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Harvard Lunar Plates.

Measures & Reductions.

Wesley Fowler.

Volume VII.

Plate no.	Date	Page
1030	1911 April 10	1
1034	1911 April 11	16
1035	1911 April 11	31
10		
1049	1911 Apr. 16	61

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MC 1030. 1913 Jan 30. 1.

Preliminary Reduction.

	1	2	3	4
36-x	10.2852	17.6582	20.5824	24.0776
3	9.5328	17.2607	19.7250	23.6526
	+ 7524	+ 3975	+ 8574	+ 4250
49-4	28.7100	9.6725	34.1016	10.9283
1	28.5768	9.6787 .	34.1588	11.0529
4-1	+ 1332	- 62	- 572	-1246

Star	x-3	-3975	-1884	-5x	+1905
1	+7524	= +3549	- 5398 = -1849	-51 = -1900	= +5
2	+3975	= 0	-1818 = -1818	-88 = -1906	= -1
3	+8574	= +4599	- 6411 = -1812	-103 = -1915	= -10
4	+4250	= + 275	- 2055 = -1780	-120 = -1900	= +5
Mean	17.3854		- 3894	-187	= 16.7803

Star	4-1	-1332	+1855x	-4	-1877
1	+1332	= 0	+1907 = +1907	-29 = +1878	= +1
2	-62	= -1394	+3275 = +1881	-10 = +1871	= -6
3	-572	= -1904	+3818 = +1914	-34 = +1880	= +3
4	-1246	= -2578	+4467 = +1889	-11 = +1878	= +1
Mean	20.7148		+3225	-21	= 20.7143

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1913 Jan 30. 1.

Preliminary Reduction.

	1	2	3	4
	10.2852	17.6582	20.5824	24.0776
	9.5328	17.2607	19.7250	23.6526
	+ 7524	+ 3975	+ 8574	+ 4250
1-4	28.7100	9.6725	34.1016	10.9283
2	28.5768	9.0787	34.1588	11.0529
1-4	+ 1332	- 62	- 572	-1246

Star 2-5	-3975	-1854		-5x		+1905
1	+7524 : +3549	= 5398	= -1849	-51	= -1900	: +5
2	+3975 :	0 -1818	= -1818	-88	= -1906	: -1
3	+8574 : +4599	-6411	= -1812	-103	= -1915	: -10
4	+4250 : +275	-2055	= -1780	-120	= -1900	: +5
	17.3854	-3899		-87		167803

Star 4-1	-1332	+1855/2x		-4		-1877
1	+1332 :	0 +1907	: +1907	-29	: +1878	: +1
2	-62 :	-1394 +3275	: +1881	-10	: +1871	: -6
3	-572 :	-1904 +3818	: +1914	-34	: +1880	: +3
4	-1246 :	-2578 +4467	: +1889	-11	: +1878	: +1
	20.7148	+3215		-21		20.7143

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MC1030. 1913 Jan 30. 2.

Plate Constants.

Conditional Equations.

a	b	c	x − x	y − y
+10.29	+28.71	+1 =	+5	+1
+17.66	+ 9.67	+1 =	−1	−6
+20.58	+34.10	+1 =	−10	+3
+24.08	+10.93	+1 =	+5	+1

Mean Equations.

+13.98	+19.19	+1 =	+2.00	−2.50
+22.33	+22.52	+1 =	−2.50	+2.00
+15.44	+31.40	+1 =	−2.50	+2.00
+20.87	+10.30	+1 =	+2.00	−2.50
− 8.35	− 3.33	=	+4.50	−4.50
− 5.43	+21.10	=	−4.50	+4.50
+ 5.43	+ 2.16	=	−2.92	+2.92
	+23.26	=	−7.42	+7.42
		b =	−0.32	+0.32
− 8.35 =	+4.50	−1.06 =	+3.44	−4.50 +1.06 = −3.44
		a =	−0.41	+0.41

+2.0	−2.5	−2.5	+2.0	−2.5	+2.0	+2.0	−2.5
+5.8	+9.2	+6.4	+8.6	−5.8	−9.2	−6.4	−8.6
+6.1	+7.2	+10.0	+3.3	−6.1	−7.2	−10.0	−3.3
+13.9	+13.9	+13.9	+13.9	−14.4	−14.4	−14.4	−14.4

			c	o	o − c
− 4	− 9	+14 =	+1	+5	+4
− 7	− 3	+14 =	+4	−1	−5
− 8	−11	+14 =	−5	−10	−5
−10	− 3	+14 =	+1	+5	+4

+ 4	+ 9	−14 =	−1	+1	+2
+ 7	+ 3	−14 =	−4	−6	−2
+ 8	+11	−14 =	+5	+3	−2
+10	+ 3	−14 =	−1	+1	+2

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MC 1030. 1913 Jan 30. 2.

Plate Constants.

Conditional Equations.

a	b	c	x − 3	4 − m
+10.29	+28.71	+1	= +5	+1
+17.66	+ 9.67	+1	= −1	−6
+20.58	+34.10	+1	= −10	+3
+24.08	+10.93	+1	= +5	+1

Mean Equations.

+13.98	+19.19	+1	= +2.00	−2.50
+22.33	+22.52	+1	= −2.50	+2.00
+15.99	+31.40	+1	= −2.50	+2.00
+20.87	+10.30	+1	= +2.00	−2.50
− 8.35	− 5.33		= +4.50	−4.50
− 5.43	+21.10		= −4.50	+4.50
+ 5.43	+ 2.16		= −2.92	+2.92
	+23.26		= −7.42	+7.42
		b	= −0.32	+0.32
− 8.35	+4.50	−1.06	= +3.44	−4.50 +1.06 = −3.44
		a	= −0.41	+

+2.0	−2.5	−2.5	+2.0	−2.5	+2.0	+2.0	−2.5	
+5.8	−9.2	−6.9	+8.6	−5.8	−9.2	−6.9	−8.6	
+6.1	+7.2	+10.0	+3.3	−6.1	−7.2	−10.0	−3.3	
+13.9	+13.9	+13.9	+13.9	−14.4	−14.4	−14.4	−14.4	

		c	o		o − c
− 4	− 9	+14	+ 1	+5	+4
− 7	− 3	+10	+ 4	−1	−5
− 8	−11	+14	− 5	−10	−5
−10	− 3	+14	+ 1	+1	+4

+ 4	− 9	−14	− 1	+1	+2
+ 7	− 3	−14	− 4	−6	−2
+ 8	−11	−14	+ 5	+3	−2
+10	− 3	−14	− 1	+1	+2

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1912 Nov. 26. 3

MC 1030

Comparison Stars - Measures.

	d		n		d		n	
1								
25.7	15061		17706		13996		17238	
15.3	12160	69	10617	18	11141	40	10094	89
	66		18		35		90	
	59		14		06		50	
	15.2895		.2906		25.7140		.7155	
2								
18.3	15940		15620		16076		16909	
34.4	12660	67	8900	01	9486	89	13487	90
	65		93		90		91	
	27		20		68		09	
	34.3272		.3278		18.3417		18.3420	
3								
15.4	16600		17544		18169		14781	
9.9	7628	25	16531	36	12349	49	10611	66
	20		33		46		04	
	04		44		79		92	
	9.8980		.5989		15.4173		.4178	
4								
11.9	16307		15103		16009		15470	
33.0	15595	91	5821	21	15226	21	6232	44
	94		20		30		41	
	00		01		99		70	
	33.0714		.0720		11.9218		.9231	

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MC 1030.

Comparison Stars - measures.

	δ	ν	δ	ν
1/				
25.7	15061	17706	13996	17238
15.3	12160 49	10617 18	11141 40	10094 89
	66	18	35	90
	57	14	06	50
	15.2895.	.2906	25.7140	.7155
2				
6.3	15940	15670	16076	16909
14.9	12660 67	13890 01	94866 9	13487 90
	65	93	90	91
	27	020	68	09
	34.3272	.3278	18.3417	18.3420
3				
	16600	17544	18169	14781
5.4	7628 25	16531	3612349 49	10611 66
1.9	20	33	46	04
	04	44	79	92
	9.8980	.5989	15.4175	.4178
4				
9	16307	15102	16009	15470
10	15595 91	5821 21	15226 21	6232 49
	94	20	30	41
	60	01	99	70
	33.0714	.0720	11.9218	.9231

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MC1030-

1912 Nov. 26.

Points on moon's limb - measures.

	d	N	d	N
1			18009	15186
19.6			14547 49	8649 33
25.0			50	38
			92	87
			19.6550	.6547
2				
20.0	17681	16050		
24.6	10263 82	13404 05		
	70	96		
	75	64		
	24.7405	.7348		
3			17678	15505
20.4			12560 57	10630 10
24.0			58	27
			70	18
			20.4884	.4889
4			17754	15438
20.5			13951 60	9208 20
23.4			58	18
may			47	45
in x			20.6205	.6227
5			16781	14415
20.5			12774 94	8402 81
23.0			78	86
			80	18
			20.6001	.6027
6			16894	14300
20.2			8439 38	12736 43
22.0			37	36
			89	15
			20.1548	.1564

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MC 1030.

1912 Nov. 26. 4.

Pointings on Leonis Minoris - Measures.

L	d	N	d	N
19.6			18002	15186
25.0			14547 49	8649 33
			50	38
			92	87
			19.6550	.6547
2				
00	17681	16050		
4.6	10263 82	13404 65		
	70	16		
	75	64		
	24.7405	.7348		
3			17678	15505
0.4			12560 57	10630 10
4.0			58	27
			70	18
			20.4854	.4889
4			17754	15438
0.5			13951 60	9208 20
3.4			58	18
May			47	45
1-2			20.6205	.6227
5			16781	14415
0.5			12774 94	8402 81
3.0			78	86
			80	18
			20.6001	.6027
6			16894	14300
20.2			8439 38	12736 43
22.0			37	36
			89	15
			20.1548	.1564

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MC1030 1912 Nov. 26. 5.

Points on Moon's Limb — Measured

	d		N		d		N
7							
20.0	15312		18008				
21.8	6989	82	163585	58			
	78		60				
	24		00				
	21.8339		.8353				
8							
19.0	14421		17948				
21.4	11228	17	111255	31			
	21		30				
	27		47				
	21.3201		.3182				
9							
18.6	14458		17907				
21.4	11651	65	106768	74			
min	76		68				
in	65		10				
8							
	21.2796		.2764				
10							
18.0	14519		16855				
21.5	10780	70	105-98	06			
	77		06				
	26		57				
	21.3745		.3747				

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MC 1030 1912 Nov. 26.

Points on Nebula limbs - measured

	d			d	
7					
20.0	15312		18008		
21.8	6989	82	1635858		
	78		60		
	29		00		
	21.8359		.8353		
8					
19.0	14421		17948		
21.9	11228	17	11125	31	
	21		30		
	27		47		
	21.3201		.3182		
2					
18.6	14458		17907		
21.4	11651	65	10676	74	
min	76		68		
	65		10		
+					
	21.2796		.2764		
7					
18.0	14519		16855		
21.5	10780	70	10598	06	
	77		06		
	26		57		
	21.3745		.3747		

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MC 1030.

1913 Feb. 4.

6

Times Etc.

Ref. ✝ star. 1911. Apr. 10	10^h	21^m		−	10^h	30^m
" " moon	10	25	51.5	−	10	25 51.8
clock fast		2	49.0			
H Sid T.	10	23	02.65			
" long.	4	44	31.05			
G Sid T	15	07	33.70			
Sid T M noon	1	10	23.53			
Interval	13	57	10.17			
Reduction		2	17.15			
G. M. T.	13	54	53.02			
from Eph. Eph.						
noon 14ᵈ	11^h	31^m	40.44		+7 24	36.8
motion 1^m ÷ 1.9479				14.543		
" " $-5^m.116$		−	9.94		+1	14.4
Tabular place.	11	31	30.50		+7	25 51.2
moons parallax		56′	28.0″			
" semidiam		15	24.8			
moon's age.	11^d					

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1913 Feb. 4.

MC 10 30.

Times etc.

Sup. Pstars. 1911. Apr. 10 $10^h\ 21^m$. – $10^h\ 30^m$
Mean 10 25 51.5 – 10 35 51.8
Clock fast 2 49.0

Sid T. 10 23 02.65
Long. 4 44 31.05
Sid T 15 07 33.70
Sid T Kew 1 10 25.53
Latitude
Equation. 2 17.15
G.M.T. 13 54 53.02

From Eph. Oph.
Noon 19 $11^h\ 31^m\ 40.44$ +7 24 36.8
Noon 1st : 1.9949 14.593
–5.176 – 9.99 +1 14 4
Tabular place 11 31 30.50 +7 25 51 2

Moon parallax 56' 28.0
Semidiam 15 29.8

Moon's age. 11d

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	Pos. ∠	Resid.
1	211°.2	−31
2	223.6	+29
3	249.2	−33
4	270.0	+22
5	278.2	+24
6	309.8	+15
7	316.4	−11
8	348.9	−102
9	00	+44
10	17.8	+34

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MC 1030.
Center of Nucleus

36 − x		x − X_0		Δx	$(x-X_0)^2$	$(x-X_0)^2+(y-Y_0)^2$	O − C
1	16.34 52	− 1.0413	+	2	1.0839	4.0220	− 71
2	16.0000	− 1.3865	+	2	1.9218	4.0292	+ 1
3	15.5114	− 1.8751	+	1	3.5156	4.0254	− 37
4	15.3784	− 2.0081		0	4.0325	4.0325	+ 34
5	15.3986	− 1.9879	−	0	3.9517	4.0336	+ 45
6	15.8444	− 1.5421	−	1	2.3784	4.0330	+ 39
7	16.0000	− 1.3865	−	2	1.9230	4.0304	+ 13
8	17.0000	− 0.3865	−	2	0.1496	4.0199	− 92
9	17.3865	0.0000	−	2	0.0000	4.0337	+ 46
10	18.0000	+ 0.6135	−	2	0.3762	4.0311	+ 20

mean: 4.0291 − 2

44 − y		y − Y_0		Δy	$(y-Y_0)^2$
1	19.0000	− 1.7139	−	2	2.9381
2	19.2624	− 1.4515	−	2	2.1074
3	20.0000	− 0.7139	−	1	0.5098
4	20.7139	0.0000		0	0.0000
5	21.0000	+ 0.2861	+	0	0.0819
6	22.0000	+ 1.2861	+	2	1.6546
7	22.1654	+ 1.4515	+	2	2.1074
8	22.6809	+ 1.9670	+	3	3.8703
9	22.7220	+ 2.0081	+	3	4.0337
10	23.6254	+ 1.9115	+	3	3.6549

Approximate Center

x = 16.0 y: 19.2624
22.1654
41.4278

mean y: 20.7139
y = max 22.7220
x = 2.0081
x = min = 15.3784
mean x 17.3865

X_0 = 17.3865
Y_0 = 20.7139

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MC 1030.

	x	$x - x_0$		Δx	$(x-x_0)^2$	$(x-x_0)^2+(y-y_0)^2$	O - C
1	16.3152	- 1.0413	+	2	1.08389	4.02220	- 71
2	16.0000	- 1.3865	+	2	1.92218	4.02932	+ 1
3	15.5114	- 1.8751	+	1	3.51626	4.03854	- 37
4	15.3784	- 2.0081	+	0	4.03225	4.03225	+ 34
5	15.3986	- 1.9879	-	0	3.95117	4.03336	+ 45
6	15.8444	- 1.5421	-	1	2.37784	4.03330	+ 39
7	16.0000	- 1.3865	-	2	1.92220	4.03304	+ 13
8	17.0000	- 0.3865	-	2	0.14946	4.01999	- 92
9	17.3865	0.0000	+	2	0.0000	4.03231	+ 46
10	18.0000	+ 0.6135	+	2	0.37622	4.03111	+ 20

mean: 4.02991 - 2

	y	$y - y_0$		Δy	$(y-y_0)^2$
1	18.0000	- 1.7139	-	2	2.93781
2	19.2624	- 1.4515	-	2	2.10774
3	20.0000	- 0.7139	-	1	0.50978
4	20.7139	0.0000		0	0.00000
5	21.0000	+ 0.2861	+	0	0.08189
6	22.0000	+ 1.2861	+	2	1.65546
7	22.1654	+ 1.4515	+	2	2.10774
8	22.6809	+ 1.9670	+	3	3.86989
9	22.7220	+ 2.0081	+	3	4.03237
10	22.6254	+ 1.9115	+	3	3.65491

Approximate Center

$x = 16.0$ y: 19.2624
22.1654
41.4278
mean y: 20.7139
y = max: 22.7220
x = 2.0081
x = min: 15.3784
mean x: 17.3865

$X_0 = 17.3865$
$Y_0 = 20.7139$

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Formation of Normals

	at	an	bn
1	+ 1.77	+ 73.7	+ 121.3
2	+ 2.02	- 1.4	- 1.5
3	+ 1.34	+ 69.5	+ 26.2
4	0.00	- 68.4	0.0
5	- 0.58	- 89.5	+ 13.0
6	- 1.98	- 60.0	+ 50.4
7	- 2.02	- 18.1	+ 18.9
8	- 0.77	+ 35.8	- 181.0
9	0.00	0.0	+ 92.5
10	+ 1.16	+ 12.2	+ 38.2
	+ 0.94	- 46.2	+ 178.0

$[aa] = +19.33$ $[bb] = +20.96$

$[ac] = -11.02$ $[bc] = +5.05$ $[cn] = -2$

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MC1030 1913 Feb. 5. 6

Morris Carter.

Conditional Equations

	a	b	c	O	c	O − C
1	− 1.04	− 171	+ 1	= − 71	+ 24 − 30 − 34	: − 40	− 31
2	− 139	− 145	+ 1	= + 1	+ 32 − 26 − 34	: − 28	+ 29
3	− 188	− 0.71	+ 1	= − 37	+ 43 − 13 − 34	: − 4	− 33
4	− 201	0.00	+ 1	= + 34	+ 46 0 − 34	: + 12	+ 22
5	− 1.99	+ 0.29	+ 1	= + 45	+ 46 + 5 − 34	: + 17	+ 28
6	− 1.54	+ 1.29	+ 1	= + 39	+ 35 + 23 − 34	: + 24	+ 15
7	− 1.39	+ 1.45	+ 1	= + 13	+ 32 + 26 − 34	: + 24	− 11
8	− 0.89	+ 1.97	+ 1	= − 92	+ 9 + 35 − 34	: + 10	− 102
9	0.00	+ 2.01	+ 1	= + 46	0 + 36 − 34	: + 2	+ 44
10	+ 0.61	+ 1.91	+ 1	= + 20	− 14 + 34 − 34	: − 14	+ 34
						− 177 + 172	

Average (O−C) = 35

Normal Equations.

a	b	c	
+ 19.53	+ 0.94	− 11.02	= − 46
+ 0.94	+ 20.96	+ 5.05	= + 178
− 11.02	+ 5.05	+ 10.00	= − 2
− 0.94	− 0.05	+ 0.54	= + 2
+ 11.02	+ 0.54	− 6.29	= − 26
	+ 20.91	+ 5.59	= + 180
	+ 5.59	+ 3.71	= − 28
	− 5.59	− 1.49	= − 48
		+ 2.22	= − 76
	− 8.41	− 5.59	= + 42
	+ 12.50		= + 222
+ 2.05	− 0.94	− 1.86	= + 0
+ 45.79	− 20.96	− 41.45	= + 8
+ 21.38		− 12.88	= − 46
+ 46.68		− 36.40	= + 186
− 16.50		+ 12.88	= − 66
+ 4.88			= − 112

$\frac{\Delta a}{\Delta c} = +0.583$

$\frac{\Delta b}{\Delta c} = -0.267$

c = − 34

b = + 18

a = − 23 −

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MC1030 1913 [illegible] 8

Conditional Equations.

	a	b	c	O	c	O − C
1	− 1.04	− 1.71	+1	− 71	+ 24 − 30 − 34 :	− 40	− 31
2	− 1.39	− 1.45	+1	+ 1	+ 32 − 26 − 34 :	− 28	+ 29
3	− 1.88	− 0.71	+1	− 37	+ 43 − 13 − 34 :	− 4	− 33
4	− 2.01	0.00	+1	+ 34	+ 46 0 − 34 :	+ 12	+ 22
5	− 1.99	+ 0.29	+1	+ 45	+ 46 + 5 − 34 :	+ 17	+ 28
6	− 1.54	+ 1.29	+1	+ 39	+ 35 − 23 − 34 :	+ 24	+ 15
7	− 1.39	+ 1.45	+1	+ 13	+ 32 − 26 − 34 :	+ 29	− 11
8	− 0.39	+ 1.97	+1	− 92	+ 9 + 35 − 34 :	+ 10	− 102
9	0.00	+ 2.01	+1	+ 46	0 − 36 − 34 :	+ 2	+ 44
10	+ 0.61	+ 1.91	+1	+ 20	− 14 + 34 − 34 :	− 14	+ 34

− 177 + 172

Normal Equations. Average (O−C) = 55

a	b	c	
+ 19.53	+ 0.94	− 11.02	= − 46
+ 0.94	+ 20.96	+ 5.05	= + 178
− 11.02	+ 5.05	+ 10.00	= − 2
− 0.94	− 0.05	+ 0.54	= + 2
+ 11.02	+ 0.54	− 6.29	= − 26
	+ 20.91	+ 5.59	= + 180
	+ 5.59	+ 3.71	= − 28
	− 5.59	− 1.49	= − 48
		+ 2.22	= − 76
	− 8.41	− 5.59	= + 42
	+ 12.50		= + 222

c = − 34

b = + 18

a	b	c	
+ 2.05	− 0.94	− 1.86	= + 0
+ 45.79	− 20.96	− 4.45	= + 8
+ 21.38		− 12.88	= − 46
+ 46.68		− 36.40	= + 186
− 16.50		+ 12.88	= − 66
+ 4.88			= − 112

a = − 23

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MC 1030. 1913 Feb 5. 9

Moons mean position (1911.0).

$X_0 = 17.3865$
$\frac{1}{2}a = -11$
17.3854

$Y_0 = 20.7139$
$\frac{1}{2}b = +9$
20.7148

From preliminary Reduction $x = 16.7803$ $y = 20.7143$
" computed plate Constants $ax = -7$ $+7$
$by = -7$ $+7$
$c = +14$ -14
16.7803 20.7143

$\xi = -1.2197$ $\eta = -1.2857$

log ξ = 0.086275n log Tan δ = 9.09923
∴ cos δ = 9.996855 δ^2 = 0.1737
∴ const = 8.507124 ∴ cost = 7.0534
∴ η_1 = 6.3194
η = + 2
$\eta_0 = -1.2859$

∴ $(\alpha - A)$ = 1.582115 log η_0 = 0.109211n
∴ const = 7.331115

$\alpha - A$ = − 38.21 ∴ $(\delta - D)$ = 2.778066n

A = 11^h 32 58. $\delta - D$ = − 599.9
α = 11^h 32^m 19.79 = − 9 59.9

Red. add. app. + 1.30 D = 7 03 07

α' = 11 32 21.09 δ = 6° 53′ 07.1″

Red. add. C. app. − 64

δ' = +6 53 00.7

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MC 1030. 1913 Feb. 5. 9

Means of plates (1911.0).

$X_0 = 17.3865$ $Y_0 = 20.7139$

$\frac{1}{2}a = -11$ $\frac{1}{2}b = +9$

17.3854 20.7148

From Jordan Reduction $x = 16.7803$ $y = 20.7143$

" computed plate constants -7 $+7$

-7 $+7$

$+14$ -14

16.7803 20.7143

$\xi = -1.2198$ $\eta = -1.2857$

$\log \xi = 0.08625_n$ $\log \eta = 9.09723$

$\cos \delta = 9.99686$ $\delta^2 = 0.1737$

$\cos \delta = 8.50769$ $\cos \delta = 7.0534$

$\log (\delta - A) = 1.58215$ $\log \eta = 6.3194$

$\eta = +2$

$\eta_0 = -1.2859$

$\alpha - A = -38.21$ $\log \eta_0 = 0.10921_n$

$\cos \delta = 7.33115$

$\log (\delta - D) = 2.77806_n$

$A = 11^h 32^m 58.$ $\delta - D = -599.9$

$\alpha = 11^h 32^m 19.79$ $= -9' 59.9$

Red. to app. $+1.30$ $D = 7° 03' 07''$

$\alpha' = 11^h 32^m 21.09$ $\delta = 6° 53' 07.1$

Red. to app. -64

$\delta' = +6° 53' 00.7$

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1030. Lunar parallax.

α' = 11h 32m 21.09s ✓
δ = 10 23 02.65" ✓
G-α = −1 09 18.44 ✓
= −17° 19' 36" ✓

−6 16

−17 13 20

9.957727
0.000000
001992
tan γ = 4.977719

γ = 43 29 45.5

+ 6 53 00.7

γ − δ = 36 36 44.8

9.826400
8.214450
9.775554
016222
sin(δ−δ') = 7.979666

δ − δ' = + 32 48.3

δ + 7 25 49.0

Am Ehp. δ = + 7 25 51.2 ✓

O−C − 2.2

Corr to stand. radius − 0.1

Final (O−C) − 2.3

δ' = + 6° 53' 00.7" ✓

π = 56' 28.0" ✓

9.869135 ✓
8.215504 ✓
9.473955 ✓
000367 ✓
sin(α−α') = 7.562225 ✓

α − α = −12° 32.80 ✓
− 50.19 ✓

α = 11 31 30.90 ✓
α = 11 31 30.50 ✓
+ 0.40
+ 0.02
+ 0.42

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1030. Lunar parallax.

α' = 11h 32m 21.09s
θ = 10 23 02.65
θ − α = −1 09 18.44
= −17° 19' 36"

−6 16

−17 13 20

9.95727
0.00000
001992
Lun f = 497719

f = 43 29 45.5

+ 6 53 00.7

f S = 36 36 44.8

9.82640
8.21150
9.77554
016222
sin(S−S') 797966

S − S' = + 32 48.3

S + 7 25 49.0

Lun Eph. S = + 7 25 51.2

O − C − 2.2

Corr to Stand radius − 0.1

Lunar lo. cl − 2.3

S' = + 6° 53' 00.7

Π = 56' 28.0

9.86913
8.21550
9.47395n
000367
sin(α − α') 756225

α − α = −12° 32.80

− 50.19

q = 11 31 30.999

q = 11 31 30.50

+ 0.49

+ 0.02

+ 0.42

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MC 1034.

1912 Nov. 26
1913 Jan 6.

Comparison stars Standard Coordinates.

	1 no.	mag.	2 no	mag.
C	1667	5.9	1678	8.0
C	$12^h\ 13^m\ 32^s.66$		$12^h\ 19^m\ 53^s.89$	
L		7 0		.90
E		6 4		.85
Mean		.67		.88
Prec	+	33.80	+	33.75
1911.	12 14	06.47	12 20	07.63
A	12 21	38	12 21	38
$\alpha - A$ =	− 7	31.53	− 1	30.37
sec$(\alpha - A)$	−	451.45	−	90.37
log	2.654611 n		1.956021 n	
cos δ	9.999999		9.999977	
" ξ_0	1.161844 n		0.463033 n	
ξ_0	− 14.5157		− 2.9042	
ξ_1	−	98	−	6
ξ		3.4745		15.0952
x		3.4268		15.1582
x − ξ		− 477		+ 630
C	− 0° 13′	53.0	+ 1° 56	15.7
L		52.6		.8
E		53.0		.3
Mean		52.9		.6
Prec	− 3	40.4	− 3	39.7
1911	− 0 17	33.3	+ 1° 52	35.9
D	+ 0 47	59	+ 0 47	59
$\delta - D$ =	− 1 05	32.3 ✓	+ 1 04	36.9 ✓
tan$(\delta - D)$	−	3932.8 ✓	+	3877.4 ✓
log	3.594701 n ✓		3.588574 ✓	
" η_0	0.925855 n ✓		0.919699 ✓	
" tan δ	7.7081 n ✓		8.5154 ✓	
" ξ^2	2.3237 ✓		0.9261	
" η_1	7.0852 n ✓		6.4949	
η_0	− 8.4304 ✓		+ 8.3117 ✓	
η_1	−	12	+	3 ✓
η	13.5684 ✓		30.3120 ✓	
y	13.6446 ✓		30.3089 ✓	
y − η	+ 762 ✓		− 31 ✓	

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1911PASP..23..181

MC 1034. 1912 Nov. 26. 16
1913 Jan 6.

Comparison stars standard Coordinates.

1	No.	mag.	2	No.	mag.
C	1667	5.9		1678	8.0
C	$12^h\ 13^m\ 32^s.66$			$12^h\ 19^m\ 33^s.89$	
L		70			90
E		64			85
Mean		67			88
Prec	+	33.80		+	33.75
1911.	12 14	06.47		12 20	07.63
A	12 21	38		12 21	88
A-A	− 7	31.53		− 1	30.37
(B-A)	−	451.45		−	90.37
log	2.654611			1.956021	
sin δ	9.999998			9.999977	
I₀	1.161844			0.463034	
S₀	− 14.5157			− 2.9042	
S₁	−	98		−	6
S²	3.47745			1.509522	
S³	3.4268			1.51582	
S-S	− 477			+ 630	
C	− 0° 13′	530		+ 1° 56′	15.7
L		52.6			.8
E		53.0			3
Mean		52.9			6
Prec	− 3	40.4		− 2	39.7
1911	− 0 17	33.3		+ 1° 52	35.9
D	+ 0 47	59		+ 0 47	59
D₁	− 1 05	32.3		+ 1 04	36.9
(D-D₁)	−	39328		+	38774
log	3.594710			3.588554	
M₀	0.925855			0.919649	
tan δ	7.70811			8.51549	
S²	23237			09261	
M₁	7.08552			6.49949	
M₀	− 8.4304			+ 8.3117	
M₁	−	12		+	3
M	13.5684			30.3120	
δ	13.6446			30.3089	
δ-M	+ 762			− 31	

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Comparison Stars - Standard Coordinates.

	3	no.	mag
C	16	79	8.9
C	12^h 20^m	10^s.80	
L			78
Σ			80
mean			.79
Prec	+	33.81	
α 1911	12 20	44.60	
A	12 21	38	
α−A	− 0	53.40	
sin(α−A)	−	53.40	
log(sin(α−A))	1.727544	n	
" cos δ	9.999998		
" 5°.	0.234766	n	
3$_0$	−1.71700		
3$_1$	−	5	
3	16.28225		
x	16.21996		
x−3	−629		
C	−0° 30	57.4	
L		.4	
Σ		.2	
mean		.3	
Prec	− 3	39.6	
1911	−0° 34	36.9	
D	+0 47	59	✓
δ−D	−1 22	35.9	✓
tan(δ−D)	−	4956.9	✓
log "	3.695211	n	
" η_0	1.026356	n	
" tan δ	8.00300	✓ n	
" ξ^2	0.48856	✓	
" η_1	55420	✓ n	
η_0	−10.62599	✓	
η_1		0	
η	11.37411	✓	
y	11.36855		
y−η	−	56	✓

	4	no.	mag
	16	97	7.9
	12^h 26	^{m} 07^s.99	
		08.00	
		07.96	
		07.98	
	+	33.74	
	12 26	41.72	
	12 21	38	
	+ 5	03.72	
	+	303.70	
	2.482449		
	9.999978		
	0.989946		
	+9.76033		
	+	37	
	27.76400		
	27.82336		
	+	596	
	+1° 52	47.2	
		47.5	
		46.9	
		47.2	
	− 3	39.1	
	+1 49	08.1	
	+0 47	59	
	+1 01	09.1	✓
	+	3669.5	✓
	3.564611	✓	
	0.895776		
	8.50188	✓	
	1.97899	✓	
	75341		
	+7.86622	✓	
	+	34	✓
	29.86966	✓	
	29.78722		
	−	824	

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Comparison Star Standard Coordinates.

	3 no. mag.	4 no. mag.
C	1679 8.9	1691 7.9
C	$12^h\ 20^m\ 10^s.80$	$12^h\ 26^m\ 07^s.99$
L	78	08.00
E	80	07.96
mean	.79	07.98
Prec	+ 33.81	+ 33.74
1911	12 20 44.60	12 26 41.72
A	12 21 3s	12 21 3s
A	− 0 53 40	+ 5 03.72
(A−A)	− 53 40	+ 303.70
log(sin 1")	1.727546m	2.482449
0		
cos δ	999998	9.999978
S°	0.23476m	0.98946
S₀	−1.7170	+9.7603
S₁	− 5	+ 37
S	16.2825	27.7640
r	16.2196	27.8236
−3	−689.	+ 596.
C	−0° 30′ 31.4	+1° 52′ 47.2
L	.4	47.5
E	.2	46.9
mean	.3	47.2
Prec	− 3 39.6	− 3 39.1
1911	−0° 34′ 36.9	+1° 49′ 08.1
D	+0 47 59	+0 47 59
−D	−1 22 35.9	+1 01 09.1
(A−D)	− 4956.9	+ 3669.5
log r	3.695216m	3.564611
η₀	1.026364m	0.895776
tan δ	8.00300m	8.5018
ξ²	04856	14789
η₁	53420m	75341
η₀	−10.62599	+7.8662
η₁	0	+ 34
η	11.37741	29.8696
ξ	11.36855	29.7872
ξ−η	− 56	− 824

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Comparison Stars - measured.

	y d	y N	x d	x N
1/				
3.5.	15513	15947	17420	15370
13.6	9067 70	12396 85	11678 78	11097 98
	69	95	71	94
	12	35	12	70
	13.6443	.6450	3.4261	.4274
2/				
15.2	17779	15960	14142	18065
30.4	14689 94	9060 55	5731 22	16488 86
	94	59	26	80
	80	70	46	75
	30.3087	.3091	15.1581	.1582
3/				
16.2	15502	14745	14399	13996
11.4	11807 20	8430 35	6589 00	11799 95
	15	40	87	00
	91	48	98	89
	11.3681	.3689	16.2194	.2197
4/	larger one in ring			
27.8			16690	16328
29.8	18250	16416	14927 22	80991 01
	10370 65	14284 90	28	92
	62	90	84	33
	36	16		
	29.7873	.7872	27.8237	8235

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Comparison Stars - measured.

d	N	d	N
15513	15947	17420	15370
9067 70	17396 85-	11678 78	11097 98
69	95-	71	94
12	35-	12	70
13.6443	.6450	3.4261	.4274
17779	15960	14142	18065-
14689 94	9060 55-	5731 22	16488 86
99	59	26	80
80	70	46	75-
30.3087	.3091	15.1581	.1582
15502	14743	14397	13996
11847 20	8436 35-	6589 00	11799 95-
15-	40	87	00
91	48	98	89
11.3681	.3689	16.2194	.2197
		16690	16328
18250	16416	14927 22	80991 01
10370 65-	14264 90	28	92
62	90	84	33
36	16		
		27.8237	8235-
29.7873	.7872		

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MC1034 1912 Nov. 27.

Points on moon's limb - measured.

	y	d	N	x	d	N
1/	16.0	14752	15796			
	22.4	10743 47	9810 01			
		52	85			
		47	01			
		22.4003	.4000			
2/	15.0	13807	14738			
	22.6	9.96 95	11541 36			
	max in y	99	45			
		04	51			
		22.6808	.6799			
3/	14.0	17843	14686			
	22.4	13691 91	8850 63			
		76	64			
		45	00			
		22.4158	.4165			
4/	13.5				19027	17720
	22.0				13912 11	12790 86
					09	90
					31	14
					13.4882	.4928
5/	13.0					
	21.0				8287 81	14070
					80	13862 60
					8089	49
					13.0194	.0213
6/	13.0	x = 13.0 is tangent to moon's limb.				
	26.6					
	min in x					

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MC 1054 1912 Nov 27

Points on moon's limb - measured.

	a		N		a	N
16.0	14752		15796			
24	10743	47	9810	01		
	52		85			
	47		01			
	22.4003		.4066			
15.0	13807		14738			
22.6	6996	95	11541	36		
	99		45			
	04		51			
	22.6803		.6799			
1.0	17543		14686			
2.9	13691	91	8950	63		
	76		64			
	45		00			
	22.4158		.4165			
3					19027	17720
13.5					13912	11 12790 80
2.0					09	90
					31	14
					13.4852	.4928
5						
13.0						
21.0					8287	81 14070
					80	13802 60
					8089	49
					13.0194	.0213
6						
13.0	x = 17.0 in tangent to moon's limb.					
4.6						
mm						
=						
x						

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MC1034 1912 Nov. 27. 20.

Morris Limb — measured.

	d	N	d	N
7				
13.2			17132	18098
20.0			837865	1685149
			89	41
			43	94
			13.1235	.1251
8				
13.9			10226	13315 21-
19.0			9723 21	21
			17	12843
			13.9494	.9523
9				
14.0	9813	11065		
18.9	2219	107545 2		
	9511	63		
	189693	.9691		

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MC 1034

1917 Dec. 27. 20.

Drowning hut - measured.

	d	N
13.2	17132	18098
20.0	839865	1685149
	89	41
	43	94
	13.1235	.1251
13.9	10226	13215 21
19.0	9723	21
	17 21	12843
	13.9494	.9523
14.0	9813	11065
18.9	72 19	1075452
	9111	63
	1.89693	.9691

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Mean Measured Coords - Comp. Stars
Center of Plate

	x	y
1	3.4268	13.6446
2	15.1582	30.3089
3	16.2196	11.3685
4	27.8236	29.7872
4	62.63	85.11
	15.66	21.28
	- 18	- 22
	2.34	0.72
	31	465
	234	360
	702	432
	7254	288
		33480

	R.A.	Decl.
	12h 14m 06s	- 0 17 33
	20 08	+ 1 52 36
	20 45	- 0 34 37
	26 42	+ 1 49 08
4	81 41	+ 2 49 34
	12h 20m 25	+ 0 42 24
	+ 1 13	+ 5 35
	12 21 38	+ 0 47 59

A = 12h 21m 38s
D = + 0° 47' 59"

Preliminary Reduction.

Star	x - 3 - 66.54			+ 1385	
1	- 477 - 907	=	- 1384	= + 1	incapable of
2	+ 630 - 2015	=	- 1385	= 0	improvement
3	- 629 - 756	=	- 1385	= 0	
4	+ 596 - 1981	=	- 1385	= 0	
mean	14.9847	- 1376		= 14.9856	

Star	y - m + 64x			+ 24	- 1008
1	+ 762 + 220	=	+ 982	+ 27 = + 1009	= + 1
2	- 31 + 970	=	+ 939	+ 61 = + 1000	= - 8
3	- 56 + 1038	=	+ 982	+ 23 = + 1005	= - 3
4	- 824 + 1780	=	+ 956	+ 60 = + 1016	. + 8
mean	20.6938	+ 959		+ 41	= 20.6980

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MC 1034

1911 January 6.

	x	y
1	3.4268	13.6446
2	15.1552	30.3089
3	16.2796	11.3685
+	37.8236	29.7877
4	62.65	85.11
	15.66	21.28
	18	
	234	0.72
	31	4.65
	234	3.60
	702	432
	725	338
		334.80

				R.A.	Decl.
12	14	06	−	0 17	33
	20	08	+	1 52	36
	20	45	−	0 34	37
	26	42	+	1 49	08
4	81	41	+	2 49	34
12	20	25	+	0 42	24
	1	13	+	5	33
12	21	38	+	0 47	59

A = 12h 21m 38s

D = +0° 47′ 59″

Preliminary Reduction.

Star	x − 5	−66.54		+1385	
1	−477	−707	= −1384	= +1	incapable of
2	+630	−2015	= −1385	= 0	improvement
3	−629	−754	= −1385	= 0	
4	+596	−1981	= −1385	= 0	
mean	14.9847	−1376		= 14.98556	

Star	y − 7	+64.6		+24		−100 x
1	+762	+1270	= +982	+27	= +1009	= +1
2	−31	+970	= +939	+61	= +1000	= −8
3	−56	+1038	= +982	+23	= +1005	= −3
+	−824	+1780	= +956	+60	= +1016	= +8
mean	20.6938	+959		+41		= 20.6930

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MC1034 1913 Jan. 22. 22

Plate constants.

a	b	c		y − y
3.43	+ 13.64	+ 1	=	+ 1
15.16	+ 30.31	+ 1	=	− 8
16.22	+ 11.37	+ 1	=	− 3
27.82	+ 29.79	+ 1	=	+ 8

mean equations

a	b	c		
+ 9.30	+ 21.98	+ 1	=	− 3.50
+ 21.02	+ 20.58	+ 1	=	+ 2.50
+ 9.82	+ 12.50	+ 1	=	− 1.00
+ 21.49	+ 30.05	+ 1	=	0.00
− 11.72	+ 1.40		=	− 6.00
− 11.67	− 17.55		=	− 1.00
+ 11.67	− 1.39		=	+ 5.96
	− 18.94		=	+ 4.96

b = − 0.26

−11.72a = − 6.00 + 0.37 = − 5.63 a = + 0.48

− 3.5	+ 7.5	− 1.0	0.0
− 4.5	− 10.0	− 4.7	− 10.3
+ 5.7	+ 5.4	+ 3.3	+ 7.9
− 2.3	− 2.2	− 2.4	− 2.4

c

				c	O	O − c
+ 2	− 4	− 2	=	− 4	+ 1	+ 5
+ 7	− 8	− 2	=	− 3	− 8	− 5
+ 8	− 3	− 2	=	+ 3	− 3	− 6
+ 13	− 8	− 2	=	+ 3	+ 8	+ 5

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1913 Jan 22

Plate constants

a	b	c	y − y₁
3.43	+ 13.64	+ 1 =	+ 1
15.16	+ 30.31	+ 1 =	− 8
16.22	+ 11.37	+ 1 =	− 3
27.82	+ 29.79	+ 1 =	+ 8

mean equations

a	b	c	
+ 9.30	+ 21.98	+ 1 =	− 3.50
+ 21.02	+ 20.58	+ 1 =	+ 2.50
+ 9.82	+ 12.50	+ 1 =	− 1.00
+ 21.49	+ 30.05	+ 1 =	0.00

− 11.72 + 1.40 = − 6.00

− 11.67 − 17.55 = − 1.00

+ 11.67 − 1.39 = + 5.96

− 18.94 = + 4.96 b = − 0.26

− 11.72 a = − 6.00 + 0.37 − 5.63 a = + 0.48

− 3.5	+ 7.5	− 10	0.0
− 4.5	− 10.1	− 4.7	− 10.3
+ 5.7	+ 5.4	+ 3.3	+ 7.9
− 2.3	− 2.2	− 2.4	− 2.4

			C	O	O − C
+ 2 −	4	− 2	= − 4	+ 1	+ 5
+ 7 −	8	− 2	= − 3	− 6	− 5
+ 8 −	3	− 2	= + 3	− 3	− 6
+ 13 −	8	− 2	= + 3	+ 8	+ 5

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1034. 1913 Feb. 5.

Times Etc.

Expt. to stars 1911 Apr. 11	11h	39m		−	11h	48m
" " moon	11	43	44.3	−	11	43 44.5
clock fast		2	49.0			
H Sid T.	11	40	55.4			
H long.	4	44	31.05			
G. Sid T.	16	25	26.45			
Sid T. m. noon	1	14	20.09			
Interval	15	11	06.36			
Reduction	−	2	29.26			
G. M. T.	15	08	37.10			

From Am Eph.

Moon 15h	12h	19m	20.s75	+1°	16′	54.″9
Motion in 1m = 1.s8794				= 14.760		
" " 8.618	+		16.20	−	2	07.2
Tabular place	12	19	36.95	+1°	14′	47.″7
Moon's parallax		55′	57.″7			
" semidiam		15′	16.″5			

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1034. 1913 Feb. 5. 23

Trans Chr.

Expt stars 1911 Apr. 11	11	39		11	48	
moon	11	43	44.3	11	43	49.5
closest pass		2	49.0			
H Sid T.	11	40	55.4			
H long.	4	49	31.05			
G. Sid T.	16	25	26.45			
Sid T. in moon.	1	14	20.09			
Interval	15	11	06.36			
Reduction		2	29.76			
G. M. T.	15	08	37.10			

From Conn Ephs.

moon 15h	12h	19m	20.°75	+1°	16′	54.″9
Motion in l^m = 1.°8793			14.760			
" = 8,618			16.20	−	2.	07.2
Tabular place	12	19,	36.95	+1°	14′	47.″7
moon's parallax		55′	57.7			
" semidiam		15′	16.5			

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Pt	Pos. ∠.	Resid.
9	209°.7	+17
8	211.3	−41
7	249.6	− 2
6	270.0	−38
5	278.8	+95
4	311 0	−31
3	330.3	−46
2	0.0	+53
1	30.5	+ 1

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MC1034. 1913 Jan. 28.

Center of moon.

	x	$x - X_0$		Δx	$(x-X_0)^2$	$(x-X_0)^2+(y-Y_0)^2$	O-C
1	16.0000	+ 1.0124	−	2	1.02445	3.9407	− 89
2	15.0000	+ 0.0124	−	2	0.00001	3.9522	+ 26
3	14.0000	− 0.9876	−	2	0.97559	3.9475	− 21
4	13.4905	− 1.4971	−	1	2.24116	3.9511	+ 15
5	13.0204	− 1.9672	−	0	3.86699	3.9643	+ 147
6	13.0000	− 1.9876	−	0	3.95005	3.9505	+ 9
7	13.1247	− 1.8633	+	0	3.47119	3.9520	+ 24
8	13.9508	− 1.0368	+	1	1.07488	3.9413	− 83
9	14.0000	− 0.9876	+	2	0.97500	3.9468	− 28
					mean =	3.9496	0

	y	$y - Y_0$	Δy	$(y-Y_0)^2$
1	22.4002	+ 1.7074	+ 3	2.91662
2	22.6804	+ 1.9876	+ 4	3.95021
3	22.4164	+ 1.7236	+ 3	2.97118
4	22.0000	+ 1.3072	+ 3	1.70995
5	21.0000	+ 0.3072	+ 1	0.09449
6	20.6928	0.0000	0	0.00000
7	20.0000	− 0.6928	− 1	0.48001
8	19.0000	− 1.6928	− 3	2.86665
9	18.9692	− 1.7236	− 3	2.97118

Approximate center of moon.

$x = 14.0$ $y = 22.4164$

18.9692

41.3856

Mean y = 20.6928

y-mar = 22.6804

R = 1.9876

x-mn = 13.0000

X = 14.9876

$X_0 = 14.9876$

$Y_0 = 20.6928$

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MC 1054. 1913 Aug 28. 24

Centre of mass.

	x	$x - X_0$		Δ	$(x-X_0)^2$	$(x-X_0)^2 \cdot q$	o-c
1	16.0000	+1.0124	−	4	1.0245	3.9407	−89
2	15.0000	+0.0124	−	2	0.0001	3.9522	+26
3	14.0000	−0.9876	−	2	0.9753	3.9475	−21
4	13.4905	−1.4971	−	1	2.2416	3.9511	+15
5	13.0204	−1.9672	−	0	3.8699	3.9643	+147
6	13.0000	−1.9876	−	0	3.9505	3.9505	+9
7	13.1243	−1.8633	+	0	3.4719	3.9520	+24
8	13.9508	−1.0368	+	1	1.0748	3.9913	−83
9	14.0000	−0.9876	+	2	0.9753	3.9468	−28
					mean	3.9496	0

	y	$y - Y_0$		Δy	$(y-Y_0)^2$
1	22.4002	+1.7074	+	3	2.9162
2	22.6804	+1.9876	+	4	3.9521
3	22.4164	+1.7236	+	3	2.9718
4	22.0000	+1.3072	+	3	1.7095
5	21.0000	+0.3072	+	1	0.0944
6	20.6928	0.0000		0	0.0000
7	20.0000	−0.6928	−	1	0.4801
8	19.0000	−1.6928	−	3	2.8665
9	18.9692	−1.7236	−	3	2.9718

Approximate centre of mass.

$x = 14.0$ $y = 22.4164$

18.9692

41.3856

mean y 20.6928

y max 22.6804

R 1.9876

P 13.0000

X 1.4876

$X_0 = 14.9876$

$Y_0 = 20.6928$

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Formation of Normals.

No	ab	am	bm
1	+ 1.73	- 89.9	- 152.0
2	+ 0.02	+ 0.0	+ 51.8
3	- 1.70	+ 20.8	- 36.1
4	- 1.97	- 23.5	+ 19.6
5	- 0.61	- 290.0	+ 45.6
6	- 0.00	- 18.0	+ 0.0
7	+ 1.28	- 44.6	- 16.6
8	+ 1.76	+ 86.9	+ 140.0
9	+ 1.70	+ 27.7	+ 48.2
	+ 2.21	-331.1	+100.5

[aa] = +17.58 [bb] = +17.96

[ac] = -9.32 [bc] = +2.94 [cm] = 0

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MC 1034. 1913 Feb. 5

Morris Center.

Conditional Equations.

	a	b	c	O		C	O-C
1	+1.01	+1.71	+1	= −89		−58 +35 −67 = −90	+1
2	+0.01	+1.99	+1	= +26		−1 +41 −67 = −27	+53
3	−0.99	+1.72	+1	= −21		+59 +35 −67 = +25	−46
4	−1.50	+1.31	+1	= +15		+86 +27 −67 = +46	−31
5	−1.97	+0.31	+1	= +147		+113 +6 −67 = +52	+95
6	−1.99	+0.00	+1	= +9		+114 +0 −67 = +47	−38
7	−1.86	−0.69	+1	= +24		+107 −14 −67 = +26	−2
8	−1.04	−1.69	+1	= −83		+60 −35 −67 = −42	−41
9	−0.99	−1.72	+1	= −28		+57 −35 −67 = −45	+17

+166 −158

average (O-C) = 36.

Normal Equations.

$$+17.58 + 2.21 - 9.32 = -331$$
$$+2.21 + 17.96 + 2.94 = +100$$
$$-9.32 + 2.94 + 9.00 = 0$$

$\frac{\Delta a}{\Delta b} = +0.559$

$$-2.21 - 0.25 + 1.12 = +40$$
$$+9.32 + 1.12 - 4.95 = -176$$

$$+17.71 + 4.06 = +140$$
$$+4.06 + 4.05 = -176$$

$\frac{\Delta b}{\Delta c} = -0.229$

$$-4.06 - 0.93 = -32$$
$$+3.12 = -208$$

$c = -67$

$$-4.07 - 4.06 = +140$$
$$+13.64 = +280$$

$b = +20$

$$+7.01 - 2.21 - 6.76 = 0$$
$$+56.95 - 17.96 - 54.95 = 0$$

$$+24.59 - 16.08 = -331$$
$$+59.16 - 52.01 = +100$$

$$-18.29 + 16.08 = -31$$

$$+6.30 = -362$$

$a = -57$

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MC 1054. 1913 Feb. 5. 25

Moon's Centre.

Conditional Equations.

	a	b	c	O	C	O-C
1	+1.61	+1.71	+1	= −89	−58 +35 −67	= −90	+1
2	+0.01	+1.99	+1	= +26	− 1 +41 −67	= −27	+53
3	−0.99	+1.72	+1	= −21	+57 +35 −67	= +25	−46
4	−1.50	+1.31	+1	= +15	+86 +27 −67	= +46	−31
5	−1.97	+0.31	+1	= +147	+113 + 6 −67	= +52	+95
6	−1.99	+0.00	+1	= +9	+114 + 0 −67	= +47	−38
7	−1.86	−0.69	+1	= +34	+107 −24 −67	= +26	− 2
8	−1.04	−1.69	+1	= −83	+ 60 −35 −67	= −42	−41
9	−0.99	−1.72	+1	= −28	+ 57 −35 −67	= −45	+17

+106 −158

Average (O-C) = 36.

Normals Equations.

+17.58 + 3.21 − 9.32 = −331
+ 3.21 + 17.96 + 3.94 = +100
− 9.32 + 3.94 + 9.00 = 0

− 3.21 − 0.35 + 1.12 = + 40
+ 9.32 + 1.12 − 4.95 = −176

+17.71 + 4.06 = +140
+ 4.06 + 4.052 = −176

− 4.06 − 0.93 = − 32
+ 3.12 = −208 c = −67

− 4.07 − 4.06 = +140
+13.64 = +280 b = +20

+ 7.01 − 2.21 − 6.76 = 0
+56.95 − 17.96 − 54.95 = 0

+24.59 − 16.08 = −331
+52.16 − 52.01 = +100

−18.29 + 16.08 = − 31

+ 6.30 = −362 a = −57

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MC1034 1913 Feb. 6. 26

Moon's mean position (1911.0)

$X_0 = 14.98476$ $\quad Y_0 = 20.6928$

$\frac{1}{2}a = -29$ $\quad \frac{1}{2}b = +10$

14.98447 $\quad 20.6938$

from prelim Reduction — plate constants.

$X = 14.9856$ $\quad Y = 20.6930$

$ax =$ $\quad +.7$

$by =$ $\quad -5$

$c =$ $\quad -2$

$\xi = -3.0144$ $\quad \eta = -1.3070$

$\log \xi = 0.479920_n$ $\quad \log \tan \delta = 8.1358$

$\log \cos \delta = 9.99997$ $\quad \log \xi^2 = 0.9584$

$\log \text{const} = 8.50724$ $\quad \log \eta_1 = 6.1476$

$(\alpha - A) = 1.97199_m$ $\quad \eta_1 = +1$

$(\alpha - A) = -93.75$ $\quad \eta_0 = -1.3071$

$= -1\ 33.75$ $\quad \log \eta_0 = 0.11631_n$

$A = 12\ 21\ 38$ $\quad \log \text{const} = 7.33115$

$\alpha = 12^h\ 20^m\ 04^s.25$ $\quad (\delta - D) = 2.78516_m$

Reduction to apparent place $+1.34$ $\quad \delta - D = -609.8$

$\alpha' = 12\ 20\ 05.59$ $\quad = -10\ 09.8$

$D = +0\ 47\ 59$

$\delta = +0^\circ\ 37'\ 49''.2$

Reduction to apparent place -9.0

$\delta' = +0\ 37\ 40.2$

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MC 1034. 1913 Feb. 6. 26

Means mean position (1911.0).

X_0 = 14.9876 Y_0 = 20.6928
Σn = −29 Σn = +10
14.9847 20.6938

from photos Radcliffe
plate Cape Bird

X = 14.9856 Y = 20.6930
ax + 7
by − 5
c − 2

ξ = −3.0144 η = −1.3070

log S = 0.47920n log Tan S = 6.13588
S = 9.99997 ξ^2 = 0.9584
cosec = 8.50724 η_1 = 6.1476

G − A = 1.97199n η_1 = + 1
(G − A) = − 93.75 η_0 = −1.3071

= − 0 1 33 75 log η_0 = 0.11631n
cosec = 7331.5
A = 12 21 38 (G − D) = 12.78516n

A = 12 20 04.25 δ − D = − 609.8
= − 10 09.8

Radcliffe plane + 1.34 D = +0 47 59.

α' = 12 20 05.59 δ = +0° 37' 49.2

Radcliffe plane − 90

δ' = +0 37 40.2

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1034 Red. ad & alt.

H + α_0	4	48	=	72°	δ_0	+0°	38′
H	16	28	=				
α_0	12	20	=				
G	18	26					
G + α_0	6	46	=	101° 30′			

log cos δ_0 = 8.8801 n
∴ L = 00000
∴ (L) = 0.8801 n

log cos (G + α_0) = 9.2997 n
∴ q = 0.8743
∴ sin (G + α_0) = 9.9912
∴ tan δ_0 = 8.0435
∴ $\frac{1}{r}$ = 8.8239

log sin δ_0 = 8.0435
∴ cos (H + α_0) = 9.4900
∴ h = 1.2784
∴ sin (H + α_0) = 9.9782
∴ sec δ_0 = 0.0000
∴ $\frac{1}{r}$ = 8.8239

log (q′) = 0.1740 n
∴ (q) = 7.7329

log (h′) = 8819
∴ (h) = 00805

f	+0.13	(q′)	−1.49
(q)	+0.01	(h′)	+0.06
(h)	+1.20	(L)	−7.59
	+1.34		−9.02

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10 3.9 Red. ad R. asth.

$H+\alpha_0$	4^h	48^m	=	72°
H	16	28	=	
α_0	12	20	=	
G	14	26		
$G+\alpha_0$	6	46	=	$101^\circ\ 30'$

δ_0 $+0^\circ\ 38'$

log cos δ_0	=	0.99801 n
b	=	00000
(L)	=	0.99801 n

log cos $(G+\alpha_0)$	=	9.29997 n
q_8	=	0.87743
sin $(G+\alpha_0)$	=	9.99122
tang δ_0	=	8.04355
$\frac{1}{15}$	=	8.82239

log sin δ_0	=	8.04355
cos $(H+\alpha_0)$	=	9.49000
h	=	1.27844
sin $(H+\alpha_0)$	=	9.97822
sec δ_0	=	0.00000
$\frac{1}{15}$	=	8.82239

log (q')	=	0.17402 n
(q)	=	77329

log (h')	=	88119
(h)	=	00805

f	+0.13
(q)	+0.01
(h)	+1.20
	+1.34

(q')	−1.49
(h')	+0.06
(L)	−7.59
	−9.02

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1°34 Lunar parallax.

α' = 12h 20m 05s.59 ✓
θ = 11 40 55.4 ✓
$\theta - \alpha'$ = − 39 10.2 ✓
= − 9° 47′ 33″ ✓

− 3 31

− 9 44

9.957727
0.000000
000630
tan γ = 9.96357

γ = 42° 36′ 00.0
δ = + 0 37 40.2

$\gamma - \delta$ = 41 58 19.8

9.826640
8.211160
9.825528
0.16949
sin(Q−δ′) 8.03277

$\delta - \delta'$ = + 37 04.3

δ + 1 14 44.5

Am Eph δ = +1 14 47.7 ✓

O − C = − 3.2

~~Correction~~ − .6

final (O − C) − 3.8

δ' = + 0° 37′ 40.2 ✓
π = 55′ 57.7 ✓

9.869138 ✓
8.211160 ✓
9.230655 ✓
0.000010 ✓
sin($\alpha - \alpha'$) 7.311148 ✓

$\alpha - \alpha'$ = − 7′ 02.58 ✓
= − 28.17s ✓

Q = 12 19 37.42 ✓
α = 12 19 36.95 ✓

+ 0.47 ✓
+ 0.10
+ 0.57

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Lunar parallax.

α' : 12h 20m 05s.59
$\odot$: 11 40 55.4
$\odot - \alpha'$ = − 39 10.2
− 9° 47′ 33″

− 3 31

− 9 49

9.995727
0.000000
000630
tan ρ = 9.996357

ρ 42° 36′ 00″

δ : + 0 37 40.2

$\rho - \delta$ 41 58 19.8

9.826400
8.211600
9.825-28
0.016949
$\sin(\alpha - \delta')$ 8.032777

$\delta - \delta'$: + 37 04.3

δ + 1 19 44.5

Comp Ephs δ = +1 14 47.7

O − C = − 3.2

Correction = − .6

Corrected (O − C) − 3.8

δ' = + 0° 37′ 40.2″

π = 55′ 57″.7

9.869913
8.211600
9.230065 n
0.000010
$\sin(\alpha - \alpha')$ 7.311148 n

$\alpha - \alpha'$ = − 7′ 02.58
= − 28.17

α : 12h 19m 37.42s

α = 12 19 36.95

+ 0.47

+ 0.10

+ 0.57

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MC 1035 1913 Jan, 6. 31

Comp. Stars Standard Coordinates.

	1	2
α	$12^h\ 14^m\ 06^s.47$	$12^h\ 20\ 07.63$
A	12 21 26	12 21 26
α − A	− 7 19.53	− 1 18.37
Sec(α−A)	− 439.46	− 78.37
log	2.642 92 m	1.894 15 m
+ log s	9.999 99	9.999 77
= ξ_0	1.150 15 m	0.401 16 m
ξ_0	+ 14.130 3	− 2.518 6
η_0	− 90	− 5
η_1	3.860 7	15.480 9
x	3.755 4	15.608 3
x − ξ	− 1053	+ 1274

	1	2
δ	$-0^\circ\ 17'\ 33''.3$	$+1^\circ\ 52'\ 35''.9$
D	+ 0 48 13.	+ 0 48 13
δ − D	− 1 05 46.3	+ 1 04 22.9
tan(δ−D)	− 3946.8	+ 3863.4
log	3.596 25 m	3.586 97
+ ξ_0	0.927 40 m	0.918 12
= tanδ	7.708 1 m	8.515 4
+ ξ^2	2.300 3	0.802 3
= η_1	7.061 8 m	6.371 1
m_0	− 8.460 6	+ 8.281 7
m_1	− 12	+ 2
m	13.538 2	30.281 9
y	13.708 6	30.285 3
y − m	+ 1704	+ 34

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1914phae.proj.18

MC 1035 — 1915 Jan. 6 — 31

Comp. Star Standard Coordinates.

	1	2
x	$12^h\ 14^m\ 06^s.47$	$12^h\ 20\ 07.63$
A	12 21 26	12 21 26
x − A	− 7 19.53	− 1 18.37
Sdec(x−A)	− 439.46	− 78.37
log	2.64292 n	1.89415 n
Cos δ	9.99999	9.99977
ξ_0	1.15015 n	0.40116 n
ξ_0	+ 141303	− 2.5186
$3\eta_0$	− 90	− 5
3	38607	154809
2	3.7559	15.6083
2−3	− 1053	+ 1274

	1	2
δ	− 0° 17′ 33″.3	+ 1° 52′ 35″.9
D	+ 0 48 13.	+ 0 48 13
δ	− 1 05 46.3	+ 1 04 22.9
Sdec δ	− 3946.8	+ 3863.4
log	3.59625 n	3.58697
η_0	0.92740 n	0.91812
tan δ	7.70811 n	8.5154
52	23003	08023
η_0	7.0618 n	6.3711
n	− 8.4606	+ 8.2817
$3\eta_0$	− 12	+ 2
η	135382	302819
ξ	137086	30.2853
ξ − η	+ 1704	+ 34

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Comp. Stars — Standard Coords.

	3	4
α	$12^h\ 20\ 44.60$	12 26 41.72
A	12 21 26	12 21 26
α−A	− 0 41.40	+ 5 15.72
Sin(α−A)	− 41.40	+ 315.69
log	1.617000 n	2499 26
" cos δ	9.999998	9.999978
" ξ_0	0.12422 n	1.00628
ξ_0	−1.3311	+10.1456
ξ_1	− 4	+ 40
ξ	16.6685	28.1496
x	16.5308	28.2677
x−ξ	−1377	+1181

δ	−0° 34′ 36.9″	+1° 49′ 08.1″
D	+0 48 13	+0 48 13
δ−D	−1 22 49.9	+1 00 55.1
tan(δ−D)	− 49709	3655.5
log	3.696433 n	3.562955
" η_0	1.02758 n	0.89410
" tan δ	8.00308	8.5018
" ξ^2	0.2484	20126
" η_1	5.3048 n	7.5678
η_0	−10.6556	+7.83762
η_1	0	+ 37
η	11.3444	29.8399
y	11.3394	29.6697
y−η	− 50	−1702

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Comp. Stars – Standard Coords.

	3	4
x	$12^h\ 20\ 44.60$	$12\ 26\ 41.72$
A	$12\ 21\ 26$	$12\ 21\ 26$
x-A	$-\ 0\ 41.40$	$+\ 5\ 15.72$
cos(x-A)	$-\ 41.40$	$+\ 315.69$
log	1.617000	2.499926
log cos δ	9.999998	9.999978
ξ_0	0.12422	1.00628
ξ_0	−1.33111	+10.1456
ξ_1	− 4.1	+ 40
ξ	166685	28.1496
x	165308	28.2677
x-ξ	−1377	+1181

	3	4
δ	$-0^\circ\ 34'\ 36.9''$	$+1^\circ\ 49'\ 08.1''$
D	$+0\ 46\ 13$	$+0\ 46\ 13$
δ-D	$-1\ 22\ 49.9$	$+1\ 00\ 55.1$
cos(δ-D)	− 49709	3655.5
log	3.696437	3.562955
η_0	1.02758	089410
tan δ	9.00308	8.50188
ξ^2	02484	20126
η_1	53048	75678
η_0	−10.6556	+7.8362
η_1	0	+ 37
η	113444	29.8399
y	11.3394	29.6697
y-η	− 50	−1702

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Comparison Stars - see Obs. 16-17 measures.

1		4				><	
32.2	d		N		d		N
30.3	14541		13816		15374		15129
	11621	22	6720	19	78010	1	12680 80
	26		20		04		70
	29		05		57		29
	30.2915		.2912		32.2441		.2452
2							
20.3	15691		12489		17368		14288
13.7	8538	40	9633	30	11278	76	10361 64
	29		35		71		72
	81		82		61		90
	18.7148		.7146		20.3911		.3923
3							
19.5	17670		15568		18366		15787
32.6	14058	60	12170	09	13050	47	11092 92
	64		72		50		96
	66		54		48		81
	32.6606		.6607		19.4693		.4691
4	15040		17943		13990		18188
7.7	11724	38	11239	35	11300	12	10860 60
14.4	29		45		10		60
	30		40		90		89
	14.3307		.3299		7.7317		.7329

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MC 1635 1912 Nov. 29. 33

Comparison stars [illegible] p. 16-17
measures.

1							
32.2	d		N		d		N
30.3	14541		13816		15374		15129
	11621	22	6720	19	78101		12680 80
	26		20		04		70
	29		05		57		29
	30.2915		.2918		32.2441		.2452
2							
30.3	15691		12489		17368		14788
13.7	8588	40	9633	30	11778	76	10361 64
	89		35		71		72
	81		82		61		90
	13.7148		.7146		20.3911		.3923
3							
14.5	17670		15568		18366		11787
32.6	14058	60	12170	69	13050	47	11092 92
	64		72		50		96
	66		54		48		81
	32.6606		.6607		19.4693		.4691
4							
	18040		17943		13990		16188
7.7	11729	38	11239	35	11300	12	10860 60
14.4	29		41		10		60
	30		40		90		89
	14.3307		.3299		7.7317		.7329

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MC 1035. 1912 Nov. 29. 34.

Prints on Morris hints. measures.

	y		x	
	d	N	d	N
1				
21.6			14550	16068
25.0			11786 65-	8835- 30
			70	32
			30	60
			21.7223	.7230
2				
22.0	17921	16990		
24.5-	11928 08	12944 30		
	07	42		
	05-	87		
	24.5997	.5950		
3				
22.2			19188	16572
24.0			11091 10	14650 40
			00	44
			77	60
			22.1921	.1925
4				
22.2			18201	16498
23.6			10371 90	14316 19
max			79	10
in			90	97
x			22188	.2183
5				
22.1			18276	16440
23.0			9241 41	15451 52
			45-	50
			60	40
			22.0980	.0989
6				
22.0	17110	15571		
22.7	9289 65-	13390		
	89	9 -90		
	05	55-		
	22.7827	.7825		

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Positions of Nebulae.

	α	N	δ	N
21.6			19550	16668
5.0			11766 65	8835 30
			70	32
			30	60
			21.72278	.7230

22.0	17921		10990	
24.5	11928	08	12944	30
	07		42	
	05		87	
	24.59197		.5950	

	19188		16572	
10	11091	16	14650	40
	00		44	
	77		60	
	22.19221		.1925	

	18201		16498	
	10371	90	14316	19
	79		10	
	90		97	
	22.21888		.2183	

	18276		16440	
	9241	41	11451	52
	45		50	
	60		40	
	22.09880		.0989	

	17110		15571	
22.0	9289	65	13390	90
22.7	89		95	
	05		55	
	22.78227		.7825	

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MC1035 1912 Nov. 29 35

Points on Moon's limb - measures.

	d	N		d	N
7				16970	16728
21.3				9782,00	13847,57
22.0				90	40
				52	28
				21.2834	.2880
8	15380		18700		
21.0	6879,93		17206,96		
21.8	86		90		
	85		85		
	21.8495		.8499		
9					
20.2	14429		17640		
21.7	7457,69		14606,01		
min	66		01		
in	30		27		
8					
	21.6926		.6967		
10					
20.0	14111		17628		
21.7	6988,75		14714,22		
	86		22		
	64		17		
	21.7127		.7094		
11					
19.3				17976	18428
22.0				9721,66	16668,73
				17	68
				80	17
				19.1735	.1750
12					
19.0	16560		17420		
22.2	15350,53		8609,10		
	51		06		
	70		11		
	22.1210		.1196		

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MC1035 1912 Nov. 29. 35

From R to Dawes's limb - measures.

	x		N
	a		
	16970		16728
	9782	00	13847 57
	90		40
	52		28
	21.2834		.2880

S	15360		18700
21.0	6879	95	17206 96
21.8	86		90
	85		85
	21.8495		.8499

	14429		17640
21.7	7457	69	14606 01
	66		01
	30		27
	21.6966		.6967

	14111		17628
21.7	6988	75	14719 82
	86		72
	69		17
	21.7127		.7094

	17976		18428
19.3	9721	66	16688 72
20.0	17		68
	80		17
	19.1735		.1750

	16560		17420
22.2	15053		8609 10
	51		06
	70		11
	22.1210		.1196

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NC 1035 1913 Jan 6. 36

Mean measured Coords - Comp. Stars.
+ Coords of center of plate
Reseau reversed.

Star	x	y
1	3.7554	13.7086
2	15.6083	30.2853
3	26.5308	11.3394
4	28.2677	29.6697
4	64.16	85.00
	16.04	21.25
	-18	-22
	1.96	0.75
	31	465
	196	375
	588	450
	60.76	300
		348.75

Mean R.A.
$12^h\ 20^m\ 25^s$
$+\quad 1\ 01$
$12\ 21\ 26 = A$

Mean Decl
$+0^\circ\ 42'\ 24''$
$+\quad 5\ 49$
$+0\ 48\ 13$

Preliminary Reductions.

Star	x-3	-1404	-½x	+2974
1	-1053	-1919 = -2972	-2 = -2974	= 0
2	+1274	-4240 = -2966	-8 = -2974	= 0
3	-1377	-1588 = -2965	-8 = -2973	= +1
4	+1181	-4154 = -2963	-14 = -2977	= -3
Mean	15.7710	-2844 =	-8 =	= 15.7832

Star	y-n	+138x	+24	-2252
1	+1704	+518 = +2222	+27 = +2249	= -3
2	+54	+2154 = +2188	+60 = +2248	= -4
3	-50	+2281 = +2231	+23 = +2254	= +2
4	-1702	+3901 = +2199	+59 = +2258	= +6
Mean	20.8138	+2176	+41	= 20.3103

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NAC 1035 1913 June 6. 96

Preliminary Reductions of Plates of Star + Comet and comparison plates taken on second.

Star	x	y
1	3.7554	13.7086
2	15.6083	30.2853
3	6.5308	11.3394
4	28.2677	29.6697
+	6416	8500
	16.04	21.25
	1916	0.75
	31	465
	196	375
	588	450
	6076	300
		34875

Mean R.A.

$$\begin{array}{rrrr} & 12^h & 20^m & 25^s \\ + & & 1 & 01 \\ \hline & 12 & 21 & 26 = A \end{array}$$

Mean Decl.

$$\begin{array}{rrrr} + & 0^\circ & 42' & 34'' \\ + & & 5 & 49 \\ \hline + & 0 & 48 & 13 \end{array}$$

Preliminary Reductions.

Star	x - 3	-1404	$-\frac{1}{2}x$	+2979
1	-1053 - 1919	= -2972	-2 = -2974	= 0
2	+1274 - 4240	= -2966	-8 = -2974	= 0
3	-1377 - 1588	= -2965	-8 = -2973	+1
4	+1181 - 4154	= -2963	-14 = -2977	-3
Mean	15.7710 - 2844	=	-8 =	= 15.7832

Star	y - x	+1388	+24	-2252
1	+1704	+518 = +2222	+27 = +2249	= -3
2	+30	+2159 = +2188	+60 = +2248	= -4
3	-50	+2281 = +2231	+23 = +2254	= +2
4	-1702	+3901 = +2199	+59 = +2258	= +6
Mean	20.3138	+2176	+4.1	= 20.3903

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Plate constants.

Conditional Equations.

a	b	c		x − 3	y − 7
3.76	+ 13.71	+ 1	=	0	− 3
15.61	+ 30.29	+ 1	=	0	− 4
16.53	+ 11.34	+ 1	=	+ 1	+ 2
28.27	+ 29.67	+ 1	=	− 3	+ 6
+ 9.68	+ 22.00	+ 1	=	0.00	− 3.50
+ 22.40	+ 20.50	+ 1	=	− 1.00	+ 4.00
+ 10.14	+ 12.52	+ 1	=	+ 0.50	− 0.50
+ 21.94	+ 29.98	+ 1	=	− 1.50	+ 1.00
− 12.72	+ 1.50		=	+ 1.00	− 7.50
− 11.80	− 17.46		=	+ 2.00	− 1.50
+ 11.80	− 1.39		=	− 0.93	+ 6.95
	− 18.85 b		=	+ 1.07	+ 5.45
	b		=	− 0.06	− 0.29
− 12.72	= + 1.00 + 0.09		=	+ 1.09	− 7.50 + 0.44 = − 7.06
	a		=	− 0.09	+ 0.71

0.0	− 1.0	+ 0.5	− 1.5	− 3.5	+ 4.0	− 0.5	+ 1.0
+ 0.8	+ 1.9	+ 0.4	+ 1.9	− 5.4	− 12.5	− 5.6	− 12.2
+ 1.3	+ 1.2	+ 0.7	+ 1.7	+ 6.4	+ 5.9	+ 3.6	+ 8.7
+ 2.1	+ 2.1	+ 2.1	+ 2.1	− 2.5	− 2.6	− 2.5	− 2.5

				c	0	0 − c
−	0 − 1	+ 2	= + 1		0	− 1
−	1 − 2	+ 2	= − 1		0	+ 1
−	1 − 1	+ 2	= 0		+ 1	+ 1
−	2 − 2	+ 2	= − 2		− 3	− 1
+	2 − 4	− 3	= − 5		− 3	+ 2
+	9 − 9	− 3	= − 3		− 4	− 1
+	9 − 3	− 3	= + 3		+ 2	− 1
+	16 − 9	− 3	= + 4		+ 6	+ 2

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MC1035 1913 Jan 22

Star constant

Conditional Equations

a	b	c	x − 3	y − 4
3.76	+ 13.71	+ 1	= 0	− 3
15.61	+ 30.29	+ 1	= 0	− 4
16.53	+ 11.34	+ 1	= + 1	+ 2
28.27	+ 29.67	+ 1	= + 3	+ 6
9.65	+ 22.00	+ 1	= 0.00	− 3.50
22.40	+ 20.50	+ 1	= − 1.00	+ 4.00
10.14	+ 12.58	+ 1	= + 0.50	− 0.50
21.94	+ 29.98	+ 1	= − 1.50	+ 1.00
− 12.72	+ 1.50		= + 1.00	− 7.50
− 11.80	− 17.46		= + 2.09	− 1.50
+ 11.80	− 1.39		= − 0.93	+ 6.95
	− 18.85	b	= + 1.07	+ 5.45
		b	= − 0.06	− 0.29
− 12.72	+ 1.00	+ 0.09	= + 1.09	− 7.50 + 0.44 = − 7.06
		a	= − 0.09	+ 0.71

0.0	− 1.0	+ 0.5	− 1.5	− 3.5	+ 4.0	− 0.5	+ 1.0
+ 0.8	+ 1.9	+ 0.9	+ 1.9	− 5.4	− 12.5	− 5.6	− 12.2
+ 13	+ 12	− 0.7	+ 1.7	+ 6.4	− 5.9	+ 3.6	+ 8.7
+ 2.1	+ 2.1	+ 2.1	− 2.1	− 2.5	− 2.6	− 2.5	− 2.5

			C	O	O − C
−	0	− 1 + 2	+ 1	0	− 1
−	1	− 2 + 2	− 1	0	+ 1
−	1	− 1 + 2	0	+ 1	+ 1
−	2	− 2 + 2	− 2	− 3	− 1
+	2	− 4 − 3	− 5	− 3	+ 2
+	9	− 9 − 3	− 3	− 4	− 1
+	9	− 3 − 3	+ 3	+ 2	− 1
+	16	− 9 − 3	+ 4	+ 6	+ 2

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Times etc.

Eq. t Star 1911 Apr. 11	11h	50m		=	11h	59m	
" to moon	11	54	34.6s	−	11	54	34.8s
clock fast		2	49.0s				
H Sid T.	11	51	45.7s				
H Long.	4	44	31.05s				
G Sid T	16	36	16.75s				
Sid T to noon	1	14	20.09s				
Interval	15	21	56.66s				
Reduction		2	31.04s				
G.M.T.	15	19	25.62s				
From Am Eph.							
moon 15h	12h	19m	20.75s		+1°	16′	54.9″
Motion in 1m = 1.8792s				14.759s			
" " 19.427		+	36.50s	−		4′	46.7″
Tabula placa	12h	19m	57.25s		+1°	12′	08.2″
Moon's parallax			56′	57.5″			
" semidiam.			15′	16.5″			

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Times etc.

Sid. time Star 1911 Apr. 11	11h	50m		=	11h	59
" Moon	11	54	34.6	-	11	54 34.8
Short fact		2	49.0			
M Sid T.	11	51	95.7			
M Long.	4	44	31.05			
G Sid T.	16	36	16.75			
Sid. T at Noon	1	14	20.09			
Interval	15	21	56.66			
Reduction		2	31.04			
G. M. T.	15	19	25.62			

From Ann. Ephem.

Moon 15h	- 12	19m	10.75	+ 1°	16'	54.9
Motion in 1m = 1.8790				14.759		
19.427	+		36.50	-	4,	4 7
Tabular place	12	19m	57.25	+ 1°	12'	08.2

Moons parallax 56' 57.5

" semidiam. 15' 16.5

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Pt.	Pos ←.	Resid.
1	228°.8	−23
2	242.8	+71
3	261.0	−70
4	270.0	−15
5	290.2	+55
6	297.0	−68
7	328.0	+10
8	337.1	+87
9.	0.0	0
10	6.6	−48
11	32.0	−36
12	38.0	+32

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MC 1035 1913 Feb 5.

Moore's Center.

	36-x	x - X₀	Δx	(x-X₀)²	(x-X₀)²+(y-Y₀)²	O-C
1	14.2774	- 1.4950	+ 1	2.2350	3.9582	- 65
2	14.0000	- 1.7724	0	3.1414	3.9695	+ 48
3	13.8077	- 1.9647	0	3.8600	3.9576	- 71
4	13.7814	- 1.9910	0	3.9641	3.9641	- 6
5	13.9016	- 1.8708	0	3.4999	3.9728	+ 81
6	14.0000	- 1.7724	0	3.1414	3.9608	- 39
7	14.7143	- 1.0581	- 1	1.1198	3.9688	+ 41
8	15.0000	- 0.7724	- 1	0.5968	3.9761	+ 114
9	15.7724	0.0000	- 1	0.0000	3.9657	+ 10
10	16.0000	+ 0.2276	- 1	0.0518	3.9603	- 44
11	16.8258	+ 1.0534	- 1	1.1094	3.9584	- 63
12	17.0000	+ 1.2276	- 0	1.5070	3.9644	- 3

mean = 3.9647 +3

	44-y	y - Y₀	Δy	(y-Y₀)²
1	19.0000	- 1.3124	- 3	1.7232
2	19.4026	- 0.9098	- 2	0.8281
3	20.0000	- 0.3124	- 1	0.0976
4	20.3124	0.0000	0	0.0000
5	21.0000	+ 0.6876	+ 1	0.4729
6	21.2174	+ 0.9050	+ 2	0.8194
7	22.0000	+ 1.6876	+ 3	2.8490
8	22.1503	+ 1.8379	+ 4	3.3793
9	22.3034	+ 1.9910	+ 4	3.9657
10	22.2890	+ 1.9766	+ 4	3.9085
11	21.0000	+ 1.6876	+ 3	2.8490
12	21.8797	+ 1.5673	+ 3	2.4574

Approximate Center.

x = 14.0 y = 19.4026
21.2174
40.6200
mean y = 20.3100
y = max = 22.3034
R = 1.9934
x = min = 13.7814
mean x = 15.7748

y = 22.0 x = 14.7143
16.8258
31.5401
mean x = 15.7700
x = min = 13.7814
R = 1.9886
y = max = 22.3034
mean y = 20.3148

Adopt $\begin{cases} X_0 = 15.7724 \\ Y_0 = 20.3124 \end{cases}$

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Chromo Center.

	x	x − X₀	Δ z	(x − X₀)²	(x − X₀)² + (y − Y₀)²	o − c
1	14.2774	− 1.4950	+ 0	2.2350	3.9582	− 65
2	14.0000	− 1.7724	0	3.1419	3.9695	+ 48
3	13.8077	− 1.9647	0	3.8600	3.9576	− 71
4	13.7814	− 1.9910	0	3.9641	3.9641	− 6
5	13.9016	− 1.8708	0	3.4999	3.9728	+ 21
6	14.0000	− 1.7724	0	3.1419	3.9608	− 31
7	14.7143	− 1.0581	− 1	1.1198	3.9688	+ 41
8	15.0000	− 0.7724	− 1	0.5968	3.9761	+ 114
9	15.7724	0.0000	− 1	0.0000	3.9657	+ 10
10	16.0000	+ 0.2276	− 1	0.0518	3.9603	− 44
11	16.8258	+ 1.0534	− 1	1.1094	3.9584	− 63
12	17.0000	+ 1.2276	− 0	1.5070	3.9644	

	y	y − Y₀	Δ y	(y − Y₀)²
1	19.0000	− 1.3124	− 3	1.7232
2	19.4026	− 0.9098	− 2	0.8281
3	20.0000	− 0.3124	− 1	0.0976
4	20.3124	0.0000	0	0.0000
5	21.0000	+ 0.6876	+ 1	0.4729
6	21.2174	+ 0.9050	+ 2	0.8194
7	22.0000	+ 1.6876	+ 3	2.8490
8	22.1503	+ 1.8379	+ 4	3.3793
9	22.3034	+ 1.9910	+ 4	3.9657
10	22.2890	+ 1.9766	+ 4	3.9085
11	22.0000	+ 1.6876	+ 3	3.8490
12	21.8797	+ 1.5673	+ 3	2.4574

Approximate Center.

x = 14.0 y = 19.4026
21.2174
40.6200
mean y 20.3100
y = max 22.3034
R 1.9934
x = min 13.7814
mean x 15.7748

y = 22.0 x = 14.7143
16.8258
31.5401
mean x 15.7700
x = min 13.7814
R 1.9886
y = max 22.3034
mean y 20.3148

Adopt { X₀ = 15.7724
Y₀ = 20.3124

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Formation of normals.

No		ab		ac		bc
1	+	1.96	+	97.5	+	85.1
2	+	1.61	−	85.0	−	43.7
3	+	0.61	+	139.0	+	22.0
4	−	0.00	+	11.9		0.0
5	−	1.29	−	151.3	+	55.9
6	−	1.61	+	69.1	−	35.4
7	−	1.79	−	43.5	+	69.4
8	−	1.42	−	87.7	+	210.0
9		0.00		0.0	+	19.9
10	+	0.45	−	10.1	−	86.7
11	+	1.77	−	66.0	−	116.3
12	+	1.93	−	3.7	−	4.7
	+	2.22	−	129.8	+	175.5

$[aa] = +24.23$ $[bb] = +2435$

$[ac] = -10.18^v$ $[bc] = +9.83^v$ $[cn] = +3$

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Morris Center.

Conditional Equations.

	a	b	c	O	C	O-C
1	-1.50	-1.31	+1	= -65	+41 -37 -46 = -42	-23
2	-1.77	-0.91	+1	= +48	+49 -26 -46 = -23	+71
3	-1.96	-0.31	+1	= -71	+54 -9 -46 = -1	-70
4	-1.99	+0.00	+1	= -6	+55 0 -46 = +9	-15
5	-1.87	+0.69	+1	= +81	+52 +20 -46 = +26	+55
6	-1.77	+0.91	+1	= -39	+49 +26 -46 = +29	-68
7	-1.06	+1.69	+1	= +41	+29 +48 -46 = +31	+10
8	-0.77	+1.84	+1	= +114	+21 +52 -46 = +27	+87
9	0.00	+1.99	+1	= +10	0 +56 -46 = +10	0
10	+0.73	+1.98	+1	= -44	-6 +56 -46 = +4	-48
11	+1.05	+1.69	+1	= -63	-29 +48 -46 = -27	-36
12	+1.23	+1.57	+1	= -3	-34 +45 -46 = -35	+32

-260 +255

Average (O-C) = 43

Normal Equations.

a	b	c	
+24.23	+2.22	-10.18	= -130
+2.22	+24.35	+9.83	= +176
-10.18	+9.83	+12.00	= +3
-2.22	-0.20	+0.93	= +12
+10.18	+0.93	-4.27	= -55
	+24.15	+10.76	= +188
	+10.76	+7.73	= -52
	-10.76	-4.80	= -84
		+2.93	= -136
	-15.00	-10.76	= +72
	+9.15		= +260
+2.30	-2.22	-2.71	-1
+25.20	-24.35	-29.70	= -7
+26.53		-12.89	= -181
+27.42		-19.87	= +169
-17.80		+12.89	= -110
+8.73			= -241

$\frac{\Delta a}{\Delta c} = +0.461$

$\frac{\Delta b}{\Delta c} = -0.446$

c = -46

b = +28

a = -28

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Moving Cluster.

Conditional Equations.

	O		C	O-C
1	−1.50 −1.31 +1 : −65	+41 −37 −46 : −42		−23
2	−1.77 −0.91 +1 : +48	+49 −26 −46 : −23		+71
3	−1.96 −0.81 +1 : −71	+54 −9 −46 : −1		−70
4	−1.19 −0.00 +1 : −6	+55 0 −46 : +9		−15
5	−1.81 −0.69 +1 : +81	+52 +20 −46 : +26		+55
6	−1.77 −0.91 +1 : −39	+49 +26 −46 : +29		−68
7	−1.06 +1.69 +1 : +91	+39 +48 −46 : +31		+10
8	−0.77 +1.84 −1 : +119	+21 +52 −46 : +27		+97
9	0.00 +1.91 +1 : +10	0 +56 −46 : +10		0
10	+0.23 +1.98 +1 : −44	−6 +56 −46 : +4		−48
11	+1.05 +1.69 +1 : −63	−29 +48 −46 : −27		−36
12	+1.23 +1.57 +1 : 3	−34 +45 −46 : −35		+32

Normals Equations.

+24.23	+ 2.22	−10.18	= −130
+ 2.22	+24.35	+ 9.83	= +176
−10.18	+ 9.83	+12.00	= +3
− 2.22	− 0.20	+ 0.93	= + 12
+10.18	+ 0.93	− 4.27	= − 55
	+24.15	+ 10.76	= +188
	+10.76	+ 7.73	= − 52
	−10.76	− 4.80	= − 54
		+ 2.93	= −136
	−15.00	−10.76	= + 72
	+ 9.15		= +260

+ 2.30	− 2.22	− 2.71	= − 1
+25.20	−24.35	−19.70	= − 17
+26.53		− 12.89	= −121
+27.42		− 19.87	= +169
−17.80		+ 12.89	= −110
+ 8.73			= −241

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Moon's mean Position (1911.0)

$X_0 = 15.7724$ $\quad Y_0 = 20.3124$

$\frac{1}{2}a = -14 \quad +14$

$15.7710 \quad 20.3138$

From preliminary Reduction $X_0 = 15.7833$ $Y = 20.3093$

" computed plate constants ax: $-1 \quad +11$

by: $-1 \quad -6$

c $\quad +2 \quad -3$

$\xi = -.22168$

$\log \xi = 0.345733_n$

$\therefore \cos\delta = 9.999998$

$+ \text{const} = 8.507124$

$\therefore (\alpha - A) = 1.853851_n$

$\alpha - A = -1^m 08.98^s$

$A = 12\ 21\ 26$

$\alpha = 12^h\ 20^m\ 17.05^s$

Read add'l aft $+134$

$\alpha' = 12\ 20\ 18.39$

$\eta = -1.6896$

$\log \tan\delta = 8.13559$

$\therefore \xi^2 = 0.7108$

$\therefore \eta_1 = 1.9001$

$\eta_1 = +1$

$\eta_0 = -1.6897$

$\log \eta_0 = 0.227811_n$

$+ \text{const} = 7.331115$

$\therefore (\delta - D) = 2.89666_n$

$\delta - D = -788.4$

$= -13\ 08.4$

$D = 0\ 48\ 13$

$\delta = +0\ 35\ 04.6$

Read add'l aft -90

$\delta' = +0\ 34\ 55.6$

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VC 1035 1913 Feb 6.

Morris Mean Position (1911.0)

X_0 = 15.7724 Y_0 = 20.3179
− 14 + 14
15.7710 20.3193

From preliminary Reduction
computed plate constants

X_0 = 15.7852 Y_0 = 20.3103
a_x − 1 + 11
b_y − 1 − 6
J + 2 − 3

ξ = −2.2168
w_ξ = 0.34573 m
cos δ = 9.99998
const = 8.50724
(x − A) 1.83851 m

x − A = − 1 08.95
A 12 21 20
α 20 17.05
Read & apl. + 139
α 12 20 1839

η = −1.6896
log η = 8.12359
b_y = 0.7108
η_1 = 1.9001
+1
η_0 = −1.6897
w_η = 0.22781 m
const = 7.23115
(y − B) 28966 m
δ − D = − 788.4
− 13 08.3
D 0 48 13
δ + 0 35 04.7
Read & apl. − 9.0
δ + 0 34 55.7

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1035 Lunar Parallax.

α' 12h 20m 18.39s
Θ 11 51 45.7
Θ−α = 28 32.7
= − 7° 08' 10"

− 2 34

− 7 05 36

995727
0.000000
0.003389
tan f = 9.960616

f = 42 24 19.0
+ 0 34 55.7

f − δ = 41 49 23.3

9.826490
8.211588
9.824011
0.171111
sin(δ−δ') = 8.033100

δ − δ' = + 37 06.0

δ = +1 12 01.3

From Ephem δ = +1 12 08.2
Θ − c − 6.9
Correction + 5
− 6.1

δ' + 0° 34' 55.3"
π 55' 57.5"

9.869135
8.211588
9.094222
0.000010
sin(δ−δ') 7.175033

α − α' = − 5' 08.64"
− 20.58

α = 12 19 57.81
κ = 12 19 57.25
+ 0.56
− 4
+ 0.52

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1035 Lemon Parallax.

α' $12^h\ 20^m\ 18^s.39$
Θ $11\ 51\ 45^s.7$
$\Theta - \alpha$ $-\ 28\ 32^s.7$
$-\ 7^\circ\ 08'\ 10''$

$-\ 2\ 34$

$-\ 7\ 05\ 36''$

9.995727
0.000000
0.000339
$\tan(\Theta - \alpha')$ 9.996066

δ' $+0^\circ\ 34'\ 55''.6$
π $55'\ 57''.5$

9.869133
8.211588
9.094222
0.000010
$\sin(\delta - \delta')$ 7.175053

$\alpha - \alpha' = -\ 5'\ 08''.64$
$-\ 20^s.58$

γ $42\ 24\ 19.9$
δ' $0\ 34\ 55.7$

$\gamma - \delta$ $41\ 49\ 23.0$

9.826900
8.211588
9.824011
0.171111
$\sin(\alpha - \delta')$ 8.033310

$\delta - \delta' = 4\ 37\ 06.0$
δ $+1\ 12\ 01.6$
Corrected $\delta = +1\ 12\ 08.2$
O - C $-\ 6.6$
Corr. Hann. $+\ 5$
$-\ 6.1$

α $12\ 19\ 57.81$
$\alpha' = 12\ 19\ 57.25$
$+\ 0.56$
$-\ 4$
$+\ 0.52$

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MC 1049

Comparison Stars - Standard Coordinates

	1	no.	mag	2	no	mag.
C		2239	6.6		2243	8.2
C	16^h	19^m	$24^s.39$	16^h	21^m	$00^s.33$
L	not given					00.33
Prec.		+	39.48		+	40.32
α	16	20	03.87	16	21	40.65
A	16	22	24	16	22	24
α−A		− 2	20.13 ✓		− 0	43.35 ✓
sin(α−A)		−	140.13 ✓		−	43.35 ✓
log		2.146538 m				1.636999 m
log cos δ		9.963208 ✓				9.953458 ✓
log ξ₀		0.617697 m				0.097768 m ✓
ξ₀		−4.1397 ✓				−1.2522 ✓ ✓
		− 18 ✓				− 3 ✓
log η₀		13.85585 ✓				16.74745 ✓
η		14.38890 ✓				16.91027 ✓
η − ξ		+.5305 ✓				+1627 ✓

C	−23°	13′	46.″2	−26°	01′	51.″5
L	not given.					51.6
Prec	−	1	33.9	−	1	32.0
δ	−23	15	20.1 ✓	−26	03	23.6 ✓
D	−24	50	17	−24	50	17
δ−D	+1	34	56.9 ✓	− 1	13	06.6 ✓
sin(δ−D)	+		5698.4 ✓	−		4387.3 ✓
log		3.755755 ✓			3.642270 m	
log η₀		1.086900 ✓			0.973355 m	
− tan δ		9.63332 m			9.68933 m	
ξ²		12340 ✓			01954 ✓	
M₁		7.9206 m			69581 m	
η₀		+12.2151 ✓			−9.4048 ✓	
		− 83 ✓			− 9	
m′		34.2068			125943	
m		34.2860			12.6654	
y − m		+ 792			+ 711	

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MC 1049.

Comparison Stars. Equatorial Coordinates.

	1 No.	2 No.
	2259 6.6	2243 8.2
	$16^h\ 19^m\ 24^s.59$	$16^h\ 21^m\ 00^s.33$
L	not given	00.33
Prec.	+ 39.48	+ 40.32
	16 20 03.87	16 21 40.65
A	16 22 24	16 22 24
$\alpha - A$	− 2 20.13	− 0 43.35
$(\alpha - A)$	− 140.13	− 43.35
$\log x$	2.146533 n	1.636999 n
cos δ	9.996320	9.995345
ξ_0	061697 n	0.09768 −
η_0	−4.1397	−1.2527
η_1	− 18	− 3
η	13.8585	16.7475
η_2	14.3890	16.9102
$\alpha - \delta$	+5305	+1627
δ	−23° 13′ 46.2″	−26° 01′ 51.5″
L	not given.	51.6
Prec.	− 1 37.9	− 1 32.0
δ	−23 15 20.1	−26 03 23.6
D	−24 50 17	−24 50 17
$\delta - D$	+1 34 56.9	− 1 13 06.6
$\log(\delta - D)$	+ 5698.4	− 4387.3
$\log \xi$	3.755575	3.642270 n
$\log \eta_0$	1.048690	0.97335 n
$\tan \delta$	9.63532 n	9.6893 n
ξ^2	12540	0.1954
M_1	79206 n	69581 n
η_0	+12.2151	−9.4048
η_1	− 83	− 9
η	34.2068	125943
η_2	34.2860	126654
$(\alpha - \delta)_m$	+ 792	+ 7191

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Comparison Stars – Stand. Coords

	No. 3	No.	Mag
C		2254	6.2
C	16^h	25^m	$14^s.47$
L			.44
Mean			.46
Prec	+		40.42
α	16	25	54.88
A	16	22	24
α − A	+	3	30.88
sin(α − A)	+		210.87
log			2.324027
cos δ			9.952388
ξ₀			0.78364
η₀			+6.07683
ξ′			+ 26
ξ			24.07899
z			24.72031
z − ξ			+ 1242
C	− 26°	19′	11″.7
L			12.3
Mean			12.0
Prec	−		1 28.5
δ	−26	20	40.5
D	−24	50	17
δ − D	− 1	30	23.5
tan(δ − D)	−		5424.8
log			3.754388
η₀			1.06553
tan δ			9.6948
ξ²			15673
η₁			6.3155
η₀			−11.6286
η′			− .207
η			10.3507
y			10.2954
y − η			− 553

	4	No.	Mag.
		2261	8.7
	16^h	27^m	$48^s.51$
			54
			52
	+		39.85
	16	28	28.37
	16	22	24
	+	6	04.37
	+		364.33
			2.561507
			9.960388
			1.02912
			+10.6935
			+ 39
			28.6974
			29.1093
			+ 4119
	−	24°	04′ 42.″9
			.3
			.6
	−		1 26.0
	− 24		06 08.6
	− 24		50 17
	+		44 08.4
	+		2648.5
			3.423006
			0.75415
			9.65077
			20582
			8.7623
			+5.67774
			− 578
			27.6196
			27.4487
			−1707

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Comparison Stars + Stand. Circle

	No. 3	No. 4
	no 2254 mag 6.2	no 2261 8.7
C.	$16^h\ 25^m\ 14^s.47$	$16^h\ 27^m\ 48^s.51$
L	.44	.54
Mean	.46	.52
Prec	+ 40.42	+ 39.85
α	16 21 54.88	16 28 28.37
A	16 22 24	16 22 24
-A	+ 3 30.88	+ 6 04.37
(α-A)	+ 21.87	+ 364.33
	23240	2.56150
δ	9.95238	9.96058
cos δ	0.78364	1.02912
	+6.0763	+10.6935
	+ 26	+ 39
	24.0789	28.6974
	24.2031	29.1093
	+ 1242	+ 4119
C.	$-26°\ 19'\ 11''.7$	$-24°\ 04'\ 42''.9$
L	12.3	.3
Mean	12.0	.6
Prec	- 1 28.5	- 1 26.0
δ	-26 20 40.5	-24 06 04.6
D	-24 50 17	-24 50 17
-D	- 1 30 23.5	+ 44 08.4
(δ-D)	- 54 24.8	+ 2648.5
	3.75438	3.42300
	1.06553	0.75415
	9.6948	9.6507
	15673	20582
	6.3155	8.7623
	-11.6286	+5.6774
	- .207	- 578
	103507	276196
	102954	27.4487
	- 553	-1707

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Comparison stars - Measures.

	y d	y N	x d	x N
1/				
21.6	14285	18361	15885	14020
9.7	71343 2	154950 0	11995 9 0	79106 0 6
	35	50	88	04
	72	61	85	20
	9.7142	.7137	21.6106	.6113
2/ very faint				
19.1	17448	15679	16452	15217
31.3	14090 9 9	900102	73354 1	143111 5
	87	09	50	16
	51	63	50	16
	31.3357	.3336	19.0892	.0903
3/				
11.8	16841	15749	18250	18248
33.7	9789 8 9	127891	16211 1 8	10265 5 6
	89	92	05	59
	31	35	57	36
	33.7045	.7046	11.7960	.7978
4/				
6.9	14351	16974	17871	17110
16.5	8830 2 9	124818 4	16780 8 0	8206 0 1
	29	77	74	99
	40	68	76	10
	16.5516	.5510	6.8906	.8908

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MC 1049 1912 Dec. 3 63

Comparison stars - Measures.

	d	N		d	N
1					
16	14285	18361		15865	14020
17	71394 32	15495 00		11995 90	79106 06
	35	60		84	04
	72	61		85	20
	97142	.7137		21.6106	.6113
	I				
11	17448	15679		16452	15217
13	14090 99	900102		73355 41	143111 15
	87	09		50	16
	51	63		50	16
	31.3357	.3336		19.0892	.0903
18	16841	15749		18250	18248
37	97894	127891		16211 18	10265 56
	89	92		05	59
	31	35		57	36
	33.7045	.7046		11.7960	.7978
9	14351	16974		17871	17110
15	88302 29	124818 84		16780 90	82061 01
	29	77		74	99
	40	68		76	10
	16.5516	.5510		6.8906	.8908

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MC 1049. 1912 Dec 3. 64.

Moons Limb - measures.

	a	N	d	N
1		4		x
18.0	16111	16406		
20.7	83504 6	14109 26		
	35	21		
	11	08		
	20.7767	.7713		
2			16179	16343
17.8			13935 26	86040 0
21.0			35	96
			87	49
			17.7751	.7748
3				
17.4			16502	15401
22.0			9912 22	11976 70
			20	69
			99	02
			17.3418	.3429
4				
17.3			16479	15400
22.2			9743 41	12104 16
rim			49	15
m			77	08
x				
			17.3266	.3291
5				
17.5			15418	14432
23.0			10370 60	9434 50
			60	56
			08	20
			17.4950	.4979
6				
18.0	14386	17541		
23.6	75150 2	14430 18		
	09	31		
	81	50		
	23.6874	.6882		

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MC 1049. 1912 Dec 3. 64.

Moons - measures.

a	N
16111	16406
8350 46	19109 26
35	21
11	08
20.7767	.7713

16179	16343
13935 26	8 6400
35	16
87	49
17.7751	.7748

16502	15401
9912 22	11976 70
20	69
99	02
17.3418	.3429

16979	15400
9743 41	12104 16
49	15
77	04
17.3266	.3291

15418	14432
10370 60	9434 50
60	56
04	20
17.4950	.4979

14366	17541
7515 02	14430 18
09	31
81	50
23.6874	.6882

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MC 1049. 1912 Dec 3. 65

Nuovis Lenti - measures.

4.

	d	N
7/		
18.5		
24.0		
	very oblique	
8/		
19.0	18011	16756
24.1	16782 77	79445-6
	79	45
	04	52
	24.1231	.1196
9/	17990	16761
19.2	16657 5-9	80700 90
24.1	60	90
max	87	60
in		
y:	24.1331	.1325

x

d	N
15835	17408
10990 85	17155 5-0
87	51
30	00
18.5155	.5252

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MC 1049. 1912 Dec 3. 65

Nuova luce - (nebulae)

4

	d	N	d	N
16.5			15835	17408
24.0			109902.5	17155.50
			87	51
			30	00
			18.5155	.5252

19.0	180131	16756	
24.1	167812	77	7949.56
	79		45
	64		52
	241231		.1196

	17990	16761	
19.	166577	59	1807090
24.1	60		90
mean	97		60
	24.1331		1325

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MC 1049 1913 Jan 6. 66

Reseau reversca.

	x	y
1	14.3890	34.2860
2	16.9102	12.6654
3	24.2031	10.2954
4	29.1093	27.9487
4	84.61	84.70
	21.15	21.18
	-18	21
	3.15	0.82
	31	465
	315	410
	945	492
	97.65	328
		381.30

	R.A.	Decl.
	$16^h\ 20^m\ 07^s$	$-23^\circ\ 15'\ 20''$
	21 41	-26 03 24
	25 55	-26 20 40
	28 28	-24 06 09
	96 08	19 46 33
	16^h 24 02	-24 56 38
	- 1 38	+ 6 21
	16 22 24	-24 50 17

$A = 16^h\ 22^m\ 24^s$
$D = -24^\circ\ 50'\ 17''$

Preliminary Reduction

	x-3	-1694		+2x		+463	
1	+5305	-5794	= -489	+29	= -460	=	+3
2	+1627	-2140	= -513	+34	= -479	=	-16
3	+1242	-1740	= -498	+48	= -450	=	+13
4	+4119	-4640	= -521	+58	= -463	=	0
norm	16.7594	-3.6802		+34		=	16.4411

	y-m	+177x		+174		-3914	
1	+792	+2547	= +3339	+583	= +3922	=	+8
2	+711	+2993	= +3704	+216	= +3920	=	+6
3	-553	+4283	= +3730	+175	= +3905	=	-9
4	-1707	+5152	= +3445	+466	= +3911	=	-3
norm	21.7728	+2.967		+370		=	21.7151

Plate Constants + Reseau
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MC 1049 1913 Jan 6. 62

Reseau reversed.

	x	y	R.A.	Decl
1	14.3890	34.2860	$+16^h\ 20^m\ 04^s$	$-23^\circ\ 15'\ 20''$
2	16.9102	12.6654	21 41	−26 03 24
3	24.2031	10.2954	25 55	−26 20 40
4	29.1093	27.9487	28 28	−24 06 09
			96 08	19 46 33
			16^h 29 02	−24 56 38
			− 1 38	+ 6 21
			16 22 24	−24 50 17

4 | 84.61 | 8470
21.15 | 21.18
− 18 | 22
3.15 | 0.92
31 | 462
315 | 410
945 | 492
97.65 | 328
381.30

A = $16^h\ 22^m\ 24^s$
D = $-24^\circ\ 50'\ 17''$

Preliminary Reduction.

	x	y	− 1894	+ 2x	+ 463
1	+5305	−5794	= −489	+29 −460	= +3
2	+1627	−2140	= −513	+34 −479	= −16
3	+1242	−1740	= −498	+48 −450	= +13
4	+4119	−4640	= −521	+58 −463	= 0
From	16.7594	−3680		+34	= 16.4411

	y − m	+ 1777		+ 174		− 3914
1	+792	+2547	= +3339	+583	= +3922	= +8
2	+711	+2993	= +3704	+216	= +3920	= +6
3	−553	+4283	= +3730	+175	= +3905	= −9
4	−1707	+5152	= +3445	+466	= +3911	= −3
From	21.7728	+2967		+370		= 21.7151

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Times Etc.

Exp to stars 1911 Apr. 16	17h	28m		−	17h	32m
" " moon	17	27	24.0	−	17	27 24.3
clock fast		2	50.9			
H. Sid T.	17	24	33.25			
H Long	4	44	31.05			
G Sid T	22	09	04.30			
Sid T. M noon	1	34	02.86			
Interval	20	35	01.44			
Reduction		3	27.33			
G M T	20	31	39.11			

From Am Ephem R.A.

20h	− 16h	21m	12s.33	−	23	59 34.7
Motion in 1m = 2.1016			7.288			
" + 31.652	+ 1	06.52		−	3	50.7
Tabular place	16h	22m	18s.85	−	24	03 25.4

Moon's parallax 54′ 11″.0
semidiam 14 47.3

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MC1049 1913 Feb. 6. 67

Times Etc.

Sept. Eph. 1911 Apr. 16	17h 28m	–	17h 32m
Moon	17 27 24.0	–	17 27 24.3
Clock fast	2 50.9		
H. Sid. T.	17 24 33.25		
H. Long.	4 44 31.05		
G. Sid. T.	22 09 04.30		
Sid. T. in hour	1 34 02.86		
Interval	20 35 01.44		
Reduction	3 22.53		
G. M. T.	20 31 39.11		

From Ann. Ephem.	R.A.				
20h	16h 21m	12.33	–	23 59	34.7
Motion = 1m = 2.1024		7.259			
= 31.652	+ 1	06.52	–	3	50.8
Tabular place	16h 22m	18.88	–	24 03	25.4

Moon's parallax	54'	11.0
semidiam.	14	47.5

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Pt	Pos. ∠.	Resid
9	180.°0	−142
8	173.1	0
7	158.1	+120
6	139.7	+166
5	113.9	−185
4	90.0	+11
3	83.0	−19
2	49.7	+44
1	40.3	+6

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Moon's Center.

36 − x		x − X_0	Δx	$(x-X_0)^2$	$(x-X_0)^2+(y-Y_0)^2$	O − C
1	18.00000	+ 1.22296	+ 11	1.51466	3.64118	+ 135
2	18.22500	+ 1.44546	+ 9	2.11184	3.63900	+ 107
3	18.65776	+ 1.88872	+ 2	3.56223	3.61558	− 125
+4	18.67722	+ 1.90118	0	3.61168	3.61168	− 115
5	18.50336	+ 1.73332	− 6	3.00019	3.59554	− 329
6	18.00000	+ 1.22296	− 11	1.50972	3.63364	+ 81
7	17.47796	+ 0.70092	− 13	0.50126	3.64119	+ 136
8	17.00000	+ 0.22296	− 14	0.05021	3.63885	+ 102
9	16.77704	0.00000	− 14	0.00000	3.62794	+ 11
				mean	3.62833	+ 3

44 − y		y − Y_0	Δy	$(y-Y_0)^2$
1	23.22260	+ 1.45569	+ 26	2.12772
2	23.00000	+ 1.23309	+ 22	1.52206
3	22.00000	+ 0.23309	+ 4	0.05435
4	21.76911	0.00000	+ 0	0.00000
5	21.00000	− 0.76911	− 13	0.59135
6	20.31122	− 1.45569	− 26	2.12772
7	20.00000	− 1.76911	− 31	3.14077
8	19.87786	− 1.89105	− 33	3.58644
9	19.86773	− 1.90118	− 33	3.62944

Approximate Center

x = 18.0 y = 23.22260
20.31122
43.53382
mean y = 21.76911
y = min = 19.86773
R = 1.90118
x = max = 18.67722
mean x = 16.77704

X_0 = 16.77704
Y_0 = 21.76911

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Moon's Center

36 − x		x − X_0	Δx	$(x-X_0)^2$	$(x-X_0)+(y-Y_0)$	O − C
1	18.0000	+ 1.2296	+ 11	1.5146	3.6418	+ 135
2	18.2250	+ 1.4546	+ 9	2.1184	3.6390	+ 107
3	18.6576	+ 1.8872	+ 2	3.5623	3.6158	− 125
4	18.6722	+ 1.9018	0	3.6168	3.6168	− 115
5	18.5036	+ 1.7332	− 6	3.0019	3.5954	− 329
6	18.0000	+ 1.2296	− 11	1.5092	3.6364	+ 81
7	17.4796	+ 0.7092	− 13	0.5012	3.6419	+ 136
8	17.0000	+ 0.2296	− 14	0.0521	3.6385	+ 102
9	16.7704	0.0000	− 14	0.0000	3.6294	+ 11
					mean 3.6283	± 3

44 − y		y − Y_0	Δy	$(y-Y_0)^2$
1	23.2260	+ 1.4569	+ 26	2.1272
2	23.0000	+ 1.2309	+ 22	1.5206
3	22.0000	+ 0.2309	+ 4	0.0533
4	21.7691	0.0000	+ 0	0.0000
5	21.0000	− 0.7691	− 13	0.5935
6	20.3122	− 1.4569	− 26	2.1272
7	20.0000	− 1.7691	− 31	3.1407
8	19.8786	− 1.8905	− 33	3.5864
9	19.8673	− 1.9018	− 33	3.6294

Approximate Center

x = 18.0 y = 23.2260

20.3122

43.5382

mean y = 21.7691

y − min = 19.8673

R = 1.9018

x − max = 18.6722

mean x = 16.7704

X_0 = 16.7704

Y_0 = 21.7691

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Formation of Normals.

No		ab		an		bn
1	+	1.80	+	166.0	+	197.0
2	+	1.78	+	155.0	+	131.7
3	+	0.43	-	263.3	-	28.8
4		0.00	-	218.3		0.0
5	-	1.33	-	569.0	+	253.2
6	-	1.80	+	99.6	-	118.0
7	-	1.26	+	96.5	-	240.6
8	-	0.43	+	23.4	-	192.5
9		0.00	+	0.0	-	20.9
	-	0.81	-	510.1	-	18.9

[aa] = +15.88 [bb] = +16.78

[ac] = +10.37 [bc] = -4.87 [cn] = +3

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Morris Center

Conditional Equations.

	a	b	o	c
1	+ 1.23	+ 1.46	+ 1 : + 135	- 270 + 107 + 292 : + 129
2	+ 1.45	+ 1.23	+ 1 : + 107	- 319 + 90 + 292 : + 63
3	+ 1.89	+ 0.23	+ 1 : - 125	- 415 + 17 + 292 : - 106
4	+ 1.90	0.00	+ 1 : - 115	- 418 0 + 292 : - 126
5	+ 1.73	- 0.77	+ 1 : - 329	- 380 - 56 + 292 : - 144
6	+ 1.23	- 1.46	+ 1 : + 81	- 270 - 107 + 292 : - 85
7	+ 0.71	- 1.77	+ 1 : + 136	- 156 - 130 + 292 : + 6
8	+ 0.23	- 1.89	+ 1 : + 102	- 51 - 139 + 292 : + 102
9	+ 0.00	- 1.90	+ 1 : + 11	- 0 - 139 + 292 : + 153

Normal Equations.

a	b	c	
+ 15.88	- 0.81	+ 10.37 : - 510	$\frac{\Delta a}{\Delta c}$ = -0.640
- 0.81	+ 16.78	- 4.87 : - 19	
+ 10.37	- 4.87	+ 9.00 : + 3	
+ 0.81	- 0.04	+ 0.53 : - 26	
- 10.37	+ 0.53	- 6.77 : + 333	
	+ 16.74	- 4.34 : - 45	$\frac{\Delta b}{\Delta c}$ = +0.259
	- 4.34	+ 2.23 : + 336	
	+ 4.34	- 1.12 : - 12	
		+ 1.11 : + 324	
	- 8.49	+ 4.34 : + 653	
	+ 8.30	: + 608	
- 1.72	+ 0.81	- 1.50 : - 0	
+ 35.65	- 16.78	+ 31.00 : + 10	
+ 14.16		+ 8.87 : - 510	
+ 3484		+ 26.13 : - 9	
- 11.85		- 8.87 : + 3	
+ 2.31		: - 507	

	o - c
1	+ 6
2	+ 44
3	- 19
4	+ 11
5	- 185
6	+ 166
7	+ 130
8	0
9	- 142
	+ 357 - 346

average (o - c) = 78

c = + 292

b = + 73

a = - 220

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MC 1049 1913 Feb. 6 67

Harvard Center

Conditional Equations

	a	b	o		c
1	− 1.23	+ 1.46	+ 1	: + 135	− 270 + 107 + 292 : + 129
2	+ 1.45	+ 1.23	+ 1	: + 107	− 319 − 90 + 292 : + 63
3	+ 1.89	+ 0.23	+ 1	: − 125	− 415 + 17 + 292 : − 106
4	+ 1.90	0.00	+ 1	: − 115	− 418 0 + 292 : − 126
5	+ 1.73	− 0.77	+ 1	: − 329	− 380 − 56 + 292 : − 144
6	+ 1.23	− 1.46	+ 1	: + 81	− 270 − 107 + 292 : − 85
7	+ 0.71	− 1.77	+ 1	: + 136	− 156 − 130 + 292 : + 6
8	+ 0.23	− 1.89	+ 1	: + 102	− 51 − 139 + 292 : + 102
9	+ 0.00	− 1.90	+ 1	: + 11	− 0 − 139 + 292 : + 153

Normal Equations

a	b	c		o − c
+ 15.88	− 0.81	+ 10.37	= − 510	1 + 6
− 0.81	+ 16.78	− 4.87	= − 19	2 + 44
+ 10.37	− 4.87	+ 9.00	= + 5	3 − 19
				4 + 11
+ 0.81	− 0.04	+ 0.53	= − 26	5 − 185
− 10.37	+ 0.53	− 6.77	= + 333	6 + 166
				7 + 130
	+ 16.74	− 4.34	= − 45	8 0
	− 4.34	+ 2.23	= + 336	9 − 142
				+ 357 − 344
	+ 4.34	− 1.12	= − 12	Average (o − c) = 78
		+ 1.11	= + 324	c = + 292
	− 8.49	+ 4.34	= + 653	
	+ 8.30		= + 608	b = + 73

− 1.72	+ 0.81	− 1.50	= − 0
+ 35.65	− 16.78	+ 31.00	= + 10
+ 14.16		+ 8.87	= − 510
+ 3484		+ 26.13	= − 9
− 11.85		− 8.87	= + 3
+ 2.31			= − 507

a = − 220

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Morris mean position (1911.0)

$X_0 = 167704$ ✓ $\quad Y_0 = 217691$ ✓

-110 $\quad +37$

$= 16.7594$ ✓ $\quad 21.7728$ ✓

From preliminary reduction $Y = 164411$ ✓ $\quad Y = 217151$ ✓

plate constants Vol VIII p 22 $ax = +20 \quad -18$

$by = +2 \quad +5$

$c = -27$ ✓ $\quad +17$

$x = 16.4406 \quad 21.7155$ ✓

$\xi = -1.5594$ ✓

$\log \xi = 0.193796_n$

$\log \delta = 9.957722$ ✓

$\text{const} = 8.507124$

$(\alpha - A) = 1.728800_n$ ✓

$(\alpha - A) = -\quad 58.46$ ✓

$A \quad 16\ 22\ 24$ ✓

$\alpha = 16\ 21\ 30.54$ ✓

Red ad l aff $+120$

$\alpha' = 16\ 21\ 31.74$

$\eta = -0.2845$ ✓

$\log \tan \delta = 9.66574_n$ ✓

$\delta^2 = 0.3859$

$\eta_1 = 7.1047_n$

$\eta_1 = -13$ ✓

$\eta_0 = -0.2858$ ✓

$\log \eta_0 = 9.456209_n$

$\text{arc} = 733115$ ✓

$(\delta - D) = 2.120794_n$

$\delta - D = -\quad 132.1$ ✓

$= -\quad 2\ 12.1$ ✓

$D = -24\ 50\ 17$ ✓

$\delta = -24\ 52\ 29.1$ ✓

Red ad l aff $= \quad -8.8$

$\delta' = -24\ 52\ 37.9$

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MC1049 1913 Feb. 10, 70

Morris mean position (1911.0)

$X_0 = 16.7704 - 110 = 16.7594$ $\quad Y_0 = 21.7691 + 37 = 21.7728$

From preliminary reduction $X = 16.4411$ $\quad Y = 21.7151$
plate constants Vol XIII p. 22 $ax = +20$ $\quad -18$
$by = +2$ $\quad +5$
$c = -27$ $\quad +17$
$x = 16.4406$ $\quad 21.7155$

$\xi = -1.5594$
$\log \xi = 0.192966_n$
$\cos\delta = 995772$
const. 8.507124

$(\alpha - A) = 1.728006_n$

$(\alpha - A) = - \quad 53.46$

$A \quad 16\ 22\ 24$

$\alpha = 16\ 21\ 30.54$

Red. to app. $+ \quad 1.20$

$\alpha' = 16\ 21\ 31.74$

$\eta = -0.2845$

$\log \tan\delta = 9.66544_n$
$\delta_{52} = 0.3859$
$\eta_1 = 7.1047_n$

$\eta_1 = \quad -13$

$\eta_0 = -0.2852$
$\log \eta_0 = 9.454094_n$
arc $= 733.15$

$(\delta - D) = 2.120944_n$

$\delta - D = - \quad 132.1$
$= - \quad 2\ 12.1$

$D = -24\ 50\ 17.$

$\delta = -24\ 52\ 29.1$

Red. to app. $= \quad -8.8$

$\delta' = -24\ 52\ 37.9$

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1049

Rea. ade l. apph.

H+K	8ʰ	29ᵐ = 127°	15′
H	16	08	
α_0	16	21	
G	18	31	
G+K	10	52 = 163°	

δ_0 -24 52

log i = 0.8638n
∴ cos δ_0 = 9.9578
∴ (i) 0.8216n

log cos(G+K) = 9.9806n
∴ q = 0.8645
∴ sin(G+K) = 9.4659
∴ tan δ_0 = 9.6660n
∴ $\frac{1}{r_0}$ = 8.8239

log sin δ_0 = 9.6238n
∴ cos(H+α_0) = 9.7820n
∴ h = 1.2809
∴ sin(H+α_0) = 9.9009
∴ sec δ_0 = 0.0422
∴ $\frac{1}{r_0}$ = 8.8239

log (g′) 0.8451n
∴ (q) 8.8203n

log (h′) 0.6867.
(h) 0.0479

f + 0.15
g′ − 0.07
(K) + 1.12
+ 1.20

q′) − 7.00
K′) − 6.3
(i) + 4.86
− 8.77

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1049

Rea and l. afh.

H+K	8	29	= 127° 15'
H	16	08	
K_0	16	21	
G	14	31	
G+K	10	52	= 163°

δ_0 −24 52

log k = 0.8638−
log cos δ_0 = 9.9578
(c) 0.8216n

log cos(G+K) = 9.9806n
q = 0.8695
log(G+K) = 9.4659
tan δ_0 = 9.6600−
$\frac{1}{t_0}$ = 8.8239

log sin δ_0 = 9.6238n
cos(H+K_0) = 9.7820−
h = 1.2809
log(H+K_0) = 9.1009
sec δ_0 = 0.0422
$\frac{1}{t_0}$ = 8.8239

log(g') 0.8451−
(q) 8.8203−

log(h') 0.6867.
(-h) 0.0479

t	+	0.15	
q'	−	0.07	
h	+	1.12	
	+	1.20	

t_0'	−	7.00	
k'	−	6.63	
(c)	+	4.46	
	−	8.77	

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Second order refraction.

η	η^2
+12.21	149.08
− 9.40	88.36
−11.65	135.72
+ 5.62	31.36
	4 | 404.52
	101.13
	61

× +0.3 = +0.5

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1049

Lunar Parallax.

$\alpha' = 16^h\ 21^m\ 31^s.74$
$\odot = 17\ 24\ 33.25$
$\odot - \alpha = +1\ 03\ 01.51$
$= +15^\circ\ 45'\ 22''$

$+\quad 5\ 58$

$+15\ 39\ 24$

9.957727
0.600000
001642
997369

$\gamma = 43\ 15\ 55$
$-24\ 52\ 38$
$68\ 08\ 33$

9.827640
8.19757
9.967760
0.16405
8.155562

$\delta - \delta' = +49\ 12.6$

$\delta = -24\ 03\ 26.3$

Sun Eph $\delta = -24\ 03\ 25.4$

O − C -0.9

Corr to stand radius 0.0

Final (O − C) -0.9

$\delta' = -24\ 52\ 37.9$

$\pi = 54\ 11.0$

9.869113
8.19757
9.43383
003947
$\sin(\alpha - \gamma)$ 7.54000

$\alpha - \alpha' = +11'\ 55.20$
$= +47.68$

$\alpha = 16\ 22\ 19.42$

$\alpha = 16\ 22\ 18.85$

$+0.57$

-0.02

$+0.55$

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Lemaire Parallax

α' = 16h 21m 31s.74
Θ = 17 24 33.25
Θ−α = +1 03 01.51
= +15° 45' 22"

+ 5 58

+15 39 24

9.95727
0.00000
0.01642
9.97369

δ' = −24 52 37.9

Π = 54 11.0

9.86913
8.19757
9.43383
0.03947
(δ−δ') 7.54000

α−α' = +11m 55s.20

+ 47'.68

Y 43 15 55

−24 52 34

68 08 33

9.82640
8.19757
9.96760
0.16905
8.15562

δ−δ' = +49 12.6

δ = −24 03 26.3

Eph δ = −24 03 25.4

O−C − 0.9

Corr to stand radius 0.0

Final (O−C) − 0.9

α = 16h 22m 19.42

α = 16h 22m 18.85s

+ 0.57

− 0.02

+ 0.55

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