.54	
25.5	196 08 32.10		+1 22.13		−0 7.70
		−1 49 39.82		+1 50.84	
29.5	194 18 52.28		+3 12.97		−0 9.35
		−1 46 26.85		+1 41.49	
Apr. 2.5	192 32 25.43		+4 54.46		−0 12.28
		−1 41 32.39		+1 29.21	
6.5	190 50 53.04		+6 23.67		−0 17.60
		−1 35 8.72		+1 11.61	
10.5	189 15 44.32		+7 35.28		−0 20.43
		−1 27 33.44		+0 57.18	
14.5	187 48 10.88		+8 26.46		− 20.17
		−1 19 6.98		31.01	
18.5	186 29 3.90		+8 57.47		
		−1 10 9.51			
22.5	185 18 54.39				

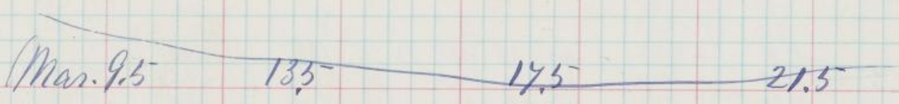
Mar. 9.5	−11 14 50.67				
		+28 47.35			
13.5	−10 46 3.32		+2 36.32		
		+31 23.67		+0 35.22	
17.5	−10 14 39.65		+2 1.10		+ ~~2 46.38~~ −5.96
		+33 24.77		~~+3 21.58~~ − 40.62	
21.5	−9 41 14.88		+1 20.48		− ~~7 4.90~~ 2.70
		+34 45.25		−0 43.32	
25.5	−9 6 29.63		+0 37.16		− 0 0.96
		+35 22.41		−0 44.28	
29.5	−8 31 7.22		−0 7.12		+ 0 0.45
		+35 15.29		−0 43.83	
Apr. 2.5	−7 55 51.93		−0 50.95		+ 0 2.23
		+34 24.34		−0 41.60	
6.5	−7 21 27.39		−1 32.53		+ 0 5.66
		+32 51.79		−0 35.94	
10.5	−6 48 35.80		−2 8.49		+ 0 7.64
		+30 43.30		−0 28.30	
14.5	−6 17 52.30		−2 36.79		+ 0 8.06
		+28 6.57		−0 20.24	
18.5	−5 49 45.99		−2 57.03		
		+25 9.48			
22.5	−5 24 36.57				

Mar. 9.5	1213519				
		−17953			
13.5	1197566		+16743		
		−1210		+910	
17.5	1196356		+17653		−525
		+16443		+385	
21.5	1212799		+18038		−524
		+34481		−139	
25.5	1247280		+17899		−455
		+52380		−594	
29.5	1299660		+17305		−414
		+69685		−1008	
Apr 2.5	1369345		+16297		−392
		+85982		−1400	
6.5	1455327		+14897		−333
		+100879		−1733	
10.5	1556206		+13164		−210
		+114043		−1943	
14.5	1670249		+11221		−55
		+125264		−1998	
18.5	1795513		+9223		
		+134487			
22.5	1930000				

2 $\delta f(x_0 = \frac{1}{2}h) = \frac{1}{4} a f_0 - \frac{1}{2}\delta^2 f(x+h)$

$\delta f x_0 + \frac{1}{2}h = \frac{1}{4} a f x_0 + \frac{1}{2}\delta^2 f(x_0 - h)$ δ

		$\delta_2 f x$	$\delta f x$	α ° ′ ″	h m s				
Mar 9.5				203 20 57.64					−11 14 50.67
10		23.80					11.33	+6 55.37	11 7 55.30
11	X	21.80	−25 37.85			X	+10.83	+7 6.68	11 00 48.62
12		19.80	25 59.65				+10.33	7 17.49	10 53 31.13
− 13		−17.80	26 19.45	201 37 46.65	13 26 31.11		+9.81	7 27.82	−10 46 3.32
14 −		−15.81	26 35.01	201 11 11.64	24 44.78		+9.28	7 37.55	10 38 25.77
15	X	−13.84	−26 50.82	200 44 20.82	22 57.39	X	+8.74	7 46.83	10 30 38.94
16		−11.88	27 4.66	200 17 16.16	21 9.08		+8.16	7 55.56	10 22 43.38
− 17		−9.93	27 16.54	199 49 59.59	19 19.97		+7.59	8 3.74	−10 14 39.65
18		−7.99	27 26.33	199 22 33.26	17 30.22		+6.98	8 11.37	10 6 28.28
19	X	−6.07	−27 34.32	198 54 58.94	15 39.93	X	+6.34	8 18.35	9 58 7.93
20		−4.14	27 40.39	198 27 18.55	13 49.		+5.69	8 24.68	9 49 45.75
− 21		−2.26	27 44.53	197 59 34.05	11 58.		+5.04	8 30.37	−9 41 14.88
22		−0.37	27 46.79	197 31 47.26	10 7.		+4.38	8 35.42	−9 32 37.66
23	X	+1.51	27 47.16	197 04 0.10	8 16.	X	+3.71	8 39.80	−9 23 57.66
24		+3.35	27 45.67	196 36 14.43	6 24.		+3.02	8 43.50	−9 15 16.16
− 25		+5.17	27 42.32	196 08 32.10	4 34.		+2.33	8 46.52	9 6 29.63
26		+6.95	27 37.71	195 40 54.99 ✓	2 43.		+1.63	8 48.85	8 57 40.78
27	X	+8.70	27 30.16	~~196 08 32.10~~ 195 13 24.88	13 0 53.	X	+0.92	8 50.48	8 48 50.30
28		+10.47	27 21.47	194 46 3.36	12 59 4.		+0.25	8 51.41	8 39 58.89
− 29		+12.10	27 ~~8.37~~ 11.05	194 18 52.28	57 15.		−0.45	8 51.66	8 31 7.22
30		+13.78	26 58.96	193 51 53.32	55 27.		−1.13	8 51.20	8 22 16.02
31	X	+15.90	26 45.16	193 25 8.14	53 40.	X	−1.82	8 50.07	8 13 25.95
Apr 1		+16.95	26 29.82	192 58 38.32	51 54.		−2.50	8 48.26	8 04 37.69
− 2		+18.46	26 12.87	~~190 50 53.01~~ 192 32 25.43	50 9.		−3.19	8 45.76	7 55 51.83
3		+19.96	25 54.44	192 06 30.97	−48 26.		−3.86	8 42.54	7 47 9.39
4	X	+21.40	25 34.48	191 40 56.51	46 43.	X	−4.54	8 38.68	7 38 30.71
5		+22.76	25 13.12	191 15 43.39	45 2.		−5.18	8 34.16	7 29 56.55
− 6		+24.06	24 50.36	~~189 15 44.32~~ 190 50 53.04	43 23.		−5.81	8 28.98	−7 21 27.59
7		+25.30	24 26.25	190 26 26.79	41 45.		6.41	8 23.13	−7 13 4.46
8	X	+26.46	24 0.95	190 02 25.84	40 9.	X	−7.00	8 16.72	7 04 47.74
9		+27.54	23 34.53	189 38 57.31	38 35.		7.59	8 9.78	6 56 37.99
− 10		+28.55	23 6.19	~~187 48 10.88~~ 189 15 44.32	37 2.		−8.07	8 2.20	6 48 35.80
11		+29.47	22 38.36	188 53 5.96	35 32.		8.50 ✓	7 54.00	6 40 41.70
12	X	+30.31	22 8.89	188 30 57.07	34 3.	X	−9.01	7 45.54	6 32 56.16
13		31.07	21 38.03	188 09 18.44	32 37.		9.44	7 36.54	6 25 19.62
− 14		+31.73	21 7.56	~~186 29 3.90~~ 187 48 10.88	31 12.		−9.84	7 27.10	6 17 52.50
15		+32.35	20 35.75	187 27 35.13	29 50.		10.23	7 17.26	6 10 35.22
16	X	+32.87	20 02.40	187 7 31.73	28 30.	X	10.59	7 7.08	6 3 28.17
17		+33.31	19 30.58	186 48 01.15	27 12.		10.84	6 56.52	5 56 31.65
− 18		+33.67	18 57.27	~~185 18 54.39~~ 186 29 3.90	25 55.		−11.11	6 45.68	5 49 45.99
19		+33.94	18 23.42	186 10 40.48	24 42.		11.35	7 34.57	5 42 11.42
20	X	+34.12	17 49.48	185 52 51.00	23 31.	X	11.55	7 23.22	5 34 48.20
21		+34.21	17 15.41	185 35 35.59	22 22.		11.70	7 11.70	5 27 36.50
− 22.5		34 21	16 41.66	185 18 54.39	21 15.				5 24 36.07



	Mar. 9.5	13.5	17.5	21.5	25.5
l sin(u + ω + ω')	9.9927846n	9.9918578n	9.9908801n	9.9898521n	9.9887741
log 2a	4902533	4915685n	4928657n	4941451	4954063n
l sin(u + B + ω')	9.2725842n	9.2974562n	9.3207918	9.3427578n	9.3634962n
log 2b	4213353	4226505n	4239479n	4252271	4264883n
l sin(u + C + ω')	9.2128662n	9.2414110n	9.2679877n	9.2928362	9.3161555n
log c	2076833n	2089985n	2102959n	2115751n	2128363n
x	–3.0411504	–3.0438720	–3.0461127	–3.0478754	–3.0491613
X	+.9779858	+.9889504	+.9951395	+.9965551	+.9932259
y	–.4942190	–.5249364	–.5555711	–.5861179	–.6165780
Y	–.1615894	–.0988902	–.0357246	+.0275921	+.0907591
z	–.2633598	–.2821051	–.3008040	–.3194562	–.3380584
Z	–.0701087	–.0429049	–.0155003	+.0119689	+.0393735
log a cos δ cos α	.3145339n	.3127953n	.3119600n	.3120335n	.3130095
log a cos δ sin α	9.8167790n	9.7950639n	9.7718047n	9.7470432	9.7208820n
log tan α	9.5022431	9.4822686	9.4598447	9.4350097	9.4078225
α	17 38 1.15	16 53 13.46	16 4 56.19	15 13 51.82	14 20 46.00
	+24.75	25.09	25.44	25.78	26.12
	197 38 25.90	196 53 38.55	196 5 21.63	195 14 17.60	194 21 12.12
log a cos δ	3354351	3319382	3292977	3275627	3267679
log a sin δ	9.5230548	9.5118967n	9.5001057n	9.4878272n	9.4782133n
l tan δ	9.1876197n	9.1799585	9.1708074	9.1602645n	9.1484454n
δ	–8 45 24.25	–8 36 21.35	–8 25 44.75	–8 13 47.54	–8 0 42.12
	– 10.97	– 11.12	– 11.28	– 11.42	– 11.58
	–8 45 35.22	–8 36 32.47	–8 25 56.03	–8 13 58.96	–8 0 53.70
lg a	.3405272	.3368557	.3340144	.3320584	.3310256
log G	346 31		347 03		347 45
α	197 38		196 5		194 21
G+α	184 09		183 8		182 6
l tan δ	9.1876n		9.1708n		9.1484n
l sin(G+α)	8.8595n		8.7377		8.5640n
l g	1.0413		1.0530		1.0640
l cos(G+α)	9.9989n		9.9993n		9.9997n
F	+0.12		+.09		+.05
	+24.63		25.35		26.07
k	24.75	25.09	25.44	25.78	26.12

~~25.5 29.5 Apr. 2.5 6.5~~ 10.5

Mar 29.5	Apr. 2.5	6.5	10.5	14.5	18.5	Apr. 22.5
9.9876471	9.9864714	9.9852476n	9.9839759n	9.9826571n	9.9812912n	9.9798791n
4966495	4978747	4990819	5002715	5014435	.5025981	5037347
9.3831279n	9.4017567n	9.4194715n	9.4363511n	9.4524646n	9.4678721n	9.4826272n
4277315	4289567	4301639	4313535	4825255	4336801	4348167
9.3381125	9.3588477n	9.3784798n	9.3971128n	9.4148866n	9.4317284n	9.4478560n
2140795	2153047	2165119	2177015	2188735	2200281	2211647
-30499778	-30503246	-30502091	-30496317	-30486014	-30471142	-30451859
+.9851959	+.9725085	+.9552164	+.9334013	+.9071867	+.8767268	+.8421957
-.6469381	-.6771945	-.7073576	-.7374025	-.7673440	-.7971724	-.8268827
+.1534929	+.2155186	+.2765483	+.3362822	+.3944262	+.4507048	+.5048656
-.3566088	-.3707046	-.3955425	-.4119213	-.4302393	-.4484939	-.4666816
+.0665927	+.0935067	+.1199882	+.1459053	+.1711307	+.1955462	+.2190436
.3148741n	3176071n	3211825n	3255629n	.3307008n	3365381	3430126n
9.6982346	9.6643372	9.6342790	9.6032746	9.5716181	9.5396626	9.5078789
9.3783606	9.3467301	9.3130965	9.2877111	9.2409123	9.2081245	9.1648663
13 26 25.55	12 31 37.93	11 37 12.08	10 43 58.03	9 52 43.45	9 4 11.32	8 18 58.26
26.47	26.82	27.19	27.56	27.97	28.39	28.81
193 26 52.02	192 32 04.75	191 37 39.27	190 44 25.59	189 53 11.42	189 4 39.71	188 19 27.07
3269345	3280714	3301758	3332275	3371883	3420023	3476034
9.4624221n	9.4496244	9.4370935	9.4249078	9.4134818	9.4030307	9.3938173
9.1354876	9.1215580n	9.1068677	9.0916803	9.0762935	9.0610284	9.0462139n
-7 46 44.81	-7 32 11.16	-7 17 18.64	-7 2 26.14	-6 47 52.27	-6 33 54.53	-6 20 48.49
11.72	-11.87	12.02	-12.17	12.33	-12.00	12.67
-7 46 56.53	-7 32 23.03	-7 17 30.66	-7 2 38.31	-6 48 4.60	-6 34 7.03	-6 21 1.16
.3309497	.3318392	.3336991	.3365148	.3402522	.3448598	.3502734

	Apr. 2.5		10.5		18.5
	348 37		348 38		352 44
	192 32		190 44		189 4
	181 09		180 22		179 48
	9.1216n		9.0917n		9.0610
	8.3020n		7.8061n		7.5429n
	1.0746		1.0850		1.0969
	9.9989n		10.0002n		10.0000
	+.03		+.01		+.00
	26.79		27.55		28.39
26.47	26.82	27.19	27.56	27.97	28.39

	°	′	″				
Mar 9.5	197	38	25.90				
				−44 47.35			
13.5	196	53	38.55		−3 29.57		
				48 16.92		+ 42.46	
17.5	196	5	21.63		2 47.11		+320
				51 4.03		45.66	
21.5	195	14	17.60		2 1.45		+117
				53 5.48		46.83	
25.5	194	21	12.12		1 14.62		+62
				54 20.10		47.45	
29.5	193	26	52.02		−0 27.17		+151
				54 47.27		48.96	
Apr 2.5	192	32	4.75		+0 21.79		+105
				54 25.48		50.01	
6.5	191	37	39.27		1 11.80		−230
				53 13.68		47.71	
10.5	190	44	25.39		1 59.51		−476
				51 14.17		42.95	
14.5	189	53	11.42		2 42.46		−635
				48 31.71		36.60	
18.5	189	4	39.71		3 19.06		
				−45 12.65			
22.5	188	19	27.17				

Mar 9.5	− 8	45	35.22				
				+9 2.75			
13.5	8	36	32.47		+1 33.29		
				10 35.94		− 11.66	
17.5	8	25	56.53		+1 21.63		− 22.8
				11 57.51		− 13.94	
21.5	8	13	58.96		+1 7.69		− 1.84
				13 5.26		− 15.78	
25.5	8	0	53.70		+ 51.91		+ 0.20
				13 57.17		− 15.58	
29.5	7	46	56.53		+ 36.33		− 1.88
				14 33.50		− 17.46	
Apr 2.5	7	32	23.03		+ 18.87		− 1.43
				14 52.37		− 18.89	
6.5	7	17	30.66		− 0.02		+ 27
				14 52.35		− 18.62	
10.5	7	2	38.31		− 18.64		+ 1.12
				14 33.71		− 17.50	
14.5	6	48	4.60		− 36.14		+ 1.94
				13 57.57		− 15.56	
18.5	6	34	7.03		− 51.70		
				13 5.87			
22.5	6	21	1.16				

Mar 9.5	.3405272				
		− 36715		+702	
13.5	.3368557		+8302		
		28413		+551	
17.5	.3340144		8850		− 152
		19560		+399	
21.5	.3320584		9252		− 122
		10308		+ 277	
25.5	.3310276		+ 9529		− 132
		− 0779		+ 145	
29.5	.3309497		+ 9674		− 115
		+ 8895		+ 30	
Apr 2.5	.3318392		9704		− 176
		18599		− 146	
6.5	.3336991		9558		− 195
		28157		− 341	
10.5	.3365148		9217		− 177
		37374		− 518	
14.5	.3402522		8699		− 115
		46073		− 633	
18.5	.3448595		8066		
		− 54139		− 74	
22.5	.3502734				

		$\int_2 f x$	$\int f x$	$f x$	
−	Mar 9.5	−12.99	15.68		
	10		− 14.78	10 50.26	
×	11		× 14.20	− 11 5.04	
	12		13.61	11 19.23	
−	13	−10.46	+ 12.99	11 32.84	
	14		12.29	11 46.29	
	15		× 11.77	11 58.68	
	16 +		11.10	12 10.42	
−	17	−7.60	− 10.46	12 21.62	×
	18		9.73	12 32.12	
	19		× 9.04	12 41.85	
	20		8.32	12 50.87	
−	21	−4.67	− 7.60	12 59.19	
	22		6.88	13 6.79	
	23		× 6.15	13 13.67	
	24		5.41	13 19.81	
−	25	−1.70	− 4.67	13 25.22	
	26		3.94	13 29.86	
	27		× 3.20	13 33.80	
	28		2.45	13 36.99	
−	29	+1.35	− 1.70	13 39.44	
	30		− 0.95	13 41.16	
	31		× 0.19 ×	13 42.11	
	Apr		+ 0.58	13 42.29	
∞−	2	+4.50	+ 1.35	13 41.91	
	3		2.14	13 40.37	
	4		+ 2.94 ×	13 38.23	
	5		3.72	13 35.30	
−	6	+7.49	+ 4.50	13 31.58	
	7		+ 5.28	13 27.08	
	8		+ 6.04 ×	13 21.80	
	9		6.79	13 15.78	
−	10	+10.18	+ 7.49	13 9.01	
	11		8.19	13 1.50	
	12		+ 8.88 ×	12 53.31	
	13		9.54	12 44.44	
−	14		+ 10.18	12 34.90	
	15		10.79	12 24.71	
	16		11.39 ×	12 13.92	
	17		11.94	12 2.53	
−	18		+ 12.48	11 50.59	
	19		13.00	11 38.15	
	20		13.50 ×	11 25.15	
	21		13.98	11 11.66	
−	22.5			10 57.68	

2.65706

°	′	″											°	′	″				m	s
197	38	2590	1	13	10	33.73				6.43			−8	45	3522	+ 469		.3405272	18	10
197	27	3564			9	50.38	4335			6.30	+ 2	6.38	8	43	2884	483	−9916	.3395356	18	7
197	16	3060			9	06.04	4434	.99		× 6.16	+ 2	1268	8	41	16.16	× 496	−9433	.3385923	18	5
197	05	1237			8	20.76	4528	94		6.00	2	1883	8	38	5733	508	−8937	.3376986	18	3
196	53	3855			7	34.57	4619	91	+ 6.43 ~~5.84~~ +	5.84	2	24.83	8	36	32.47	~~554~~ 519	−8429	.3368557	18	1
	41	5226			6	47.48	4709	90		5.67	2	3066	8	34	1.81	529	7905	.3360652	17	59
	29	5358			5	59.57	4791	82		× 5.49	+ 2	36.33	8	31	2548	× 5.38	−7376	.3353276	17	57
	17	4316			5	10.88	4869	78		5.30	+ 2	41.81	8	28	4367	5.46	−6839	.3346437	17	56
196	5	21.63			4	21.44	4944	75	× 5.84 ~~5.11~~	5.11	2	47.11	8	25	5653	~~579~~ 554	6293	.3340144	17	54
195	52	49.51			3	31.30	5014	70		4.91	2	5225	8	23	4.28	561	5738	.3334406	17	52
195	40	7.66			2	40.51	5079	65		× 4.70	+ 2	57.16	8	20	7.12	× 5.68	−5177	.3329229	17	51
195	27	16.79			1	49.12	5139	60		4.47	3	1.84	8	17	5.28	574	−4610	.3324619	17	50
195	14	17.60			0	57.17	5195	56	5.4 ~~4.24~~	4.24	3	631	8	13	5896	~~596~~ 579	4036	.3320584	17	49
195	01	10.81			0	04.72	5245	50		4.00	3	10.57	8	10	4839	584	3457	.3317127	17	48
194	47	59.14	12		59	11.81	5291	46		× 3.75	+ 3	14.57	8	7	33.82	× 589	−2873	.3314254	17	48
194	34	37 33			58	18.49	5338	42		3.50	3	18.32	8	4	15.50	593	−2285	.3311969	17	47
194	21	12.12			57	24.81	5368	35	4.24 ~~3.24~~	3.24	3	21.82	8	0	53.70	~~608~~ 596	1692	.3310276	17	49
194	7	42.26			56	30.82	5399	31		3.00	3	2503	7	57	28.67	599	1096	.3309180	17	46
193	54	8.46			55	36.56	5426	27		× 2.76	+ 3	28.03	7	54	0.64	× 602	−497	.3308683	17	46
193	40	31.47			54	42.10	5446	20		2.52	3	30.79	7	50	2985	604	+ 105	.3308788	17	47
193	26	52.02			53	47.47	5463	17	3.24 ~~2.28~~	2.28	3	33.31	7	46	56.53	~~607~~ 605	709	.3309497	17	47
193	13	10.86			52	52.72	5475	12		2.02	3	3563	7	43	20.90	606	1315	.3310812	17	47
192	59	28.75			51	57.92	5480	5		× 1.75	+ 3	37.65	7	39	4325	× 607	+ 1921	.3312733	17	47
192	45	46.46			51	03.10	5482	2		1.47	3	39.39	7	36	3.86	607	+ 2527	.3315260	17	48
192	32	4.75			50	08.33	5479	5	2.28 ~~1.18~~	1.18	3	40.86	7	32	2303	598 607	3134	.3318392	17	49
192	18	24.38			49	13.63	5470	7		0.90	3	4204	7	28	4099	606	3744	.3322136	17	50
192	4	46.15			48	19.07	5456	14		× 0.61	+ 3	42.94	7	24	5805	× 604	+ 4350	.3326486	17	51
191	51	10.85			47	24.72	5435	21		0.31	3	4354	7	21	14.51	601	+ 4953	.3331439	17	52
191	37	39.27			46	30.62	5410	25	1.18 ~~1.00~~	0.00	3	43.85	7	17	30.66	598	5554	.3336991	17	53
191	24	12.19			45	36.81	5381	30	−	0.30	3	4382	7	13	4684	594	6153	.3343144	17	54
191	10	50.39			44	43.36	5345	36		× 0.59	+ 3	43.52	7	10	3.32	× 5.89	+ 6747	.3349891	17	56
190	57	3461			43	50.31	5305	40		0.88	3	4293	7	6	20.39	583	+ 7336	.3357227	17	58
190	44	2559			42	57.70	5261	44	1.00 ~~1.17~~	1.17	3	42.05	7	2	38.31	577	7919	.3365148	18	0
190	31	2409			42	05.60	5210	51		1.45	3	4088	6	58	5743	570	8498	.3373646	18	2
190	18	3078			41	14.05	5155	55		× 1.73	+ 3	39.43	6	55	18.00	× 562	+ 9068	.3382714	18	5
190	5	46.34			40	23.09	5096	59		2.00	3	37.70	6	51	40.36	553	+ 9629	.3392343	18	7
189	53	11.42			39	32.76	5033	63	1.17 ~~2.27~~	2.27	3	3570	6	48	460	544	10182	.3402522	18	10
189	40	46.71			38	43.11	4965	68		2.52	3	33.41	6	44	31.19	535	10726	.3413248	18	12
189	28	32.79			37	54.18	4893	72		× 2.77	+ 3	30.89	6	41	0.30	× 525	+ 11261	.3424509	18	15
189	16	30.26			37	06.02	4816	77		3.01	3	2813	6	37	3217	515	+ 11786	.3436295	18	18
189	04	3971			36	18.65	4737	79	2.27 ~~3.24~~	3.24	3	2512	6	34	7.03	+ 504	12301	.3448595	18	21
188	53	1.56			35	32.10	4655	82		3.47	3	21.88	6	30	4515	493	12808	.3461403	18	24
188	41	36.41			34	46.43	4567	88		× 3.69	+ 3	1841	6	27	26.74	× 481	+ 13301	.3474704	18	28
188	30	24.75			34	01.65	4478	89		3.89	3	14.74	6	24	1206	469	+ 13761	.3488485	18	31
188	19	27.37			33	17.80	4385	93	+ 3.24 − ~~4.08~~	4.08	+ 3	10.85	− 6	21	1.16	+ 456	+ 14250	.3502734	18	35

Log $a^2(a-1)^2$ 1.3194

log 2 = .45780 log 2^2 .59580
log a = .13683 log a^2 .28386

log $2^2 a^2$ 1.26566
log $a^2(a-1)^2$ 1.31940
log I .04974

I = 1.12

ε		°	'	"
	1869	ε = 23	27	22.53
	70			22.06
	71			21.83
	72			21.36
	73			20.88
	74			
	75			19.93
	76			
	77			
	78			

Berlin M T

		X	Y	Z
Aug 31.5	1869	−9386409	+.3389355	+.1470644
Jan 26.5	1870	+5919205	−.7228071	−3136261
Mar 24.5	1871	+.9954683	+.0619577	+.0268814
Aug 17.5	1873	∓8291682	+5319998	+2308334
Feb. 25.5	1875	+9116244	−3552575	−.1541437

ε	1869	ε = 23° 27′ 22″.53
	70	22.06
	71	21.83
	72	21.36
	73	20.88
	74	
	75	19.93
	76	
	77	
	78	

Berlin MT

		X	Y	Z
Aug 31.5	1869	−9386409	+.3389355	+.1470644
Jan 26.5	1870	+5919205	−.7228071	−3136261
Mar 24.5	1871	+.9954683	+.0619577	+.0268814
Aug 17.5	1873	+8291682	+5319998	+2308334
Feb. 25.5	1875	+9116244	−3552575	−.1541437