

KG

11366

K. 906

Volume XXX



Plates

1525

1542

1543

1912phae. 100j.
PRINCETON UNIVERSITY OBSERVATORY
PRINCETON, N. J.
U. S. A.

Harvard Museum Plates.

Measures + Reductions.

Mary Fowler

Volume

Plate No.	Date	Page No.
1525	1912 Jan. 3	1
1542	1912 Jan. 9	9.
1543	1912 Jan. 9	20

NIC 15W

1913 July 3.

1

Stars measured.

d	α	δ	α	δ
1	15160	19730	17002	16800
8.2	12643	12250	9159	14649
15.3	40	45	52	58
	7.6	30	20	9.5
	<u>15.2523</u>	<u>.2517</u>	<u>8.2137</u>	<u>.2147</u>
2	14780	18878	14130	18560
12.7	7475	16195	11578	11501
25.7	77	85	80	05
	96	80	39	57
	<u>25.7316</u>	<u>.7314</u>	<u>12.7046</u>	<u>.7055</u>
3	16400	16240	17890	17940
21.9	15060	7285	16425	9389
27.1	65	89	15	90
	10	56	94	46
	<u>27.1038</u>	<u>.1031</u>	<u>21.6534</u>	<u>.8550</u>
4	15342	15685	16206	16510
21.2	10580	10440	7985	14715
21.5	80	40	90	19
	50	89	20	10
	<u>11.4766</u>	<u>.4753</u>	<u>25.1770</u>	<u>.1791</u>

blurry images

Density grade 3

VIC 1524

1913 July 3.

Stars measured

α	δ	α	δ	α	δ	α	δ
1	15 160	19750	17002	16800			
2	1264341	12250	915950	1464950			
3	40	45-45	5250	58			
	76	30	20	95			
	<u>15.25-23</u>	<u>25-17</u>	<u>8.2137</u>	<u>2147</u>			
2	14780	18878	14530	18560			
27	7475	16195	11578	11501			
57	7776	8598	8080	05-04			
	96	80	39	57			
	<u>25.7316</u>	<u>7314</u>	<u>12.7046</u>	<u>705-5</u>			
3							
19	16400	16240	17890	17940			
71	1506065	728580	1642526	9389			
	68	89	15	9093			
	10	56	94	40			
	<u>27.1038</u>	<u>1031</u>	<u>21.6534</u>	<u>8550</u>			
1							
2	15342	15685	16206	16510			
15	1058080	1044040	798585	1471522			
	80	40	90	19			
	50	89	20	70			
	<u>11.4766</u>	<u>4753</u>	<u>25.1770</u>	<u>1791</u>			

blurry images.

Density grade 3

M615W

Moon Measures

1913 July 3

2

$$\begin{array}{r}
 \frac{1}{18.0} \\
 19.8 \\
 \hline
 19316 \\
 1107085 - \\
 9570 \\
 32 \\
 \hline
 19.8249
 \end{array}
 \quad
 \begin{array}{r}
 \frac{1}{15002} \\
 1325238 \\
 4038 \\
 18 \\
 \hline
 .8238
 \end{array}$$

blowing
possibly on
terminator

$$\begin{array}{r}
 \frac{2}{17.7} \\
 20.0
 \end{array}$$

$$\begin{array}{r}
 17900 \\
 15581 \\
 9888 \\
 00 \\
 \hline
 17.7695
 \end{array}$$

$$\begin{array}{r}
 15410 \\
 7662 \\
 7988 \\
 12 \\
 \hline
 17.736
 \end{array}$$

$$\begin{array}{r}
 \frac{3}{17.2} \\
 21.0
 \end{array}$$

$$\begin{array}{r}
 12680 \\
 9080 \\
 \hline
 11495
 \end{array}$$

$$\begin{array}{r}
 11268 \\
 1003030 \\
 3230
 \end{array}$$

$$\begin{array}{r}
 17.1188
 \end{array}$$

$$\begin{array}{r}
 1235
 \end{array}$$

$$\begin{array}{r}
 10720 \\
 082 \\
 \hline
 10438
 \end{array}$$

$$\begin{array}{r}
 10327 \\
 1000914 \\
 10
 \end{array}$$

$$\begin{array}{r}
 17.0275
 \end{array}$$

$$\begin{array}{r}
 0316
 \end{array}$$

$$\begin{array}{r}
 1094250 \\
 40 \\
 \hline
 10384
 \end{array}$$

$$\begin{array}{r}
 10344 \\
 974050 \\
 6065-
 \end{array}$$

$$\begin{array}{r}
 17.0560
 \end{array}$$

$$\begin{array}{r}
 0590
 \end{array}$$

$$\begin{array}{r}
 15020 \\
 1000510 \\
 10 \\
 28
 \end{array}$$

$$\begin{array}{r}
 19488 \\
 14478 \\
 9082 \\
 72
 \end{array}$$

$$\begin{array}{r}
 17.4984
 \end{array}$$

$$\begin{array}{r}
 5007
 \end{array}$$

$$\begin{array}{r}
 \frac{4}{17.0} \\
 21.5
 \end{array}$$

$$\begin{array}{r}
 \text{min} \\
 26 \\
 \frac{5}{17.1} \\
 22.0
 \end{array}$$

$$\begin{array}{r}
 \frac{6}{17.5} \\
 23.0
 \end{array}$$

1961525

Moon measures

1913 July 5

2

a

a

a

a

$$\begin{array}{r}
 19316 \\
 18.0 \\
 198 \\
 11070.85 \\
 95.70 \\
 32 \\
 \hline
 19.8249
 \end{array}$$

$$\begin{array}{r}
 15062 \\
 13252.38 \\
 40.38 \\
 18 \\
 \hline
 18238
 \end{array}$$

blowing
partly on
lunar

$$\begin{array}{r}
 2 \\
 177 \\
 200
 \end{array}$$

$$\begin{array}{r}
 3 \\
 177 \\
 210
 \end{array}$$

$$\begin{array}{r}
 4 \\
 170 \\
 215
 \end{array}$$

$$\begin{array}{r}
 5 \\
 171 \\
 220
 \end{array}$$

$$\begin{array}{r}
 6 \\
 175 \\
 230
 \end{array}$$

$$\begin{array}{r}
 17900 \\
 15581 \\
 9888 \\
 00 \\
 \hline
 177695
 \end{array}$$

$$\begin{array}{r}
 12680 \\
 9080 \\
 11495
 \end{array}$$

$$\begin{array}{r}
 171188
 \end{array}$$

$$\begin{array}{r}
 10720 \\
 082 \\
 10438
 \end{array}$$

$$\begin{array}{r}
 170275
 \end{array}$$

$$\begin{array}{r}
 1094250 \\
 40 \\
 10384
 \end{array}$$

$$\begin{array}{r}
 170560
 \end{array}$$

$$\begin{array}{r}
 15020 \\
 1000510 \\
 10 \\
 28 \\
 \hline
 174984
 \end{array}$$

$$\begin{array}{r}
 15410 \\
 7662 \\
 7988 \\
 12 \\
 \hline
 7736
 \end{array}$$

$$\begin{array}{r}
 11268 \\
 10030 \\
 3830
 \end{array}$$

$$\begin{array}{r}
 1235
 \end{array}$$

$$\begin{array}{r}
 10327 \\
 1000914 \\
 10
 \end{array}$$

$$\begin{array}{r}
 0316
 \end{array}$$

$$\begin{array}{r}
 10344 \\
 974050 \\
 6065
 \end{array}$$

$$\begin{array}{r}
 0590
 \end{array}$$

$$\begin{array}{r}
 19488 \\
 14478 \\
 9082 \\
 92 \\
 \hline
 5007
 \end{array}$$

MC 1525

1913 July 3.

3

known measures

α	γ	δ	ϵ
2	19140	16456	
18.0	1450201	11674	
23.5	03	82	82
	50	66	
	<u>23.4643</u>	<u>4618</u>	

8	19170	16530
19.0	1098671	1472015
23.7	6876	20
	80	38
	<u>23.8203</u>	<u>8186</u>

max in γ - approx. 23.8300

9	17002	15607
20.0	10145	12458
23.6	5047	5852
	12	19
	<u>23.6861</u>	<u>6844</u>

10
20.9
23.0

possibly a terminator

16931
16090
7975
31
<u>20.9150</u>

15835
669690
90
42
<u>9149</u>

not very clear image.

MC 1525

1913 July 3.

3

known measurements

d	4	N
2	19140	16456
18.0	1450201	11074
23.5	03	8282
	50	66
	<u>23.4643</u>	<u>4618</u>

8	19170	16530
19.0	1098671	1472015
23.7	6876	20
	80	38
	<u>23.8203</u>	<u>8186</u>

max in 4 - approx. 238300

9	17002	15607
20.0	10143	12458
23.6	5047	5852
	12	19
	<u>23.6861</u>	<u>6849</u>

10
20.9
23.0

possibly a terminator

16931	15435
16090	669690
7975	90
31	42
<u>20.9150</u>	<u>9149</u>

not very clear image

MC 1525

1913 July 3.

4

	Times	etal.	
exp to stars	1912 Jan 3	2 ^h 27 ^m	- 2 ^h 39 ^m
moon		2 32	48.3
clock slow		0 1	09.1
H. Sid T.		2 33	57.6
H. long		4 44	31.05
G. Sid T.		7 18	28.65
Sid T. in moon		18 47	00.66
Interval		12 31	27.99
Reduction		2	03.11
G. M. T.		12 29	24.88

From Mount. Allen

R.A.

Decl.

moon 12 ^h	6 ^h 18 ^m 59 ^s 24 ^u	+ 27° 58' 50.0"
Motion in 1 ^m	2.8901"	0.021"
" " 294147"	+ A 25.01	+ 00.6
Tabular Place	6 ^h 20 ^m 24 ^s 25 ^u	+ 27° 58' 50.6"

Moon's parallax

69' 28.1

semidiameter

16' 20.0 16' 46.5"

939.5 10.6

1906.5 12.3

R = 1006.5"

augmentation - 12.3"

Irradiation grad (3) - 0.7

R = 1018.1"

a = 1.6

R = 2182.4"

(1+a)R = 2182.1"

R2 = 4761.5"

MC 1525

1913 July 3

4

	Times	Total	
Exp. to stars 1912 Jan 3	2' 27"	- 2' 39"	
moon	2 32	483 - 2 32	487
clock slow	01	091	
H Sid T	2 33	576	
H Long	4 44	3105	
G Sid T	7 18	2865	
Sid T in moon	18 47	0066	
Interval	12 31	2799	
Reduction		2 03.11	
G M T.	12 29	2488	

From Mount. Allen

R.A.

Decl.

Moon 12"	6" 18" 59° 24	+ 27 58 50.0
Moon 1"	28901	0.021
29.4147	+ A 2501	+ 00.6
Tabular Place	6" 20" 24° 25	- 27° 58' 50.6

Moon's parallax

60' 28.6"

semidiameter

16 - 50.0 16 + 6.5

29.106

R = 1006.5

06.5 123.

semidiameter - 12.3

In addition area (B) - 0.7

R = 1018.1

- 1.6

R = 21824

1 + a R = 21821

R = 47615

MIL 15-25

1913 July 10

5

Plate Constants

π	8.2142	12.7050	21.8542	25.1780
ξ	9.1979 ^v	13.5625	22.6989 ^v	26.2075 ^v
$\pi-\xi$	-9837	-8575	-8447	-10295

η	15.2520	25.7315	27.1034	71.4760
η	14.9456 ^v	25.4756	26.9550 ^v	113643 ^v
$\eta-\eta$	+3064	+2559	+1484	+1117

Preliminary Reduction

$\pi-\xi$	-1184	+22	+1.1602
-9837	-1800	-1.1637 + 16	= -1.1621 = -19
-8575	-3036	-1.1611 + 25	= -1.1586 = +16
-8447	-3198	-1.1645 + 44	= -1.1601 = +1
-10295	-1354	-1.1649 + 50	= -1.1599 = +3
9.2089 ^v	-2554 ^v	+38 ^v	= 20.1175 ^v

$\eta-\eta$	+1152	-4009
+3064	+945	= 4009
+2559	+1461	= +11
+1484	+2513	= -12
+1117	+2895	= +3
21.6458 ^v	+2209 ^v	= 21.4658 ^v

Tablins	$a = -2.2$	$a = -1.2$	$a - a = -1.0$	$b + a = +3.0$
Obs.	$a = -1.6$	$a = -0.1$	$a - a = -1.5$	$b + a = +3.5$
$c - 0$			+0.5	-0.5

MIL 12 25

Plate constants

1912 J. L. 10

5

π	82142	127050	218542	251780
β	91979	135625	226989	262075
$\alpha - \delta$	-9837	-8575	-8447	-10295

γ	152520	257315	271034	714760
η	197456	254756	269550	113643
$\gamma - \eta$	+3064	+2558	+1484	+1117

$$\begin{aligned}
 & -1184 \quad +22 \quad +11602 \\
 & -9837 - 1800 = -1.1637 + 16 = -1.1621 = -19 \\
 & -8575 - 3036 = -1.1611 + 25 = -1.1586 = +16 \\
 & -8447 - 3198 = -1.1645 + 44 = -1.1601 = +1 \\
 & -10295 - 1354 = -1.1649 + 50 = -1.1599 = +3 \\
 & 197089 - 2554 \quad +38 = 20.1175
 \end{aligned}$$

$$\begin{aligned}
 & \gamma - \eta \quad +1152 \quad -4009 \\
 & +3064 + 945 = +4009 = 0 \\
 & -2559 + 1461 = +4020 = +11 \\
 & +1484 + 2513 = +3997 = -12 \\
 & +1117 + 2695 = +4012 = +3 \\
 & 21.6458 + 2209 = 21.4658
 \end{aligned}$$

Tablens	$a = -22$	$a = -12$	$a - a = -10$	$b + a = +20$
Obs	$a = -16$	$a = -01$	$a - a = -15$	$b + a = +35$
$c - 0$			$+05$	-05

pt.	pos. L	resid.
1	213.8	+151
2	221.4	+109
3	252.8	+131
4	270.0	-121
5	279.3	-72
6	308.3	-43
7	326.2	+30
8	354.3	+58
9	21.0	+219

MC1525

Miron's Center

1913 July 10 6

x	$x - x_0$	Δx	$(x - x_0)^2$	R^2	$0 - C$
1 18.0000	-1.2150	+6	1.4748	4.7886	+271
2 17.7716	-1.4434	+5	2.0819	4.7872	+257
3 17.1212	-2.0938	+2	4.3831	4.7990	+375
-4 17.0296	-2.1854	0	4.7760	4.7760	+145
5 17.0575	-2.1575	-1	4.6552	4.7811	+196
6 17.4994	-1.7156	-4	2.9447	4.7802	+187
7 18.0000	-1.2150	-6	1.4777	4.7821	+206
8 19.0000	-0.2150	-7	0.0466	4.7733	+118
9 20.0000	+0.7850	-7	0.6152	4.7764	+149
10 20.9150	+1.7000	-4	2.8886	4.7241	

Comp. R: 4.7615

y	$y - Y_0$	Δy	$(y - Y_0)^2$
1 19.8244	-1.6206	+2	3.3138
2 20.0000	-1.6450	+2	2.7053
3 21.0000	-0.6450	+1	0.4159
4 21.6450	0.0000	0	0.0000
5 22.0000	+0.3550	-1	0.1259
6 23.0000	+1.3550	-2	1.8355
7 23.4630	+1.8180	-2	3.3044
8 23.8194	+2.1744	-3	4.7267
9 23.6852	+2.0402	-3	4.1612
10 23.0000	+1.3550	-2	1.8355

Approx. Center

$$x = 18.0 \quad y = 19.8244$$

$$23.4630$$

$$43.2874$$

$$\text{Mean } y = 21.6437$$

$$y = \text{max} = 23.8300$$

$$R = 2.1863$$

$$x = \text{min} = 17.0296$$

$$x_0 = 19.2150$$

$$y = 23.0 \quad x = 17.4994$$

$$20.9150$$

$$38.4144$$

$$\text{Mean } x = 19.2072$$

$$x = \text{min} = 17.0296$$

$$R = 2.1776$$

$$23.8300$$

$$21.6524$$

Assume $x_0 = 19.2150$

$$y_0 = 21.6450$$

MC1525 *huvio's Center* 1913 July 10 6

	x	$x - x_0$	Δx	$(x - x_0)^2$	K^2	$10 - C$
1	180000	-12150	+6	14748	47886	+271
2	177716	-14934	+5	20819	47872	+257
3	171212	-20438	+2	43831	47990	+375
4	170296	-21854	0	47760	47760	+145
5	170575	-21575	-1	46552	47811	+196
6	174999	-17156	-9	29447	47802	+157
7	180000	-12150	-6	14777	47821	+116
8	190000	-02150	-7	00466	47733	+118
9	200000	+07850	-7	06152	47764	+149
10	209150	+17000	-4	25600	47241	
Comp. R.				47615		

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	198244	-18206	+2	33138
2	200000	-16450	+2	27053
3	210000	-06450	+1	04159
4	216450	00000	0	00000
5	220000	+03550	-1	01259
6	230000	+13550	-2	18355
7	234630	+18150	-2	33044
8	238194	+21744	-3	47267
9	236852	+20402	-3	41612
10	230000	+13550	-2	18355

Approx Center

$x - 180$	$y = 198244$
	<u>234630</u>
	432874
mean y	216437
$y - \text{max}$	238300
R	21863
$x - \text{min}$	170296
X	172159

$y - 230$	$x = 174994$
	<u>209150</u>
	384144
mean x	192072
$x - \text{min}$	170296
K	21776
	<u>238300</u>
	216524

Assume $X = 19.2150$
 $Y = 21.6450$

Formation of Normals

	ab	du	bm
1	+ 2.22	- 330.6	- 493.2
2	+ 2.38	- 226.1	- 424.0
3	+ 0.34	- 197.4	- 60.2
4	- 0.00	- 317.6	+ 0.0
5	- 0.78	- 423.4	+ 70.6
6	- 2.34	- 321.6	+ 254.3
7	- 2.22	- 263.5	+ 393.1
8	- 0.48	- 26.0	+ 256.0
9	+ 1.61	+ 117.7	+ 304.0
	+ 0.73	- 1988.5	+ 300.7

1	+ 2.22	- 330.5	- 493.0
2	+ 2.38	- 370.0	- 424.0
3	+ 1.36	- 784.0	- 243.5
4	- 0.00	- 317.5	+ 0.0
5	- 0.78	- 423.0	+ 70.5
6	- 2.34	- 321.5	+ 254.5
7	- 2.22	- 251.5	+ 374.8
8	- 0.48	- 26.0	+ 256.0
9	+ 1.61	+ 117.8	+ 304.0
	+ 1.75	- 2706.2	+ 993

giving (3) full wt.

Residuals

	O	C	O - C
1	+ 271	+ 148 - 28 = + 120	+ 151
2	+ 257	+ 173 - 25 = + 148	+ 109
3	+ 375	+ 254 - 10 = + 244	+ 131
4	+ 145	+ 266 + 0 = + 266	- 121
5	+ 196	+ 263 + 5 = + 268	- 72
6	+ 187	+ 209 + 21 = + 230	- 43
7	+ 206	+ 148 + 28 = + 176	+ 30
8	+ 118	+ 27 + 33 = + 60	+ 58
9	+ 149	- 96 + 31 = - 65	+ 214

$$+ 693 - 236 = + 457$$

$$\text{Average} = + 51$$

$$\text{Average (O - C)} = 103$$

15-25

Moon's Center Conditional Equations

7

	a	b	c	0	c	0-c
1	-1.22	-1.82	+271	+109-32	+77	+194
2	-1.44	-1.65	+207	+128-29	+99	+158
3	-2.09	-0.65	+375	+186-12	+174	+201
4	-2.19	+0.00	+145	+195+0	+195	-50
5	-2.16	+0.36	+196	+192+6	+198	-2
6	-1.72	+1.36	+187	+103+24	+177	+10
7	-1.22	+1.82	+206	+109+32	+141	+75
8	-0.22	+2.17	+118	+20+39	+59	+59
9	+0.79	+2.04	+149	-70+36	-34	+183

Average: 104.

Average: +85

Normal Equations

$$+2246 + 0.73 = -1988$$

$$+ 0.73 + 20.59 = +301$$

$$- 0.73 - 0.02 = +65$$

$$+ 20.57 = +266$$

$$b = +17.8$$

$$- 0.03 - 0.73 = -11$$

$$+ 2243 = -1999$$

$$a = -89.0$$

Normal Equations

$$+2246 + 1.75 = -2706$$

$$+ 1.75 + 20.59 = +99$$

$$- 1.75 - 0.14 = +211$$

$$+ 20.45 = +310$$

$$b = +15.2$$

$$+2246 = -2706 - 27 = -2733$$

$$a = -121.8$$

Small change in radius

15-20

Knowns Center Conductance Equations

	a	b	0		c	0-c
1	-1.22	-1.52	+271	+109-32	+77	+194
2	-1.44	-1.65	+257	+128-29	+99	+158
3	-2.09	-0.65	+375	+186-12	+174	+201
4	-2.19	+0.00	+145	+195+0	+195	-50
5	-2.16	+0.36	+196	+192+6	+198	-2
6	-1.72	+1.36	+187	+153+24	+177	+10
7	-1.22	+1.82	+216	+109+32	+141	+75
8	-0.22	+2.17	+118	+20+39	+59	+59
9	+0.79	+2.04	+149	-70+36	-34	+183

Average 10

Normal Equations

$$+2246 + 0.73 = -1988$$

$$+ 0.73 + 20.59 = +301$$

$$- 0.73 - 0.02 + 65$$

$$+ 20.57 = +366$$

$$b = +17.8$$

$$- 0.03 - 0.73 - 11$$

$$+ 2243 = -1999$$

$$a = -89.0$$

Normal Equation

$$+2246 + 1.75 = -2706$$

$$+ 1.75 + 20.59 = +99$$

$$- 1.75 - 0.19 + 211$$

$$+ 20.45 = +310$$

$$b = +15.2$$

$$+2246 = -2706 - 27 - 2733$$

$$a = -121.8$$

Red. ad. e. app.

 $\delta + 27 \quad 34$

$$H + \alpha \quad 5 \quad 37 = 84^\circ 15'$$

$$H \quad 23 \quad 14$$

$$\alpha = 6 \quad 23$$

$$G \quad 16 \quad 42$$

$$G + \alpha \quad 23 \quad 08 = 346^\circ 15'$$

$$l \cos S \quad 9.9477$$

$$l \quad 0.2403 \sim$$

$$(l) \quad 0.1880 \sim$$

$$l \sin S \quad 9.6654$$

$$\cos(H + \alpha) \quad 9.0008$$

$$h \quad 1.3095$$

$$\sin \quad 9.9978$$

$$\sec S \quad 0.0523$$

$$\frac{h}{\sin} \quad 8.8239$$

$$l \cos(G + \alpha) \quad 9.9874$$

$$s \quad 0.9033$$

$$\sin \quad 9.3760 \sim$$

$$\tan b \quad 9.7177$$

$$r' \quad 8.8239$$

$$(s') \quad 0.8907$$

$$(s) \quad 8.8209 \sim$$

$$(h') \quad 9.9757$$

$$(h) \quad 0.1835$$

$$b \quad -0.41$$

$$s \quad -0.07$$

$$h \quad +1.53$$

$$+1.05$$

$$s' \quad +7.78$$

$$s \quad +0.95$$

$$i \quad -1.54$$

$$+7.19$$

1525 Moon's Mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 & = & 19.2150^{\vee} \\
 Y_0 & = & 21.6450^{\vee} \\
 \text{---} & & \text{---} \\
 \text{---} & = & 61^{\vee} \quad \text{---} = + 8^{\vee} \\
 \hline
 & & 19.2089^{\vee} \quad 21.6458^{\vee}
 \end{array}$$

From Prelim Reduction $X = 20.1175^{\vee}$ $Y_0 = 21.4658^{\vee}$

Plate Constants $a_x = + 7$ $a_y = - 16$

$b_x = + 27$ $b_y = - 3$

$c = - 31$ $c = + 17$

$X = 20.1178^{\vee}$ $Y = 21.4656^{\vee}$

$$\begin{array}{rcl}
 \bar{z} & = & + 2.1178^{\vee} \\
 \log \bar{z} & = & 0.32589^{\vee} \\
 \dots \log 8 & & 9.94769^{\vee} \\
 \dots \text{const} & & 8.50724
 \end{array}$$

$$(X-A) \quad 1.87096^{\vee}$$

$$A-A \quad + 1 \quad 14.30^{\vee}$$

$$A \quad 6^h \quad 22 \quad 03^{\vee}$$

$$X_0 \quad 6 \quad 23 \quad 17.30^{\vee}$$

$$\text{Red.} \quad + 1.05^{\vee}$$

$$X' = 6 \quad 23 \quad 18.35^{\vee}$$

$$\eta = -0.5344^{\vee}$$

$$\begin{array}{rcl}
 \log \tan \delta & & 9.7165^{\vee} \\
 \dots \bar{z}^2 & & 0.6522^{\vee}
 \end{array}$$

$$\begin{array}{rcl}
 \dots \eta_1 & & 7.4221^{\vee} \\
 \eta_1 & = & + 26^{\vee}
 \end{array}$$

$$\eta_0 = -0.5370$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 9.72997^{\vee} \\
 \dots \text{const} & & 7.33115^{\vee}
 \end{array}$$

$$-(V-D) \quad 2.39882^{\vee}$$

$$8-D \quad - \quad 4 \quad 10.5^{\vee}$$

$$D = + 27 \quad 37 \quad 51^{\vee}$$

$$S_0 = + 27 \quad 33 \quad 40.5^{\vee}$$

$$\text{Red.} \quad + \quad 7.2^{\vee}$$

$$8' = + 27 \quad 33 \quad 47.7^{\vee}$$

1525 Hoon's Hoon Position (1912.0)

$$\begin{array}{r}
 X_0 = 192150 \\
 - 61 \\
 \hline
 192189
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 216450 \\
 + 9 \\
 \hline
 216459
 \end{array}$$

True Position (Reduction) $X = 20.1175$ $Y = 21.4658$

Plate Constants $a_x = +7$ $a_y = -16$

$b_x = +27$ $b_y = -3$

$c = -31$ $c = +17$

$X = 20.1178$ $Y = 21.4656$

$$\begin{array}{l}
 z = +2.1178 \\
 \log z = 0.32589 \\
 \log s = 9.94769 \\
 \text{const} = 8.50724
 \end{array}$$

$$(K-A) = 187096$$

$$A-A = +114.30$$

$$A = 6.2203$$

$$d_0 = 6.2317.30$$

$$\text{Red.} = +1.05$$

$$X' = 6.2318.35$$

$$z = -0.5349$$

$$\begin{array}{l}
 \log \tan s = 9.7165 \\
 s^2 = 0.6522
 \end{array}$$

$$\begin{array}{l}
 \eta_1 = 74221 \\
 \eta_2 = +26
 \end{array}$$

$$\eta_0 = -0.5370$$

$$\begin{array}{l}
 \log \eta_0 = 9.72997 \\
 \text{const} = 7.33115
 \end{array}$$

$$(A-D) = 2.39882$$

$$S-D = -410.5$$

$$D = +2737.51$$

$$S_0 = +2733.40.5$$

$$\text{Red.} = +7.2$$

$$S = +2733.47.7$$

1525 Lunar Parallax

$$\begin{array}{r} \alpha' = 6^h 23^m 18.35^s \\ G = 2 \quad 3.3 \quad 57.6 \\ - 3 \quad 49 \quad 20.8 \\ - \quad 57^s \quad 20' \quad 12'' \end{array}$$

$$\begin{array}{r} - \quad 21 \quad 21 \quad 40 \\ - \quad 56 \quad 58 \quad 32 \end{array}$$

$$\begin{array}{r} 995727 \\ 999999 \\ \hline 026361 \\ 022087 \end{array}$$

$$\begin{array}{r} \eta = 58 \quad 58 \quad 4.6 \\ 27 \quad 33 \quad 50 \\ 31 \quad 24 \quad 56 \end{array}$$

$$\begin{array}{r} 9.82640 \\ 8.25236 \\ 9.71704 \\ \hline 006703 \\ 786289 \end{array}$$

$$\delta - \delta' = +25 \quad 04 \quad 9$$

$$\delta = +27 \quad 58 \quad 51.7$$

$$\text{Nautical } \delta = +27 \quad 58 \quad 50.6$$

$$0 - 0$$

$$+ 1.1$$

$$\delta = +27 \quad 33 \quad 47.7$$

$$\pi = 61 \quad 28.1$$

$$\begin{array}{r} 9.86913 \\ 8.25236 \\ 9.92524 \\ \hline 005399 \\ 810072 \end{array}$$

$$\alpha - \alpha' = -43 \quad 21.12$$

$$= -2 \quad 53.41$$

$$\alpha = 6 \quad 20 \quad 24.94$$

$$\alpha = 6 \quad 20 \quad 24.25$$

$$+ 0.69$$

MC 1542

Stars - Measures

1913 July 8.

9

	d	N	d	N	d	N
1	15027	17060	17923	16715		
7.8	13250	8820	16240	8386	99	
9.2	4042	18	35-41	9096		
	19	40	12	10		
	<u>9.1781</u>	<u>.1774</u>	<u>7.8318</u>	<u>.8318</u>		
2	9					
14.8	15107	19196	15365	15316		
29.5	9919090	1510807	1393733	672827		
	90	10	29	29		
	07	80	52	10		
	<u>29.5917</u>	<u>.5918</u>	<u>14.8570</u>	<u>.8583</u>		
3						
31.3	13250	1168080	17055	17450		
9.0	1269925	78	969080	1481508		
	22	11065	8084	1008		
		40		58		
	<u>9.0628</u>	<u>.0614</u>	<u>31.2640</u>	<u>.2641</u>		
4						
32.6	17720	18500	18159	18849		
28.1	1654140	968081	1490599	1209190		
	39	80	95-99	9290		
	10	07	60	35		
	<u>28.1179</u>	<u>.1174</u>	<u>32.6741</u>	<u>.6749</u>		

long (z) narrow images

Grade 4

1101542

Stars - Measures

1913J-678

9

	α	δ	α	δ	α	δ	α	δ
1	15027		17060		17923		16715	
7.4	13250		8820	11	16240		8386	97
9.2	4042		18		35-41		9096	
	19		40		12		10	
	<u>91781</u>		<u>1774</u>		<u>78318</u>		<u>8318</u>	
2	9							
148	15107		19196		15365		15316	
295	1919090		1510807		1393733		672827	
	90		10		29		29	
	07		80		52		10	
	<u>295917</u>		<u>5918</u>		<u>148570</u>		<u>8583</u>	
3								
313	13250		1168080		17055		17450	
90	1269925		78		969080		1481508	
	22		11065		8089		1008	
					40		58	
	<u>9.0628</u>		<u>.0614</u>		<u>31.2640</u>		<u>2641</u>	
4								
326	17720		185500		18159		18849	
28.1	1654140		968081		1490595		1209190	
	39		80		95-95		9290	
	10		07		60		35	
	<u>28.1179</u>		<u>1174</u>		<u>32.6741</u>		<u>6749</u>	

long (2) narrow images

Grade 4

118
59

MC1542
moon - Uranus
d 4

1913 July 8.

10

d 26

N

1 17895 15560
17.0 19711 13709
17.8 1878 9499
98 50
17.8181 .8137

2 min in 4 = 17.7420

2
18.0 16839 14626
17.8 8861 12620
56 60 1624
49 20
17.7988 .7995

3
18.5 18080 16110
18.0 13300 10879
1010 6270
70 20
18.5232 .5245

4
19.0 16024 19100
18.4 12298 12820
1822 1620
24 90
18.3711 .3725

5
19.4 16416 18710
19.0 10500 14620
1109 1010
09 14
19.4095 .4099

6 max in 4 = 19.5610

15330 17792
10842 12281
31 37 6980
30 90
19.5507 .5514

6
19.5
20.0

M61542

Moon - Uranus

d 4

1913 July 8

10

d 26

2

17895	15560
-------	-------

170 19711	13709
-----------	-------

178 1818	9499
----------	------

98	50
----	----

<u>17.8181</u>	<u>8137</u>
----------------	-------------

2

mean in 4 =	<u>17.7420</u>
-------------	----------------

2

18.0 16839	14626
------------	-------

17.8 886160	1262024
-------------	---------

56	1624
----	------

49	20
----	----

<u>17.7988</u>	<u>7995</u>
----------------	-------------

3

18.5

18.0

18080

13300

1010

70

185232

16110

10879

6270

20

5245

4

19.0 16024	19100
------------	-------

18.4 1229815	12820
--------------	-------

1822	1620
------	------

24	90
----	----

<u>18.3711</u>	<u>3725</u>
----------------	-------------

5

194

190

16416

1050009

1109

09

194095

18710

1462010

10

14

4099

mean 4 =	<u>19.5610</u>
----------	----------------

15330

1084237

31

30

195507

17792

1228180

6980

90

5514

6

19.5

20.6

17
17.

MC 1542 Moon Measures. 1913 July 6. 11

7	a	4	n	a	x	n
19.0	15030		16526			
21.3	1603028		850080			
	42		9880			
	20		30			
	<u>21.1995</u>		<u>.1964</u>			

8 Scratch.

18.6	19529	15500	18816	15815
21.5	1427980	10736	14720	986189
	70	3530	1822	8089
	23	04	30	15
	<u>21.5250</u>	<u>.5282</u>	<u>18.5898</u>	<u>.5938</u>

scratch instead of n. 1

9	17548	18728	18760	15764
17.4	10036	1619601	12780	1168090
17.7	4546	1009	7886	80
	44	18	60	20
	<u>17.7503</u>	<u>.7483</u>	<u>.4021</u>	<u>.4084</u>

MC 1542

Moon's maximum

1913 July 6

11

7	a	4	n	a	n
190	15030		16526		
21.5	16030	28	850050		
	42		9850		
	20		30		
	<u>21.1995</u>		<u>1964</u>		

8 Scratch

186	19529	15500	18816	115815
21.5	14279	10736	14720	986185
	80	3130	1522	8085
	70		30	15
	23	04		
	<u>21.5250</u>	<u>5232</u>	<u>185895</u>	<u>5938</u>

Scratch instead of no. 1

2	17548	18728	18760	15764
4	10036	1619601	12780	1165090
7	4546	1009	7586	80
	44	18	60	70
	<u>17.7503</u>	<u>7483</u>	<u>4021</u>	<u>4054</u>

MC 1542

Standard across.

A. B. (Strasbourg) no. 4611 mag 6.7

capit. no. 1705 mag 7.1

12

A. B. 12^h 25^m 42.34

C 12 29 15.66
 L 72
 E 69

Mean 12 29 15.69

Prec +36.99

A 12 26 19.33

12 29 52.53

A 12 31 34

12 31 34

A-A - 5 14.67

- 1 41.47

Sine(A-A) - 3 14.64

- 101.47

log 2.49782^m2.00634^m-cos 9.99916^v9.99914^v-S. 1.00422^m0.51352^m

S. -10.0977

-3.2623^v

S. 67

- 6^vS. 7.8956^v14.7371^v

S. 7.8318

14.8576^v

- 638

S-E - 685

+1205^v

A. B. -30 30' 30.7

C -0 51 23.6

L 23.3

E 23.4

Mean -0 51 23.4

Prec -3 59.1

-3 58.3

d -3 34 29.8

-0 55 21.7^v

D -1 54 28

-1 54 28

S-D -1 40 01.8

+ 59 06.3^v

tan(S-D) -6003.5

+3546.6^vlog 3.77840^m3.54981^vno 1.40955^m0.88096^vtan S 8.7957^m8.2070^m-S 20080^v10270^v" 7.8571^m6.2874^vno -12.8691^v+7.6026^v

no - 72

- 2^vno 9.1237^v29.6024^vno 9.1778^v29.5918^v

no +541

-106^v

M.C. 1542

Standard observer

A. G. (Shalburg) no. 46117 mag 6.7

Cape no. 1705 mag 7.1

25. 12 25 4234

C 12 29 15.66

L 72

E 69

Mean 12 29 15.69

Prec +36.99

A 12 26 19.33

A 12 31 34

A-A - 5 14.67

Smp(A-A) - 3 14.64

log 2.49782

cos 9.99916

3. 1.00422

I. -100977

I. - 67

I. 78956

I. 78318

I. - 638

I-I - 145

A. G. - 30 30' 30.7

Prec - 3 59.1

d - 3 34 29.8

D - 1 54 28

S-D - 1 40 01.8

tan(S-D) - 60035

log 3.77840

m₀ 1.00955

Tan S 8.7957

S² 20080m₁ 78571m₀ -128691m₁ - 72

m 91237

y 91778

y-y +541

C -0 51 23.6

L 233

E 234

Mean -0 51 23.4

- 3 58.3

-0 55 21.7

-1 54 28

+ 59 06.3

+35466

3.54981

0.88096

8.2070

10270

6.2874

+76026

- 2

29.6024

29.5918

-106

MC 1542 Standard Curves.

13

Cape No. 1722 mag. 7.8

Cape No. 1724 mag. 6.1

C	12	37	51.86
L			91
E			84
Mean	12	37	51.87
Prec			+36.85
R	12	38	28.72
A	12	31	34
A-A		+6	54.72
sin(A-A)		+4	14.66
log			2.61769
-cord			9.99916
S ₀			1.12409
S ₀			+13.3073
S ₁			+110
S ₂			31.3183
S ₃			31.2640
S ₄ -S ₃			-543

E	-3	29	46.7
L			47.3
E			46.9
Mean	-3	29	47.0
Prec		-3	59.4
J	-3	33	46.4
D	-1	54	28
S-D	-1	39	18.4
tan(B-D)			-5960.1
log			3.77526
-40			1.10641

tan S			8.7942
S ₀			22482
S ₁			8.0958

M ₀	-1	2.7765
M ₁	-	125
M ₂		9.2110
M ₃		9.0621
M ₄		-1489

y-y

			+36.71	+36.92
12	39	06.58	06.79	
12	31	34		
	+7	32.58	32.79	
	+4	52.50	452.71	
		2.65562	2.65582	
		9.99992	9.99992	
		1.16278	1.16298	
	+14.5479	+14.5540		
	+88	+88		
	32.5567	32.5628		
	32.6745	32.6745		
	+1178	+1117		

-1	01	37.0		
	-3	55.0	-3	57.1
-1	05	32.0		34.1
-1	54	28		
	+48	56.0		53.9
	+29	36.2		2934.1
	3.46779		3.46748	
	0.79894		0.79863	

8.2802	
23.256	
7.6592	

+6.2941	+6.2897
-46	-46
28.2895	28.2851
28.1176	28.1176
-1719	-1675

1912phae-w3bj

13

Cape No. 17.22 mag 7.8

Cape No. 17.24 mag 6.1

C 12 37 51.86

12 38 29.87

L 91

E 84

Mean 12 37 51.87

P. 12 38 29.87

R 12 38 28.72

A 12 31 34

R-A + 6 54.72

sin(x-A) + 4 19.66

log 2.61767

-cos 9.99916

S. 1.12409

S₀ + 13.3073S₁ + 110S₂ 31.3183S₃ 31.2640S₄ - 543

C - 3 29 46.7

L 47.3

E 46.9

Mean - 3 29 47.0

P. - 3 59.4

J - 3 33 46.4

D - 1 54 28

S-D - 1 34 18.4

tan(B-A) - 59.60.1

log 3.77526m

-m₀ 1.10641m

tan S 8.7942m

-m₀ 2.2482-m₁ 8.0958mm₀ - 12.7765m₁ - 1.25m₂ 9.2110m₃ 9.0621m₄ - 14.89m₅ - 14.89

- 1 01 37.0

- 3 55.0

- 1 05 32.0

- 1 54 28

+ 48 56.0

+ 29 36.2

346.779

079.894

8280.2m

23256

76592m

+ 6.2941

- 46

28.2895

1176

- 14.19

HAC 1542

1913 July 9.

14

Times etc.

Expt. star 1912 Jan 9	11 ^h 55 ^m			- 12 ^h 07 ^m
moon	12 00	47.8	- 12 00	48.0
clock slow	01	11.3		
H. Sid. T.	12 01	59.2		0-0- -0 ^h 29 ^m
H. Long.	4 44	31.05		
G. Sid. T.	16 46	30.21		
Sid. T. Moon	19 10	40.01		
Interval	21 35	50.24		
Reduction		3	32.29	
G. M. T.	21 32	17.95		

Bruckhauf Alm.					
moon 21 ^h	12 ^h 29 ^m	52.79	- 1 22	55.5	
Amotion 1 ^m	1.9537		15.572		
32.2992	+ 1	03.10	- 8	23.0	
Tabular place	12 30	55.89	- 1 31	18.5	

Moon's parallax

57.254

Semi-diameter

15.409

9392 = 11.3
940. = 11.4

= 940.4

Aug = + 11.4

Imaginary (4) - 0.8

R = 951.0

a = + 3.6

R = 2.0386

(1+a) R = 2.0393

R2 = 915.87

11461542

1913 July 9

14

Times etc

Expt stan 1912 Jan 9 11^h 55^m - 12^h 07^m
 noon 12 00 47.8 - 12 00 48.0
 clock slow 01 11.3

H. L. 12 01 59.2
 H. long 4 44 31.05
 G. L. 16 46 30.21
 S. L. 19 10 40.01
 Interval 21 35 50.24
 Radiation 3 32.29
 A. M. T. 21 32 17.95

Brown and Allen R A Black
 noon 21^h 12 29 52.79 - 1 22 55.5
 Motion in 1^m 1.95.37 15.572
 32.2992 + 1 03.10 - 8 23.0
 Tabular place 12 30 55.89 - 1 31 18.5

Moon's parallax
 Semidiameter

$\mu = 11.3$
 $\mu' = 11.4$

Ang = 94.04
 Imidial (4) = +11.4
 R = -0.8
 R = 951.0

= +3.6

R = 20386
 (1 hr) R = 20393
 R² = 91587

MC 1542

Center of Plate

1913 July 10.

15

α	δ	R.A.	Decl
7.8318	9.1778	12 ^h 26 ^m 19	-3 34 30
14.8576	29.5918	29 53	-6 55 22
31.2640	9.0621	38 29	-3 33 46
32.6745	28.1176	39 07	-1 05 32
186.6279	75.95	132 108	-7 127 130
21.66	18.99	12 33 27	-2 16 48
-18	-22	-1 53	+22 20
3.66	3.01	12 31 34	-1 54 28
31	465		
11 3 ^s	1400"		

$$A = 12^h 31^m 34^s$$

$$D = -1^\circ 54' 28''$$

Preliminary Reduction

$$\begin{aligned} \alpha - 3 &= 884 & -42 & & +1472 \\ -638 &= 808 & -1446 - 31 &= -1477 &= -5 \\ +1205 &= 2604 & -1399 - 59 &= -1458 &= +14 \\ -543 &= 797 & -1340 - 125 &= -1465 &= +7 \\ +1117 &= 2474 & -1357 - 130 &= -1487 &= -15 \\ 175289 &= 1741 & -70 & & -17495-0 \end{aligned}$$

$$\begin{aligned} \delta - 2 &+ 872 & +34 & & -1259 \\ +541 &+ 681 & +1222 + 28 &= +1250 &= -9 \\ -106 &+ 1293 & +1187 + 89 &= +1276 &= +17 \\ -1489 &+ 2720 & +1231 + 27 &= +1258 &= -1 \\ -1675 &+ 2843 & +1168 + 84 &= +1252 &= -7 \\ 19.7838 &+ 1525 & +59 & & = 19.8163 \end{aligned}$$

Tables $a = -0.9$ $b = -3.7$ $a - b = +2.8$ $b + d = +0.8$
 cbs $+3.6$ -2.4 $+6.0$ $+0.6$
 $c - 0$ -3.2 $+0.2$

Residuals

- 3	+ 9	+ 6	- 5
- 6	+ 9	+ 3	+ 4
- 13	+ 9	- 4	+ 7
- 13	+ 9	- 4	- 15

O-C

- 11

+ 11

+ 11

- 11

C

O

O-C

- 3 + 5 - 3 = - 1	- 9	- 8
- 5 + 17 - 3 = + 9	+ 17	+ 8
- 12 + 5 - 3 = - 10	- 1	+ 9
- 12 + 16 - 3 = + 1	- 7	- 8

C

O

O-C

+ 2 - 5 + 5 = + 2	- 1	- 3
+ 4 - 17 + 5 = - 8	- 6	+ 2
+ 9 - 5 + 5 = + 9	+ 11	+ 2
+ 10 - 17 + 5 = - 2	- 5	- 3

C

O

O-C

+ 1 + 6 - 14 = - 7	- 26	- 19
+ 1 + 21 - 14 = + 8	+ 26	+ 18
+ 2 + 6 - 14 = - 6	+ 13	+ 19
+ 2 + 20 - 14 = + 8	- 11	- 19

MC 1542-1543

1913 Sept 27.

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Plato Constants

1543

	$x-3$	$4-m$	$7L-3$	$4-m$
$7.90 + 9.12 + 1 =$	-5	-9	-1	-26
$14.74 + 29.60 + 1 =$	$+14$	$+17$	-6	$+26$
$31.32 + 9.21 + 1 =$	$+7$	-1	$+11$	$+13$
$32.56 + 28.29 + 1 =$	-15	-7	-5	-11
$11.32 + 19.36 + 1 =$	$+4.50$	$+4.00$	-3.50	0.00
$31.94 + 18.75 + 1 =$	-4.00	-4.00	$+3.00$	$+1.00$
$19.61 + 9.16 + 1 =$	$+1.00$	-5.00	$+5.00$	-6.50
$23.65 + 28.94 + 1 =$	-0.50	$+5.00$	-5.50	$+7.50$
$-20.62 + 0.61 =$	$+8.50$	$+8.00$	-6.50	-1.00
$-4.04 - 19.78 =$	$+1.50$	-10.00	$+10.50$	-14.00
$+4.04 - 0.12 =$	-1.66	-1.56	$+1.27$	$+0.20$
$-19.90 =$	-8.66	-11.56	$+11.77$	-13.80
$b =$	$+0.00$	$+0.58$	-0.59	$+0.69$
$-20.62 =$	-0.44	-0.37	$+0.30$	$+0.07$

$+3.5$	-4.0	$+1.0$	-0.5	$+4.0$	-4.0	-5.0	$+5.0$
$+4.7$	$+13.2$	$+8.7$	$+9.7$	$+4.2$	$+11.8$	$+7.3$	$+8.7$
-0.2	-0.1	-0.1	-0.2	-11.2	-10.9	-5.3	-16.8
$+9.0$	$+9.1$	$+9.1$	$+9.0$	-3.0	-3.1	-3.0	-3.1
$c \text{ for } x-5 (1542)$				$c \text{ for } (4-m) (1542)$			

-3.5	$+3.0$	$+5.0$	-5.5	0.0	$+1.0$	-6.5	$+7.5$
-3.4	-9.5	-5.8	-7.0	-0.8	-2.2	-1.3	-1.6
$+11.4$	$+11.0$	$+5.4$	$+17.0$	-13.4	-13.0	-6.4	-20.0
$+4.5$	$+4.5$	$+4.6$	$+4.5$	-14.2	-14.2	-14.2	-14.1

MC 1542-1543

1913 Sept 27

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Plate constants

543

	2-3	4-5	7-8	9-10
$790 + 912 + 1 =$	-5	-9	-1	-26
$1474 + 2960 + 1 =$	719	+17	-6	+26
$3132 + 921 + 1 =$	+7	-1	+11	+13
$3256 + 2829 + 1 =$	-15	-7	-5	-11
$1132 + 1936 + 1 =$	+450	+900	-350	000
$3194 + 1875 + 1 =$	-400	-400	+300	+100
$1961 + 916 + 1 =$	+100	-500	+500	-650
$2365 + 2894 + 1 =$	-050	+500	-550	+750
$-2062 + 061 =$	+850	+800	-650	-100
$-404 - 1978 =$	+150	-1000	+1050	-1400
$+404 - 0.12 =$	-166	-150	+127	+020
$-1990 =$	-800	-1156	+1177	-1380
$\therefore =$	+008	+058	-059	+069
$\therefore =$	-041	-037	+030	+007

+45	-40	+10	-05
+47	+182	+87	+97
+72	-04	+01	-02
+90	+91	+91	+90

C for 2-5 (1542)

+40	-40	-50	+50
+42	+118	+73	+57
-112	-109	-13	-168
-30	-31	-30	-31

C for (9-10) (1542)

35	+30	+50	-55
34	-95	-58	-70
14	+110	+54	+170
15	+45	+46	+45

00	+10	-65	+75
-08	-22	-13	-16
-134	-130	-64	-200
-142	-142	-142	-141

1
2
3
4
5
6
7
8
(1)

1
2
3
4
5
6
7
8
(1)

MC 1542

Center of Moon

1913 July 23

	x	$x - X_0$	$(x - X_0)^2$	R^2
1	17.4052	-0.0129	0.0002	4.1451
2	18.0000	+0.4819	0.2322	4.1764
3	18.5238	+1.0057	1.0114	4.2008
4	19.0000	+1.4819	2.1960	4.1934
5	19.4097	+1.8916	3.5782	4.1944
6	19.5510	+2.0329	4.1327	4.1790
7	19.0000	+1.4819	2.1960	4.1934
8	18.5918	+1.0737	1.1528	4.1786
(1)	17.0000	-0.5181	0.2684	4.1466

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.7493	-2.0356	-3	4.1449
2	17.8992	-1.9857	-3	3.9442
3	18.0000	-1.7849	-2	3.1894
4	18.3718	-1.4131	-2	1.9974
5	19.0000	-0.7849	-1	0.6162
6	20.0000	+0.2151	0	0.0463
7	21.1980	+1.4131	+2	1.9974
8	21.5241	+1.7392	+2	3.0258
(1)	17.8159	-1.9690	-3	3.8782

Approximately Center

$$x = 19.0 \quad y = 18.3718$$

$$21.1980$$

$$39.5698$$

$$\text{mean } y = 19.7849$$

$$y = \text{min} = 17.7420$$

$$R = 2.0429$$

$$x = \text{max} = 19.5610$$

$$X_0 = 17.5181$$

$$19.7834$$

$$17.7420$$

$$2.0414$$

$$19.5610$$

$$17.5186$$

$$\text{Center } \begin{cases} X_0 = 17.5181 \\ Y_0 = 19.7849 \end{cases}$$

$$X_0 = 17.5272$$

$$Y_0 = 19.7836$$

MC 1542

Center of Mass

1913 July 23

	x	$x - x_0$	$(x - x_0)^2$	R^2
1	174052	-0.0529	0.0002	41451
2	180000	+0.4819	0.2322	41764
3	185238	+1.0057	1.0114	42008
4	190000	+1.4819	2.1960	41934
5	194097	+1.8916	3.5782	41944
6	195510	+2.0329	4.1327	41790
7	190000	+1.4819	2.1960	41934
8	185918	+1.0737	1.1528	41786
(1)	170000	-0.5181	0.2684	41466

	y	$y - y_0$	$(y - y_0)^2$
1	17.7493	-2.0356	4.1449
2	17.7992	-1.9857	3.9442
3	18.0000	-1.7849	3.1894
4	18.3718	-1.4131	1.9974
5	19.0000	-0.7849	0.6162
6	20.0000	+0.2151	0.0463
7	21.1980	+1.4131	1.9974
8	21.5241	+1.7392	3.0258
(1)	17.8159	-1.9690	3.8782

Approximate Center

$$x = 190 \quad y = 18.3718$$

$$21.1980$$

$$39.5698$$

$$\text{mean } y = 19.7849$$

$$y_{\text{min}} = 17.7420$$

$$R = 2.0429$$

$$x_{\text{max}} = 19.5610$$

$$x_0 = 17.5181$$

Center

$$\{ x = 17.5181$$

$$\{ y = 19.7849$$

$$\{ y = 19.7849$$

$$x_0 = 17.5272$$

$$y_0 = 19.7836$$

pt.	hrs.	resid.
1	195.0	-54
2	183.4	-30
3	166.6	+29
4	150.7	+139
5	133.7	-3
6	112.6	-67
7	[83.8	-228] $\frac{1}{2}$ wt.
8	76.2	+61
9	31.5	+5

(1542) Luovon's Center

1913 Sept 27

		$(x - x_0)$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.00000	-0.5272	0.2779	4.1509	- 78
(H)	17.4052	-0.1220	0.0149	4.1545	- 42
2	18.00000	+0.4728	0.2235	4.1625	+ 38
3	18.5238	+0.9966	0.9932	4.1752	+ 165
4	19.00000	+1.4728	2.1691	4.1628	+ 41
5	19.4097	+1.8825	3.5438	4.1580	- 7
6	19.5510	+2.0238	4.0958	4.1427	- 160
7	19.00000	+1.4728	2.1691	4.1702	+ 115
8	18.5918	+1.0646	1.1334	4.1634	+ 47

comp. 122 4.1587

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
1	17.8159	-1.9677	-3	3.8730
(H)	17.7493	-2.0343	-3	4.1396
2	19.9992	-1.9844	-3	3.9390
3	18.00000	-1.7836	-2	3.1820
4	18.3718	-1.4118	-2	1.9937
5	19.00000	-0.7836	-1	0.6142
6	20.00000	+0.2164	0	0.0469
7	21.1980	+1.4144	+2	2.0011
8	21.5241	+1.7405	+2	3.0300

Moon's mean position (1912.0)

$$X_0 = 17.5272 \quad Y_0 = 19.7836$$

$$a = \begin{array}{r} +17 \\ 17.5289 \end{array} \quad b = \begin{array}{r} +2 \\ 19.7838 \end{array}$$

$$\text{from Prelim Reduction } X = 17.4950 \quad Y = 19.8163$$

$$\text{Plate constant } \alpha = +7 \quad \alpha = +6$$

$$\log = 0 \quad \log = -11$$

$$c = -9 \quad c = +3$$

$$X = 17.4948 \quad Y = 19.8161$$

$$\beta = -0.5052$$

$$\eta = -2.1839$$

$$\log \delta = 9.70346$$

$$\log \mu \delta = 8.4850$$

$$\cos \delta = 9.99968$$

$$9.4069$$

$$\sin \delta = 8.50724$$

$$\eta = 49453$$

$$(A-A) = 1.9654$$

$$\log \eta = 0.33923$$

$$A-A = -8572$$

$$\cos \eta = 7.33115$$

$$A = 12 \quad 31 \quad 54$$

$$(A-D) = 3.00808$$

$$X_0 = 12 \quad 31 \quad 18.28$$

$$\delta - D = -16 \quad 58.8$$

$$D = -1 \quad 59 \quad 28$$

$$S_0 = -2 \quad 11 \quad 26.8$$

(1542) Luovon's Center

1913 Sept 27

		$(x - x_0)$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17 00 00	-0.5272	0.2779	4.1509	- 78
(H)	17 40 52	-0.1220	0.0149	4.1545	- 42
2	18 00 00	+0.4728	0.2235	4.1625	+ 38
3	18 52 38	+0.9966	0.9932	4.1752	+ 165
4	19 00 00	+1.4728	2.1691	4.1628	+ 41
5	19 40 97	+1.8825	3.5438	4.1580	- 7
6	19 55 10	+2.0238	4.0958	4.1427	- 160
7	19 00 00	+1.4728	2.1691	4.1702	+ 115
8	18 59 18	+1.0646	1.1334	4.1634	+ 47
		Comp. 122		4.1587	

	y	$(y - y_0)$	$0 y$	$(y - y_0)^2$
1	17 81 59	-1.9677	-3	3.8730
(H)	17 74 43	-2.0343	-3	4.1396
2	17 99 92	-1.9844	-3	3.9390
3	18 00 00	-1.7836	-2	3.1820
4	18 37 18	-1.4118	-2	1.9937
5	19 00 00	-0.7836	-1	0.6142
6	20 00 00	+0.2164	0	0.0469
7	21 19 80	+1.4144	+2	2.0011
8	21 52 41	+1.7405	+2	3.0300

Formation of Normals.

	ab	ac	bc
1	+ 1.02	+ 40.6	+ 153.7
2	+ 0.24	+ 50	+ 85.3
3	- 0.93	+ 17.9	- 75.2
4	- 1.78	+ 165.0	- 293.7
5	- 2.07	+ 60.3	- 57.8
6	- 1.47	- 13.2	+ 5.5
7	+ 0.11	- 80.8	- 8.8
8	+ 2.07	+ 169.0	+ 162.2
9	+ 1.84	+ 49.8	+ 81.8
	- 0.97	+ 413.6	+ 53.0

Moon's Mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 = 17.5272 & Y_0 = 19.7836 \\
 \text{2a} = +17 & \text{2b} = +2 \\
 \hline
 17.5289 & 19.7838
 \end{array}$$

From Prelim Reduction $X = 17.4950$ $Y = 19.8163$

Plate Constants

ax =	+ 7	ay =	+ 6
bx =	0	by =	- 11
cx =	- 9	cy =	+ 3

$$\begin{array}{rcl}
 X = 17.4948 & Y = 19.8161
 \end{array}$$

$$\begin{array}{l}
 \bar{z} = -0.5052 \\
 \log S = 9.70346 \\
 \text{const} = 9.99968 \\
 \text{unst} = 8.50724
 \end{array}$$

$$\begin{array}{l}
 \eta = -2.1839 \\
 \log \mu S = 8.4850 \\
 \bar{z}^2 = 9.4069 \\
 \eta_1 = 4.9453
 \end{array}$$

$$(X-A) = 1.29654$$

$$X-A = -85.72$$

$$A = 12 \ 31 \ 34$$

$$\alpha_0 = 12 \ 31 \ 18.28$$

$$\text{Red} = 0.14$$

$$\alpha = 12 \ 31 \ 18.14$$

$$\log \eta_0 = 0.33923$$

$$\text{const} = 7.33115$$

$$(d-D) = 3.00808$$

$$d-D = -16 \ 58.8$$

$$D = -1 \ 54 \ 28$$

$$\delta_0 = -2 \ 11 \ 26.8$$

$$\text{Red} = -0.8$$

$$\delta = -2 \ 11 \ 27.6$$

MC 1542

Moon's center

1913 Sept. 29,

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Conditional Equations.

	a	b	c	0-c	
1	-0.52	-1.97	= -78	-17-7 = -24	-54
2	-0.12	-2.03	= -42	-4-8 = -12	-30
3	+0.47	-1.98	= +38	+16-7 = +9	+29
4	+1.00	-1.78	= +165	+33-7 = +26	+139
5	+1.47	-1.41	= +41	+49-5 = +44	-3
6	+1.88	-0.78	= -7	+63-3 = +60	-67
7	+2.02	+0.22	= -160	+67+1 = +68	-228
8	+1.47	+1.41	= +115	+49+5 = +54	+61
9	+1.06	+1.74	= +47	+35+7 = +42	+5

Average = 67

Normal Equations.

$$\begin{aligned}
 +12.57 - 00.97 &= +414 \\
 -0.97 + 22.80 &= +53 \\
 +0.97 - 0.08 &= +32 \\
 +22.72 &= +85 \quad b = +3.8 \\
 -0.04 + 0.97 &= +2 \\
 +12.53 &= +416 \quad a = +33.2
 \end{aligned}$$

Approximate Solution

$$\begin{aligned}
 +230 - 9.17 &= +124 \\
 +542 + 2.48 &= +75 \\
 -5.42 + 21.60 &= -292 \\
 +24.08 &= -217 \quad b = -9 \\
 +230 &= +124 - 83 = +41 \quad a = +18
 \end{aligned}$$

See last page of book
for Lunar parallaxes etc.

Red. ad. locum aph

S

- 2 11

$$H + \alpha \quad 11 \quad 22 = 170^\circ 30'$$

$$K \quad 22 \quad 51$$

$$K \quad 12 \quad 31 -$$

$$G \quad 16 \quad 58$$

$$G + \alpha \quad 5 \quad 29 = 82^\circ 15'$$

$$L \cos S \quad 9.9997$$

$$i \quad 0.4200m$$

$$(i) \quad 0.4197m$$

$$L \cos(G + \alpha) \quad 9.1298$$

$$g \quad 0.9107$$

$$\sin \dots \quad 9.9960$$

$$\tan S \quad 8.5812m$$

$$h \quad 8.8239$$

$$(g') \quad 0.0405$$

$$(g) \quad 8.3118m$$

$$h \quad -0.34$$

$$g \quad -0.02$$

$$h \quad +0.22$$

$$-0.14$$

$$L \sin S \quad 8.5809m$$

$$\cos(H + \alpha) \quad 9.9940m$$

$$h \quad 1.3075$$

$$\sin \dots \quad 9.2176$$

$$\sec S \quad 0.0003$$

$$h \quad 8.8239$$

$$(h') \quad 9.8824$$

$$(h) \quad 9.3493$$

$$g' \quad +1.10$$

$$g \quad +0.76$$

$$i \quad -2.63$$

$$= 0.77$$

AAC 1542

Unconstrained

1913 Sept 21

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Candidate Equations

	a	b	c	d	e	f	g
1	-0.52	-197	=	-78	-17	-7	-24
2	-0.12	-203	=	-42	-4	-8	-12
3	+0.47	+198	=	+38	+16	-7	+9
4	+1.00	+178	=	+165	+33	-7	+26
5	+1.47	+141	=	+41	+49	-5	+44
6	+1.88	+078	=	-7	+63	-2	+60
7	+2.02	+020	=	-160	+67	+1	+68
8	+1.47	+141	=	+115	+49	+5	+54
9	+1.06	+174	=	+47	+35	+7	+42

Average $\sigma = 0.7$

Normal Equations

$$\begin{aligned}
 +12.57 - 00.97 &= +414 \\
 -0.97 + 22.80 &= +53 \\
 +0.97 - 0.08 &= +32 \\
 +22.72 &= +85 \quad b = +38 \\
 -0.04 + 0.97 &= +2 \\
 +12.53 &= +416 \quad a = +33.2
 \end{aligned}$$

Approximate Solution

$$\begin{aligned}
 +230 - 9.17 &= +124 \\
 +542 + 2.48 &= +75 \\
 -542 + 21.60 &= -292 \\
 +24.08 &= -217 \quad b = -9 \\
 +230 + 12.4 - 83 &= +41 \quad a = +14
 \end{aligned}$$

See last page of book
for linear parameters etc

1913 Sept. 27

Remembrance (4)

d 4 N

1	17470	16100
	13344	1020415
	5048	1510
	72	92
	<u>11.4124</u>	<u>.4118</u>

2	16715	17520
	8428	1581213
	2630	12
	18	30
	<u>31.8289</u>	<u>.8290</u>

3	17344	15290
	1421001	84403228
	0508	2526
	30	94
	<u>11.3134</u>	<u>.3136</u>

4	15960	18820
	1232016	124407066
	12	757066
	50	26
	<u>30.3640</u>	<u>.3648</u>

AAC 1543

1913 July 9.

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Star Measures

α	δ	α	δ	α	δ	α	δ
1. 16362		16804		19278		16505	
5.3 12244		1089799		1199898		13766	
11.5 37	42	00	99	00	98	65	72
	40		68		69		09
<u>11.4112</u>		<u>4116</u>		<u>5.2728</u>		<u>.2738</u>	
2. 15758		18648		16002		15542	
12.3 74	49	16940	40	8820	15	12710	08
31.8 44	52	40		10		10	
	40		58		00		50
<u>31.8295</u>		<u>.8290</u>		<u>12.2814</u>		<u>.2835</u>	
3. 17778		15150		17312		16811	
28.6 146	15	8288	85	14290	85	9825	31
41.4 14	17	89		85		29	
	43		50		90		26
<u>11.3149</u>		<u>.3137</u>		<u>28.6982</u>		<u>.6994</u>	
4. 19335		17338		16061		17880	
201 15680	75	10990	88	7023	20	16898	02
204 79		85		15		93	
	10		45		40		98
<u>30.3647</u>		<u>.3647</u>		<u>30.0977</u>		<u>.0984</u>	

Grade 4

VIC 1543

1913 July 9

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Stars measured

	d	N	d	N
1	16362	16504	19278	16505
53	12249	1089799	1199898	1376672
11.5	3742	00	0098	6172
	40	68	69	09
	<u>11.4112</u>	<u>4116</u>	<u>5.2728</u>	<u>2738</u>
2				
123	15758	18648	16002	15542
318	744952	1694040	882015	1271008
	44	40	10	10
	40	58	00	50
	<u>318295</u>	<u>5290</u>	<u>122814</u>	<u>2835</u>
3				
28.6	17778	15150	17312	16811
414	1461517	828885	1429085	982531
	14	89	85	2931
	43	50	90	26
	<u>11.3149</u>	<u>3137</u>	<u>286982</u>	<u>6994</u>
4				
301	19335	17338	16061	17880
304	1568075	1099088	702320	1689802
	79	858	11	93
	10	45	40	98
	<u>30.3647</u>	<u>3647</u>	<u>30.0977</u>	<u>0984</u>

Grade 4

MC 1543

1913 July 9

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known measures -

	d	n	d	n
	16779	19346		
16.8	1313026	1298080		
18.4	25	76		
min	69	54		
y	18.3648	1.3628		
2				
120	15760	18360		
18.4	1203035	12066		
	28	6572		
	50	62		
	18.3725	1.3707		
3				
180	15678	17408		
18.7	823940	1484038		
	40	42		
	70	11		
	18.7432	1.7431		

16292	19115
921614	1617579
08	80
70	30
18.2937	1.2941

15197	18169
1333230	10035
29	3230
75	72
18.8137	1.8139

14167	17180
1268085	8665
84	6062
45	90
18.8519	1.8527

4
18.3
19.0

5
18.8
20.0

6
18.8
20.2
max

MC 1543

1913 July 9

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moon measures

d	n	d	n
16779	19346		
108 1313026	1298080		
184 25	76		
69	54		
18.3648	3628		
15760	18360		
184 1203035	12060		
28	65-72		
50	62		
18.3725	3707		
15678	17408		
187 823940	1484038		
40	42		
70	11		
18.7432	7431		

16292	19113
921614	1617579
08	80
70	30
182937	2941
15197	18169
1333220	1003530
29	32
75	72
18.8137	8139
14167	17180
1268081	866562
84	60
45	90
18.8519	8527

6.
188
202
max
2

11C 1543

1913 July 9.

22

Moon - Measures.

2
18.7
21.0

18061
1571415
13
41
18.7658

17220
957576
65-76
30
.7656

8
18.0
221
19370
1869082
78
50

22.0685

16490
677075
6.7
20

.0653

9
17.7
22.2
Scratch
18730
1642028
11
20

22.2308

18519
1080909
10
39

.2275

18640
1595050
6250
30

17.7317

18808
1152028
22
30

.7301

11C 15+3

1913 July 9

22

Moon Mercurius

d n d n

2
18.7
21.0

180.61 172.20
157.14 95.75-76
13.15 65-76
41 30
187658 7656

8
180 19370 16490
221 1869082 677075-
78 67
50 20
22.0685 10653

9 18720 18640 18608
22.2 1642028 1595050 115-2028
11 6250
20 30
22.2308 2275 177317 7301

MC 1543

Times etc.

1913 July 9.23

Exp to stars

1912 Jan 9

12^m 42^m ✓- 12 54^m

... moon

12 48

29.4^m

- 12 48

29.6^m

clock slow

01

11.3^m

H Sid T.

12 49

40.8^m

H Long

4 44

31.0^m

S Sid T.

17 34

11.8^m

Sid T. m. m. m.

19 10

40.0^m

Interw.

22 23

31.8^m

Reduction

3

40.10^m

G. m. T.

22 19

51.7^m

From Raut Alu

R. A.

Decl

moon 22

12^m31^m49.9^m

- 1

38

29.5^m

Moon in m

1.95-18

15.547^m... 19.8623^m

+ 38.77

- 5

08.8^m

Tabular place

12

32

28.75^m

- 1

43

38.3^m

Moon's parallax

57, 23.5^m

- Schindian

15 39.9^m

934 = 11.3

940 = 11.4

R = 939.9^maugmentation + 11.4^mInradiation (4) - 0.8^mR = 950.5^mR = 2037.5^mR² = 41514^m

MG 1543 Times etc 1913 July 9 (23)
 Exp to stars 1912 Jan 9 12^m 42^m - 12 54^m
 moon 12 48 29.4 - 12 48 29.6
 clock slow 01 11.3^m

Heliot 12 49 40.8^m
 H long 4 44 31.05^m
 S. Sec 17 34 11.85^m
 S. Sec in room 19 10 40.01^m
 Interval 22 23 31.84^m
 Reduction 3 40.10^m
 G. M. T. 22 19 51.74^m

From Rautalms R. G. Obs
 moon 22 12^m 31^m 49.98 - 1 38 29.5^m
 motion 19.8623 19.17 15.547
 + 38.77 - 5 08.8
 Tabular place 12 32 28.76 - 1 43 38.3

Moon's parallax 07' 23.5"
 Semidiameter 15' 39.9"

934 - 11.3
 940 - 11.4

R = 939.9
 augmentation + 11.4
 irradiation (4) = 0.8
 R = 950.5

R = 2037.5
 R = 915.14

Prelim Red.

1913 July 19

24

$$\begin{array}{rclcl}
 x & \cdot 5.2733^{\checkmark} & 12.2824^{\checkmark} & 28.6988^{\checkmark} & 30.0980^{\checkmark} \\
 z & 7.8956 & 14.7371^{\checkmark} & 31.3183^{\checkmark} & 32.5628 \\
 x-z & -2.6223 & -2.4547 & -2.6195 & -2.4587 \\
 & & & & 24648
 \end{array}$$

$$\begin{array}{rclcl}
 y & 11.4114^{\checkmark} & 31.8292^{\checkmark} & 11.3143^{\checkmark} & 30.3647^{\checkmark} \\
 \eta & 9.1237^{\checkmark} & 29.6024^{\checkmark} & 9.2110^{\checkmark} & 28.2851^{\checkmark} \\
 y-m & +2.2877^{\checkmark} & +2.2268^{\checkmark} & +2.1033 & +2.0796
 \end{array}$$

Remainder y

$$\begin{array}{rclcl}
 y & 11.4121 & 31.8290 & 11.3135 & 30.3644 \\
 m & 9.1237 & 29.6024 & 9.2110 & 28.2851 \\
 y-m & 2.2884 & 2.2266 & 2.1025 & 2.0793
 \end{array}$$

Preliminary Reduction

$$\begin{array}{rclcl}
 x-z & = 824 & -2 & +27163 \\
 -2.6223 - 936 & = -2.7159 & -5 & = -2.7164 & = -1 \\
 -2.4547 - 2610 & = -2.7157 & -12 & = -2.7169 & = -6 \\
 -2.6195 - 928 & = -2.7123 & -29 & = -2.7152 & = +11 \\
 -2.4648 - 2490 & = -2.7138 & -30 & = -2.7168 & = -5 \\
 16.8180 - 1673 & & -17 & & = 19.3653^{\checkmark} \\
 y-m & +812 & +54 & & -2.3394 \\
 +2.2884 + 427 & = +2.3311 & +57 & = +2.3368 & = -26 \\
 +2.2266 + 995 & = +2.3261 & +159 & = +2.3420 & = +26 \\
 +2.1025 + 2325 & = +2.3350 & +57 & = +2.3407 & = +13 \\
 +2.0793 + 2438 & = +2.3231 & +152 & = +2.3383 & = -11 \\
 20.4036 + 1362 & & +102 & & = 18.2106^{\checkmark}
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables } a & = -0.9 & b & = -3.7 & a^2 & = +2.8 & b+a & = +0.6 \\
 \text{Ob.} & +1.3 & & -4.3 & & +5.6 & & +0.5
 \end{array}$$

$$\begin{array}{rclcl}
 c-u & & & -2.8 & & +0.1
 \end{array}$$

Preliminary Result

1913 Feb 14

$$\begin{array}{r}
 x - 5.2733 \quad 12.2829 \quad 28.6988 \quad 30.0980 \\
 78956 \quad 14.7371 \quad 31.3183 \quad 32.5628 \\
 2-3 - \underline{27777} \quad -24547 \quad -26195 \quad -\underline{24587} \\
 -26223 \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 24648
 \end{array}$$

$$\begin{array}{r}
 y \quad 11.4114 \quad 31.8292 \quad 11.3143 \quad 30.3647 \\
 91237 \quad 29.6024 \quad 92110 \quad 28.2851 \\
 +2.2877 \quad +2.2268 \quad +2.1033 \quad -\underline{20756} \\
 \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 20796
 \end{array}$$

Remainder y.

$$\begin{array}{r}
 y \quad 11.4121 \quad 31.8290 \quad 11.3135 \quad 30.3644 \\
 m \quad 91237 \quad 29.6024 \quad 92110 \quad 28.2851 \\
 y-m \quad 22884 \quad 22266 \quad 21025 \quad 20793
 \end{array}$$

Preliminary Reduction

$$\begin{array}{r}
 x-3 \quad -824 \quad +2 \quad +27163 \\
 -2.6223 - 936 = -27159 - 5 = -27164 \quad = -1 \\
 -2.4547 - 2610 = -27157 - 12 = -27169 \quad = -6 \\
 -2.6195 - 928 = -27123 - 29 = -27152 \quad = +11 \\
 -2.4648 - 2490 = -27138 - 30 = -27168 \quad = -5 \\
 16.8180 - 1673 \quad -17 \quad = 19.3653 \\
 y-m \quad +812 \quad +54 \quad -23394 \\
 +2.2884 + 427 = +23311 + 57 = +23368 \quad = -26 \\
 +2.2266 + 995 = +23261 + 159 = +23420 \quad = -26 \\
 +2.1025 + 2325 = +23350 + 57 = +23407 \quad = +13 \\
 +2.0793 + 2438 = +23231 + 152 = +23383 \quad = -11 \\
 20.4036 + 1362 \quad +102 \quad = 18.2106
 \end{array}$$

$$\begin{array}{r}
 \text{Tables } a = -0.9 \quad b = -3.7 \quad a^2 = +2.8 \quad b + a = +0.6 \\
 Qb \quad +1.3 \quad -4.3 \quad +5.6 \quad +0.5
 \end{array}$$

$$C - 0 \quad -2.8 \quad +0.1$$

pt.	pos. \angle	residual
1	180.0	+1.15
2	174.7	+1.29
3	144.4	+4.3
4	133.5	-2.1
5	101.5	-5.0
6	[90.0	-1.29] <i>int</i>
7	73.0	-1.9
8	35.6	+1.35
9	26.8	+1.66

MC 1543.

1913 Sept. 27

Known's Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)^2 (y - Y_0)^2$	$0 - 0$
1	16.8110	0.0000	0.0000	4.1686	+172
2	17.0000 + 0.1890	0.0359	0.0013	4.1725	+211
3	18.0000 + 1.1890	1.4137	2.0000	4.1769	+255
4	18.2939 + 1.4829	2.1990	4.8368	4.1738	+224
5	18.8138 + 2.0028	4.0112	16.0900	4.1753	+239
6	18.8523 + 2.0413	4.1669	17.3620	4.1669	+155
7	18.7657 + 1.9547	3.8208	14.5947	4.1749	+235
8	18.0000 + 1.1890	1.4137	2.0000	4.1769	+255
9	17.7309 + 0.9199	0.8462	0.7161	4.1757	+243
			$R^2 =$	4.1514	

	$y - Y_0$	Δy	$(y - Y_0)^2$
-1	18.3638 - 2.0412	-5	4.1686
2	18.3716 - 2.0334	-5	4.1368
3	18.7432 - 1.6618	-4	2.7632
4	19.0000 - 1.4050	-3	1.9748
5	20.0000 - 0.4050	-1	0.1641
6	20.4050	0	0.0000
7	21.0000 + 0.5950	+1	0.3541
8	22.0669 + 1.6619	+4	2.7632
9	22.2292 + 1.8242	+5	3.3295

Approximate Center

$$x = 18.0 \quad y = 18.7432$$

$$22.0669$$

$$40.8101$$

$$\text{mean } y = 20.4050$$

$$y - \text{min} = 18.3638$$

$$R = 20.412$$

$$x - \text{max} = 18.8523$$

$$\text{mean } x = 16.8111$$

$$\text{Center } \begin{cases} X_0 = 16.8110 \\ Y_0 = 20.4050 \end{cases}$$

1161543

1913 Sept 27

Known Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$(y - Y_0)^2$	$0 - 0$
1	16.8110	00000	00000	41686	+172	
2	170000 + 0.1890	00359	00359	41725	+211	
3	180000 + 1.1890	14137	14137	41769	+255	
4	182939 + 14829	21990	21990	41738	+224	
5	188138 + 20028	40112	40112	41753	+239	
+6	188523 + 20413	41669	41669	41669	+155	
7	187657 + 19547	38208	38208	41749	+235	
8	180000 + 1.1890	14137	14137	41769	+255	
9	177309 + 09199	08462	08462	41757	+243	
			$R^2 =$	4.15141		

	$y - Y_0$	$0y$	$(y - Y_0)^2$
-1	183638 - 20412	-5	41686
2	183716 - 20334	-5	41368
3	187432 - 16618	-4	27632
4	190000 - 14050	-3	19748
5	200000 - 04050	-1	01641
6	204050	0	00000
7	210000 + 05950	+1	03541
8	220669 + 16619	+4	27632
9	222292 + 18242	+5	33295

Approximate Center

$$x = 18.0, y = 18.7432$$

$$220669$$

$$408101$$

$$\text{mean } y = 20.4050$$

$$y - \text{min} = 183638$$

$$R = 20412$$

$$x - \text{max} = 18.8523$$

$$\text{mean } x = 16.8111$$

$$\text{Center } \begin{cases} X_0 = 16.8110 \\ Y_0 = 20.4050 \end{cases}$$

Formulation of Normals

	ab	an	bn
1	- 0.00	+ 0.0	- 350.9
2	- 0.39	+ 40.1	- 428.3
3	- 1.98	+ 303.5	- 423.3
4	- 2.07	+ 331.5	- 313.6
5	- 0.80	+ 478.0	- 95.6
6	+ 0.00	+ 74.5	+ 0.0
7	+ 1.17	+ 458.2	+ 141.0
8	+ 1.98	+ 303.5	+ 423.3
9	+ 1.67	+ 223.6	+ 442.3
10	- 0.42	+ 2212.9	- 605.1

MC 1543

1913 Sept 27

Knowns Center Conditional Equations.

	a	b	c	0 - c
1	0.00 - 2.04 =	+172	0 + 57 =	+57 + 115
2	+0.19 - 2.03 =	+211	+ 26 + 56 =	+82 + 129
3	+1.19 - 1.66 =	+255	+ 166 + 46 =	+212 - 43
4	+1.48 - 1.40 =	+224	+ 206 + 39 =	+245 - 21
5	+2.00 - 0.40 =	+239	+ 278 + 11 =	+289 - 50
6	+2.04 + 0.00 =	+155	+ 284 - 0 =	+284 - 129
7	+1.95 + 0.60 =	+235	+ 271 - 17 =	+254 - 19
8	+1.19 + 1.66 =	+285	+ 166 - 46 =	+120 + 135
9	+0.92 + 1.82 =	+274	+ 128 - 51 =	+77 + 166

Average - 70

Normals.

$$+ 15.82 - 0.42 = +2213$$

$$- 0.42 + 19.65 = -605$$

$$+ 0.42 - 0.01 = +59$$

$$+ 19.64 = -546$$

$$b = -27.8$$

$$- 0.01 + 0.42 = -13$$

$$+ 15.81 = +2200$$

$$a = +139.1$$

M1543

1913 Sept 27.

Knowns Center Conditional Equations

	a	b	0	c	0 = c
1	0.00	-2.04	= +1.72	0. + 5.7 = +5.7	+1.15
2	+0.19	-2.03	= +2.11	+ 2.6 + 5.6 = +8.2	+1.29
3	+1.19	-1.66	= +2.55	+ 1.66 + 4.6 = +2.12	+ .43
4	+1.48	-1.40	= +2.24	+ 2.06 + 3.9 = +2.45	- .21
5	+2.00	-0.40	= +2.39	+ 2.78 + 1.1 = +2.89	- .50
6	+2.04	+0.00	= +1.55	+ 2.84 - 0 = +2.84	- 1.29
7	+1.95	+0.60	= +2.35	+ 2.71 - 1.7 = +2.84	- .19
8	+1.19	+1.66	= +2.55	+ 1.66 - 4.6 = +1.20	+ 1.35
9	+0.92	+1.82	= +2.43	+ 1.28 - 5.1 = - 1.77	+ 1.66

Average = 70

Unknowns

$$+ 1.582 - 0.42 = +2.213$$

$$- 0.42 + 1.965 = - 6.05$$

$$+ 0.42 = 0.01 = + .59$$

$$+ 1.964 = - 5.96$$

$$b = - 2.78$$

$$- 0.01 + 0.42 = - .13$$

$$+ 1.581 = + 2.200$$

$$a = + 1.391$$

1543 Moon's Mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 = 16.8110^\circ & Y_0 = 20.4050^\circ \\
 \pm a = +70^\circ & \pm b = -14^\circ \\
 \hline
 16.8180 & 20.4036
 \end{array}$$

From Prelim Reduction $X = 19.3653^\circ$ $Y = 18.2106^\circ$

Plate Constants α	- 6	- 1
β	+ 11	- 13
ζ	- 5	+ 14

$$\begin{array}{rcl}
 \bar{z} = +1.3653^\circ \\
 \log \bar{z} & 0.13523^\circ \\
 \cos \delta & 9.99962^\circ \\
 \text{const} & 8.50724^\circ \\
 \text{---}(\delta - \kappa) & 1.62837^\circ
 \end{array}$$

$$a - A = + 42.50^\circ$$

$$A = 12^\circ 31' 34''$$

$$X_0 = 12^\circ 32' 16.50''$$

$$\text{Red} = - 0.14$$

$$X' = 12^\circ 32' 16.36''$$

$$\eta = -3.7894^\circ$$

$$\begin{array}{rcl}
 \log \tan S & 8.5943^\circ \\
 \log \bar{z}^2 & 0.2705^\circ \\
 \log \eta_1 & 5.9182^\circ
 \end{array}$$

$$\eta_1 = - 1^\circ$$

$$\eta_0 = -3.7893^\circ$$

$$\begin{array}{rcl}
 \log \eta_0 & 0.57856^\circ \\
 \text{const} & 7.33115^\circ
 \end{array}$$

$$(+ - D) = 3.24741^\circ$$

$$S - D = - 29^\circ 27.7'$$

$$D = - 1^\circ 54' 28''$$

$$S = - 2^\circ 23' 55.9''$$

$$\text{Red} = - 0.7$$

$$S' = - 2^\circ 23' 56.4''$$

1543 known mean Position (1912.0)

$$\begin{array}{r}
 X_1 = 168110 \quad Y_1 = 204050 \\
 \pm a = \quad + 70 \quad \pm b = \quad - 14 \\
 \hline
 168180 \quad 204036
 \end{array}$$

$$\begin{array}{rcl}
 \text{From Prelim Reduction } X & = & 19.3653 \quad Y = 18.2106 \\
 \text{Plate Constants } a_x & = & -6 \quad -1 \\
 & b_y & +11 \quad -13 \\
 & c & -5 \quad +14
 \end{array}$$

$$\begin{array}{rcl}
 S & = & +1.3653 \\
 \log S & & 0.13523 \\
 \cos S & & 9.99962 \\
 \sin S & & 8.50724
 \end{array}$$

$$(d - \pi) \quad 1.62837$$

$$d - A \quad + \quad 42.50$$

$$A \quad 12 \quad 31 \quad 34$$

$$X_0 \quad 12 \quad 32 \quad 16.50$$

$$\text{Red} \quad - \quad 14$$

$$d' \quad 12 \quad 32 \quad 16.36$$

$$\eta = -3.7894$$

$$\begin{array}{rcl}
 \log \tan S & & 8.50943 \\
 S^2 & & 0.2705 \\
 \eta_1 & & 59182
 \end{array}$$

$$\eta_1 = -1$$

$$\eta_0 = -3.7893$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 0.57856 \\
 \text{const} & = & 7.33115
 \end{array}$$

$$(d - D) \quad 3.24741$$

$$S - D = -29 \quad 27.7$$

$$D = -1 \quad 54 \quad 28$$

$$S = -2^\circ 23' 55.7''$$

$$\text{Red} \quad - \quad 0.7$$

$$S' = -2 \quad 23 \quad 56.4$$

1543

Red. ad l. apph.

$$H + \alpha \quad 11^\circ \quad 23' = 170^\circ 45'$$

$$H \quad 22 \quad 51$$

$$\alpha \quad 12 \quad 32$$

$$G \quad 16 \quad 58$$

$$G + \alpha \quad 5^\circ \quad 30' = 82^\circ 30'$$

$$l \cos(G + \alpha) = 9.1157$$

$$\dots g = 0.9107$$

$$\dots \sin = 9.9963$$

$$\dots \tan = 8.6223m$$

$$\dots \frac{1}{\tan} = 8.8239$$

$$\dots (g') = 0.0264$$

$$\dots (g) = 8.3532m$$

$$\begin{array}{rcl} f & = & -0.34 \\ g & = & -0.02 \\ h & = & +0.22 \\ \hline & & -0.14 \end{array}$$

$$S'_0 = -2^\circ 24'$$

$$l \cos S = 9.9996$$

$$\dots l = 0.4194m$$

$$\dots (l) = 0.4190m$$

$$l \sin S = 8.6220m$$

$$\dots \cos(H + \alpha) = 9.9943m$$

$$\dots h = 1.3075$$

$$\dots \sin = 9.2061$$

$$\dots \sec S = 0.0004$$

$$\dots \frac{1}{\sec} = 8.8239$$

$$\dots (h') = 9.9238$$

$$\dots (h) = 9.3379$$

$$\begin{array}{rcl} g' & = & +1.06 \\ h' & = & +0.84 \\ l & = & -2.62 \\ \hline & & -0.72 \end{array}$$

1543

Red ad l aph

$$A + \alpha \quad 11 \quad 23 = 170^\circ 45'$$

$$H \quad 22 \quad 51$$

$$X \quad 12 \quad 32$$

$$G \quad 16 \quad 58$$

$$G + \alpha \quad 5 \quad 30 = 82^\circ 30'$$

$$l \cos(G + \alpha) \quad 9 \quad 1 \quad 1 \quad 5 \quad 7$$

$$q \quad 0 \quad 9 \quad 1 \quad 0 \quad 7$$

$$\sin \quad 9 \quad 9 \quad 9 \quad 6 \quad 3$$

$$1 \cos S \quad 8 \quad 6 \quad 2 \quad 2 \quad 3 \sim$$

$$1 \quad 8 \quad 8 \quad 2 \quad 3 \quad 9$$

$$(8') \quad 0 \quad 0 \quad 2 \quad 6 \quad 4$$

$$(8) \quad 8 \quad 3 \quad 5 \quad 3 \quad 2 \sim$$

$$\begin{array}{rcl} f & = & -0.34 \\ g & = & -0.02 \\ h & = & +0.22 \\ \hline & = & -0.14 \end{array}$$

$$S_0 = -2^\circ 24'$$

$$l \cos S = 9 \quad 9 \quad 9 \quad 9 \quad 6$$

$$l \quad 0 \quad 4 \quad 1 \quad 9 \quad 4 \sim$$

$$(l) \quad 0 \quad 4 \quad 1 \quad 9 \quad 0 \sim$$

$$l \sin S \quad 8 \quad 6 \quad 2 \quad 2 \quad 0 \sim$$

$$\cos(H + \alpha) \quad 9 \quad 9 \quad 9 \quad 4 \quad 3 \sim$$

$$h \quad 1 \quad 3 \quad 0 \quad 7 \quad 5 \sim$$

$$\sin \quad 9 \quad 2 \quad 0 \quad 6 \quad 1$$

$$\sec S \quad 0 \quad 0 \quad 0 \quad 0 \quad 4$$

$$1 \quad 8 \quad 8 \quad 2 \quad 3 \quad 9$$

$$(2') \quad 9 \quad 9 \quad 2 \quad 3 \quad 8$$

$$(2) \quad 9 \quad 3 \quad 3 \quad 7 \quad 9$$

$$\begin{array}{rcl} g' & = & +1.06 \\ h' & = & +0.84 \\ i & = & -2.62 \\ \hline & = & -0.72 \end{array}$$

1543 Lunar Parallax

$$\alpha' = 12^{\circ} 32' 16.36''$$

$$\theta = 12^{\circ} 49' 40.8''$$

$$+ 17' 24.4''$$

$$+ 4^{\circ} 21' 06''$$

$$+ 1' 36''$$

$$+ 4^{\circ} 19' 30''$$

$$9.95727''$$

$$0.00000''$$

$$0.00123''$$

$$9.95850''$$

$$p = 42^{\circ} 16' 00''$$

$$- 2^{\circ} 23' 56''$$

$$44^{\circ} 39' 56''$$

$$9.82640''$$

$$9.22255''$$

$$9.84693''$$

$$0.17225''$$

$$8.06813''$$

$$s - s' = + 40' 13.1''$$

$$s = - 1^{\circ} 43' 43.3''$$

$$\text{True Alt } s = - 1^{\circ} 43' 38.3''$$

$$0 - c$$

$$- 50$$

$$+ 0.50$$

$$s' = - 2^{\circ} 23' 56.4''$$

$$\pi = 57' 23.5''$$

$$9.86913''$$

$$8.22255''$$

$$8.88012''$$

$$0.00020''$$

$$6.97200''$$

$$\alpha - \alpha' = + 3' 13.39''$$

$$= + 12.89''$$

$$\alpha = 12^{\circ} 32' 29.25''$$

$$\alpha = 12^{\circ} 32' 28.75''$$

1912phae proj. Lunar Parallaxes

$$\alpha' = 12 \quad 32 \quad 16 \quad 36$$

$$\delta = 12 \quad 49 \quad 40 \quad 4$$

$$+ 17 \quad 24 \quad 9$$

$$+ 4 \quad 21 \quad 06$$

$$+ 1 \quad 36$$

$$+ 4 \quad 19 \quad 30$$

$$995727$$

$$000000$$

$$000123$$

$$995850$$

$$f = 42 \quad 16 \quad 00$$

$$- 2 \quad 23 \quad 56$$

$$+ 4 \quad 39 \quad 56$$

$$982640$$

$$422255$$

$$984693$$

$$017225$$

$$806813$$

$$s - s' = + 40 \quad 131$$

$$s = -1 \quad 43 \quad 433$$

$$\text{New Alm } s = -1 \quad 43 \quad 383$$

$$0 - c$$

$$- 50$$

$$s' = -2 \quad 23 \quad 564$$

$$\pi = 57 \quad 23 \quad 5$$

$$9.86913$$

$$822255$$

$$888012$$

$$000020$$

$$697200$$

$$\alpha - \alpha' = + 3 \quad 13 \quad 39$$

$$+ 12 \quad 89$$

$$\lambda = 12 \quad 32 \quad 2925$$

$$\alpha = 12 \quad 32 \quad 2876$$

$$+ 049$$

1542 Lunnan Parallax,

$$\alpha' = 12^h 31^m 18^s.14^v$$

$$\theta = 12 \quad 01 \quad 59.2^v$$

$$- 29 \quad 18.9^v$$

$$- 70 \quad 19' \quad 44''^v$$

$$- \quad \quad \quad 2 \quad 43^v$$

$$- \quad 7 \quad 17^v$$

$$9.95727^v$$

$$0.00000$$

$$0.00352^v$$

$$\hline 9.96079^v$$

$$\gamma = 42 \quad 25 \quad 02^v$$

$$- 2 \quad 11 \quad 28^v$$

$$44 \quad 36 \quad 30^v$$

$$9.82640^v$$

$$8.22279^v$$

$$9.84650^v$$

$$0.17102^v$$

$$\hline 8.06669^v$$

$$\delta - \delta' = \quad + 40 \quad 05.1^v$$

$$\delta = -1 \quad 31 \quad 22.5^v$$

$$\alpha = 12 \quad 30 \quad 56.46^v$$

$$\text{Nautical } \delta = -1 \quad 31 \quad 18.5^v$$

$$\alpha = 12 \quad 30 \quad 15.589^v$$

$$0 - c \quad \quad \quad - 4.0^v$$

$$+ 0.57^v$$

$$\delta' = -2^\circ 11' 27.6''^v$$

$$11 = 57 \quad 25.4^v$$

$$9.86913^v$$

$$8.22279^v$$

$$9.10573^v$$

$$0.00015^v$$

$$\hline 7.19780^v$$

$$\delta - \delta' = -5' 25.26''^v$$

$$= -21.68^v$$

542

Human Parallel

$$S = 12^{\circ} 31' 18.14''$$

$$U = 12^{\circ} 01' 19.2''$$

$$- 29' 18.9''$$

$$- 7^{\circ} 19' 44''$$

$$- 12' 43''$$

$$- 7' 17''$$

$$9.95727$$

$$000000$$

$$000352$$

$$990079$$

$$S = 42^{\circ} 25' 02''$$

$$- 2^{\circ} 11' 28''$$

$$44^{\circ} 36' 30''$$

$$9.82640$$

$$9.22279$$

$$9.84650$$

$$017100$$

$$806669$$

$$S - S = +40^{\circ} 051''$$

$$S = -1^{\circ} 31' 22.4''$$

$$\text{Hartshorn } S = -1^{\circ} 31' 18.5''$$

$$U - C = 3.9$$

$$S = 2^{\circ} 11' 27.5''$$

$$U = 57^{\circ} 20.4''$$

$$9.86913$$

$$8.22279$$

$$9.10593$$

$$000015$$

$$719770$$

$$U - S = -5^{\circ} 25' 18''$$

$$= -41.68$$

$$12^{\circ} 30' 56.46''$$

$$\alpha = 12^{\circ} 30' 15.89''$$

$$-0.57$$

