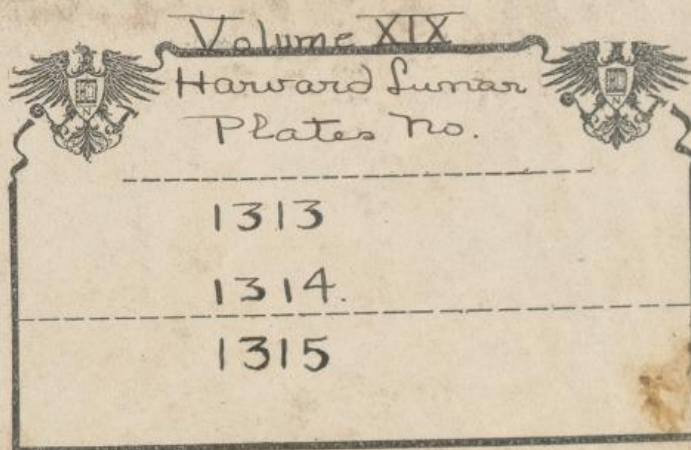


KG

11366
u.895



Harvard Lunar Plates
Measurements and Reductions.
Mary Fowler

Volume XIX

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MC1313				Standard Catalog				1913 May 6			
Cape No. 125 mag 8.4				allanys				Cape No. 142 mag 6.2			
C	0 ^h	53 ^m	09 ^s .00	0 ^h	52 ^m	15 ^s .22	0 ^h	59 ^m	41 ^s .70		
L			09						71		
E			01						68		
Mean	0	53	09.03				0	59	41.70		
Prece			+ 34.02		+ 1	51.32			+ 34.15		
α	0	53	43.05	0	54	06.54	1	00	15.85		
δ	0	58	06	0	58	06	0	58	06		
$(\alpha - A)$	-	4	22.95	-	3	59.46	+	2	09.85		
$\sin(\alpha - A)$			- 262.93			- 239.45			+ 129.85		
$\log \dots$			2.41984			2.37922			2.11344		
$\cos \delta$			9.99904			9.99908			9.99822		
$\dots \bar{\alpha}_0$			0.92612			0.88554			0.61890		
$\bar{\alpha}_0$			- 8.4356			- 7.6832			+ 4.1582		
$\bar{\alpha}_1$			- 1.5			- 1.1			+ 1.5		
$\bar{\alpha}$			9.5629			10.3157			22.1597		
$\dots \bar{\alpha}$			1.4214			12.1660			24.1550		
$\alpha - \bar{\alpha}$			+ 1.8585			+ 1.8503			+ 1.9953		
C	+ 3°	45'	22".8	+ 3°	31'	47".6	+ 5°	07'	12".85		
L			21.9						13.59		
E			23.0						13.18		
Mean	+ 3	45	22.9				+ 5	07	13.21		
Prece		+ 3	34.5		+ 1	1 42.5		+ 3	32.96		
δ	+ 3	48	57.4	+ 3	43	30.1	+ 5	10	46.2		
D	+ 3	44	20	+ 3	44	20	+ 3	44	20		
$\delta - D$		+ 4	37.4		- 0	49.9	+ 1	26	26.2		
$\tan(\delta - D)$			+ 277.4			- 49.9			+ 5187.3		
$\log(\delta - D)$			2.44311			1.69810			3.71494		
$\log \gamma_1$			4.77426			9.02925			1.04609		
$\dots \tan \delta$			8.8239			8.8136			8.9573		
$\dots \bar{\alpha}^2$			1.8522			1.7711			1.2378		
$\log m_1$			7.7295			7.6381			7.2485		
γ_0	+ 0.59465			- 0.1070			+ 1.11197				
γ_1	+ 536			+ 43			+ 18				
γ	22.6000			21.8973			33.1215				
γ	19.7244			19.0118			30.0709				
$\gamma - \gamma$			- 2.8756			- 2.8855			- 3.0506		

MC1213			Standard Corvado			1913 May 6		
Cape M. 13.5 mag 8.4			Cape M. 24.5 mag 7.6			Cape M. 19.2 mag 6.2		
C	0 ^h	53 ^m 09 ^s 00	0 ^h	52 ^m 15 ^s 22	0 ^h	59 ^m 41 ^s 70		
L		09				71		
E		01				68		
mean	0	53 09.03				0 59 41.70		
Pruc		+ 34 02		+ 1 51.32		+ 34.15		
X	0	53 43.05	0	54 06.54	1	00 15.85		
A	0	58 06	0	58 06	0	58 06		
X-A1	-	4 22.95	-	3 59.46	+	2 09.85		
m(X-A1)		- 262.93		- 239.45		+ 129.85		
wg.		2.41984		2.37922		2.11344		
cos		9.99904		9.99908		9.99822		
Σ ₀		0.92612		0.88554		0.61890		
Σ ₀		- 8.4356		- 7.6832		+ 4.1582		
Σ ₁		- 15		- 11		+ 15		
Σ ₂		9.5629		10.3157		221597		
Σ ₃		11.4214		12.1660		241550		
-Σ		+ 18585		+ 1.8503		+ 19953		
C	+ 3°	45' 22".8	+ 3°	31' 47".6	+ 5°	07' 12".85		
L		22.9				13.59		
E		23.0				13.18		
mean	+ 3	45 22.9			+ 5	07 13.21		
mc		+ 3 34.5		+ 1 1 42.5		+ 3 32.96		
S	+ 3	48 57.4	+ 3	43 30.1	+ 5	10 46.2		
D	+ 3	44 20	+ 3	44 20	+ 3	44 20		
S-D		+ 4 37.4		- 0 49.9	+ 1	26 26.2		
S-D-D)		+ 2 77.4		- 49.9		+ 5 18.73		
g(S-D)		2.44311		1.69810		3.71494		
g ₃		9.77426		9.02925		1.04609		
h ₀		8.8239		8.8136		8.9573		
h ₁		1.8522		1.7711		1.2378		
h ₂		7.7295		7.6381		7.2485		
h ₀		+ 0.5946		- 0.1070		+ 11.1197		
h ₁		+ 50		+ 43		+ 18		
h ₂		226000		21.8973		331215		
h ₃		17.7244		19.0118		30.0709		
h ₄		- 28756		- 28855		- 30506		

NIC1313

Standard Coordinates

1913 May 6/2

Cape no. 144⁴ mag 6.4

Cape no. 146 mag 8.0

C	1 ^h 00 ^m	38 ^s 76
L		76
E		73
Mean	1 00	38.75
Prece		+ 34.08
α	1 01	12.83
A	0 58	06
$\alpha - A$	+ 3	06.83
$\sin(\alpha - A)$		+ 186.82
$\log$	2.271	43
$\cos$	9.998	70
$\sin$	0.777	37
Σ	+ 5989	25
Σ_1		+ 95
Σ	2399	02
Σ	2590	97
$\Sigma - \Sigma_1$	+ 1919	5
C	+ 4 ^o 22	33.3
L		33.0
E		32.6
Mean	+ 4 22	33.0
Prece	+ 3	31.5
S	+ 4 26	04.5
D	+ 3 44	20
$S - D$	+ 41	44.5
$\tan(S - D)$		+ 2504.6
$\log$	3.398	44
$\sin$	0.729	89
$\tan S$	8.887	9
Σ	1.554	7
Σ	7.496	0
Σ	+ 5.369	0
Σ	+ 31	
Σ	2737	21
Σ	24.29	94
$\Sigma - \Sigma_1$	- 3.072	7

C	1 ^h 00 ^m	56.24
L		29
E		28
Mean	1 00	56.27
Prece		+ 33.98
α	1 01	30.25
A	0 58	06
$\alpha - A$	+ 3	24.25
$\sin(\alpha - A)$		+ 204.24
$\log$	2.310	14
$\cos$	9.999	48
$\sin$	0.816	86
Σ	+ 6.555	92
Σ_1		+ 15
Σ	24.56	07
Σ	26.31	56
$\Sigma - \Sigma_1$	+ 1.754	9
C	+ 2 ^o 44	22.7
L		23.1
E		22.3
Mean	+ 2 44	22.7
Prece	+ 3	32.7
S	+ 2 47	55.4
D	+ 3 44	20
$S - D$	- 56	24.6
$\tan(S - D)$		- 3384.9
$\log$	3.529	55
$\sin$	0.860	70
$\tan S$	8.689	2
Σ	1.633	7
Σ	7.376	3
Σ	- 7.255	60
Σ	+ 24	
Σ	14.74	54
Σ	11.66	60
$\Sigma - \Sigma_1$	- 3.079	4

NIC1313

Standard Coordinates

1913 May 6

Cape no. 144⁴ mag 6.4

Cape no. 146 mag 8.1

C	1 ^m 00 ^m 38.76
L	76
B	73
Mean	1 00 38.75
Proc	+ 340 ⁵
S	1 01 12.83
A	0 58 06
S-A	+ 3 06.83
sin(S-A)	+ 186.82
log	2.27143
cos	9.99870
Σ	0.77737
Σ	+598925
Σ	+95
T	239902
X	259097
X-Σ	+19195

C	1 ^m 00 ^m 56.24
L	29
B	28
Mean	1 00 56.27
Proc	+ 339 ⁸
S	1 01 30.25
A	0 58 06
S-A	+ 3 24.25
sin(S-A)	+ 204.24
log	2.31014
cos	9.99948
Σ	0.81686
Σ	+6.5592
Σ	+15
T	24.5607
X	26.3156
X-Σ	+17549

C	+4° 22 33.3
L	33.0
B	32.6
Mean	+4 22 33.0
Proc	+ 3 31.5
S	+4 26 04.5
D	+3 44 20
S-D	+ 41 44.5
tan(S-D)	+2504.6
log	3.39894
Σ	0.72989
tan δ	8.8879
Σ	1.5547
Σ	7.9960
Σ	+53690
Σ	+ 31
Σ	273721
Σ	242994
Σ	-3.0727

C	+2 44 22.7
L	23.1
B	22.3
Mean	+2 44 22.7
Proc	+ 3 32.7
S	+2 47 55.4
D	+3 44 20
S-D	- 56 24.6
tan(S-D)	- 3384.9
log	3.52955
Σ	0.86070
tan δ	8.6892
Σ	1.6337
Σ	7.3763
Σ	-7.2560
Σ	+ 24
Σ	14.7454
Σ	16.6660
Σ	-3.0794

MC 1313

1913 May 6.

Plate Center

R.A.

Decl.

x	y	h	k	l	x	y	l
11.42	19.72	0	53	43	+3	48	57
1217	19.01	0	54	06	+3	43	30
2416	30.07	1	00	16	+5	10	46
2591	24.30	1	01	13	+4	26	04
26.31	26.67	1	01	30	+2	47	55
59997	119.77	4	50	42	19	57	12
1999	2395	0	58	08	3	59	26
-18	22	-	1	02	-15	06	
2.00	195	0	58	06	3	44	20
31	465						
62	906						

Center $\left\{ \begin{array}{l} X = 0^h 58^m 06^s \\ Y = +3^{\circ} 44' 20'' \end{array} \right.$

Preliminary Reduction

x	y	h	k	l	x	y	l
20-7	-1314	-	-	-	-1.5992	-	-
+1.8585	-2584	+1.6001	-11	+1.5990	-2		
+1.8103	-2491	+1.6012	-12	+1.6000	+8		
+1.9953	-3939	+1.6014	-24	+1.5990	-2		
+1.9195	-3183	+1.6012	-26	+1.5986	-6		
+1.7549	-1528	+1.6021	-26	+1.5995	+3		
17.6167	-2865	-18			-1.57292		

x	y	h	k	l	x	y	l
4-7	+1372	+2.7188					
-2.8756	+1565	-2.7191	-3				
-2.8815	+1667	-2.7188	0				
-3.0106	+3309	-2.7197	-9				
-3.0727	+3550	-2.7177	+11				
-3.0794	+3605	-2.7189	-1				
-1.8681	+2413				2.48282		

MC1313 - Comp. Stars - Measures 1913 Mar. 7. 3

irregular

	<i>d</i>	<i>N</i>	<i>d</i>	<i>N</i>
1	16646	17429	18134	16672
11.4	938509	1466062	12342	1245657
19.7	9096	5962	4539	507
mag.	49	30	30	70
84				

19.7257 .7231 11.4212 .4217

2	11650	996270	15930	15405
12.2	1153040	70	7581	1375040
19.0	40	98.43	9086	45
			25	00

19.0113 .0124 12.1660 .1659

3 *look up ident. food*

24.2	17860	14986	15221	117927
30.1	1715050	5692	674953	1686829
	45	9590	5653	60
mag	50	85	10	20
6.2				

30.0711 .0707 24.1541 .1560

4				
25.8	17670	16419	17504	17521
24.4	1467066	9412	16590	8420
mag	73	0710	9092	11720
64	67	20	00	26

24.2999 .2990 25.9087 .9007

5				
26.6	15366	15929	17387	16178
11.4	867580	1257580	1052020	1301010
mag	80	7980	16	1010
80	40	19	65	66

24.6668 .6652 26.3147 .3164

MC 1313

1913 May 6.

Plate Center

R.A.

Decl.

x	y	h	m	s	h	m	s
11.42	19.72	0	53	43	+3	48	57
12.17	19.01	0	54	00	+3	43	30
24.16	30.07	1	00	16	+5	10	46
25.91	24.30	1	01	13	+4	26	04
26.31	26.67	1	01	20	+2	47	55
5 99.97	119.77	4	50	42	19	57	12
19.99	23.95	0	58	08	3	59	26
-1.8	-22	-	1	02	-	15	06
2.00	1.95	0	58	06	3	44	20
3.5	4.65						
62	906						

Center { $\Delta = 0^h 58^m 06^s$
 $\Delta \rho = +3 \ 44 \ 20$

Preliminary Reduction

26-3	-1314	-x	-1.5992		
+1.8585	-2584	+1.6001	-11	+1.5990	-2
+1.8503	-2491	+1.6012	-12	+1.6000	+8
+1.9955	-3939	+1.6014	-24	+1.5990	-2
+1.9195	-3183	+1.6012	-26	+1.5986	-6
+1.7549	-1528	+1.6021	-26	+1.5995	+3
moon	17.6167	-2865	-1.5		
					=1.57292

4-7	+1372	+2.7188
-2.8756	+1565	= -2.7191 = -3
-2.8815	+1667	= -2.7188 = 0
-3.0506	+3309	= -2.7197 = -9
-3.0727	+3550	= -2.7177 = +11
-3.0794	+3605	= -2.7189 = -1
note		
21.8681	+2413	= 24.8

Tables a ~ -1.0 a ~ +2.8 a ~ -1.8 b + a ~ -3.5
 a ~ +0.8 a ~ +0.1 a ~ -0.7 b + a ~ -6.4

MC1313 - Comp. Stars - Measures

1913 Mar. 21.

3

Reseau reversed.

<i>irregular in size</i>	α	δ	α	δ
1	16646	17429	18131	16672
11.4	938509	1466062	12342	1245657
19.7	9096	59	45-39	5-0
mag	49	30	30	70
59				
	<u>19.7257</u>	<u>.7231</u>	<u>11.4212</u>	<u>.4217</u>
2	11650	996270	15930	15405
12.2	1153040	70	7581	1375040
19.0	40	9843	9086	4540
			25	00
	<u>19.0113</u>	<u>.0124</u>	<u>12.1660</u>	<u>.1659</u>
3	look up identification			
B+2	17860	14986	15221	17927
30.1	1715050	5692	674953	1636869
	45	9590	56	60
mag	50	85	10	20
6.2				
	<u>30.0711</u>	<u>.0707</u>	<u>24.1541</u>	<u>.1560</u>
4				
25.8	17670	16419	17504	17521
24.4	1467066	941210	1659092	842020
mag	73	07	90	1720
64	67	20	00	26
	<u>24.2999</u>	<u>.2990</u>	<u>25.9087</u>	<u>.9007</u>
5				
26.6	15366	15929	17387	16178
11.4	867580	1257580	1052020	1301010
	80	7980	16	10
mag	40	19	65	66
8.0				
	<u>26.6668</u>	<u>.6652</u>	<u>26.3147</u>	<u>.3164</u>

MC1313 *on measures*

1913 May 21

4

Researcher

$$\begin{array}{r} 1 \\ 15.8 \\ 23.0 \end{array}$$

$$\begin{array}{r} 16406 \\ 14195 \\ 05 \\ 10 \end{array}$$

$$\begin{array}{r} 15286 \\ 644450 \\ 50 \\ 80 \\ 8833 \end{array}$$

$$\underline{15.8793}$$

$$\underline{8833}$$

$$\begin{array}{r} 2 \\ 16.0 \\ 23.2 \end{array} \begin{array}{r} 14540 \\ 1296780 \\ 5080 \\ 39 \\ 23.1570 \end{array}$$

$$\begin{array}{r} 15036 \\ 659288 \\ 9688 \\ 40 \\ 1553 \end{array}$$

possibly on phase limb

$$\begin{array}{r} 3 \\ 17.0 \\ 23.8 \end{array} \begin{array}{r} 18456 \\ 996868 \\ 5868 \\ 50 \\ 23.8486 \end{array}$$

$$\begin{array}{r} 18143 \\ 1662020 \\ 20 \\ 48 \\ 8476 \end{array}$$

$$\begin{array}{r} 4 \\ 17.6 \\ 23.9 \\ \text{max} \end{array} \begin{array}{r} 1215548 \\ 4648 \\ 11548 \end{array}$$

$$\begin{array}{r} 13680 \\ 1307480 \\ 7880 \end{array}$$

$$\begin{array}{r} 5 \\ 23.9398 \end{array}$$

$$\underline{9397}$$

$$\begin{array}{r} 5 \\ 18.0 \\ 23.9 \end{array} \begin{array}{r} 1148890 \\ 9190 \\ 10513 \\ 23.9023 \end{array}$$

$$\begin{array}{r} 12718 \\ 1174660 \\ 60 \\ 9037 \end{array}$$

$$\begin{array}{r} 6 \\ 19.0 \\ 23.4 \end{array} \begin{array}{r} 17411 \\ 1331001 \\ 1201 \\ 90 \\ 23.4094 \end{array}$$

$$\begin{array}{r} 15658 \\ 975045 \\ 5045 \\ 62 \\ 4088 \end{array}$$

$$\begin{array}{r} 7 \\ 19.4 \\ 23.0 \end{array}$$

$$\begin{array}{r} 16622 \\ 1010503 \\ 0503 \\ 19 \end{array}$$

$$\begin{array}{r} 16100 \\ 1259400 \\ 8900 \\ 74 \end{array}$$

19.3484

3504

Mc1313 *Spoon-measures*

1913 May. 21.

Riseaunereuse

4

1
15.8
23.0

16406
1419500
05
10

15286
6444.50
50
80
8833

15.8793

2
16.0 14540
23.2 1296780
5080
59
23.1570

15036
659288
96
40
.1553

possibly on
phase limit

3
17.0 18456
23.8 996868
58
50
23.8486

18143
1662020
20
48
.8476

4
17.6 12155
23.9 4648
max 11548
in

13680
1307480
7880

5
23.9398

.9397

5
18.0 1148890
23.9 9190
10513
23.9023

12718
1174660
60
.9037

6
17.0 17411
23.9 1331401
1201
90
23.4094

15658
975045
50
62
.4088

7
9.4
3.0

16622
10105
6503
19

16100
1259400
89
74

19.3484

.3504

MC1313 Moon Measures.

1913 Mar. 21. 5
Research reversed.
$$\begin{array}{r} 8 \\ 19.6 \\ 22.0 \end{array}$$

$$\begin{array}{r} 15578 \\ 12320 \\ 1910 \\ 98 \\ 19.6738 \end{array}$$

$$\begin{array}{r} 14976 \\ 8223 \\ 2015 \\ 64 \\ 19.6749 \end{array}$$

$$\begin{array}{r} 9 \\ 19.7 \\ 21.8 \\ \text{max} \\ 72 \end{array}$$

$$\begin{array}{r} 15578 \\ 12339 \\ 4049 \\ 72 \\ 19.6767 \end{array}$$

$$\begin{array}{r} 14945 \\ 8160 \\ 5058 \\ 35 \\ 19.6782 \end{array}$$

$$\begin{array}{r} 10 \\ 19.5 \\ 21.0 \end{array}$$

$$\begin{array}{r} 14660 \\ 9580 \\ 8893 \\ 51 \\ 19.4932 \end{array}$$

$$\begin{array}{r} 14861 \\ 9911 \\ 0019 \\ 71 \\ 19.4956 \end{array}$$

$$\begin{array}{r} 11 \\ 19.0 \\ 20.4 \\ 18500 \\ 15270 \\ 5972 \\ 12 \\ 20.3237 \end{array}$$

$$\begin{array}{r} 17680 \\ 1088000 \\ 98 \\ 65 \\ 19.3223 \end{array}$$

$$\begin{array}{r} 12 \\ 18.4 \\ 20.0 \end{array}$$

rough

MC1313 Moon measures.

1913 Mar. 21. 5
Research reversed.
$$\begin{array}{r} 8 \\ 19.6 \\ 22.0 \end{array}$$

$$\begin{array}{r} 9 \\ 19.7 \\ 21.8 \\ \text{max} \\ \sim \\ \sim \end{array}$$

$$\begin{array}{r} 10 \\ 19.5 \\ 21.0 \end{array}$$

$$\begin{array}{r} 11 \\ 19.0 \\ 20.4 \end{array} \begin{array}{r} 18500 \\ 1527072 \\ 59 \\ 12 \\ \hline 20.3237 \end{array} \begin{array}{r} 17680 \\ 1088000 \\ 98 \\ 65 \\ \hline 3223 \end{array}$$

$$\begin{array}{r} 12 \\ 18.4 \\ 20.0 \end{array} \text{rough D.}$$

$$\begin{array}{r} 15578 \\ 12320 \\ 1910 \\ 98 \\ \hline 19.6738 \end{array}$$

$$\begin{array}{r} 15578 \\ 1233949 \\ 4049 \\ 72 \\ \hline 19.6767 \end{array}$$

$$\begin{array}{r} 14660 \\ 9580 \\ 8893 \\ 51 \\ \hline 19.4932 \end{array}$$

$$\begin{array}{r} 14976 \\ 822315- \\ 2015- \\ 64 \\ \hline 6749 \end{array}$$

$$\begin{array}{r} 14945 \\ 816058 \\ 5058 \\ 35 \\ \hline 6782 \end{array}$$

$$\begin{array}{r} 14861 \\ 991119 \\ 0019 \\ 71 \\ \hline 14956 \end{array}$$

Residuals1313

$$\begin{array}{rcl}
 -2 - 11 + 16 & = & +3 \\
 -2 - 10 + 16 & = & +4 \\
 -5 - 16 + 16 & = & -5 \\
 -6 - 13 + 16 & = & -3 \\
 -6 - 7 + 16 & = & +3
 \end{array}$$

0-6

$$\begin{array}{rcl}
 -5 + 1 + 3 - 6 & = & -2 \\
 +4 + 1 + 3 - 6 & = & -2 \\
 +3 + 2 + 5 - 6 & = & +1 \\
 -3 + 3 + 4 - 6 & = & +1 \\
 0 + 3 + 2 - 6 & = & -1
 \end{array}$$

C⁴

$$\begin{array}{rcl}
 -2 & -3 \\
 0 \\
 -9 \\
 +11 \\
 -1
 \end{array}$$

0

0-C

$$\begin{array}{rcl}
 -1 \\
 +2 \\
 -10 \\
 +10 \\
 0
 \end{array}$$

1314

$$\begin{array}{rcl}
 -2 - 9 + 14 & = & +3 \\
 -3 - 9 + 14 & = & +2 \\
 -5 - 14 + 14 & = & -5 \\
 -6 - 11 + 14 & = & -3 \\
 -6 - 6 + 14 & = & +2
 \end{array}$$

$$\begin{array}{rcl}
 -6 & 0 + 12 - 13 & = -1 \\
 +6 & 0 + 12 - 13 & = -1 \\
 +3 & 0 + 18 - 13 & = +5 \\
 -3 & 0 + 15 - 13 & = +2 \\
 0 & 0 + 8 - 13 & = -5
 \end{array}$$

$$\begin{array}{rcl}
 -6 \\
 +4 \\
 -9 \\
 +16 \\
 -5
 \end{array}$$

$$\begin{array}{rcl}
 -5 \\
 +5 \\
 -14 \\
 +14 \\
 0
 \end{array}$$

1315

$$\begin{array}{rcl}
 -7 - 4 + 16 & = & +5 \\
 -7 - 4 + 16 & = & +5 \\
 -16 - 5 + 16 & = & -5 \\
 -17 - 4 + 16 & = & -5 \\
 -17 - 2 + 16 & = & -3
 \end{array}$$

$$\begin{array}{rcl}
 0 & -6 + 10 & = +4 \\
 +2 & -6 + 9 & = +3 \\
 +12 & -13 + 14 & = +1 \\
 -11 & -14 + 12 & = -2 \\
 0 & -15 + 6 & = -9
 \end{array}$$

$$\begin{array}{rcl}
 -3 \\
 +11 \\
 -4 \\
 +3 \\
 -8
 \end{array}$$

$$\begin{array}{rcl}
 -7 \\
 +8 \\
 -5 \\
 +5 \\
 +1
 \end{array}$$

VIC 1313-14-15 Plate Constant

1913 May 7

6

Conditional Equations

$+9.56 + 22.60 + 1 = -2$	-3	-3	-6	$+5$	-3
$+10.32 + 21.90 + 1 = +8$	$+9$	$+8$	$+4$	$+7$	$+11$
$+22.16 + 33.12 + 1 = -2$	-9	-2	-9	$+7$	-4
$+23.99 + 27.37 + 1 = -6$	$+11$	-6	$+16$	-16	$+3$
$+24.56 + 14.75 + 1 = +3$	-1	$+2$	-5	-3	-8

$+9.94 + 22.25 + 1 = +3.00 - 1.50 + 2.50 - 1.00 + 6.00 + 4.00$
$+23.57 + 25.08 + 1 = -1.67 + 0.33 - 2.00 + 0.67 - 4.00 - 3.00$
$+14.81 + 19.75 + 1 = +3.00 - 1.33 + 2.33 - 2.33 + 3.00 + 0.00$
$+23.08 + 39.24 + 1 = -4.00 + 1.00 - 4.00 + 3.50 - 4.50 + 0.50$
$-13.63 - 283 = +4.67 - 1.83 + 4.50 - 1.67 + 10.00 + 7.00$
$-8.27 - 10.49 = +7.00 - 2.33 + 6.33 - 5.83 + 7.50 + 0.50$
$+8.27 + 1.72 = -2.53 + 1.11 - 2.73 + 1.01 - 6.06 - 4.25$
$-8.77 = +4.17 - 1.22 + 3.60 - 4.82 + 1.44 - 3.75$
$b = -0.48 + 0.14 + 0.41 + 0.55 - 0.16 + 0.43$
$c = -0.24 + 0.10 - 0.24 + 0.11 - 0.70 - 0.60$

1313

$+3.0$	-1.7	$+3.0$	-4.0	-1.5	$+0.3$	-1.3	$+1.0$
$+2.4$	$+5.7$	$+3.6$	$+5.5$	-2.0	-2.5	-1.6	-2.4
$+10.7$	$+12.1$	$+9.5$	$+14.5$	-3.1	-3.5	-2.8	-4.2
$+16.1$	$+16.1$	$+16.1$	$+16.0$	-5.6	-5.7	-5.7	-5.6
$c \text{ for } (70-3)$				$c \text{ for } (4-4)$			

1314

$+2.5$	-2.0	$+2.3$	-4.0	-1.0	$+0.7$	-2.3	$+3.5$
$+2.4$	$+5.8$	$+3.6$	$+5.7$	-0.1	-0.2	-0.1	-0.2
$+9.1$	$+10.8$	$+8.1$	$+12.4$	-12.2	-13.8	-10.9	-16.6
$+19.0$	$+14.1$	$+14.0$	$+14.1$	-13.3	-13.3	-13.3	-13.3
$c \text{ for } (70-3)$				$c \text{ for } (4-4)$			

1315

$+6.0$	-4.0	$+3.0$	-4.5	$+4.0$	-3.0	0.0	-0.5
$+7.0$	$+16.5$	$+10.4$	$+16.2$	$+6.0$	$+14.1$	$+8.0$	$+13.9$
$+3.6$	$+3.9$	$+3.2$	$+4.8$	-9.6	-10.8	-8.5	-13.0
$+16.6$	$+16.4$	$+16.6$	$+16.5$	$+0.4$	$+0.3$	$+0.4$	$+0.4$
$c \text{ for } (70-3)$				$c \text{ for } (4-4)$			

Residuals

<u>1313</u>	C	0	0-C	C	0	0-C
$-2-11+16=+3$	-2	$-5+1+3=-6$	-2	-3	$-5-1=-6$	
$-2-10+16=+4$	$+8$	$+4+1+3=-6$	-2	0	$+1-2=-1$	
$-5-16+16=-5$	-2	$+3+2+5=-6$	$+1$	-9	-10	
$-6-13+16=-3$	-6	$-3+3+4=-6$	$+7$	$+11$	$+10$	
$-6-7+16=+3$	$+3$	$0+3+2=-6$	-1	-1	0	

<u>1314</u>						
$-2 - 9 + 14 = +3$	-3	-6	$0 + 12 - 13 = -1$	-6	-5	
$-3 - 9 + 14 = +2$	$+8$	$+6$	$0 + 12 - 13 = -1$	$+4$	$+3$	
$-5 - 14 + 14 = -5$	-2	$+3$	$0 + 12 - 13 = -1$	-9	-14	
$-6 - 11 + 14 = -3$	-6	-3	$0 + 15 - 13 = +2$	$+16$	$+14$	
$-6 - 6 + 14 = +2$	$+2$	0	$0 + 8 - 13 = -5$	-5	0	

1315																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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VIC 1313-14-15 Plate Constant

1913 May 7.

6

Conditional Equations 1313

1314

+9.56 + 22.60 + 1 = -2	-3	-3	-6	+5	-3
+10.32 + 21.90 + 1 = +8	0	+8	+4	+7	+11
+22.16 + 33.12 + 1 = -2	-9	-2	-9	+7	-4
+23.99 + 27.37 + 1 = -6	+11	-6	+16	-16	+3
+24.56 + 14.75 + 1 = +3	-1	+2	-5	-3	-8
+9.94 + 22.25 + 1 = +3.00 - 1.50 + 2.50 - 1.00 + 6.00 + 4.00					
+23.57 + 25.08 + 1 = -1.67 + 0.33 - 2.00 + 0.67 - 4.00 - 3.00					
+14.81 + 19.75 + 1 = +3.00 - 1.33 + 2.33 - 2.33 + 3.00 0.00					
+23.08 + 30.24 + 1 = -4.00 + 1.00 - 4.00 + 3.50 - 4.50 - 0.50					
-13.63 - 2.83 = +4.67 - 1.83 + 4.50 - 1.67 + 10.00 + 7.00					
-8.27 - 10.49 = +7.00 - 2.33 + 6.33 - 5.83 + 7.50 + 0.50					
+8.27 + 1.72 = -2.83 + 1.11 - 2.73 + 1.01 - 6.06 - 4.25					
-8.77 = +4.17 - 1.22 + 3.60 - 4.82 + 1.44 - 3.75					
b = -0.48 + 0.14 = -0.41 + 0.55 = -0.16 + 0.43					
c = -0.24 + 0.10 = -0.24 + 0.01 = -0.70 = 0.60					

1313

+3.0	-1.7	+3.0	-4.0
+2.4	+5.7	+3.6	+5.5
+10.7	+12.1	+9.5	+14.5
+16.1	+16.1	+16.1	+16.0

c for (70-3)

-1.5	+0.3	-1.3	+1.0
-2.0	-2.5	-1.6	-2.4
-3.1	-3.5	-2.8	-4.2
-5.6	-5.7	-5.7	-5.6

c for (4-7)

1314

+2.5	-2.0	+2.3	-4.0
+2.4	-5.8	+3.6	+5.7
-9.1	-10.8	+8.1	+12.4
+19.0	+14.1	+14.0	+14.1

c for (70-3)

-1.0	+0.7	-2.3	+3.5
-0.1	-0.2	-0.1	-0.2
-12.2	-13.8	-10.9	-16.6
-13.3	-13.3	-13.3	-13.3

c for (4-7)

1315

+6.0	-4.0	+3.0	-4.5
+7.0	+16.5	+10.4	+16.2
+3.6	-3.9	-5.2	+4.8
+16.6	+16.4	+16.6	+16.5

c for (70-3)

+4.0	-3.0	0.0	-0.5
+6.0	+14.1	+8.6	+13.9
-9.6	-10.8	-8.5	-13.0
+0.4	+0.3	+0.4	+0.4

c for (4-7)

MC1313

1913 May 7 7

Times etc

Exp. to star 1911 Oct 7 $3^h 04^m$ $-3^h 16^m$
 Moon $3 09 39.5^s -3 09 39.7^s$
 Clock slow $0 41.6^s$

H Sid T $3 10 21.2^s$ ✓
 H Comp $4 44 31.05^s$ ✓
 G Sid T $7 54 52.25^s$ ✓
 Sid T. to Moon $13 00 03.64^s$ ✓
 Interval $18 54 48.61^s$ ✓
 Reduction $3 05.91^s$ ✓
 G to T $18 51 42.70^s$ ✓

From Am Eph. $R A$ Decl.
 Moon 19^h $0^h 58^m 49.96^s +4 45 18.2^s$ ✓
 Motion in 1^m = 2.0493^s 16.094^s ✓
 " " -8.2883^s -16.99^s $-2 13.4^s$ ✓
 Tabular Place $0 58 32.97^s +4 43 04.8^s$ ✓

Moon's Parallax $58 22.0$ ✓
 Moon's Semidiam. $15 55.7$

VIC 1313

1913 May 7 7

Times Etc
Exp. to star 1911 Oct 7 3^h 04^m -3^h 16^m
Moon 3 09 39.5 -3 09 39.7
clock slow 0 41.6

H Sid P 3 10 21.2
H hour 4 44 31.05
G Sid T 7 54 52.25
Sid T to Moon 13 00 03.64
Interval 18 54 48.61
Reduction 3 05.91
G to T. 18 51 42.70 = 19^h - 8^m 17.30

From Am Eph. R A Dec
Moon 19^h 0^h 58^m 49.96 +4 45 18.2
Moon in T = 2.0494 16.099
-8.2883 - 16.99 - 2 13.4
Tabular Plan 0 58 32.97 +4 43 04.8

Moon's Parallax 58 22.0
Moon's Semidiam. 15 55.7

Formation of normals.

No	ab	ac	bz
1	- 197	- 399	+ 26.1
2	- 208	+ 2050	- 2118
3	- 122	- 11.61	+ 3740
4	+ 000	+ 00	- 2780
5	+ 078	+ 420	+ 2220
6	+ 213	+ 1770	+ 1975
7	+ 197	+ 130.0	+ 850
8	+ 007	- 1920	- 92
9			
10	- 163	- 58.2	+ 26.6
11	- 214	+ 2038	- 227.0
	- 409	+ 4616	+ 7612

$$[aa] = +18.64 \quad [bb] = +22.14$$

$$[ac] = +3.84 \quad [bc] = +8.85 \quad [cz] = +472$$

MC1313 Moon's Center

1913 May 7

8

x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1 15.8813	-1.7337	+4	3.0044	4.2908	+23
2 16.0000	-1.6150	+4	2.6070	4.2721	-164
3 17.0000	-0.6150	+6	0.3775	4.3074	+189
4 17.6150	0.0000	+7	0.0000	4.3019	+134
5 18.0000	+0.3850	+7	0.1488	4.2994	+109
6 19.0000	+1.3850	+5	1.9196	4.3013	+128
7 19.3494	+1.7344	+4	3.0095	4.2959	+175
8 19.6744	+2.0594	+0	(4.2411)	4.2591	-276
~~9 19.6774~~	~~+2.0624~~	~~+0~~	~~4.2535~~	~~4.2535~~	~~+29~~
10 19.4944	+1.8794	-3	3.5310	4.2812	-31
11 19.0000	+1.3850	-5	1.9168	4.2982	+147

mean = 4.2885

y	$y - y_0$	Δy	$(y - y_0)^2$
1 23.0000	+1.1340	+2	1.2864
2 23.1562	+1.2902	+2	1.6651
3 23.8481	+1.9821	+3	3.9299
4 23.9398	+2.0738	+3	4.3019
5 23.9030	+2.0370	+3	4.1506
6 23.4091	+1.5431	+2	2.3817
7 23.0000	+1.1340	+2	1.2864
8 22.0000	+0.1340	0	0.0180
9 21.8660	0.0000	0	0.0000
10 21.0000	-0.8660	-1	0.7502
11 20.3230	-1.5430	-2	2.3814

Approximate Center

$$x = 19.0 \quad y = 23.4091$$

$$\underline{20.3230}$$

$$43.7321$$

$$\text{mean } y = 21.8660$$

$$y = \text{max} = 23.9398$$

$$R = 2.0738$$

$$x = \text{max} = 19.6774$$

$$\text{mean } x = 17.6036$$

$$y = 23.0 \quad x = 15.8813$$

$$\underline{19.3494}$$

$$35.2307$$

$$\text{mean } x = 17.6154$$

$$x = \text{max} = 19.6774$$

$$R = 2.0620$$

$$y = \text{max} = 23.9398$$

$$21.8778$$

$$\text{Assume } \begin{cases} x_0 = 17.6150 \\ y_0 = 21.8660 \end{cases}$$

Formation of normals.

No	ab	ac	bc
1	- 1.97	- 39.9	+ 26.1
2	- 2.08	+ 26.50	- 21.18
3	- 1.22	- 11.61	+ 37.40
4	+ 0.00	+ 0.0	+ 27.80
5	+ 0.78	+ 42.0	+ 22.20
6	+ 2.13	+ 17.70	+ 19.75
7	+ 1.97	+ 130.0	+ 85.0
8	+ 0.07	- 19.20	- 9.2
9			
10	- 1.63	- 58.2	+ 26.6
11	- 2.14	+ 203.8	- 227.0
	- 4.09	+ 461.6	+ 761.2

$$[aa] = +18.64$$

$$[bb] = +22.14$$

$$[ac] = +3.84$$

$$[bc] = +8.85$$

$$[cw] = +472$$

MC1313 Moons Center

1913 May 7

8

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$y - y_0$	
1	15.8813	-1.7337	+4	3.0044	4.2908	0	+23
2	16.0000	-1.6150	+4	2.6070	4.2721	-1.64	-164
3	17.0000	-0.6150	+6	0.3775	4.3074	+1.49	+149
4	17.6150	0.0000	+7	0.0000	4.3019	+1.34	+134
5	18.0000	+0.3850	+7	0.1488	4.2994	+1.09	+109
6	19.0000	+1.3850	+5	1.9196	4.3013	+1.28	+128
7	19.3494	+1.7344	+4	3.0095	4.2959	+1	+75
8	19.6744	+2.0594	+0	4.2411	4.2591	+1.8	-276
9	19.6774	+2.0624	+0	4.2535	4.2535	+2.1	-329
10	19.4944	+1.8794	-3	3.5310	4.2812	+4.2	-31
11	19.0000	+1.3850	-5	1.9168	4.2482	+5.0	+147

mean = 4.2585

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	23.0000	+1.1340	+2	1.2864
2	23.1562	+1.2902	+2	1.6651
3	23.8481	+1.9821	+3	3.9299
4	23.9398	+2.0738	+3	4.3019
5	23.9030	+2.0370	+3	4.1506
6	23.4091	+1.5431	+2	2.3817
7	23.0000	+1.1340	+2	1.2864
8	22.0000	+0.1340	0	0.0180
9	21.8660	0.0000	0	0.0000
10	21.0000	-0.8660	-1	0.7502
11	20.3230	-1.5430	-2	2.3814

Approximate Center

$$x: 19.0 \quad y: 23.4091$$

$$\begin{array}{r} 20.3230 \\ 437321 \end{array}$$

mean $y = 21.8660$

$y = \text{max} = 23.9398$

$R = 2.0738$

$x = \text{max} = 19.6774$

mean $x = 17.6036$

$$y = 23.0 \quad x = 15.881$$

$$\begin{array}{r} 19349 \\ 35230 \end{array}$$

mean $x = 17.615$

$x = \text{max} = 19.677$

$R = 2.062$

$y = \text{max} = 23.939$

21.877

$$\text{Assume } \begin{cases} x_0 = 17.6150 \\ y_0 = 21.8660 \end{cases}$$

+17.57

MC1313

Moon's Center

1913 May 7

9

Conditional Equations

a b c = 0

c

0-c

1	-1.73	+1.13	+12	- +23	- 60	+ 48	- 3	= -15	+ 38
2	-1.62	+1.29	+1	= -164	- 57	+ 55	- 3	= -5	-159
3	-0.62	+1.98	+1	= +189	- 22	+ 84	- 3	= +59	+130
4	0.00	+2.07	+1	= +134	+ 0	+ 88	- 3	= +85	+ 49
5	+0.38	+2.04	+1	= +109	+ 13	+ 86	- 3	= +96	+ 13
6	+1.38	+1.54	+1	= +128	+ 48	+ 65	- 3	= +110	+ 18
7	+1.73	+1.13	+1	= +75	+ 60	+ 48	- 3	= +105	- 30
8 wt	+2.06	+0.13	+1	= -276	+ 32	+ 5	- 3	= +74	-350 (-174)
9 reject	+0.00			= -329	+ 72		- 3	= +69	-398
10	+1.88	-0.89	+1	= -31	+ 66	- 37	- 3	= +26	- 57
11	+1.38	-1.54	+1	= +149	+ 48	- 65	- 3	= -20	+167

Normal Equations

a

b

c

$$\begin{aligned}
 +17.57 - 4.09 + 3.84 &= +462 \\
 - 4.09 + 22.14 + 8.85 &= +761 \\
 + 3.84 + 8.85 + 9.50 &= +472
 \end{aligned}$$

$$\begin{aligned}
 + 4.09 - 0.95 + 0.89 &= +107 \\
 - 3.84 + 0.89 - 0.89 &= -101
 \end{aligned}$$

$$\begin{aligned}
 + 21.19 + 9.74 &= +868 \\
 + 9.74 + 8.66 &= +371
 \end{aligned}$$

$$\begin{aligned}
 - 9.74 - 4.47 &= -398 \\
 + 4.19 &= -27
 \end{aligned}$$

$$\begin{aligned}
 - 10.90 - 9.74 &= -417 \\
 + 10.29 &= +451
 \end{aligned}$$

$$\begin{aligned}
 - 0.76 + 4.09 + 1.63 &= +141 \\
 + 1.63 - 8.85 - 3.53 &= -320
 \end{aligned}$$

$$\begin{aligned}
 +16.81 &+ 5.47 = +603 \\
 + 5.47 &+ 15.97 = +152
 \end{aligned}$$

$$\begin{aligned}
 - 5.02 &- 5.47 = -139 \\
 + 11.79 &= +464
 \end{aligned}$$

giving (8) 1/2 wt

$$\Sigma = -420 + 415$$

$$\text{Average } (0-c) = 76$$

$$\frac{\Delta x}{\Delta y} = -0.63$$

$$\frac{\Delta x}{\Delta y} = -0.94$$

$$c = -6.4$$

$$b = +44.0$$

$$a = +39.4$$

MC1313

Innovative Center

1913 May 7.

9

Conditional Equations

 $a + b + c = 0$ c $0 - c$

1	-1.73	+1.13	+1	= +23	-60	+48	-3	= -15	+38
2	-1.62	+1.29	+1	= -164	-57	+55	-3	= -5	-159
3	-0.62	+1.98	+1	= +189	-22	+84	-3	= +59	+130
4	0.00	+2.07	+1	= +134	0	+88	-3	= +85	+49
5	+0.38	+2.04	+1	= +109	+13	+86	-3	= +96	+13
6	+1.38	+1.54	+1	= +148	+48	+65	-3	= +110	+18
7	+1.73	+1.13	+1	= +75	+60	+48	-3	= +105	-30
8 wt	+2.06	+0.13	+1	= -276	+82	+5	-3	= +74	-350
9 repeat									
10	+1.88	-0.89	+1	= -31	+66	-37	-3	= +26	-57
11	+1.38	-1.54	+1	= +149	+48	-65	-3	= -20	+167

Normal Equations

 a b c

$$\begin{aligned}
 +18.64 &= 409 + 3.84 = +462 \\
 -409 &+ 2214 + 885 = +761 \\
 +3.84 &+ 885 + 9.50 = +472
 \end{aligned}$$

$$\begin{aligned}
 +409 &= 0.90 + 0.84 = +101 \frac{1}{2} \\
 -384 &+ 0.84 - 0.79 = -95
 \end{aligned}$$

$$\begin{aligned}
 +21.24 &+ 969 = +862 \frac{1}{2} \\
 +969 &+ 871 = +377
 \end{aligned}$$

$$\begin{aligned}
 -969 &- 437 = -389 \\
 +4.34 &= -12
 \end{aligned}$$

$$\begin{aligned}
 -10.78 &- 9.69 = -419 \\
 +10.46 &= +443
 \end{aligned}$$

$$c = -3$$

$$b = +42$$

$$\begin{aligned}
 +1.77 &+ 409 + 439 = +218 \\
 -9.60 &- 22.14 - 23.78 = -1180
 \end{aligned}$$

$$\begin{aligned}
 +20.41 &+ 823 = +680 \\
 -13.69 &- 14.93 = -419
 \end{aligned}$$

$$\begin{aligned}
 -7.53 &- 823 = -231 \\
 +12.88 &= +449
 \end{aligned}$$

$$a = +35$$

MC1313 Moons mean Position (1911.0) 1913 May 13 10

$$\begin{array}{rcl}
 X_0 = 17.6150 & Y_0 = 21.8660 & \\
 \frac{1}{2}u = +20 & \frac{1}{2}v = +22 & \\
 \hline
 17.6170 & 21.8682 &
 \end{array}$$

From Prelim Reduction. $X = 15.7295$ $Y = 24.8283$

Plate Constant

$u =$	- 4	+ 2
$by =$	- 12	+ 3
$cl =$	+ 16	- 6

correction for tilt - 2

$$\begin{array}{rcl}
 \bar{z} = -2.2773 & \eta = +2.8282 & \\
 \log \bar{z} = 0.35628 & \log \tan S = 8.8446 & \\
 \log S = 9.99889 & \log S^2 = 0.7132 & \\
 \log \cos \delta = 8.50724 & \eta_1 = 6.6112 & \\
 & \eta_1 = +4 &
 \end{array}$$

$$(V-A) = 1.85095$$

$$X-A = 10.82$$

$$A = 05806$$

$$X_0 = 05655.18$$

$$\text{Red to app place} +3.01$$

$$X' = 05658.19$$

$$\eta_0 = +2.8278$$

$$\log \eta_0 = 0.45155$$

$$\log(S-D) = 3.12046$$

$$S-D = +21'59.5$$

$$D = +34420$$

$$S_0 = +40619.5$$

$$\text{Red to app place} +20.9$$

$$S' = +40640.9$$

H61313

Moons. Mean Position (1911.0) 1913 May 1 10

$$X_0 = 17.6150$$

$$Y_0 = 21.8660$$

$$\frac{1}{2} \Delta = +17$$

$$\frac{1}{2} \Delta = +21$$

$$17.6167$$

$$21.8681$$

From Prelim Reduction, $X = 15.7272$ $Y = 24.8282$ Place Constants $u = -4$ $+2$ $v = -12$ $+3$ $w = +16$ -6 corrections for tilt -2

$$S = -2.2720$$

$$\eta = +2.8281$$

$$\log S = 0.35660$$

$$\log S = 999889$$

$$\text{const} = 8.50724$$

$$\log T \text{ on } S = 8.8446$$

$$S^2 = 0.7132$$

$$\eta_1 = 6.6112$$

$$\eta_1 = +4$$

$$(V-A) = 1.85009$$

$$X-A = 1.1087$$

$$\eta_0 = +2.8277$$

$$A = 0.5806$$

$$\log \eta_0 = 0.45144$$

$$733115$$

$$X_0 = 0.565519$$

$$\log(S-D) = 3.12029$$

Red waff. place $+301$

$$S-D = +21.592$$

$$X' = 0.565820$$

$$D = +3.4420$$

$$S_0 = +4.06192$$

Red waff. place $+20.9$

$$S' = +4.06401$$

MC 1313

Rumai Parallax.

1913 May 13.

11

$$\begin{aligned}\alpha' &= 0^{\circ} 56' 58.19'' \\ \theta &= 3 10 21.2 \\ \theta - \alpha' &= +2 13 23.0 \\ &= +33^{\circ} 20' 45.0''\end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = +11 54.5$$

$$\alpha - \alpha' - \frac{1}{2}(\alpha - \alpha') = +33^{\circ} 08' 52''$$

$$\begin{aligned}\log \tan \phi' &= 9.95727 \\ \cos \frac{1}{2}(\alpha - \alpha') &= 0.00000 \\ \cos(\theta - \alpha' - \frac{1}{2}(\alpha - \alpha')) &= 9.92286 \\ \log \tan \gamma &= 0.03441\end{aligned}$$

$$\gamma = +47^{\circ} 16' 0.4''$$

$$\delta' = +4 06 40.1$$

$$\delta - \delta' = 43 09 22.3$$

$$\begin{aligned}\log \sin \phi' &= 9.82640 \\ \sin \pi &= 8.22987 \\ \sin(\gamma - \delta') &= 9.03505 \\ \sin \gamma &= 9.86600\end{aligned}$$

$$\log \sin(\delta - \delta') = 8.02532$$

$$\delta - \delta' = +36 26.5$$

$$\delta = +4 43 06.9 \quad \alpha = 0 58 33.46$$

$$\text{Ann Eph } \delta = +4 43 04.8'' \quad \alpha = 0 58 32.97''$$

$$0 - C = +2.1 \quad 0 - C = +0.49$$

$$\begin{aligned}\log \sec \phi' &= 9.86913 \\ \sin \pi &= 8.22987 \\ \sin(\theta - \alpha') &= 9.74012 \\ \cos \delta &= 9.99853\end{aligned}$$

$$\log \sin(\alpha - \alpha') = 7.84059$$

$$\alpha - \alpha' = +23^{\circ} 49.0''$$

$$= +1^{\circ} 35.27''$$

MC 1313

Raman Venkatesh

1913 May 13.

11

$$\alpha' = 0^{\circ} 56' 58.14''$$

$$\delta = 3^{\circ} 10' 21.2''$$

$$\theta - \alpha' = +2^{\circ} 13' 23.1''$$

$$= +33^{\circ} 20' 46.5''$$

$$\frac{1}{2}(\theta - \alpha') = +11^{\circ} 54.5''$$

$$\theta - \alpha' - \frac{1}{2}(\theta - \alpha') + 33^{\circ} 08' 52''$$

$$\log \tan \phi' = 9.95727$$

$$\cos \frac{1}{2}(\theta - \alpha') = 0.00000$$

$$- \cos(\theta - \alpha' - \frac{1}{2}(\theta - \alpha')) = 9.92286$$

$$\log \tan \gamma = 0.03441$$

$$\gamma = +47^{\circ} 16' 03.4''$$

$$\delta' = +4^{\circ} 06' 40.1''$$

$$43^{\circ} 09' 22.3''$$

$$\gamma - \delta' =$$

$$\log \sec \phi' = 9.82640$$

$$\sin \pi = 8.22987$$

$$\dots (\gamma - \delta') = 9.83505$$

$$\gamma = 9.86600$$

$$\log \sin(\delta - \delta') = 8.02532$$

$$\delta - \delta' = +36^{\circ} 26.5''$$

$$\delta' = +4^{\circ} 43' 06.6''$$

$$\text{Ann Eph } \delta = +4^{\circ} 43' 04.8''$$

$$0 - C$$

$$0 - C$$

$$+0.50$$

$$\delta' = +4^{\circ} 06' 40.1''$$

$$\pi = 58^{\circ} 22.0''$$

$$\log \sec \phi' = 9.86912$$

$$\sin \pi = 8.22987$$

$$\sin(\theta - \alpha') = 9.74012$$

$$\dots \cos \delta = 9.99853$$

$$\log \sin(\theta - \alpha') = 7.84059$$

$$\alpha - \alpha' = +23^{\circ} 49''$$

$$= 1^{\circ} 35' 27''$$

$$\alpha = 0^{\circ} 58' 33.47''$$

$$\alpha = 0^{\circ} 58' 32.97''$$

MC1314 - Comparison Staw - Measures - 1913 Mar. 22. 14.

	d	v	d	v
1	1198075	11607	18165	16561
9.5	8075	1109500	1281123	1789090
18.9	11481	0100	2117	9090
			71	50

<u>18.9503</u>	<u>.9492</u>	<u>9.4650</u>	<u>.4666</u>
2			
10.3 16215	14813	16991	15370
18.3 1377060	724040	913029	1319000
65	40	25	02
95	06	75	50

<u>18.2445</u>	<u>.2432</u>	<u>10.2150</u>	<u>.2169</u>
3			
22.1 14457	16310	16330	17930
29.4 1050800	1024035	744650	1678270
0800	30	46	70
30	11	10	20
<u>29.3939</u>	<u>3924</u>	<u>22.1135</u>	<u>.1155</u>

<u>4</u>			
23.9 18003	15121	15010	1100200
23.5 1163025	1149905	14139	00
28	91	3948	10255
03	30		
<u>23.6375</u>	<u>.6374</u>	<u>23.9132</u>	<u>.9154</u>

<u>5</u>			
24.4 11191	804555	18210	15030
11.0 1109086	5361	1238991	1081010
87	7970	90	10
		04	10
<u>11.0103</u>	<u>.0085</u>	<u>24.4183</u>	<u>.4212</u>

MC 1314 - Comparison Star - Measures - 1913 Mar. 22. 14.

	d	v	d	v
1	1198075	11607	18165	16561
9.5	80	1109500	1281123	1189090
18.9	11481	01	2117	9090
			71	50

<u>18.9503</u>	<u>.9492</u>	<u>9.4650</u>	<u>.4666</u>
2			
10.3 16215	14813	16991	15370
18.3 1377060	724048	913029	1319000
65	40	25	02
95	06	75	50

<u>18.2445</u>	<u>.2432</u>	<u>10.2150</u>	<u>.2169</u>
3			
22.1 14457	16310	16330	17930
29.4 10508060	1024035	744650	1678270
0806	30	46	70
30	11	10	20
<u>29.3939</u>	<u>3924</u>	<u>22.1135</u>	<u>.1155</u>

<u>4</u>			
23.9 18003	15121	15010	1140200
23.5 1163025	1149905	1413948	00
28	91	39	10255
63	30		
<u>236375</u>	<u>.6374</u>	<u>23.9132</u>	<u>.9154</u>

<u>5</u>			
24.4 11191	804558	18210	15030
11.0 1109086	5361	1238991	1081010
87	7970	90	10
		04	10
<u>11.0163</u>	<u>0085</u>	<u>24.4183</u>	<u>.4212</u>

D

MC1314

Magn - means

1913 Mar 22 - 15

1
14.7
23.0 possibly on terminator

16790
1440089
91-89
00
19.7603

18910
11310
08/3
08
7598

2
15.0
23.8

14168
1185050
65-80
70
23.2299

17428
967880
75-80
27
2251

possibly on terminator

3
16.0
23.6

18583
1191013
17
83
23.6666

17500
1412535
41
02
6633

4
16.2
337
max
6
7

18562
1169078
87
62
23.6877

16518
1335048
39
20
6827

fuzzy edge.

5
17.0
23.5

17510
1185040
35
16
23.5671

16575
1219095
91
80
5615

6
17.8
23.0

16690
865058
60
90
22.8034

18190
1555060
60
82
17.8370

16324
789894
0094
11
8417

7
18.0
27.7

16690
865058
60
90
22.8034

18742
1678085
70
40
8036

MC1314 Magn-Measures.

1913 Mar 22 - 15.

<u>1</u>					
14.7				16790	18910
23.0	possibly on			1440089	11310
	terminator			91	08/3
				00	08
				<u>14.7603</u>	<u>7598</u>

<u>2</u>	14168	17428
15.0	11850	9678
23.8	61-80	75-80
	70	27
	<u>23.2299</u>	<u>2251</u>

possibly on
terminator

<u>3</u>	18583	17500
16.0	11910	1412535
23.6	17	41
	87	02
	<u>23.6666</u>	<u>6633</u>

<u>4</u>	18562	16518
16.2	11690	1335048
23.7	87	39
max	62	20
	<u>23.6877</u>	<u>6827</u>

fuzzy edge.

<u>5</u>	17510	16575
17.0	11850	1219095
23.5	35-40	91
	16	80
	<u>23.5671</u>	<u>5615</u>

<u>6</u>					
17.8				18190	16324
23.0				1555060	789894
				60	0094
				82	11
				<u>17.7370</u>	<u>8417</u>

<u>7</u>	16690	18742
18.8	8650	1678085
27.7	6058	70
	70	40
	<u>22.6034</u>	<u>8036</u>

MC1314 moon-measures.

1913 Mar 22. 16

$$\begin{array}{r} 8 \\ 18.3 \\ 22.0 \end{array}$$

$$\begin{array}{r} 2 \\ 18.4 \\ 21.6 \\ \text{max} \\ \text{in} \\ 20 \end{array}$$

$$\begin{array}{r} 10. \\ 18.3 \\ 21.0 \end{array}$$

$$\begin{array}{r} 11 \\ 18.0 \\ 20.5 \\ 14497 \\ 10079 \\ 7876 \\ 00 \\ \hline 20.4420 \end{array}$$

$$\begin{array}{r} 12 \\ 17.5 \\ 20.0 \end{array}$$

13

$$\begin{array}{r} 15902 \\ 1028090 \\ 8690 \\ 98 \\ \hline 4385 \end{array}$$

$$\begin{array}{r} 17300 \\ 1063230 \\ 30 \\ 90 \\ \hline 183337 \end{array}$$

$$\begin{array}{r} 16335 \\ 995043 \\ 48 \\ 32 \\ \hline 18.3614 \end{array}$$

$$\begin{array}{r} 15359 \\ 813540 \\ 35 \\ 50 \\ \hline 18.2784 \end{array}$$

$$\begin{array}{r} 18040 \\ 1391024 \\ 20 \\ 30 \\ \hline 17.5880 \end{array}$$

$$\begin{array}{r} 18620 \\ 1528070 \\ 86 \\ 20 \\ \hline 3341 \end{array}$$

$$\begin{array}{r} 185565 \\ 1492620 \\ 30 \\ 65 \\ \hline 3640 \end{array}$$

$$\begin{array}{r} 17520 \\ 1472926 \\ 28 \\ 17 \\ \hline 2791 \end{array}$$

$$\begin{array}{r} 15810 \\ 991010 \\ 20 \\ 94 \\ \hline 5887 \end{array}$$

MC 1314 moon measures.

1913 Mar. 22. 16

$$\begin{array}{r} 8 \\ 18.3 \\ 22.0 \end{array}$$

$$\begin{array}{r} 2 \\ 18.4 \\ 21.6 \\ \text{max} \\ \text{in} \\ 21 \end{array}$$

$$\begin{array}{r} 10 \\ 18.3 \\ 21.0 \end{array}$$

$$\begin{array}{r} 11 \\ 18.0 \\ 20.5 \\ 14497 \\ 10079 \\ 7876 \\ 00 \\ \hline 204420 \end{array}$$

$$\begin{array}{r} 13 \\ 17.5 \\ 20.0 \end{array}$$

13

$$\begin{array}{r} 15902 \\ 1028090 \\ 8690 \\ 98 \\ \hline 4385 \end{array}$$

$$\begin{array}{r} 17300 \\ 1063230 \\ 30 \\ 90 \\ \hline 183337 \end{array}$$

$$\begin{array}{r} 16335 \\ 995043 \\ 48 \\ 32 \\ \hline 183614 \end{array}$$

$$\begin{array}{r} 15359 \\ 813540 \\ 3540 \\ 50 \\ \hline 182784 \end{array}$$

$$\begin{array}{r} 18040 \\ 1391024 \\ 20 \\ 30 \\ \hline 175880 \end{array}$$

$$\begin{array}{r} 18620 \\ 1528070 \\ 86 \\ 20 \\ \hline 3341 \end{array}$$

$$\begin{array}{r} 18565 \\ 1492620 \\ 3020 \\ 65 \\ \hline 3690 \end{array}$$

$$\begin{array}{r} 17520 \\ 1472926 \\ 2826 \\ 17 \\ \hline 2791 \end{array}$$

$$\begin{array}{r} 15810 \\ 991010 \\ 20 \\ 94 \\ \hline 5887 \end{array}$$

Tables $a = -1.4$ $e = -2.9$ $a - e = +1.5$ $b + a = -4.3$
Obs $a = -2.2$ $e = -2.4$ $a - e = +0.2$ $b + a = -7.4$

MC 1314

1913 May 7.

17

Preliminary Reduction

x	9.4658	10.2160	22.1145	23.9143	24.4198
3	9.5629	10.3157	22.1597	23.9902	24.5607
x-3	- 971	- 997	- 452	- 759	- 1409
y	18.9498	18.2438	29.3932	23.6374	11.0094
y	22.6000	21.8973	33.1215	27.3721	14.7454
y-y	-3.6502	-3.6535	-3.7283	-3.7347	-3.7360

x-3	- 524	+ 2x	+ 1934
-971	- 985	-1956 + 19	= -1937 = -3
-997	- 949	-1946 + 20	= -1926 = +8
-452	-1528	-1980 + 44	= -1936 = -2
-759	-1229	-1988 + 48	= -1940 = -6
-1409	-572	-1981 + 49	= -1932 = +2
moon	16.3016	-1124	+ 33 = 16.3859

y-y	+59x	+3y	+3.5881
-3.6502	+55.8	-35944 + 57	= -3.5887 = -6
-3.6535	+60.3	-35932 + 55	= -3.5877 = +4
-3.7283	+130.5	-35978 + 88	= -3.5890 = -9
-3.7347	+141.1	-35936 + 71	= -3.5865 = +16
-3.7360	+144.1	-35919 + 33	= -3.5886 = -5
moon	21.6190	+962	+65 = 25.3098

Exp. to stars	1911 Oct 7	3 ^h 18 ^m	-3 ^h 30 ^m
" " Moon		3 23	5 00 -3 23 50.2
Clock slow			41.6
H. Sid. T.		3 24	31.7
H. Long.		4 44	31.05
G. Sid. T.		8 09	02.75
Sid. T. the Moon		13 00	03.64
Interval		19 08	59.11
Reduction		3	08.23
G. M. T.		19 05	50.88

From Naut. Alman.		P. Q.	Heal.
Moon 19 ^h	0 ^h 58	49.96	+4 45 18.2
Motion in 1 ^m	2.0497		16.093
" " 5.848		+ 11.99	+ 1 34.1
Tabular Place	0 59	01.95	+4 46 52.3
Moon's parallax	58	22.3	
" " semidiameter	15	55.8	

MC 1314

1913 May 7.

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Preliminary Reduction

2	94658	102160	221141	239143	244198
3	95629	103157	221597	239902	245607
2-3	-971	-997	-452	-759	-1409
4	189498	182438	293932	236374	110094
4	226000	218973	331215	273721	147454
4-3	-36502	-36535	-37283	-37347	-37360

2-3	-524	+2x	+1934
-971 - 985	-1956	+19	-1937 = -3
-997 - 949	-1946	+20	-1926 = +8
-452 - 1528	-1980	+44	-1936 = -2
-759 - 1229	-1988	+48	-1940 = -6
-1409 - 572	-1981	+49	-1932 = +2
moon	163016-1124	+33	= 163859

4-4	+59x	+34	+35881
-36502 + 558	-35944	+57	-35887 = -6
-36535 + 603	-35932	+55	-35877 = +4
-37283 + 1305	-35978	+88	-35890 = -9
-37347 + 1411	-35936	+71	-35865 = +16
-37360 + 1441	-35919	+23	-35886 = -5
1.6190 + 962	+65		= 253098

Exp. to stars	1911 Oct 7	3 18	-3 30
moon		3 23	5 00 -3 23 50.2
clock show			41.6
H. Sid. T.		3 24	31.7
H. long.		4 44	31.05
G. Sid. T.		8 09	02.75
Sid. T. the moon		13 00	03.64
Interval		19 08	59.11
Reduction		3	08.23
G. in T.		19 05	50.88

From Kant. Alm.		P.A.	black.
moon 19"	0" 58	49.96	+4 45 18.2
moon - 1" 20497			16.093
.. 5.848		+ 11.99	+ 1 34.7
Tabular Place	0 59	01.95	+4 46 52.3
moon's parallax	58	223	
semidiameter	15	55.8	

Formation of Normals.

No	ab	an	bn
1	-2.12	+131.0	-117.0
2	-0.52	+120.0	-148.0
3	-0.61	+66	-45.0
4	+0.00	-00	-378.0
5	+1.36	-76.3	-212.0
6	+2.12	-63.1	-56.5
7	+2.01	+233.0	+162.0
8	+0.77	+162.8	+30.2
9	+0.00	-86.5	-0.0
10	-0.31	+156.5	-49.1
11	-2.01	+268.6	-187.0
12	-2.09	+257.5	-324.3
	-1.40	+110.1	-1324.7

$$[ac] = +8.50 \quad [aa] = +21.82$$

$$[by] = +8.05 \quad [bx] = +23.06 \quad [cn] = +29$$

Correction for phase $\begin{cases} X = +89' = +1.5 \\ Y = -1^{\circ} 22' = -1.37 \end{cases}$

	x	y	yx	xy	$(xx+yy)$	$2.95(xx+yy)^2$
6	+1.54	+1.38	+2.31	-1.89	+0.42	+1
7	+1.70	+1.18	+2.55	-1.62	+0.93	+3
8	+2.03	+0.38	+3.05	-0.51	+2.54	+19
9	+2.06	0.00	+3.09	0.00	+3.09	+28
10	+1.98	-0.62	+2.97	+0.85	+3.82	+43
11	+1.70	-1.18	+2.55	+1.62	+4.17	+51
12	+1.29	-1.62	+1.98	+2.22	+4.20	+52

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Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$o - c$
1	14.7600	-1.5395	+5	2.3685	4.2679	-85
2	15.0000	-1.2995	+6	(1.6612)	4.2394	-370
3	16.0000	-0.2995	+8	0.0892	4.2742	-22
4	16.2995	0.0000	+8	0.0000	4.2581	-183
5	17.0000	+0.7005	+8	0.4918	4.2655	-109
6	17.8394	+1.5399	+5	2.3728	4.2722 +1	-41
7	18.0000	+1.7005	+5	2.8934	4.2808 +3	+137
8	18.3339	+2.0345	+1	4.1396	4.2825 +19	+80
9	18.3627	+2.0632	0	(4.2568)	4.2568 +28	-1684
10	18.2788	+1.9793	-2	(3.9168)	4.3038 +43	+317
11	18.0000	+1.7005	-5	2.8900	4.2871 +51	+158
12	17.5884	+1.2889	-6	1.6597	4.2912 +52	+200

kurca: 4 2 7 6 4

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	23.6000 + 1.3780 + 2	1.8994		
2	23.2275 + 1.6055 + 2	(2.5782)		
3	23.6650 + 2.0430 + 3	4.1750		
4	23.6852 + 2.0632 + 3	4.2581		
5	23.5643 + 1.9423 + 3	3.7737		
6	23.0000 + 1.3780 + 2	1.8994		
7	22.8035 + 1.1815 + 2	1.3964		
8	22.0000 + 0.3780 + 0	0.1429		
9	21.6220 0.0000 0	(0.0000)		
10	21.0000 - 0.6220 - 1	(0.3870)		
11	20.4402 - 1.1818 - 2	1.3971		
12	20.0000 - 1.6220 - 2	2.6315		

A approximate Center

$$x = 18.0 \quad y = 22.8035$$

4 3 2 4 3 7

mean $y = 21.6218$

y-max 236852

$$K = 2.0634$$

mean $\bar{x} = 16.2993$

$$y = 23 \quad x = 147600$$

17 8394

325994

mean $\bar{x} = 16.2997$

Assume $\begin{cases} X_0 = 162995 \\ Y = 216220 \end{cases}$

M41 314

1913 May 5

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Moon's Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	147600	-15395	+5	23685	42679	-85
2	150000	-12995	+6	16612	42394	-370
3	160000	-02995	+8	00892	42742	-22
4	162995	00000	+8	00000	42581	-183
5	170000	+07005	+8	04918	42655	-109
6	178394	+15399	+5	23728	42722	+1
7	180000	+17005	+5	28934	42898	+137
8	183339	+20345	+1	41396	42825	+19
9	183627	+20632	0	42568	42568	+28
10	182788	+19793	-2	39168	43038	+43
11	180000	+17005	-5	28900	42871	+51
12	175884	+12889	-6	16597	42912	+52
				mean	42764	-2

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	230000	+13780	+2	18994
2	232275	+16055	+2	25782
3	236650	+20430	+3	41750
4	236852	+20632	+3	42581
5	235643	+19423	+3	37737
6	230000	+13780	+2	18994
7	228035	+11815	+2	13964
8	220000	+03780	+0	01429
9	216220	00000	0	00000
10	210000	-06220	-1	03870
11	204402	-11818	-2	13971
12	200000	-16220	-2	26315

A Approximate Center

$$x = 18.0 \quad y = 228035$$

$$204402$$

$$432437$$

$$\text{mean } y = 216218$$

$$y = \text{max } 236852$$

$$K = 20634$$

$$x = \text{max } 183627$$

$$\text{mean } x = 162993$$

$$y = 23 \quad x = 147600$$

$$178394$$

$$325994$$

$$\text{mean } x = 162997$$

$$\text{Assume } \left\{ \begin{array}{l} x = 162995 \\ y = 216220 \end{array} \right.$$

MC1314 Inno's Center 1913 May 8 19
 Conditional Equations.

	a	b	c	0	c	0-c
1	-1.54	+1.38	+1	-85	-63	-83 +16 = -130 +45
2	-1.30	+1.61	+1	-370	-27	-48 +18 = -67 -118 (-235)
3	-0.30	+2.04	+1	-22	-12	-123 +16 = -119 +97
4	+0.00	+2.06	+1	-183	0	-125 +16 = -109 -74
5	+0.70	+1.94	+1	-1.09	+29	-117 +16 = -72 -37
6	+1.54	+1.38	+1	-41	+63	-83 +16 = -4 -37
7	+1.70	+1.18	+1	+137	+70	-71 +16 = +15 +122
8	+2.03	+0.38	+1	+80	+83	-23 +16 = +76 +4
9	+2.06	+0.00	+1	-168	+42	0 +8 = +50 -134 (-268)
10	+1.98	-0.62	+1	+317	+41	19 +8 = +68 +90 (+187)
11	+1.70	-1.18	+1	+158	+70	-71 +16 = +157 +1
12	+1.29	-1.62	+1	+200	+53	-98 +18 = +167 +33

Normal Equations.

$$\begin{aligned}
 +1936 - 1.40 + 8.50 &= +1110 \\
 -1.40 + 22.31 + 8.05 &= -1325 \\
 +8.50 + 8.05 + 10.50 &= +29
 \end{aligned}$$

$$\begin{aligned}
 +1.40 - 0.10 + 0.61 &= +80 \\
 -8.50 + 0.61 - 3.73 &= -487
 \end{aligned}$$

$$\begin{aligned}
 +22.21 + 8.66 &= -11245 \\
 +8.66 + 6.77 &= -461
 \end{aligned}$$

$$\begin{aligned}
 -8.66 - 3.382 + 4.85 \\
 +3.39 + 2.8
 \end{aligned}$$

$$\begin{aligned}
 -11.02 - 8.66 + 5.86 \\
 +11.19 = -6.59
 \end{aligned}$$

$$\begin{aligned}
 -0.09 + 1.40 + 0.50 &= -83 \\
 +0.50 - 8.05 - 2.91 &= +478
 \end{aligned}$$

$$\begin{aligned}
 +19.27 + 19.00 &= +1027 \\
 +29.00 + 27.59 &= +503
 \end{aligned}$$

$$\begin{aligned}
 -10.68 - 19.00 &= -596 \\
 +18.58 = +434
 \end{aligned}$$

$$+392 - 400$$

Average (0-c) = 75
 giving (2)(9)(10) = 180

$$\frac{\Delta x}{\Delta a} = -0.85$$

$$\frac{\Delta y}{\Delta b} = -0.77$$

$$c = +7.1$$

$$b = -19.0$$

$$a = +50.2$$

M41314

Moon's Center

1913 May 8

19.

Conditional Equations

	a	b	0		c	0-c			
1	-154	+138	+1	-85	-63	-83	+16	-130	+45
2	-130	+161	+1	-370	-27	-48	+18	-67	-118 (-235)
3	-030	+204	+1	-22	-12	-123	+16	-119	+97
4	+0.00	+206	+1	-183	+0	-125	+16	-109	-74
5	+0.70	+194	+1	-1.09	+29	-117	+16	-72	-37
6	+154	+138	+1	-41	+63	-83	+16	-4	-37
7	+170	+118	+1	+137	+70	-71	+16	-15	+122
8	+203	+038	+1	+80	+83	-23	+16	-76	+4
9	+306	+0.00	+1	-168	+42	-0	+18	-50	-134 (-264)
10	+198	-062	+1	+317	+41	-19	+18	-38	+90 (-182)
11	+170	-118	+1	+158	+70	-71	+16	-157	+1
12	+129	-162	+1	+200	+53	-98	+16	-167	+33

Normal Equations.

$$\begin{aligned}
 +21.82 - 1.40 + 8.50 &= +1110 \\
 -1.40 + 23.06 + 8.05 &= -1325 \\
 +8.50 + 8.05 + 10.50 &= +25
 \end{aligned}$$

$$\begin{aligned}
 +1.40 - 0.09 + 0.545 &= +71 \\
 -8.50 + 0.545 - 3.31 &= -432
 \end{aligned}$$

$$\begin{aligned}
 +22.97 + 8.595 &= -1254 \\
 +8.59 + 7.19 &= -408 \\
 -8.59 - 3.22 &= +470 \\
 +3.97 &= +63
 \end{aligned}$$

$$\begin{aligned}
 -10.30 - 8.59 &= +489 \\
 +1.267 &= -767
 \end{aligned}$$

$$\begin{aligned}
 +148 + 1.40 + 183 &= +4 \\
 -24.37 - 23.06 - 30.10 &= -58
 \end{aligned}$$

$$\begin{aligned}
 +2330 &+ 1033 = +1114 \\
 -2597 &- 2205 = -1394
 \end{aligned}$$

$$\begin{aligned}
 -1208 &- 1033 = -652 \\
 +1122 &+ 460
 \end{aligned}$$

Average (0-c) = 75
 giving (2)(9)(10) = 20

$$c = +16$$

$$b = -66$$

$$\begin{aligned}
 +41 + 1 \\
 a = \frac{20}{10} = 2
 \end{aligned}$$

MC 1314

1913 May 13.

Moon's Mean Position (1911.0)

$$\begin{array}{rcl}
 X_0 & = & 16.2995^\circ \\
 Y & = & 21.6220^\circ \\
 \frac{1}{2}a & = & \begin{array}{r} +25 \\ 16.3020^\circ \end{array} \quad \begin{array}{r} -30 \\ 21.6190^\circ \end{array}
 \end{array}$$

$$\begin{array}{rcl}
 \text{From Prelim Reduction } X & = & 16.3863^\circ \\
 \text{Plate Constants } \alpha & & -4 \\
 & & -10 \\
 & & +14 \\
 \text{Correction for tilt} & & -1
 \end{array}$$

$$\begin{array}{rcl}
 \xi & = & -1.6138^\circ \\
 \log \xi & = & 0.20785^\circ \\
 \cos \delta & = & 9.99885^\circ \\
 \text{const.} & = & 8.50724
 \end{array}$$

$$\begin{array}{rcl}
 (d-A) & = & 1.70176^\circ
 \end{array}$$

$$\begin{array}{rcl}
 d-A & = & 50.32^\circ
 \end{array}$$

$$\begin{array}{rcl}
 A & = & 0.5806^\circ
 \end{array}$$

$$\begin{array}{rcl}
 d_0 & = & 0.5715.68
 \end{array}$$

$$\begin{array}{rcl}
 \text{Red to App.} & & +3.01
 \end{array}$$

$$\begin{array}{rcl}
 d' & = & 0.5718.69
 \end{array}$$

$$\eta = +3.3099^\circ$$

$$\log \tan \delta = 8.8624^\circ$$

$$\begin{array}{rcl}
 \xi^2 & = & 0.4159^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \eta_1 & = & 6.3317^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \eta_1 & = & +2^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \eta_0 & = & +3.3097^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \log & = & 0.51979^\circ \\
 & & 7.33115
 \end{array}$$

$$\log (S-D) = 3.18864^\circ$$

$$\begin{array}{rcl}
 S-D & = & +25' 44.0^\circ
 \end{array}$$

$$\begin{array}{rcl}
 D & = & +3' 44.20^\circ
 \end{array}$$

$$\begin{array}{rcl}
 S_0 & = & +4' 10.040^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \text{Red to App.} & & +20.9
 \end{array}$$

$$\begin{array}{rcl}
 S' & = & +4' 10.24.9^\circ
 \end{array}$$

MC 1314

1913 May 13.

Moon's Mean Position (1911.0)

$$\begin{array}{rcl}
 X_0 & = & 16.2995 \\
 Y & = & 21.6220 \\
 \frac{1}{2}a & = & \frac{+21}{-30} \\
 & & 16.3016 \qquad 21.6190
 \end{array}$$

$$\begin{array}{rcl}
 \text{From Prelim Reduction} & X = 16.3859 & Y = 25.3098 \\
 \text{Plate constants } \alpha & & -4 \\
 & \text{by} & -10 \\
 & c & +14 \\
 \text{Correction for tilt} & & -1
 \end{array}$$

$$\begin{array}{rcl}
 \delta & = & -16.142 \\
 \log \delta & = & 0.20795 \\
 \cos \delta & = & 9.99885 \\
 \text{const.} & = & 8.50724
 \end{array}$$

$$(d-A) = 1.70186 \text{ m}$$

$$d-A = 50.33$$

$$A = 0.5806$$

$$d_0 = 0.571567$$

$$\text{Red to App.} = +3.01$$

$$d' = 0.571868$$

$$\eta = +3.3099$$

$$\begin{array}{rcl}
 \log \tan \delta & = & 8.8624 \\
 \delta^2 & = & 0.4159
 \end{array}$$

$$\begin{array}{rcl}
 \eta_1 & = & 6.3317 \\
 \eta_2 & = & +2
 \end{array}$$

$$\eta_0 = +3.3097$$

$$\begin{array}{rcl}
 \log & = & 0.51979 \\
 & & 7.33115
 \end{array}$$

$$\log(\delta-D) = 3.18864$$

$$\delta-D = +25' 44.0$$

$$D = +3 \quad 44 \quad 20$$

$$\delta_0 = +4 \quad 10 \quad 040$$

$$\text{Red to App.} = +20.9$$

$$\delta' = +4 \quad 10 \quad 249$$

M6 1314

Lunar Parallax.

1913 May 13.

$$\begin{aligned} \alpha' &= 0^h 57^m 18.6^s 9'' \\ \theta &= 3 \quad 24 \quad 31.7 \\ \theta - \alpha' &= 2 \quad 27 \quad 13.0'' \\ &= +36^\circ 48' 15'' \end{aligned}$$

$$\delta' = +4^\circ 10' 24.9''$$

$$\pi = 58' 22.3''$$

$$\begin{aligned} \log \sin \phi' &= 9.86913 \\ \sin \pi &= 8.22991'' \\ \sin(\theta - \alpha') &= 9.77748'' \\ \cos \delta &= 9.99848'' \end{aligned}$$

$$\log \sin(\alpha - \alpha') = 7.87804$$

$$\alpha - \alpha' = +25' 57.6''$$

$$= +1'' 43.84''$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \cos \frac{1}{2}(\alpha - \alpha') &= 0.00000 \\ \alpha(\theta - \alpha' - \frac{1}{2}(\alpha - \alpha')) &= 9.90469'' \end{aligned}$$

$$\tan \gamma = 0.05258''$$

$$\gamma = +48 \quad 27 \quad 36.0''$$

$$\delta' = +4 \quad 10 \quad 24.9$$

$$\delta - \delta' = +44 \quad 17 \quad 11.1$$

$$\begin{aligned} \log \sin \phi' &= 9.82640 \\ \sin \pi &= 8.22991'' \\ \sin(\gamma - \delta') &= 9.84400'' \\ \gamma &= 9.87419'' \end{aligned}$$

$$\log \sin(\delta - \delta') = 8.02612''$$

$$\delta - \delta' = +36.30.6''$$

$$\delta = +4 \quad 46 \quad 55.5''$$

$$\text{Run Opb } \delta = +4 \quad 46 \quad 52.3''$$

$$O - C = +3.2''$$

$$\alpha = 0 \quad 59 \quad 02.58''$$

$$\alpha = 0 \quad 59 \quad 01.95''$$

$$O - C = 0.58''$$

M61314

Lunar Parallax.

1913 May 13.

$$\begin{aligned} \alpha' &= 0^h 57^m 18^s.68 \\ \delta &= 3 \quad 24 \quad 31.7 \\ \delta - \alpha' &= 2 \quad 27 \quad 13.0 \\ &= +36^\circ 48' 15'' \end{aligned}$$

$$\delta' = +4^\circ 10' 24.9''$$

$$\pi = 58' 22.3''$$

$$\log \sec \phi' = 9.86913$$

$$\sin \pi = 8.22991$$

$$\sin(\delta - \alpha') = 9.77748$$

$$\cos \delta = 9.99848$$

$$\log \sin(\delta - \alpha') = 7.87804$$

$$\alpha - \alpha' = +25' 57.6''$$

$$= +1^\circ 43.84''$$

$$\frac{1}{2}(\alpha - \alpha') = +12 \quad 59$$

$$\delta - \alpha' - \frac{1}{2}(\alpha - \alpha') = 36 \quad 35 \quad 16''$$

$$\log \tan \phi' = 9.95727$$

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.00000$$

$$\alpha(\delta - \alpha' - \frac{1}{2}(\alpha - \alpha')) = 9.90469$$

$$\tan \gamma = 0.05258$$

$$\gamma = +48 \quad 27 \quad 36.0$$

$$\delta' = +4 \quad 10 \quad 24.9$$

$$\delta - \delta' = 144 \quad 17 \quad 11.1$$

$$\log \sec \sin \phi' = 9.82640$$

$$\sin \pi = 8.22991$$

$$\sin(\gamma - \delta') = 9.84400$$

$$\gamma = 9.87419$$

$$\log \sin(\delta - \delta') = 8.02612$$

$$\delta - \delta' = +36 \quad 30.6$$

$$\delta = +4 \quad 46 \quad 55.5$$

$$\alpha = 0 \quad 59 \quad 02.52$$

$$\text{True App } \delta = +4 \quad 46 \quad 52.3$$

$$\alpha = 0 \quad 59 \quad 01.95$$

$$O - C = +3.2$$

$$O - C = 0.59$$

MC 1315

1913 March 25

22

Comparison Stars - Measures -

	d	y	N		d	y	N
1	15256		17081		14960		16640
8.9	10770		11550		14055		7510
18.5	65	65	50	53	55		10
	44		65		50		20
	<u>18.4484</u>		<u>4479</u>		<u>8.9095</u>		<u>9112</u>
2							
9.6	16428		18516		18396		15885
17.7	897072		15962	54	15010	02	9248
	70		56		03		52
	21		96		86		65
	<u>17.7452</u>		<u>7496</u>		<u>9.6612</u>		<u>6621</u>
3							
21.9	15478		17862		14890		17309
28.1	6200	00	17120		10450		12035
	00		15	19	50	510	29
	70		42		86		00
	<u>28.9271</u>		<u>9258</u>		<u>21.5262</u>		<u>5269</u>
4							
23.3	17107		15951		18388		16135
232	15357		7700		11786	90	12700
	54	50	94	95	90		08
	98		40		68		15
	<u>23.1751</u>		<u>1754</u>		<u>23.3414</u>		<u>3420</u>
5							
23.9	16779		14326		16017		14887
10.5	11250		9840		14860		6.00
	50	48	36	40	70	61	10
	65		16		03		65
	<u>10.5523</u>		<u>5517</u>		<u>23.8849</u>		<u>8861</u>

MC 1315

1913 March 25.

22

Comparison Stars - Measures -

	d	y	N		d	x	N
1	15256		17081		14960		16640
8.9	10770		11550	53	14055	53	7510
18.5	65	65	50		55		10
	44		65		50		20
	<u>18.4484</u>		<u>4479</u>		<u>89095</u>		<u>9112</u>
2							
1.6	16428		18516		18396		15885
7.7	8970	72	15962	54	15010	02	9248
	70		56		03		52
	21		96		86		65
	<u>17.7452</u>		<u>7446</u>		<u>9.6612</u>		<u>6621</u>
3							
11.5	15478		17862		14890		17309
28.9	6200	00	17120	19	10150	50	12035
	00		15		50	50	29
	70		42		86		00
	<u>28.9271</u>		<u>9258</u>		<u>21.5262</u>		<u>5269</u>
4							
23.3	17107		15951		18388		16135
23.2	15357	50	7700	95	11786	90	12700
	54		94		90		08
	98		40		68		15
	<u>23.1751</u>		<u>1754</u>		<u>23.3414</u>		<u>3420</u>
5							
3.9	16779		14326		16017		14887
0.5	11250	48	9840	40	14860	61	6.005
	50		36		70		10
	65		16		03		65
	<u>10.5523</u>		<u>5517</u>		<u>23.8849</u>		<u>8861</u>

1315. Argon-Measured

1913 Mar 25- 23

1
14.8 possibly on phase
23.0 limit

d x
15566
14159.60
60
54
14.8596

N
17915
9282.91
10
96
.8600

2
14490 16375
15.0 1313035- 774827
23.2 20 28
73 60
23.1360 .1372

3
16.0 18406 15460
23.6 1207285 1174546
74 55
89 50
23.6318 .6293

4
16.3 17308 15492
23.7 10.62616 1212035-
16 20
90 75
23.6677 .6639

5
17.0 17314 14544
23.5- 1156053 1027572
49 70
00 38
23.5752 .5731

6
17.9 15238 15288 1179830
23.0 1424856 1424856 4020
55 55
17.9065 .9083

7
18.0 1114060 9180
22.9 41 807086
10082 75
22.8936 .8897

1915. Argon-Measured

1
14.8 possibly on phase
23.0 limit.

1913 Mar 25. 23
d N
15566
1415960
60
59
14.8596

17915
9282634
10
96
.8600

2
14490 16375
15.0 1313035- 774827
23.2 20 28
73 60
23.1360 .1372

3
16.0 18406 15460
23.6 1207285 1174546
74 55
89 50
23.6318 .6293

4
16.3 17308 15492
23.7 1062616 1212035-
max 16 20
90 75
y 23.6677 .6639

5
17.0 17314 14544
23.5- 1156053 1027572
49 70
00 38
23.5752 .5731

6
17.9 15238 15288 1177830
23.0 1424856 1424856 4020
55 55
17.90654 .9083

7
18.0 1114060 9180
22.9 41 807086
10082 75
22.8936 .8897

1315 Moon-measures,

1911 March 25.

24.

8
18.4
22.0

4
18.4
21.5
max
in
2c

10
18.3
21.0

11
18.0 18445 15261
20.4 1537077 830881
87 8998
30 39
20.3062 3048

12
17.6
20.0

15700
980100
05
84

18.4111

15741
1015569
70
33

18.4428

14782
841930
30
65

18.3655

18812
1467073
70
02

4137

16750
1229089
87
50

4461

17720
1406050
60
12

3660

17723
14640 30
50
00

17.6924

14019
705257
40
99

6955

1315 (Moon-measures).

1911 March 25.

24.

8
18.4
22.0

4
18.4
21.5
max
in
x

10
18.3
21.0

11
18.0 18445 15261
20.4 1537077 830880
87 8998
30 39
20.3062 3048

12
17.6
20.0

15700 18812
980100 1467073
05 70
84 02
18.4111 .4137

15741 16750
1015569 1229089
707 87
33 50
18.4428 .4461
14782 17720
841930 1406050
30 60
65 12
18.3655 .3660

17723 14019
14640 30 705257
50 40
00 99
17.6924 .6955

Tables $a = -1.8$ $e = -3.1$ $a - e = +1.3$ $b + ae = 5.0$
Obs $a = -3.7$ $e = -4.6$ $a - e = +0.9$ $b + ae = 8.8$

MC 1315 Preliminary Reduction				1913 May 7		25 ²
x	8.9104	9.6616	21.5266	23.3417	23.8855	
3	9.5629	10.3157	22.1597	23.9902	24.5607	
x-3	-6525	-6541	-6331	-6485	-6752	
y	18.4482	17.7449	28.9264	23.1752	10.5520	
y	22.6000	21.8973	33.1215	27.3721	19.7454	
y-y	-4.1518	-4.1524	-4.1951	-4.1969	-4.1934	
x-3	-274	+32	+6909			
-6525-406	-6931	+27	-6904	=	+5	
-6541-390	-6931	+29	-6902	=	+7	
-6331-636	-6967	+65	-6902	=	+7	
-6485-510	-6995	+70	-6925	=	-16	
-6752-232	-6984	+72	-6912	=	-3	
16.3847-475	+49			=	17.0330	
y-y	+302	+54	+4.1116			
-4.1518+267	-4.1251	+92	-4.1159	=	-3	
-4.1524+290	-4.1234	+89	-4.1145	=	+11	
-4.1951+646	-4.1305	+145	-4.1160	=	-4	
-4.1969+700	-4.1269	+116	-4.1153	=	+3	
-4.1934+717	-4.1217	+53	-4.1164	=	-8	
21.5990+492	+108			=	25.7746	

Times Etc.

Exp. to stars	1911 Oct 7,	3 ^h 32 ^m	-3 ^h 44 ^m
moon	3	37	40.1-3 37 40.4
Clock slow			41.6
H Sid T.	3	38	21.85
H long	4	44	31.05
B Sid T.	8	22	52.90
Sid T. in moon	13	00	03.64
Interval	19	22	49.26
Reduction		3	10.50
G. M. T.	19	19	38.76

From Nant. Alm.

Moon 19	0 ^h 58 ^m 49 ^s 96 ^u	+4 ^o 45' 18.2"
Motion in 1 ^m	-2.0500"	16.091"
19646	+4027	+5 16.1"
Tabular Place	0 59 30.23	+4 50 34.3"
Moon's Parallax	58' 22.7"	
Semidiameter	15' 55.9"	

M6131 - Preliminary Reduction				1913 May 7. 25	
α	8.9104	9.6616	21.5266	23.3417	23.8855
δ	9.5629	10.3157	22.1197	23.9902	24.5607
$\alpha - \delta$	-6525	-6541	-6331	-6485	-6752
η	18.4482	17.7449	28.9264	23.1752	10.5520
η	22.6000	21.8973	33.1215	27.3721	19.7454
$\eta - \eta$	-4.1518	-4.1524	-4.1951	-4.1969	-4.1934
$\alpha - \delta$	-224	+32		+6909	
-6525 - 406	-6931	+27	-6904	=	+5
-6541 - 390	-6931	+29	-6902	=	+7
-6331 - 636	-6967	+65	-6902	=	+7
-6485 - 570	-6995	+70	-6925	=	-16
-6752 - 232	-6984	+72	-6912	=	-3
163847 - 435		+49		=	17.0330
$\eta - \eta$	+302	754		+4.1116	
-4.1518 + 267	-4.1251	+92	-4.1159	=	-3
-4.1524 + 290	-4.1234	+89	-4.1145	=	+11
-4.1951 + 646	-4.1305	+145	-4.1160	=	-4
-4.1969 + 700	-4.1269	+116	-4.1153	=	+3
-4.1934 + 717	-4.1217	+53	-4.1164	=	-8
21.5990 + 492		+108		=	25.7746

Times etc					
Exp to stars	1911 Oct 7.	3 ^h 32 ^m		-3 ^h 44 ^m	
Moon		3 37	40.1	-3 37	40.4
Clock slow			41.6		
H Sid T.		3 38	21.85		
H hour		4 44	31.05		
B Sid T.		8 22	52.90		
Sid T in Moon		13 00	03.64		
Interval		19 22	49.26		
Reduction		3	10.50		
G. M. T.		19 19	38.76		

Moon Naut Alman.		R. A.		Decl.	
Moon 19		0 ^h 58 ^m	49.96	+4 [°] 45'	18.2
Motion in 1 ^m	-2.0500			16.091	
19.646			+39.27	+5	16.1
Tabular Place		0 59	29.23	+4 50	34.3
Moon's Parallax		58'	22.7		
Semi-diam		+5'	55.9		

Formation of Normals.

No	ab	un	in
1	-2.14 +	6.1 -	5.6
2	-2.12 +	95.5 -	106.0
3	-0.78 +	27.6 -	14.6.0
4	+0.00 -	00 -	18.38
5	T 1.22 +	16.0 +	51.4
6	+2.14 +	125.0 +	115.0
7	+2.09 +	103.5 +	82.8
8	+0.81 +	16.2 +	3.2
9	+0.00 -	150.0 -	00
10	-1.19 +	242.0 -	73.0
11	-2.09 +	163.2 -	130.7
12	-2.10 -	30.2 +	36.8
	-4.16 +	614.9 -	355.9

$$aa = +24.20 \quad ac = +8.44$$

$$bb = +25.02 \quad bc = +8.62 \quad cm = +1$$

Correction for phase

No	x	y	Xx	Yy	(xx+yy)	2.95(xy+yy)
6	+1.52	+1.40	+2.53	-1.75	+0.78	+2
7	+1.62	+1.29	+2.70	-1.61	+1.09	+3
8	+2.03	+0.40	+3.38	-0.50	+2.88	+2.4
9	+2.06	0.00	+3.43	0.00	+3.43	+3.5
10	+1.98	-0.60	+3.30	+0.75	+4.05	+4.8
11	+1.62	-1.29	+2.70	+1.61	+4.31	+5.5
12	+1.31	-1.60	+2.18	+2.00	+4.18	+5.2

$$\begin{cases} X = +100' = +1.67 \\ Y = -10'15' = -1.25 \end{cases}$$

$$(xx+yy) \quad 2.95(xy+yy)$$

MC1315		Moon's Center		1913 May 6		26
	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$0 - C$
1	14.8598	-1.5232	+7	2.3180	4.2814	-4
2	15.0000	-1.3830	+7	1.9107	4.2749	-69
3	16.0000	-0.3830	+9	0.1460	4.2746	-72
4	16.3830	0.0000	+10	0.0000	4.2729	-89
5	17.0000	+0.6170	+9	0.3819	4.2844	+26
6	17.9074	+1.5244	+7	2.3259	4.2898	+2
7	18.0000	+1.6170	+6	2.6166	4.2879	+3
8	18.4124	+2.0294	+2	4.1193	4.2802	+29
+9	18.4444	+2.0614	+0	(4.2493)	4.2493	+35
10	18.3658	+1.9828	-3	3.9303	4.2892	+46
11	18.0000	+1.6170	-6	2.6128	4.2864	+55
12	17.6940	+1.3110	-7	1.7169	4.2743	+52
				mean =	4.2838	+1

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	23.0000	+1.4010	+2	1.9634
2	23.1366	+1.5376	+2	2.3642
3	23.6306	+2.0316	+3	4.1286
+4	23.6658	+2.0668	+3	4.2729
5	23.5742	+1.9752	+3	3.9026
6	23.0000	+1.4010	+2	1.9634
7	22.8916	+1.2926	+2	1.6713
8	22.0000	+0.4010	+1	0.1609
9	21.5990	0.0000	+0	0.0000
10	21.0000	-0.5990	-1	0.3589
11	20.3055	-1.2935	-2	1.6736
12	20.0000	-1.5990	-2	2.5574

Approximate Center

$x = 18$	$y = 22.8916$	$z = 23.0$	$z = 14.8598$
	<u>20.3055</u>		<u>17.9074</u>
	431971		327672
mean $y = 21.5986$		mean $x = 16.3836$	
$y - \max = 23.6658$			
$R = 20672$			
$x - \max = 18.4444$			
mean $x = 16.3772$			

Assume $\begin{cases} x_0 = 16.3830 \\ y_0 = 21.5990 \end{cases}$

MIL 315		Moon's Center		1913 May 8		26
	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - c$
1	14.8598	-1.5232	+7	2.3180	4.2814	-4
2	15.0000	-1.3830	+7	1.9107	4.2749	-69
3	16.0000	-0.3830	+9	0.1460	4.2746	-72
4	16.3830	0.0000	+10	0.0000	4.2729	-89
5	17.0000	+0.6170	+9	0.3818	4.2844	+26
6	17.9074	+1.5244	+7	2.3259	4.2898	+82
7	18.0000	+1.6170	+6	2.6166	4.2879	+64
8	18.4124	+2.0294	+2	4.1193	4.2802	+8
9	18.4444	+2.0614	+0	4.2493	4.2493	-145
10	18.3658	+1.9828	-3	3.9303	4.2892	+122
11	18.0000	+1.6170	-6	2.6128	4.2864	+101
12	17.6940	+1.3110	-7	1.7169	4.2743	-23
mean =				4.2818		+1

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	23.0000	+1.4010	+2	1.9634
2	23.1366	+1.5376	+2	2.3642
3	23.6306	+2.0316	+3	4.1286
4	23.6658	+2.0668	+3	4.2729
5	23.5742	+1.9752	+3	3.9026
6	23.0000	+1.4010	+2	1.9634
7	22.8916	+1.2926	+2	1.6713
8	22.0000	+0.4010	+1	0.1609
9	21.5990	0.0000	+0	0.0000
10	21.0000	-0.5990	-1	0.3589
11	20.3055	-1.2935	-2	1.6736
12	20.0000	-1.5990	-2	2.5574

Approximate Center

$$x = 18 \quad y = 22.8916$$

$$\underline{20.3055}$$

$$43.1971$$

$$\text{mean } y = 21.5986$$

$$y = \text{max} = 23.6658$$

$$R = 20672$$

$$x = \text{max} = 18.4444$$

$$\text{mean } x = 16.3772$$

$$y = 23.0 \quad x = 14.8598$$

$$\underline{17.9074}$$

$$32.7672$$

$$\text{mean } x = 16.3836$$

$$\text{Assume } \begin{cases} x = 16.3830 \\ y = 21.5990 \end{cases}$$

① - Hays
New 0

		an	bu
1	-41	+ 62.4	- 57.5
2	-97	+ 134.0	- 149.3
3	-17	+ 6.4	- 34.5
4	-71	- 0.0	- 147.0
5	+26	+ 16.1	+ 51.5
6	+64	+ 97.4	+ 89.5
7	-10	- 16.2	- 12.9
8	+26	+ 52.8	+ 10.4
9	-115	- 237.0	- 0.0
10	+67	+ 132.9	- 40.3
11	-37	- 60.0	+ 47.8
12	+60	+ 78.5	- 96.0
		7267.3	-338.3

ML1315 Moon's Center

1913 May 8.

Conditional Equations

	a	b	c	0	Residuals	c	a - c	
1	-1.52	+1.40	+1	-4	-52	-25	-77	+73
2	-1.38	+1.54	+1	-69	-47	-25	-72	+3
3	-0.38	+2.03	+1	-72	-13	-25	-38	-34
4	+0.00	+2.07	+1	-89	+0	-25	-25	-64
5	+0.62	+1.98	+1	+26	+21	-25	-4	+30
6	+1.52	+1.40	+1	+82	+52	-25	+27	+55
7	+1.62	+1.29	+1	+64	+55	-25	+30	+34
8	+2.03	+0.40	+1	+8	+69	-25	+44	-36
9	+2.06	+0.00	+1	-290	+35	-12	+23	-168 ^{wt} (-336)
10	+1.98	-0.60	+1	+122	+68	-25	+43	+79
11	+1.62	-1.29	+1	+101	+55	-25	+30	+71
12	+1.31	-1.60	+1	-23	+45	-25	+20	-43

Normal Equations

$$\begin{aligned}
 +28.14 - 4.16 + 8.44 &= +615 \\
 - 4.16 + 25.02 + 8.62 &= -356 \\
 + 8.44 + 8.62 + 11.50 &= +1
 \end{aligned}$$

$$\begin{aligned}
 + 4.16 - 0.75 + 1.52 &= +101 \\
 - 8.44 + 1.52 - 3.08 &= -224
 \end{aligned}$$

$$\begin{aligned}
 + 24.29 + 10.14 &= -245 \\
 + 10.14 + 8.42 &= -223
 \end{aligned}$$

$$\begin{aligned}
 - 10.14 - 4.23 &= +102 \\
 + 4.19 &= -121
 \end{aligned}$$

$$\begin{aligned}
 - 12.20 - 10.14 &= +268 \\
 + 12.07 &= 23
 \end{aligned}$$

$$\begin{aligned}
 - 0.69 + 4.16 + 1.43 &= -59 \\
 + 1.43 - 8.62 - 2.97 &= +123
 \end{aligned}$$

$$\begin{aligned}
 + 22.45 &+ 9.87 = +556 \\
 + 29.87 &+ 8.53 = +124
 \end{aligned}$$

$$\begin{aligned}
 - 11.42 &- 9.87 = -144 \\
 + 11.03 &= +412
 \end{aligned}$$

$$+3456345(-515)$$

$$\text{Average } (0-6) = 60 (72)$$

$$\text{giving } (9) \frac{1}{2} \text{ wt}$$

$$\frac{\Delta x}{\Delta z} = -0.86$$

$$\frac{\Delta y}{\Delta z} = -0.85$$

$$c = -29$$

$$b = +2.0$$

$$a = +37.4$$

ML1315 Orion's Center.

1913 May 8.

Conditional Equations

	a	b	c	0	lands	c	0 - c
1	-1.52	+1.40	+1	= -4	-52	-25 = -77	+73
2	-1.38	+1.54	+1	= -69	-47	-25 = -72	+3
3	-0.38	+2.03	+1	= -72	-13	-25 = -38	-34
4	+0.00	+2.07	+1	= -89	+0	-25 = -25	-64
5	+0.62	+1.98	+1	= +26	+21	-25 = -4	+30
6	+1.52	+1.40	+1	= +82	+52	-25 = +27	+55
7	+1.62	+1.29	+1	= +64	+55	-25 = +30	+34
8	+2.03	+0.40	+1	= +8	+69	-25 = +44	-36
9	+2.06	+0.00	+1	= -290	+35	-12 = +23	-168
10	+1.98	-0.60	+1	= +122	+68	-25 = +43	+79
11	+1.62	-1.29	+1	= +101	+55	-25 = +30	+71
12	+1.31	-1.60	+1	= -23	+45	-25 = +20	-43

Normal Equations.

$$+24.20 - 4.16 + 8.44 = +6.15$$

$$- 4.16 + 25.02 + 8.62 = -3.56$$

$$+ 8.44 + 8.62 + 11.50 = +1$$

$$+ 4.16 - 0.72 + 1.45 = +10.6$$

$$- 8.44 + 1.95 - 2.94 = -21.4$$

$$+ 24.30 + 10.07 = -2.50$$

$$+ 10.07 + 8.56 = -2.13$$

$$- 10.07 - 4.175 = +10.4$$

$$+ 4.38 = -10.8$$

$$- 11.85 - 10.07 = +25.0$$

$$+ 12.45 = 0$$

$$+ 14.08 + 4.16 + 5.55 = +0$$

$$- 24.52 - 25.02 - 33.42 = -3$$

$$+ 28.28 + 13.99 = +6.15$$

$$- 28.68 - 24.80 = -3.59$$

$$- 16.19 - 13.99 = -20.2$$

$$+ 12.09 = +4.12$$

$$+345 = 345$$

$$\text{Average } (0 - c) = 60$$

$$\text{given } (9) \frac{1}{2} \text{ wt}$$

$$c = -25$$

$$b = 0$$

$$a = +34$$

Haym

$$S = 0.9677$$

$$\log = 998574 m$$

$$999881$$

$$950724$$

$$1.47969$$

$$\alpha - A - - 30.18$$

MC1315 Ononis Mean Position (1911.0)

$$\begin{array}{r} \kappa_0 = 16.3830 \\ + a = + 19 \\ \hline 16.3849 \end{array}$$

$$\begin{array}{r} \gamma = 21.5990 \\ + b = 0 \\ \hline 21.5990 \end{array}$$

$$\begin{array}{rcl} \text{From Prelim Red. } X = & 17.0330 & Y = 25.7746 \\ \text{plate constant } \alpha_x & - & 12 & - & 10 \\ & & & & \\ & \alpha_y & - & 4 & + & 11 \\ & C & + & 16 & & 0 \end{array}$$

$$z = -0.9672$$

$$\log z = 9.98582m$$

$$\cos \delta = 9.99881$$

$$\text{const} = 8.50724$$

$$(d-A) = 1.47949m$$

$$d-A = -30.16^{\circ}$$

$$A = 05806$$

$$\kappa_0 = 0573584$$

$$\text{Red} = +3.01$$

$$q' = 0573885$$

$$\eta = +3.7747$$

$$\log \tan \delta = 8.8694$$

$$\log 52 = 9.9709$$

$$\eta_1 = 58937$$

$$\eta_1 = +1$$

$$\eta_0 = +3.7746$$

$$\log \eta_0 = 0.57687$$

$$7.33115$$

$$(S-D) = 3.24572$$

$$S-D = +2920.8$$

$$D = +34420$$

$$S_0 = +41340.8$$

$$\text{Red to Aph.} = 209$$

$$S' = +41401.7$$

MC 1315 Snows mean Prelim (19110)

$$X_0 = 16.3830$$

$$Y = 21.5990$$

$$\begin{array}{r} 16.3830 \\ + 0.07 \\ \hline 16.3847 \end{array}$$

$$\begin{array}{r} 21.5990 \\ - 0 \\ \hline 21.5990 \end{array}$$

$$\begin{array}{rcl} \text{Iron Prelim Red} & X = & 17.0330 \\ \text{plate constant} & - & 12 \\ & + & 4 \\ & + & 16 \end{array} \quad \begin{array}{rcl} Y = & 25.7746 \\ & - & 10 \\ & + & 11 \\ & & 0 \end{array}$$

$$Z = -0.9670$$

$$\eta = +3.7747$$

$$\log S = 9.98543m$$

$$\cos \delta = 9.99881$$

$$\cos t = 8.50724$$

$$\log \tan \delta = 8.8694$$

$$\log \eta = 9.9709$$

$$\eta = 5.8937$$

$$(d-A) = 14.7938m$$

$$\eta = +1$$

$$d-A = 30.16$$

$$\eta_0 = +3.7746$$

$$A = 0.5806$$

$$\log \eta_0 = 0.57687$$

$$7.33115$$

$$X_0 = 0.573584$$

$$(d-D) = 3.24572$$

$$\text{Red} = +3.01$$

$$S-D = +29.20.8$$

$$q' = 0.573885$$

$$D = +3.44.20$$

$$S_0 = +4.13.40.8$$

$$\text{Red to Apr.} = 20.9$$

$$S' = +4.14.01.7$$

VIC 1315

Lunar Parallax

1913 May 14

$$\begin{aligned}
 \alpha' &= 0^h 57^m 38^s.85 \\
 \theta &= 3 \quad 38 \quad 21.85 \\
 \theta - \alpha' &= +2 \quad 40 \quad 43 \\
 &= +40^\circ 10' 45''
 \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = +13 \quad 59$$

$$\theta - \alpha' - \frac{1}{2}(\alpha - \alpha') = +39 \quad 56 \quad 46$$

$$\begin{aligned}
 \log \tan \phi' &= 9.95727 \\
 \cos \frac{1}{2}(\alpha - \alpha') &= 0.000000 \\
 \cos(\theta - \alpha' - \frac{1}{2}(\alpha - \alpha')) &= 9.88476
 \end{aligned}$$

$$\log \tan \gamma = 0.07251$$

$$\gamma = +49^\circ 45' 39.2$$

$$\delta' = +4 \quad 14 \quad 01.7$$

$$\gamma - \delta' = +45 \quad 31 \quad 37.5$$

$$\begin{aligned}
 \log \sin \phi' &= 9.82640 \\
 \sin \pi &= 8.22995 \\
 \sin(\gamma - \delta') &= 9.85344 \\
 \sin \gamma &= 9.88273
 \end{aligned}$$

$$\log \sin(\delta - \delta') = 8.02706$$

$$\delta - \delta' = 36 \quad 35.3$$

$$\delta = +4 \quad 50 \quad 36.0$$

$$\text{Am Ephs } \delta = +4 \quad 50 \quad 34.3$$

$$O - C = +1.7$$

$$\delta' = +4^\circ 14' 01.7$$

$$\pi = 58' 22.7$$

$$\begin{aligned}
 \log \cos \phi' &= 9.86913 \\
 \sin \pi &= 8.22995 \\
 \sin(\theta - \alpha') &= 9.80968 \\
 \cos \delta &= 9.99844
 \end{aligned}$$

$$\log \sin(\alpha - \alpha') = 7.91032$$

$$\begin{aligned}
 \alpha - \alpha' &= +27' 57.8 \\
 &= 1^m 51^s.85
 \end{aligned}$$

$$\alpha = 0 \quad 59 \quad 30.70$$

$$\alpha = 0 \quad 59 \quad 30.23$$

$$O - C = +0.47$$

MC1315

1913 May 14

Lunar Parallax

$$\begin{aligned}
 \alpha' &= 0^{\circ} 57' 38.85 \\
 \delta &= 3 \quad 38 \quad 21.85 \\
 -\alpha' &= +2 \quad 40 \quad 43 \\
 &= +40^{\circ} 10' 45''
 \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = +13 \quad 59$$

$$\alpha - \alpha' - \frac{1}{2}(\alpha - \alpha') = 39 \quad 56 \quad 46$$

$$\log \tan f' = 9.95727$$

$$\cos \frac{1}{2}(\alpha - \delta) = 0.00000$$

$$\cos(\alpha - \delta) = \frac{1}{2}(\alpha - \delta) = 9.88476$$

$$\log \tan f = 0.07251$$

$$f = +49^{\circ} 45' 39.2$$

$$\delta' = +4 \quad 14 \quad 01.7$$

$$f - \delta' = +45 \quad 31 \quad 37.5$$

$$\log \sin f = 9.82640$$

$$\sin \pi = 8.22995$$

$$\sin(f - \delta') = 9.85344$$

$$\sin f = 9.88273$$

$$\log \sin(\delta - \delta') = 8.02706$$

$$\delta - \delta' = 36 \quad 35.3$$

$$\delta = +4 \quad 50 \quad 36.0$$

$$\text{True Eph. } \delta = +4 \quad 50 \quad 34.3$$

$$O - C = +1.7$$

$$\delta' = +4^{\circ} 14' 01.7$$

$$\pi = 58' 22.7$$

$$\log \cos f' = 9.86913$$

$$\sin \pi = 8.22995$$

$$\sin(\delta - \alpha') = 9.80968$$

$$\cos \delta = 9.99844$$

$$\log \sin(\alpha - \delta) = 7.91032$$

$$\alpha - \delta' = +27' 57.8$$

$$= 1^{\circ} 51' 8.5$$

$$\alpha = 0 \quad 59 \quad 30.70$$

$$\alpha = 0 \quad 59 \quad 30.23$$

$$O - C = +0.47$$

