

KG

11366

v. 937

Vol. LXI



Plate

2493

2494

2782



Harvard Lunar Plates

Measures and Reductions

Mary Fowler.

Volume ~~XLI~~ LXI.

Plate No.	Date	Page
2493	1913 Jan. 22	1
2494	" "	12
2782	1913 Feb. 15	21

2493

Star measures

1914 Feb. 9.

1

	d	x	d	x
1	16725	1389510	14332	12517
8.0	15929	0510	4042	1229000
13.1	3530	13110	14132	9000

13.0794.07938.0206.0224

2	19225	17820	19585	17005
8.8	1484800	12190	18120	844139
30.5	40	8895	30	52
	29	15	90	89
	<u>30.4381</u>	<u>.4374</u>	<u>8.8538</u>	<u>.8547</u>

3 very fr. star image + near lines

31.3	17590	16710	17852	16170
17.5	1379096	1051220	967060	1433030
	88	21	55	88
	68	09	22	50
	<u>17.3790</u>	<u>.3809</u>	<u>31.1834</u>	<u>.1833</u>

grades 6 or fainter.

2493

Star measures

1914 Feb. 9.

1

	d	u	d	u
1	16725	1389510	14332	12517
8.0	15929	05	4042	1229000
13.1	3530	13110	14132	90

13.079407938020610224

2	19225	17820	19585	17005
8.8	14848	12190	18120	844139
305	40	8895	30	52
	29	15	90	89
	<u>30.4381</u>	<u>4374</u>	<u>8.8538</u>	<u>8547</u>

3 very faint star map + measure lines

31.3	17590	16710	17852	16170
17.5	1379096	1051220	967060	1433030
	88	21	55	38
	68	09	22	50
	<u>17.3790</u>	<u>3809</u>	<u>31.1834</u>	<u>1833</u>

Grades 6 or fainter.

2493 Moon-measures

2

$$\begin{array}{r}
 1 \\
 20.0 \quad 16092 \\
 19.6 \quad 104450 \\
 \quad 4843 \\
 \quad 67 \\
 \hline
 19.5654
 \end{array}
 \qquad
 \begin{array}{r}
 18085 \\
 1367180 \\
 76 \\
 95 \\
 \hline
 .5587
 \end{array}$$

ft. and
may be on
termination

$$\begin{array}{r}
 2 \\
 20.8 \\
 20.0
 \end{array}$$

$$\begin{array}{r}
 16470 \\
 1416070 \\
 60 \\
 61 \\
 \hline
 208095
 \end{array}
 \qquad
 \begin{array}{r}
 19573 \\
 1143520 \\
 30 \\
 70 \\
 \hline
 .8143
 \end{array}$$

$$\begin{array}{r}
 3 \\
 21.0 \quad 14557 \\
 20.2 \quad 1266050 \\
 \quad 62 \\
 \quad 70 \\
 \hline
 20.1903
 \end{array}$$

$$\begin{array}{r}
 20433 \\
 1235545 \\
 29 \\
 38 \\
 \hline
 1906
 \end{array}$$

$$\begin{array}{r}
 4 \\
 21.5 \\
 21.0
 \end{array}$$

$$\begin{array}{r}
 15605 \\
 1024028 \\
 20 \\
 00 \\
 \hline
 21.4627
 \end{array}
 \qquad
 \begin{array}{r}
 16319 \\
 1167879 \\
 81 \\
 30 \\
 \hline
 .4645
 \end{array}$$

$$\begin{array}{r}
 5 \\
 21.6 \\
 21.5 \\
 \text{max} \\
 26
 \end{array}$$

$$\begin{array}{r}
 14520 \\
 1013025 \\
 30 \\
 26 \\
 \hline
 21.5606
 \end{array}
 \qquad
 \begin{array}{r}
 16425 \\
 10835 \\
 3230 \\
 22 \\
 \hline
 .5591
 \end{array}$$

$$\begin{array}{r}
 6 \\
 21.5 \\
 22.0
 \end{array}$$

$$\begin{array}{r}
 14492 \\
 981000 \\
 05 \\
 98 \\
 \hline
 21.5310
 \end{array}
 \qquad
 \begin{array}{r}
 17485 \\
 1215040 \\
 3040 \\
 83 \\
 \hline
 .5344
 \end{array}$$

2493 Moon - measures

2

$$\begin{array}{r}
 1 \\
 20.0 \\
 19.6 \\
 \hline
 16092 \\
 1084650 \\
 4843 \\
 07 \\
 \hline
 19,5654
 \end{array}
 \qquad
 \begin{array}{r}
 18085 \\
 1367180 \\
 76 \\
 95 \\
 \hline
 5587
 \end{array}$$

ft. and
may be on
terminal

$$\begin{array}{r}
 2 \\
 208 \\
 200 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 16470 \\
 1416070 \\
 60 \\
 61 \\
 \hline
 208095
 \end{array}
 \qquad
 \begin{array}{r}
 19573 \\
 1143520 \\
 30 \\
 70 \\
 \hline
 8143
 \end{array}$$

$$\begin{array}{r}
 3 \\
 210 \\
 202 \\
 \hline
 14557 \\
 1266050 \\
 62 \\
 70 \\
 \hline
 20,1903
 \end{array}
 \qquad
 \begin{array}{r}
 20433 \\
 1235545 \\
 29 \\
 38 \\
 \hline
 1906
 \end{array}$$

$$\begin{array}{r}
 4 \\
 21.5 \\
 21.0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 15605 \\
 1024028 \\
 20 \\
 00 \\
 \hline
 21,4627
 \end{array}
 \qquad
 \begin{array}{r}
 16319 \\
 1167879 \\
 81 \\
 30 \\
 \hline
 4645
 \end{array}$$

$$\begin{array}{r}
 5 \\
 21.6 \\
 21.5 \\
 \hline
 \text{man} \\
 \hline
 70
 \end{array}$$

$$\begin{array}{r}
 14520 \\
 1013025 \\
 30 \\
 26 \\
 \hline
 21,5606
 \end{array}
 \qquad
 \begin{array}{r}
 16425 \\
 10835 \\
 3230 \\
 22 \\
 \hline
 5591
 \end{array}$$

$$\begin{array}{r}
 6 \\
 21.5 \\
 22.0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 14492 \\
 981000 \\
 0500 \\
 98 \\
 \hline
 21,5310
 \end{array}
 \qquad
 \begin{array}{r}
 17485 \\
 1215040 \\
 3040 \\
 83 \\
 \hline
 5344
 \end{array}$$

145 A2
136 2.9

2493 moon-measures

$\begin{array}{r} 21.0 \\ 23.1 \end{array}$
 $\begin{array}{r} 10129 \\ 910060 \\ 11 \end{array}$
 $\begin{array}{r} 1326070 \\ 7770 \\ 12255 \end{array}$
 very bad
point

23.1025
1011

$\begin{array}{r} 20.0 \\ 23.7 \end{array}$
 $\begin{array}{r} 20030 \\ 1269042 \\ 56 \\ 35 \end{array}$
 $\begin{array}{r} 16545 \\ 13935 \\ 3032 \\ 60 \end{array}$

23.7387
7383

$\begin{array}{r} 19.3 \\ 23.8 \\ \text{max} \\ 10 \end{array}$
 $\begin{array}{r} 20099 \\ 1181628 \\ 20 \\ 10 \end{array}$
 $\begin{array}{r} 17450 \\ 1574342 \\ 40 \\ 57 \end{array}$

23.8287
8291

$\begin{array}{r} 19.0 \\ 23.7 \end{array}$
 $\begin{array}{r} 19152 \\ 1123235 \\ 25 \\ 65 \end{array}$
 $\begin{array}{r} 17390 \\ 1535042 \\ 45 \\ 07 \end{array}$

23.7931
7953

Very fr. image of moon.

7 point near 7.

$\begin{array}{r} 21.1 \\ 23.0 \end{array}$

$\begin{array}{r} 14540 \\ 5530 \end{array}$

13629

21.0913

$\begin{array}{r} 12480 \\ 11550 \\ 88680 \end{array}$

21.0898

2493 moon-measures

2 10129 13260
21.0 910000 7770
23.1 11 12255

very bad
print

23,1025

1011

9 20030 16545
20.0 1264042 13935
23.7 56 3032
35 60
23.7387 7383

10 20099 17450
23.8 1181628 1574342
max 20 40
5 10 57
8 238287 8291

14 19152 17390
19.0 11232 1535042
23.7 2535 4542
65 07
23.7931 7953

Very fr. image of moon.

7. point near 7.

21.1
23.0

14540
5530
13629

21.0913

12480
1155080
48680

21.0898

2493 Times etc

Eph to star 1913 Jan 22	7 ^h	14 ^m		- 7 ^h	26 ^m	
" Moon	7	19	35.9	- 7	19	36.2
clock fast		0	38.6			
H. Sid T	7	18	57.45		6 - x - 1 ^h	35 ^m
H long	4	44	31.05			
G. Sid T	12	03	28.5			
Sid T. in Moon	20	04	54.86			
Interval	15	58	33.64			
Reduction		2	37.04			
G. M. T	15	55	56.60			

From hant Alm			R. A.		Decl.	
Moon 16 ^h	8 ^h	54 ^m	04 ^s 13	+ 21°	47'	26.7
Motion in 2.5847				12.272		
" - 4.0567			10.49	+	49.8	
Tabular place	8	53	53.64	+ 21	48	16.5

Moon's age 15 days

$$\begin{aligned} 934 &= 13.7 \\ 1003 &= 15.8 \end{aligned}$$

parallax	61' 15" 38
Semidiameter	16 42.9
R	1002.9
Augmentation	+ 15.8
Irradiation (b)	- 1.1
R ~	1017.6
R =	2.1814
(1+a) R =	2.1816
R' =	4.7594

$$a = +1.0$$

2493	Times etc				
Exh. to stars 19.3 Jan 22	7 ^h	14 ^m		- 7 ^h	26 ^m
" " Moon	7	19	35.9	- 7	19 36.2
clock fast		0	38.6		
H. Sid T	7	18	57.45	6-X-1 ^h	35 ^m
H. long	4	44	31.05		
G. Sid T	12	03	28.5		
Sid T in Moon	20	04	54.86		
Interval	15	58	33.64		
Reduction		2	37.04		
G. in T.	15	55	56.60		

From hant Alm			R. G.		Decl.
Moon 16 ^m	8 ^h	54 ^m	09.13	+ 21°	47' 26.7
Moon in 2.5847				12.272	
+ 4.0567	-		10.49	+	49.8
Tabulamphaea	8	53	53.64	+ 21	48 16.5

Moons age 15 days.

4 = 13.7	parallax	61' 15.38
3 = 15.8	semidiam	16 42.9
	R	1003.9
	Augmentation	+ 15.8
	Imaginal diam (6)	- 1.1
	R =	1017.6
	R =	2.1819
a = + 1.0	(1 + a) R =	2.1816
	R =	9.7594

2493

Plate Constants

x	y	R.A.	Decl.
60215	130794	8 48 57	+20 17 48
88542	304378	49 17	+22 32 47
311834	173800	9 01 46	+20 51 46
3 4806	3 6090	1 158 120	1 62 100 141
16.02	20.30	8 53 20	+21 14 07
-18	-22	+1 01	+ 13 14
1.98	1.70	8 54 21	+21 27 21
31	466		
615	794		

$$A = 8^h 54^m 21^s$$

$$D = +21^\circ 27' 21''$$

$$\begin{aligned}
 2-3 & -49.54 & -72 & +2664 \\
 -2008 - 648 & = -2656 & -8 & = -2664 = 0 \\
 -1148 - 1507 & = -2655 & -9 & = -2664 = 0 \\
 -1774 - 860 & = -2634 & -31 & = -2665 = -1 \\
 193789 - 1072 & & -19 & = 19.5362
 \end{aligned}$$

$$\begin{aligned}
 4-m & +4592 & -4 & -207 \\
 -149 + 368 & = +219 & -13 & = +206 = -1 \\
 -169 + 406 & = +237 & -30 & = +207 = 0 \\
 -1207 + 1431 & = +224 & -17 & = +207 = 0 \\
 21.6467 + 889 & & -22 & = 21.7127
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } c &= -0.1 & d &= -0.1 & a-c &= 0.0 & b+d &= +0.9 \\
 \text{Obs } a &= +1.0 & e &= +1.0 & a-e &= 0.0 & b+d &= +3.6
 \end{aligned}$$

2493

Plate Constants

α	δ	R.A	Decl.
50215	130794	8 48 57	+20 17 48
88542	304378	49 17	+22 32 47
311834	173800	9 01 46	+20 51 46
3 4806	3 6090	1 158 120	1 62 100 141
16.02	2030	8 53 20	+21 14 07
-18	-22	+1 01	+ 13 14
198	170	8 54 21	+21 27 21
31	466		
615	794		

$$A = 8^h 54^m 21^s$$

$$D = +21^\circ 27' 21''$$

$$\begin{aligned}
 2-3 & -4954 & -70 & +2664 \\
 2008 - 648 & = -2656 & -8 & = -2664 & = 0 \\
 1148 - 1507 & = -2655 & -9 & = -2664 & = 0 \\
 1774 - 860 & = -2634 & -31 & = -2665 & = -1 \\
 193789 - 1072 & & -19 & & = 195362
 \end{aligned}$$

$$\begin{aligned}
 4-\eta & +4592 & -4 & -207 \\
 -149 + 368 & = +219 & -13 & = +206 & = -1 \\
 -169 + 406 & = +237 & -30 & = +207 & = 0 \\
 -1207 + 1431 & = +224 & -17 & = +207 & = 0 \\
 216467 + 889 & & -22 & & = 217127
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } \alpha & = -0.1 & \delta & = -0.1 & \alpha - \delta & = 0.0 & \alpha + \delta & = +0.9 \\
 \text{Obs } \alpha & = +1.0 & \delta & = +1.0 & \alpha - \delta & = 0.0 & \alpha + \delta & = +3.6
 \end{aligned}$$

2493 Standard Coordinates.

	Cape W. 1228 mg 6.8	Cape W. 1230 mg 8.0	Cape W. 1255 mg 7.7
C	8° 48' 12.17	8° 48' 31.83	9° 01' 01.06
L	22	86	0095
E	14	77	01.01
mean	8° 48' 12.18	8° 48' 31.82	9° 01' 01.01
Prece	+ 4471	+ 4517	+ 4454
X	8° 48' 56.89	8° 48' 16.99	9° 01' 45.55
A	8° 54' 21	8° 54' 21	8° 54' 21
X-A	- 5' 24.11	- 5' 04.01	+ 7' 24.55
sin(A)	- 324.08	- 303.99	+ 444.47
log	2.51065m	2.48286m	2.64784
cos	9.97216	9.96547	9.97055
Σ	0.99005m	0.95557m	1.12563
Σ ₀	- 9.7735	- 9.0276	+ 13.3545
Σ ₁	- 42	- 34	+ 63
Σ	8.2223	8.9690	31.3608
Σ ₂	8.0215	8.8542	31.1834
Σ-Σ	- 2008	- 1148	- 1774
C + 20° 20'	43.8	+ 22° 35' 44.8	+ 20° 54' 54.8
L	43.2	45.3	54.3
E	43.3	43.5	54.2
mean + 20	20 43.4	+ 22 35 44.5	+ 20 54 54.4
Prece	- 2 54.9	- 2 57.7	- 3 08.1
S + 20	17 48.5	+ 22 32 46.8	+ 20 51 46.3
D + 21	27 21	+ 21 27 21	+ 21 27 21
S-D	- 1 09 32.5	+ 1 05 25.8	- 35 34.7
tan(D)	- 41.73.1	+ 39.26.3	- 21.34.8
log	3.62046m	3.59398	3.32936m
-η ₁	0.95161m	0.92513	0.66051
tan S	9.5680	9.6882	9.5810
Σ ²	1.9801	1.9111	2.2513
η ₁	8.6015	8.5827	8.8857
Σ ₀	- 8.9456	+ 8.4164	- 4.5762
η ₁	+ 399	+ 383	+ 769
Σ	13.0943	30.4547	17.5007
η	13.0794	20.4378	17.3800
Σ-η	- 149	- 169	- 1207

2493 Standard Coordinates

Cape W. 1228 mag 6.8 Cape W. 1230 mag 6.8 Cape W. 1255 mag 7.7

C	8° 48' 12.17	8° 48' 31.83	9° 01' 01.06
L	22	86	0095
B	14	77	01.01
mean	8° 48' 12.18	8° 48' 31.82	9° 01' 01.01
Pre	+ 4471	+ 45.17	+ 4454
X	8° 48' 56.89	8° 49' 16.99	9° 01' 45.55
A	8° 54' 21	8° 54' 21	8° 54' 21
X-A	- 5' 24.11	- 5' 04.01	+ 7' 24.55
sin(A)	- 324.08	- 303.99	+ 444.97
log	2.51065	2.48286	2.64784
cos	9.97216	9.96547	9.97055
E	0.99005	0.95557	1.12563
Σ	- 9.7735	- 9.0276	+ 13.3545
Σ_1	- 42	- 34	- 63
Σ	82223	89690	313608
Σ	8.0215	8.8542	31.1834
2-5	- 2008	- 1148	- 1779

C + 20° 20'	43.8	+ 22° 35'	44.8	+ 20° 54'	54.8
L	432		453		543
B	433		435		542
mean + 20	20	22	35	20	54
Pre	- 2	- 2	577	- 3	081
S + 20	17	22	32	20	51
D + 21	27	21	27	21	21
S-D	- 1	05	258	- 35	347
Tan(D)	- 4173.1	+ 39263		- 21348	
log	3.62046	3.59398		3.32936	
η	0.95161	0.92513		0.66051	
$\tan S$	9.5680	9.6882		9.5810	
Σ	1.9801	1.9111		2.2513	
η_1	86015	85827		8.8857	
η_0	- 8.9456	+ 8.4164		+ 4.5762	
η_1	+ 379	+ 383		+ 767	
Σ	130943	304547		175007	
η	130794	204378		17.3800	
$\eta - \eta$	- 149	- 169		- 1207	

	p	$p-c$	$\lambda \sin(p-c)$	$\rho \cos(p-c)$	θ	Corr.	Correction
1	163.5	148	-0.4	+4.6	-3.9	+0.6	+56
2	138.8	124	-0.6	+3.0	-2.1	+0.5	+47
3	131.9	117	-0.6	+2.5	-1.6	-0.3	-28
4	107.2	92	-0.7	+0.2	+0.8	+0.6	+56
5	90.0	75	-0.7	+1.4	+2.4	+0.3	+28
6	80.8	66	-0.6	-2.2	+3.1	0.0	0
7	51.8	37	-0.4	-4.3	+5.0	+0.1	+9
8	48.9	33	-0.4	-4.6	+5.3	-0.2	-19
9	16.5	1	0.0	-5.4	+5.7	-0.2	-19
10	0.0	-15	+0.2	-5.2	+5.3	+0.4	+38
11	-10.0	-25	+0.3	-4.9	+4.9	-0.5	-47

$$c = 15^\circ$$

$$\log \lambda = -0.7$$

$$\log \rho = -5.4$$

	~~0-c~~	<del></del>	~~Corr 0-c~~	old resid.	Wayne corr	new resid.
2	~~+56~~	~~+47~~	~~+9~~	2 +109	+18	+91
3	~~-107~~	~~-28~~	~~-79~~	3 -54	-18	-36
4	~~+48~~	~~+56~~	~~-8~~	4 +95	+119	-24
5	~~-25~~	~~+28~~	~~-53~~	5 +13	+18	-5
6	~~+44~~	~~0~~	~~+44~~	6 +75	-18	+93
7	~~+21~~	~~+9~~	~~+12~~	7 +28	+18	+10
8	~~-138~~	~~-19~~	~~-119~~	8 -138	-28	-110
9	~~+22~~	~~-19~~	~~+41~~	9 -2	-18	+16
10	~~+28~~	~~+38~~	~~-10~~	10 -9	+37	-46
11	~~-40~~	~~-47~~	~~+7~~	11 -82	-55	-27
Average	-53		+113 -269			

$$\text{Average} = 38$$

	p	Corr	$0-c$
148	-4.7	+0.6	+55
124	-3.3	+0.2	+18
117	-2.8	-0.2	-18
92	-0.6	+1.3	+119
75	+1.0	+0.2	+18
66	+1.9	-0.2	-18
37	+4.2	+0.2	+18
33	+4.5	-0.3	-28
1	+5.7	-0.2	-18
345	+5.7	+0.4	+37
335	+5.6	-0.6	-55

2493

Luvon's Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$o - c$
1	20.0000	+0.6220	0.3869	4.7362	-2.32 reject
2	20.8119	+1.4339	2.0561	4.7703	+1.09
3	21.0000	+1.6220	2.6309	4.7540	- .54
4	21.4636	+2.0856	4.3497	4.7689	+ .95
+5	21.5599	+2.1819	4.7607	4.7607	+ .13
6	21.5327	+2.1547	4.6427	4.7669	+ .75
7	21.0906	+1.7126	2.9330	4.7622	+ .28
8	20.0000	+1.6220	2.6309	4.7459	-1.35 2 wr
9	20.0000	+0.6220	0.3869	4.7592	- .2
10	19.3780	0.0000	0.0000	4.7585	- .9
11	19.0000	-0.3780	0.1429	4.7512	- .82

Comp $R^2 = 4.7594$

	y	$y - Y_0$	$(y - Y_0)^2$
1	19.5620	-2.0855	4.3493
2	20.0000	-1.6475	2.7142
3	20.1904	-1.4571	2.1231
4	21.0000	-0.6475	0.4192
5	21.6475	0.0000	0.0000
6	22.0000	+0.3525	0.1242
7	23.0000	+1.3525	1.8292
8	23.1018	+1.4543	2.1150
9	23.7385	+2.0910	4.3723
+10	23.8289	+2.1814	4.7585
11	23.7942	+2.1467	4.6083

Approx. Center

$$x: 21.0 \quad y: 20.1904$$

$$23.1018$$

$$43.2922$$

$$X_0 = 21.6461$$

$$y = \text{max} = 23.8289$$

$$R = 2.1814$$

$$x = \text{max} = 21.5599$$

$$X_0 = 19.3785$$

$$x: 20.0 \quad y: 19.5620$$

$$23.7385$$

$$43.3005$$

$$Y_0 = 21.6502$$

$$\text{Center} \left\{ \begin{array}{l} X_0 = 19.3780 \\ Y_0 = 21.6475 \end{array} \right.$$

2493

Known Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$o - c$
1	20.0000	+0.6220	0.3869	4.7362	-2.32
2	20.8119	+1.4339	2.0561	4.7103	+1.09
3	21.0000	+1.6220	2.6309	4.7540	-5.4
4	21.4636	+2.0856	4.3497	4.7689	+9.5
5	21.5599	+2.1819	4.7607	4.7607	+1.3
6	21.5327	+2.1547	4.6427	4.7669	+7.5
7	21.0906	+1.7126	2.9330	4.7622	+2.8
8	20.0000	+0.6220	0.3869	4.7459	-1.35
9	20.0000	+0.6220	0.3869	4.7542	-2
10	19.3780	0.0000	0.0000	4.7585	-4
11	19.0000	-0.3780	0.1429	4.7512	-8.2

Computed $R^2 = 4.7599$

	y	$y - Y_0$	$(y - Y_0)^2$
1	19.5620	-2.0855	4.3493
2	20.0000	-1.6475	2.7142
3	20.1904	-1.4571	2.1231
4	21.0000	-0.6475	0.4192
5	21.6475	0.0000	0.0000
6	22.0000	+0.3525	0.1242
7	23.0000	+1.3525	1.8292
8	23.1018	+1.4543	2.1150
9	23.7385	+2.0910	4.3723
10	23.8289	+2.1814	4.7585
11	23.7942	+2.1467	4.6083

Approx. Center

$$x: 21.0 \quad y: 20.1904$$

$$23.1018$$

$$4.32922$$

$$X_0 = 21.6461$$

$$y_{\text{max}} = 23.8289$$

$$R = 2.1814$$

$$x_{\text{max}} = 21.5599$$

$$X_0 = 19.3785$$

$$x: 20.0 \quad y: 19.5620$$

$$23.7385$$

$$4.33005$$

$$Y_0 = 21.6502$$

$$\text{Center } \left\{ \begin{array}{l} X_0 = 19.3785 \\ Y_0 = 21.6475 \end{array} \right.$$

Formation of Comets

ab

bn

bn

With Hay's Correction
an

bn

	ab	bn	bn	With Hay's Correction an	bn
2	- 2.36	+ 156.0	- 180.0	+ 130.0	- 150.0
3	- 2.36	- 87.5	+ 78.9	- 58.4	+ 52.6
4	- 1.36	+ 198.2	- 61.8	- 50.2	+ 15.6
5	+ 0.00	+ 28.3	+ 0.0	- 10.9	- 0.0
6	+ 0.75	+ 161.2	+ 26.3	+ 200.0	+ 32.6
7	+ 2.31	+ 47.9	+ 37.8	+ 17.1	+ 13.5
8	+ 1.18	- 109.3	- 97.9	- 178.1	- 159.5
9	+ 1.30	- 1.2	- 4.2	+ 9.9	+ 33.5
10	+ 0.00	- 0.0	- 19.4	- 0.0	- 100.0
11	- 0.82	+ 31.2	- 176.2	+ 10.6	- 58.1
	- 1.36	+ 424.8	- 396.7	+ 70.0	- 319.8
(8) full wt	+ 3.54				
	+ 218				

O	C	O - C
+ 91	+ 6 + 24 = + 30	+ 61
- 36	+ 7 + 21 = + 28	- 64
- 24	+ 9 + 9 = + 18	- 42
- 5	+ 9 - 0 = + 9	- 14
+ 93	+ 9 - 5 = + 4	+ 89
+ 10	+ 7 - 19 = - 12	+ 22
- 1.60	+ 7 - 21 = - 14	- 96
+ 16	+ 3 - 30 = - 27	+ 43
- 46	+ 0 - 31 = - 31	- 15
- 27	- 2 - 31 = - 33	+ 6

+ 221 - 231
Average = 45

2493

Moon's Center
Conditional Equations

	a	b	0	c	0-c
2	+1.43	-1.65	= +109	+25 + 28 = +53	+56
3	+1.62	-1.96	= -54	+28 + 25 = +53	-107
4	+2.09	-0.65	= +95	+36 + 11 = +47	+48
5	+2.18	+0.00	= +13	+38 - 0 = +38	-25
6	+2.15	+0.35	= +75	+37 - 6 = +31	+44
7	+1.71	+1.35	= +28	+30 - 23 = +7	+21
~~1/2~~ 8	+1.62	+1.45	= -135	+28 - 25 = +3	-138
9	+0.62	+2.09	= -2	+11 - 35 = -24	+22
10	+0.00	+2.18	= -9	+0 - 37 = -37	+28
11	-0.38	+2.15	= -82	-16 - 36 = -42	-40

+219 - 310

Average = 53

Normal Equations

$$+23.22 - 1.36 = +425$$

$$- 1.36 + 22.01 = -397$$

$$+ 1.36 - 0.08 = +25$$

$$+ 21.93 = -372$$

$$b = -16.95$$

$$+23.22 = +425 - 23 = 402$$

$$a = +17.3$$

with Hayis correction (giving 80 full weight)

$$+24.53 + 21.8 = +70$$

$$+ 21.8 + 23.06 = -320$$

$$- 21.8 - 0.19 = -6$$

$$+ 22.87 = -326$$

$$b = -14.2$$

$$+24.53 = +70 + 31 = +101$$

$$a = +4.1$$

Arc measured: 149 Average (0-c) = -9

$$\frac{p-c}{m} = 0.14$$

$$\frac{-9}{14} = -0.64$$

$$\Delta a = -0.7$$

$$+ 22.56 - 1.36 = +425$$

$$- 1.36 + 21.48 = -397$$

$$+ 1.36 - 10.08 = +26$$

$$+ 21.40 = -371$$

$$b = -17.3$$

$$+ 22.56 = +425 - 23 = +402 \quad a = +17.8$$

2493

known Center Con dilution Equations

T	a	b	O	C	O-C
2	+1.43	-1.65	+1.09	+2.5 + 2.8 = +5.3	+5.6
3	+1.62	-1.96	-54	+2.8 + 2.5 = +5.3	-1.07
4	+2.09	-0.65	+95	+3.6 + 1.1 = +4.7	+4.8
5	+2.18	+0.00	+13	+3.8 - 0 = +3.8	-2.5
6	+2.15	+0.35	+75	+3.7 - 6 = +3.1	+4.4
7	+1.71	+1.35	+28	+3.0 - 2.3 = +.7	+2.1
8	+1.62	+1.45	-1.35	+2.8 - 2.5 = +.3	-1.38
9	+0.62	+2.09	-2	+1.1 - 3.5 = -2.4	+2.2
10	+0.00	+2.18	-9	+0 - 3.7 = -3.7	+2.8
11	-0.38	+2.15	-82	-6 - 3.6 = -4.2	-4.0

+219 - 310

Average = 53

Normal Equations

$$+2322 - 136 = +425$$

$$- 136 + 2201 = -397$$

$$+ 136 - 008 = + 25$$

$$+ 21.93 = -372$$

$$b = -16.9$$

$$+2322 + 425 = 23402$$

$$a = +17.3$$

Arc measured: 149 Average O-C: -9

$$\frac{p_c}{a} = 0.14$$

$$\frac{-9}{14} = -0.64$$

$$\Delta z = -0.7$$

2493 Luvor's Mean Position (1913.0)

$$X_0 = 19.3780^\circ \quad Y_0 = 21.6475^\circ$$

$$\frac{1}{2}a = \frac{+9}{19.3789} \quad \frac{1}{2}b = \frac{-8}{21.6467}$$

$$\text{Hayn} (19.3782) \quad (21.6468)$$

$$\text{From Plate Constants } X = 19.5362^\circ \quad Y = 21.7127^\circ$$

$$(19.5355) \quad (21.7128)$$

$$z = +1.5362^\circ \quad (1.5355) \quad \eta = -0.2873^\circ \quad (0.2872)$$

$$\log \bar{z} = 0.18645^\circ \quad (0.18624) \quad \log \tan S = 9.5917^\circ$$

$$\therefore \cos S = 9.96892^\circ \quad \therefore S^2 = 0.3729^\circ$$

$$\therefore \sin S = 8.50724^\circ \quad \therefore \eta_1 = 7.0534^\circ$$

$$\therefore (z-A) = 1.71029^\circ \quad (1.71008)$$

$$x-A = +51.32^\circ \quad (51.30)$$

$$A = 8 \ 54 \ 21^\circ$$

$$\alpha_0 = 8 \ 55 \ 12.32^\circ \quad (12.30)$$

$$\text{Red at lapp} + 1.71^\circ$$

$$\alpha' = 8 \ 55 \ 14.03^\circ \quad (14.01)$$

$$\eta_0 = -0.2883^\circ \quad (0.2882)$$

$$\log \eta_0 = 9.45984^\circ \quad (4.5969)$$

$$7.33115^\circ$$

$$\therefore (z-D) = 2.12869^\circ \quad (2.12854)$$

$$S-D = -2 \ 14.5^\circ \quad (14.4)$$

$$D = +21 \ 27 \ 21^\circ$$

$$S_0 = +21 \ 25 \ 06.5^\circ \quad (06.4)$$

$$\text{Red} = -0.1^\circ$$

$$S = +21 \ 25 \ 06.4^\circ \quad (06.3)$$

2493 Luvu's Mean Position (1913.0)

$$X_0 = 19.3780 \quad Y_0 = 21.6475$$

$$\begin{array}{r} 20 = \quad \quad 9 \\ 19.3789 \end{array} \quad \begin{array}{r} 10 = \quad \quad -8 \\ 21.6467 \end{array}$$

From Plate Constants $X = 19.5362 \quad Y = 21.7127$

$$z = +1.5362$$

$$\eta = -0.2873$$

$$\begin{array}{r} \log z = 0.18645 \\ \dots \dots 996892 \\ 850724 \end{array}$$

$$\log \tan S = 9.5917$$

$$\dots \dots 0.3729$$

$$70534$$

$$\dots \eta = 70180$$

$$(d-A) = 1.71029$$

$$\eta_1 = +10$$

$$A - A \quad + \quad 5732$$

$$\eta_0 = -0.2883$$

$$A = 8 \quad 54 \quad 21$$

$$\log \eta_0 = 9.45984$$

$$733115$$

$$A_0 = 8 \quad 55 \quad 12.32$$

$$\text{add plate} + \quad 171$$

$$(d-D) = 212869$$

$$A' = 8 \quad 55 \quad 1403$$

$$S-D = - \quad 2 \quad 14.5$$

$$D = +21 \quad 27 \quad 21$$

$$S_0 = +21 \quad 25 \quad 06.5$$

$$\text{Red} = - \quad 0.1$$

$$S = +21 \quad 25 \quad 06.4$$

2493 Red. ad l. aph.

$$H + \alpha \quad 6 \quad 53 = 103^\circ 15'$$

$$H \quad 21 \quad 58$$

$$\alpha_0 \quad 8 \quad 55$$

$$G \quad 18 \quad 27$$

$$G + \alpha \quad 3 \quad 22 = 50^\circ 30'$$

$$\log \cos (H + \alpha) \quad 9.8035$$

$$\log \cos \quad 0.9477$$

$$\log \sin \quad 9.8874$$

$$\log \tan S \quad 9.5935$$

$$\log \frac{1}{\tan} \quad 8.8239$$

$$\log (S') \quad 0.7512$$

$$\log (S) \quad 9.2525$$

$$+ 0.14$$

$$+ 0.18$$

$$+ 1.39$$

$$+ 1.71$$

$$S_0 + 21^\circ 25'$$

$$\log \cos S \quad 9.9689$$

$$\log \cos \quad 0.6422$$

$$\log (S) \quad 0.6111$$

$$\log \sin S \quad 9.5625$$

$$\log \cos (H + \alpha) \quad 9.3602$$

$$\log \cos \quad 1.3009$$

$$\log \sin \quad 9.9883$$

$$\log \sec S \quad 0.0311$$

$$\log \frac{1}{\tan} \quad 8.8239$$

$$\log (H') \quad 0.2236$$

$$\log (H) \quad 0.1442$$

$$S' \quad + 5.64$$

$$H' \quad - 1.67$$

$$L \quad - 40.8$$

$$- 0.11$$

2493 Red ad e. aph.

$$S_0 + 21^\circ 25'$$

$$H + \alpha \quad 6 \quad 53 = 103^\circ 15'$$

$$H \quad 21 \quad 58$$

$$\alpha_0 \quad 8 \quad 55$$

$$G \quad 18 \quad 27$$

$$G + \alpha \quad 3 \quad 22 = 50^\circ 30'$$

$$\log \cos(H + \alpha) \quad 9.8035$$

$$\quad \quad \quad 0.9477$$

$$\log \sin \quad 9.8879$$

$$\log \tan S \quad 9.5935$$

$$\log \frac{1}{\cos} \quad 8.8239$$

$$\log (S') \quad 0.7512$$

$$\log (S) \quad 9.2525$$

$$\begin{array}{r} f \\ \log \\ \hline +0.19 \\ +0.18 \\ +1.39 \\ \hline +1.71 \end{array}$$

$$\begin{array}{r} \log \cos S \quad 9.9689 \\ \quad \quad \quad 0.6422 \\ \hline 0.6111 \end{array}$$

$$\log \sin S \quad 9.5625$$

$$\log \cos(H + \alpha) \quad 9.3602$$

$$\quad \quad \quad 1.3009$$

$$\log \sin \quad 9.9883$$

$$\log \cos S \quad 0.0311$$

$$\log \frac{1}{\cos} \quad 8.8239$$

$$\log (H') \quad 0.2236$$

$$\log (H) \quad 0.1442$$

$$\begin{array}{r} S' \\ H' \\ \hline +5.64 \\ -1.67 \\ \hline -4.08 \\ \hline -0.11 \end{array}$$

2493

Lunar Parallax

$$\begin{aligned} \alpha' &= 8^h 55^m 14.03^s \checkmark \\ \delta &= 7 \quad 18 \quad 57.45 \checkmark \\ &= -1 \quad 36 \quad 16.6 \checkmark \\ &= -24^\circ 04' 09'' \checkmark \end{aligned}$$

$$= 9 \quad 57 \quad \checkmark$$

$$= -23 \quad 54 \quad 12 \checkmark$$

$$9.95727 \checkmark$$

$$0.00000 \checkmark$$

$$0.03894 \checkmark$$

$$999621 \checkmark$$

$$\gamma = 44^\circ 45' 00'' \checkmark$$

$$21 \quad 25 \quad 06 \checkmark$$

$$23 \quad 19 \quad 54 \checkmark$$

$$9.82640 \checkmark$$

$$8.25086 \checkmark$$

$$9.59775 \checkmark$$

$$0.15242 \checkmark$$

$$782743 \checkmark$$

$$s - s' = +23 \quad 06.3 \checkmark$$

$$s = +21 \quad 48 \quad (12.6) \checkmark$$

$$\delta' = +21^\circ 25' 06.4 \checkmark$$

$$\pi = 61' 15.38 \checkmark$$

$$9.86913 \checkmark$$

$$8.25086 \checkmark$$

$$9.61049 \checkmark$$

$$0.03224 \checkmark$$

$$776272 \checkmark$$

$$\alpha - \alpha' = -19' 54.39 \checkmark$$

$$= -1^\circ 19.63 \checkmark$$

$$\alpha = 8 \quad 53 \quad (54.38) \checkmark$$

$$\alpha = 8 \quad 53 \quad 54.40 \checkmark$$

$$\alpha = 8 \quad 53 \quad 53.64 \checkmark$$

$$O - C = -3.8 \checkmark$$

$$\text{with Wayne correction } (-3.9) \checkmark$$

$$+0.76 \checkmark$$

$$(+0.74) \checkmark$$

$$\text{Nautical Almanac } \delta = +21 \quad 48 \quad 16.5 \checkmark$$

2493

Linear Parallax

$$\begin{array}{r}
 \alpha' = 8^h 55^m 14.03^s \\
 \delta = 7 \quad 18 \quad 57.45 \\
 - 1 \quad 36 \quad 16.6 \\
 - 24^{\circ} \quad 04' \quad 09''
 \end{array}$$

$$- \quad \quad \quad 9 \quad 57$$

$$- 23 \quad 54 \quad 12$$

$$995727$$

$$000000$$

$$003894$$

$$999621$$

$$\gamma \quad 44 \quad 45' \quad 00''$$

$$21 \quad 25 \quad 06$$

$$23 \quad 19 \quad 54$$

$$982640$$

$$825086$$

$$959775$$

$$015242$$

$$782743$$

$$S = 5' \quad +23 \quad 06.3$$

$$S \quad +21 \quad 48 \quad 12.7$$

$$\text{Nant Allen } S = +21 \quad 48 \quad 16.5$$

$$O-C \quad - \quad 3.8$$

$$\delta = +21^{\circ} \quad 25' \quad 06.4''$$

$$\pi = 61' \quad 15.38''$$

$$9.86913$$

$$8.25086$$

$$9.61049$$

$$0.03224$$

$$776272$$

$$\alpha - \alpha' = -19' \quad 54.39$$

$$= -1^m \quad 19.63$$

$$\delta = 53 \quad 54.40$$

$$\alpha = 8 \quad 53 \quad 53.69$$

$$+0.76$$

2494 Stars - measured 1914 Feb. 10

	d	n	d	n
1	15281	15125	15490	14910
7.5	878994	1164029	1137180	900611
12.5	9594	30	80	21
	03	23	82	00
	<u>12.6502</u>	<u>.6509</u>	<u>7.5890</u>	<u>.5891</u>
2	8335	823840	14700	13972
8.4	824335	40	902530	963022
30.0	40	8150	30	26
			80	60
	<u>30.0096</u>	<u>.0089</u>	<u>8.4339</u>	<u>.4341</u>
3	954750	19420	19110	19795
30.8	50	1876170	1663039	1226771
16.9	8905	70	40	80
			01	90
	<u>16.9356</u>	<u>.9347</u>	<u>30.7528</u>	<u>7518</u>

Grade 6 or fainter.

Faint images and ft. reserve lines.

2494

Stars - measured

1914 Feb 10

	1	2	3	4
1	15281	15125	15490	14910
75	8789	11640	11371	9006
125	9594	30	80	21
	03	23	82	00
	<u>126502</u>	<u>6509</u>	<u>75890</u>	<u>5891</u>

2	8335	8238	14700	13972
84	8243	40	9021	9630
300	40	8110	30	26
			80	60
	<u>300096</u>	<u>0089</u>	<u>84339</u>	<u>4341</u>

3	9547	19420	19110	19795
308	50	1876	16630	12267
169	8905	70	40	80
			01	90
	<u>169356</u>	<u>9347</u>	<u>307528</u>	<u>7518</u>

Grade 6 - fainter.

Faint images and ft. research lines.

2494 moon-measures.

	d	y	n	d	xc	n
1	17590		14087			
20.0	1040085		1133010			
18.7	01		2034			
	00		00			
	<u>18.7202</u>		<u>7232</u>			

very ft.

2		
20.7		
19.0	very ft.	

18638	16377
1670431	8285
2246	8080
30	60
<u>20.5088</u>	<u>.5081</u>

3	17178	15782
21.0	1599075	699720
19.2	70	0320
	80	90
	<u>19.1200</u>	<u>.1229</u>

16870	16595
1386780	9599
67	9499
70	95
<u>21.7000</u>	<u>.6998</u>

5	
21.9	
20.8	
max	
m	
76	

15760	16689
1464040	7798
40	9597
55	91
<u>20.8881</u>	<u>.8893</u>

6	
21.5	
22.0	

15612	17840
1141008	1203540
00	61
05	30
<u>21.5797</u>	<u>.5789</u>

2494 known - measures.

	d	4	n	d	n
1	17590		14087		
200	1040085-		1133010		
187	01		2039		
	00		00		
	<u>18.7202</u>		<u>7232</u>		

very ft.

$$\begin{array}{r} 3 \\ 207 \\ 19.0 \end{array}$$

very ft.

$$\begin{array}{r} 18638 \\ 1670431 \\ 2246 \\ 30 \\ \hline 20.8088 \end{array}$$

$$\begin{array}{r} 16377 \\ 8285- \\ 8080 \\ 60 \\ \hline 8081 \end{array}$$

3	17178	15782
21.0	1599075-	699720
19.2	70	0320
	80	90
	<u>19.1200</u>	<u>1229</u>

$$\begin{array}{r} 4 \\ 216 \\ 20.0 \end{array}$$

$$\begin{array}{r} 16870 \\ 1386780 \\ 67 \\ 70 \\ \hline 21.7000 \end{array}$$

$$\begin{array}{r} 16195- \\ 9599 \\ 9499 \\ 95- \\ \hline 6998 \end{array}$$

$$\begin{array}{r} 5- \\ 219 \\ 208 \\ \text{max} \\ - \\ \hline \end{array}$$

$$\begin{array}{r} 15760 \\ 1464040 \\ 40 \\ 55- \\ \hline 20.8881 \end{array}$$

$$\begin{array}{r} 16689 \\ 7798 \\ 9997 \\ 91 \\ \hline 8893 \end{array}$$

$$\begin{array}{r} 6 \\ 215- \\ 220 \end{array}$$

$$\begin{array}{r} 15612 \\ 1141008 \\ 00 \\ 05- \\ \hline 21.5797 \end{array}$$

$$\begin{array}{r} 17840 \\ 1203040 \\ 61 \\ 30 \\ \hline 5789 \end{array}$$

2494 *moon-measures*
 d 4 n d n
 2 20010 17685
 21.0 - 1357170 1406250
 22.5 70 50
 18 90
22.6445 6367
 8 15296 1317066
 20.0 1485055 64
 23.0+ 44 12720
23.0446 0447
 9 14321 1334950
 19.3 1368089 42
 23.1 81 12692
 max
 23.0638 0655
 4

2494 *hiron - lucanus* d n n

2	20010	17685
210	1357170	1406250
221	70	50
	18	90
	<u>22.6445</u>	<u>.6367</u>

8	15296	1317066
200	1485055	64
2301	44	12720
	<u>230446</u>	<u>.0447</u>

9	14321	1334950
143	1368089	42
231	81	12692
max		
23	<u>23.0638</u>	<u>.0655</u>
4		

2494 Times etc.

Exp. stan	1913 Jan 22	7 ^h 27 ^m	-7 ^h 39 ^m
" " Moon		7 33 33.8	-7 33 34.0
clock fast		0 38.6	
H. Sid. T.		7 32 55.3	$\Theta - \alpha = -1^h 22^m$
H. long		4 44 31.0	
G. Sid. T.		12 17 26.3	
Sid. T. in Moon		20 04 54.8	
Interval		16 12 31.4	
Reduction		2 39.3	
G. W. T.		16 09 52.1	

From Kant. Allen.	R.A.	Decl.
Moon 16 ^h	8 ^h 54 ^m 04 ^s 13	+21° 47' 26.7
Motion in 1 ^m 2.5839		12 29.0
" 9.8695	+25.50	- 2 01.3
Tabular place	8 54 29.63	+21 45 25.4

Moon's age	15.7 days	"
" parallax	61"	15.44
" semidian.	16	42.9
R =	1002.9	
Augmentation	+16.1	
Irradiation (b)	- 1.1	
R =	1017.9	
R =	21820	
(1+a) R =	21821	
R ² =	4.7615	

$934 = 13.95$
 $1003 = 16.1$
 $a = +0.3$

2494 Times etc

Exp. Error	1913 Jan 22	7 ^m 27 ^{ss}	- 7 ^m 39 ^{ss}
Clock		7 33	33.8 - 7 33 34.0
clock fast		0	38.6
H. Sid. T.		7 32	55.3
H. long.		4 44	31.05
G. Sid. T.		12 17	26.35
Sid. T. in hours		20 04	54.86
Interval		16 12	31.49
Reduction		2	39.32
G. W. T.		16 09	52.17

From Kant. Allen	R.A.	Decl.
Moon 16"	8 ^h 54 ^m 04 ^s 13	+ 21° 47' 26.7"
Moon 1" 2.5839		12.290
9.8695	+ 25.50	- 2 01.3
Tabular place	8 54 29.63	+ 21 45 25.4

Moon age 15.7 days	
parallel	61" 15.44
semidiam	16 42.9
R _r	1002.9
Augmentation	- 16.1
Trans. diam. (b)	- 11
R ₁	1017.9
R ₂	21820
(1+a) R ₁	21821
R ₂	47615
a = +0.3	

2494

Plate Constants

2	7.5890	8.4340	30.7523
3	8.2223	8.9690	31.3608
2-3	-6333	-5350	-6085

4	12.6506	30.0092	16.9352
7	13.0943	30.4547	17.5007
4-7	-4437	-4455	-5655

2-3	-5674	+14	-32	+7052
-6333	-717	-7050 + 1	-7049 - 2	-7051 = +1
-5350	-1702	-7052 + 3	-7049 - 3	-7052 = 0
-6085	-960	-7045 + 2	-7043 - 9	-7052 = 0
197061	-1184	+2	-6	= 20.2925

4-7	+5292	-1.54	-12	+4056
-4437	+401	-4036 - 19	-4055 - 1	-4056 = 0
-4455	+446	-4009 - 45	-4054 - 1	-4055 = +1
-5655	+1627	-4028 - 25	-4053 - 3	-4056 = 0
20.8825	+1042	-31	-2	= 21.3890

Tables $a = -0.1$ $e = -0.1$ $a - e = 0.0$ $b + a = +0.5$
 Obs $a = +0.3$ $e = +1.5$ $a - e = -1.2$ $b + a = +3.8$

2494

Plate Constants

x	7.5890	8.4340	30.7523
y	8.2223	8.9690	31.3608
$x-y$	-6333	-5350	-6085

x	12.6506	30.0092	16.9352
y	13.0943	30.4547	17.5007
$x-y$	-4437	-4455	-5655

$x-y$	-5674	+14	-32	+7052
-6333	-717	-7050 + 1	-7049 - 2	-7051 + 1
-5350	-1702	-7052 + 3	-7049 - 3	-7052 - 0
-6085	-960	-7045 + 2	-7043 - 9	-7052 - 0
197061	-1184	+2	-6	= 202925

$x-y$	+5292	+154	-12	+4056
-4437	+401	-4036 - 19	-4055 - 1	-4056 - 0
-4455	+446	-4009 - 45	-4054 - 1	-4055 - 1
-5655	+1627	-4028 - 25	-4053 - 3	-4056 - 0
208825	+1042	-31	-2	= 213890

Tables $a = -0.1$ $b = -0.1$ $a-b = 0.0$ $b+a = +0.5$
 Obs $a = +0.3$ $b = +1.5$ $a-b = -1.2$ $b+a = +3.8$

	Old O-C	Hayns.	new(O-C)
1	-45	+9	-54
2	-27	0	-27
3	+135	+110	+25
4	-102	-55	-47
5	-17	+18	-35
6	-83	-37	-46
7	-5	+28	-33
8	-32	0	-32
9	-21	+37	-58

2494 Luovon's Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	20.00000	+0.2930	0.0858	4.7570	-4.5
2	20.8884	+1.1014	1.2131	4.7588	-2.7
3	21.00000	+1.2930	1.6718	4.7750	+13.5
4	21.6999	+1.9929	3.9716	4.7513	-10.2
5	21.8887	+2.1817	4.7598	4.7598	-1.7
6	21.5793	+1.8723	3.5055	4.7532	-8.3
7	21.00000	+1.2930	1.6718	4.7610	-5
8	20.00000	+0.2930	0.0858	4.7583	-3.2
9	19.7070	0.0000	0.0000	4.7594	-2.1

$$\text{Comp } R^2 = 4.7615$$

	y	$y - y_0$	$(y - y_0)^2$
1	18.7217	-2.1613	4.6712
2	19.00000	-1.8830	3.5457
3	19.1214	-1.7616	3.1032
4	20.00000	-0.8830	0.7797
5	20.8830	0.0000	0.0000
6	22.00000	+1.1170	1.2477
7	22.6406	+1.7576	3.0892
8	23.0446	+2.1616	4.6725
9	23.0646	+2.1816	4.7594

Approx. Center

$$x = 20.0 \quad y = 18.7217$$

$$23.0446$$

$$41.7663$$

$$y_0 = 20.8842$$

$$y_{\text{max}} = 23.0646$$

$$R = 2.1816$$

$$x_{\text{max}} = 21.8887$$

$$x_0 = 19.7071$$

$$y = 21.0 \quad y = 19.1214$$

$$22.6406$$

$$41.7620$$

$$y_0 = 20.8810$$

$$\text{Center } \begin{cases} x_0 = 19.7070 \\ y_0 = 20.8830 \end{cases}$$

2499

	p	p-c	B. Int	+4 cos p	Dist of true line from mean	Corr. to Huy's Conclusion	Corr. to be applied (distances)
1	172.2	-157°	-0.3	+5.0	-4.4	+0.1	+9
2	149.6	-135	-0.4	+3.8	+3.7	0.0	0
3	183.7	-129	-0.4	+3.4	-2.7	+1.3	+122
4	144.0	99	-0.7	+0.8	+0.2	+0.4	+37
5	90.0	-75	-0.7	-1.4	+2.4	+0.3	+28
6	59.0	46	-0.0	-3.4	+4.7	-0.8	-75
7	36.3	21	-0.2	-5.1	+5.6	+0.5	+47
8	7.8	-8	+0.1	-5.2	+5.5	+0.1	+9
9	0.0	-15	+0.2	-5.2	+5.3	+0.4	+37

$$C = 15^\circ$$

Of Selenometer

$$\text{corr} = -0.7 \text{ lat} - 50.4$$

$$= -x - y$$

$$-x \text{ from } p + 4 \cos p + 0.26$$

= dist of true line
beyond mean line

To fit Huy's conclusion

Change signs

$$(O-C)^2 \text{ O-C corr}$$

-61	-70
-26	-26
+141	+19
-75	-172
+21	-17
-39	+36
+30	-12
-6	-15
0	-37

O.K.

	O	corr		corr O-C
1157	-5.0	+0.1	+9	-70
1345	-3.9	0.0	0	-26
129	-3.5	+1.2	+110	+31
99	-1.2	-0.6	-55	-20
75	+1.0	+0.2	+18	+3
46	+3.7	-0.4	-37	-2
21	+5.2	+0.2	+28	+7
352	+5.7	0.0	0	-6
345	+5.7	+0.4	+37	-37

2494 Lincoln Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	20 00 00	+0.2930	0.0858	4.7570	-4.5
2	20 80 84	+1.1014	1.2131	4.7588	-2.7
3	21 00 00	+1.2930	1.6718	4.7750	+13.5
4	21 69 99	+1.9929	3.9716	4.7513	-10.2
5	21 88 87	+2.1817	4.7598	4.7598	-1.7
6	21 57 93	+1.8723	3.5055	4.7532	-8.3
7	21 00 00	+1.2930	1.6718	4.7610	-5
8	20 00 00	+0.2930	0.0858	4.7583	-3.2
9	19 70 70	0.0000	0.0000	4.7594	-2.1

$$\text{Comp } R^2 = 4.7615$$

	y	$y - y_0$	$(y - y_0)^2$
1	18.7217	-2.1613	4.6712
2	19.0000	-1.8830	3.5457
3	19.1219	-1.7616	3.1032
4	20.0000	-0.8830	0.7797
5	20.8830	0.0000	0.0000
6	22.0000	+1.1170	1.2477
7	22.6406	+1.7576	3.0892
8	23.0446	+2.1616	4.6725
9	23.0646	+2.1816	4.7594

Approx. Center

$$x = 20.0 \quad y = 18.7217$$

$$23.0446$$

$$41.7663$$

$$Y = 20.8842$$

$$y_{\text{max}} = 23.0646$$

$$R = 2.1816$$

$$x_{\text{max}} = 21.8887$$

$$X_0 = 19.7071$$

$$y = 21.0 \quad y = 19.1219$$

$$22.6406$$

$$41.7620$$

$$Y_0 = 20.8810$$

$$\text{Center } \begin{cases} X_0 = 19.7070 \\ Y_0 = 20.8850 \end{cases}$$

Formation of Novae

With Hayn's Cor.

	ab	an	bn	an	bn
1	-0.63	-13.1	+97.1	-15.7	+116.7
2	-2.07	-29.7	+50.8	-29.7	+50.8
3	-2.27	+174.0	-238.0	+32.3	-44.0
4	-1.75	-203.0	+89.7	-9.3	+41.4
5	+0.00	-37.1	-0.0	-7.6	-0.0
6	+2.10	-155.0	-93.0	-86.0	-51.5
7	+2.27	-6.4	-8.8	-42.5	-58.1
8	+0.63	-9.3	-69.1	-9.3	-69.1
9	+0.00	-0.0	-45.8	-0.0	-126.4
	-1.72	-279.6	-217.1	-320.9	-140.2

Residuals with Hayn's Corrections.

O	C	O-C
1 -54	-6+15 = +9	-63
2 -27	-22+13 = -9	-18
3 +25	-25+12 = -13	+38
4 -47	-39+6 = -33	-14
5 -35	-43-0 = -43	+8
6 -46	-37-8 = -45	-1
7 -33	-25-12 = -37	+4
8 -32	-6-15 = -21	-11
9 -58	-0-15 = -15	-43
		+50-150
		Average = 22.

2494

Moon's Center
Conditional Equations

	a	b	0		c	0 - c
1	+0.29	-2.16	= -45	- 5 + 21 =	+ 16	- 61
2	+1.10	-1.88	= -27	- 19 + 18 =	- 1	- 26
3	+1.29	-1.76	= +135	- 23 + 17 =	- 6	+141
4	+1.99	-0.88	= -102	- 35 + 8 =	- 27	- 75
5	+2.18	+0.00	= -17	- 38 - 0 =	- 38	+ 21
6	+1.87	+1.12	= -83	- 33 - 11 =	- 44	- 39
7	+1.29	+1.76	= -5	- 23 - 17 =	- 40	+ 35
8	+0.29	+2.16	= -32	- 5 - 21 =	- 26	- 6
9	+0.00	+2.18	= -21	- 0 - 21 =	- 21	0
				+197 - 207		
				Average = 45		

Normal Equations

$$+ 16.97 - 1.72 = -280$$

$$- 1.72 + 25.87 = -217$$

$$+ 1.72 - 0.17 = -28$$

$$+ 25.70 = -245$$

$$b = -9.55$$

$$+ 16.97 = -280 - 16 = -296$$

$$a = -17.45$$

Solution with Hayn's Corrections

$$+ 16.97 - 1.72 = -321$$

$$- 1.72 + 25.87 = -140$$

$$+ 1.72 - 0.17 = -33$$

$$+ 25.70 = -173$$

$$b = -6.7$$

$$+ 16.97 = -321 - 12 = -333$$

$$a = -19.6$$

Arc measured: 172° Average $(0-c) = -1.0$

$$\frac{pc}{n} = 0.27$$

$$-\frac{1}{27} = 0.04$$

$$\Delta n = 0.0$$

2494

Innovative Center

Conditional Equations:

	a	b	0		c	0-c
1	+0.29	-2.16	= -4.5	- 5 + 21 = +16	-61	
2	+1.10	-1.88	= -27	- 19 + 18 = -1	-26	
3	+1.29	-1.76	= +1.35	- 23 + 17 = -6	+141	
4	+1.99	-0.88	= -102	- 35 + 8 = -27	-75	
5	+2.18	+0.00	= -17	- 38 - 0 = -38	+21	
6	+1.87	+1.12	= -83	- 33 - 11 = -44	-39	
7	+1.29	+1.76	= -5	- 23 - 17 = -40	+35	
8	+0.29	+2.16	= -32	- 5 - 21 = -26	-6	
9	+0.00	+2.18	= -21	- 0 - 21 = -21	0	
					+197	-207
					Average = 45	

Normal Equation

$$+1697 - 172 = -280$$

$$- 172 + 2587 = -217$$

$$+ 172 - 0.17 = -28$$

$$+ 2570 = -245$$

$$+1697 = -280 - 16 = -296$$

$$k = -9.55$$

$$a = -17.45$$

Arc assumed: 172°

Average (0-c) = -1.0

$$\frac{k-c}{n} = 0.27$$

$$-\frac{1}{27} = 0.04$$

$$\Delta n = 0.0$$

Red ad locum app.

$$S + 21^{\circ} 23'$$

$$H + \alpha \quad L \quad 54 = 103^{\circ} 30'$$

$$H \quad 21 \quad 58$$

$$\alpha \quad 8 \quad 56$$

$$G \quad 18 \quad 27$$

$$G + \alpha \quad 3 \quad 23 = 50^{\circ} 45'$$

$$\log \cos (G + \alpha) \quad 9.8012 \checkmark$$

$$q \quad 0.9478$$

$$\sin \quad 9.8890$$

$$\tan \quad 9.5928$$

$$t \quad 8.8239$$

$$(g') \quad 0.7490$$

$$(g) \quad 9.2535$$

$$b \quad +0.14$$

$$+0.18$$

$$+1.39$$

$$+1.71$$

$$L \cos S \quad 9.9690$$

$$L \quad 0.6427 \checkmark$$

$$(L) \quad 0.6117 \checkmark$$

$$L \sin S \quad 9.5618$$

$$\cos (H + \alpha) \quad 9.3682 \checkmark$$

$$h \quad 1.3009$$

$$\sin \quad 9.9878$$

$$\sec S \quad 0.0310$$

$$\frac{1}{\sin} \quad 8.8237$$

$$(h') \quad 0.2309 \checkmark$$

$$(h) \quad 0.1434$$

$$g' \quad +5.61$$

$$g \quad -1.70$$

$$L \quad -4.09$$

$$-0.18$$

2494 Moon's mean Position (1913.0)

$$\begin{array}{rcl}
 X_0 = 19.7070^\circ & Y_0 = 20.8830^\circ & \\
 \Delta\alpha = -9^\circ & \Delta\delta = -5^\circ & \\
 \hline
 19.7061^\circ & 20.8825^\circ & \\
 (19.7060) & (20.8827) &
 \end{array}$$

From Plate Constants $X = 20.2925^\circ$ $Y = 21.3890^\circ$
 (20.2924) (21.3892)

$$\bar{z} = +2.2925^\circ (2.2924) \quad \eta = -0.6110^\circ (0.6108)$$

$$\begin{array}{rcl}
 \log \bar{z} = 0.36030^\circ & (0.36024) & \log \tan \delta = 9.5924^\circ \\
 \text{.. } \cos \delta = 9.96905^\circ & & 0.7206^\circ \\
 \text{.. } \cos \delta = 8.50724 & & 7.0539^\circ \\
 & & 7.3664^\circ
 \end{array}$$

$$\text{.. } (\alpha - A) = 1.88401^\circ (1.88400)$$

$$\alpha - A = +1 \quad 16.56^\circ (16.56)$$

$$A = 8 \quad 54 \quad 21^\circ$$

$$\delta_0 = 8 \quad 55 \quad 37.56^\circ$$

$$Red = +1.71^\circ$$

$$\delta' = 8 \quad 55 \quad 39.27^\circ$$

$$\eta_1 = +23^\circ$$

$$\eta_0 = -0.6133^\circ (0.6131)$$

$$\log \eta_0 = 9.78767^\circ (9.7875) \\ 7.33115^\circ$$

$$\text{.. } (\delta - 1) = 24.5652^\circ (4.5638)$$

$$S - 1 = -4 \quad 46.1^\circ (46.0)$$

$$D = +21 \quad 27 \quad 21^\circ$$

$$S_0 = +21 \quad 22 \quad 34.9^\circ (35.0)$$

$$Red = -0.2^\circ$$

$$\delta' = +21 \quad 22 \quad 34.7^\circ (34.8)$$

from solution with Hayn's Correction in parentheses

2494 Moon's mean Position (1913.0)

$$\begin{array}{r}
 X_0 = 197070 \quad Y_0 = 208830 \\
 a = -9 \quad b = -5 \\
 \hline
 197061 \quad 208825
 \end{array}$$

From Plate Constants $X = 20.2925 \quad Y = 21.3890$

$$Z = +22925$$

$$\log Z = 0.36030$$

$$\log S = 996905$$

$$\log m = 8.50724$$

$$(d-A) = 188401$$

$$d-A = +1 \quad 10.56$$

$$A = 8 \quad 54 \quad 21$$

$$\alpha_0 = 8 \quad 55 \quad 37.56$$

$$Red = +1.71$$

$$\alpha' = 8 \quad 55 \quad 39.27$$

$$\eta = -0.6110$$

$$\log \tan \delta = 9.5924$$

$$0.7206$$

$$1.0539$$

$$7.3664$$

$$\eta_1 = +23$$

$$\eta_0 = -0.6133$$

$$\log \eta_0 = 9.78767$$

$$7.33115$$

$$(d-1) = 245652$$

$$S-1) = -4 \quad 46.1$$

$$D = +21 \quad 27 \quad 21$$

$$S_0 = +21 \quad 22 \quad 34.9$$

$$Red = -0.2$$

$$S' = +21 \quad 22 \quad 34.7$$

2494

Lunar Parallax.

$$\alpha' = 8^h 55^m 39.27^s$$

$$\delta = 7 \quad 32 \quad 55.3^s$$

$$O - \alpha = -1 \quad 22 \quad 44.0^s$$

$$= -20^\circ 41' 00''$$

$$- \quad \quad \quad 8 \quad 37^s$$

$$-20 \quad 32 \quad 23^s$$

$$9.95727^s$$

$$0.00000$$

$$0.02852^s$$

$$9.98579^s$$

$$\delta = 44 \quad 03 \quad 45.5^s$$

$$21 \quad 22 \quad 34.7^s$$

$$22 \quad 41 \quad 11^s$$

$$9.82640^s$$

$$8.25086^s$$

$$9.58624^s$$

$$0.15774^s$$

$$7.82124^s$$

$$\delta - \delta' = +22 \quad 46.7^s$$

$$(21.5)^s$$

$$\delta = +21 \quad 45 \quad 21.4^s$$

$$\text{Haukkinen. } \delta = +21 \quad 45 \quad 25.4^s$$

$$O - c \quad \quad \quad - \quad 4.0^s$$

$$\text{With Hagn's Correction } (-3.9)$$

$$\delta' + 21^\circ 22' 34.7^s \quad (34.8)^s$$

$$\Pi \quad 61' 15.44^s$$

$$9.86913^s$$

$$8.25086^s$$

$$9.54802^s$$

$$0.03209^s$$

$$7.70010^s$$

$$\alpha - \alpha' = -17 \quad 14.02^s$$

$$= -1^m 08.93^s$$

$$\alpha = 8 \quad 54 \quad 30.34^s$$

$$\alpha = 8 \quad 54 \quad 29.63^s$$

$$+0.71^s$$

$$(+0.71)$$

2494

Lunar Parallax

$$\alpha' = 5^h 55^m 39.27$$

$$\delta = 7 \quad 32 \quad 55.3$$

$$\alpha - \alpha' = -1 \quad 22 \quad 44.0$$

$$= -20^{\circ} 41' 00''$$

$$= 8 \quad 37$$

$$-20 \quad 32 \quad 23$$

$$995727$$

$$000000$$

$$002852$$

$$998579$$

$$\delta - 44 \quad 03 \quad 45.5$$

$$21 \quad 22 \quad 34.7$$

$$22 \quad 41 \quad 11$$

$$982640$$

$$825086$$

$$958624$$

$$015774$$

$$782124$$

$$\delta - \delta' = +22 \quad 46.7$$

$$\delta = +21 \quad 45 \quad 21.4$$

$$\text{hantleum } \delta = +21 \quad 45 \quad 25.4$$

$$0 - c = 40$$

$$\delta' = +21^{\circ} 22' 34.7$$

$$\delta = 61' 15.4$$

$$986913$$

$$825086$$

$$958624$$

$$003209$$

$$770010$$

$$\alpha - \alpha' = -17 \quad 14.02$$

$$= 1^{\circ} 08' 9.3$$

$$\alpha - \alpha' = 54 \quad 30.39$$

$$\alpha = 8 \quad 54 \quad 29.63$$

$$+071$$

1
7
332
15
103
24
344
26
105
17
26
26
30

2782 Stars - Measures

1914 Feb. 11

	d	n	d	n
1	809490	13380	895240	15272
71	86	13210	4940	14308
33.0	7916	1010	7980	1717
	<u>329826</u>	<u>9830</u>	<u>70967</u>	<u>10958</u>
2	20119	18269	20105	18240
15.2	1447869	1389085	1190002	1644140
10.6	67	90	2009	40
	17	60	20	35
	<u>105648</u>	<u>5623</u>	<u>151790</u>	<u>1799</u>
3	16636	15916	19263	16111
243	1222520	1032530	1199086	1338082
305	15	3630	80	89
	35	12	50	16
	<u>304416</u>	<u>14416</u>	<u>242731</u>	<u>2728</u>
4	1478181	13045	19666	17649
264	80	1219089	1334538	1398380
10.9	13912	8889	40	82
			71	60
	<u>109131</u>	<u>9144</u>	<u>263672</u>	<u>3671</u>

Calculation 720 mag. 5.5
Additional Stars

13.0	18910	18159	12641	1298998
20.4	1559986	1149290	1235050	9298
	90	8290	50	12722
	14	62		
	<u>203322</u>	<u>3327</u>	<u>129709</u>	<u>9729</u>
20.4	16319	16359	17429	16590
30.8	1483329	781921	1131208	1272009
	29	23	11	10
	05	57	20	91
	<u>301479</u>	<u>1463</u>	<u>263886</u>	<u>3878</u>

2782 Stars - Measures

1914 Feb 11.

$\begin{array}{r} 1 \\ 71 \\ 330 \end{array}$
 $\begin{array}{r} 809490 \\ 86 \\ 7916 \end{array}$
 $\begin{array}{r} 13380 \\ 13210 \\ 1010 \end{array}$

$\begin{array}{r} 895240 \\ 4940 \\ 7980 \end{array}$
 $\begin{array}{r} 15272 \\ 14308 \\ 1717 \end{array}$

3298269830709670958

$\begin{array}{r} 2 \\ 152 \\ 106 \end{array}$
 $\begin{array}{r} 20119 \\ 1447869 \\ 67 \\ 17 \\ 105648 \end{array}$
 $\begin{array}{r} 18269 \\ 1389085 \\ 90 \\ 60 \\ 15223 \end{array}$

$\begin{array}{r} 20105 \\ 1190002 \\ 2009 \\ 20 \\ 151790 \end{array}$
 $\begin{array}{r} 18240 \\ 1644140 \\ 40 \\ 35 \\ 1799 \end{array}$

$\begin{array}{r} 243 \\ 305 \end{array}$
 $\begin{array}{r} 16636 \\ 1222520 \\ 15 \\ 35 \\ 304416 \end{array}$
 $\begin{array}{r} 15916 \\ 1032530 \\ 3630 \\ 12 \\ 14416 \end{array}$

$\begin{array}{r} 19263 \\ 1199086 \\ 80 \\ 50 \\ 242731 \end{array}$
 $\begin{array}{r} 16111 \\ 1338082 \\ 8982 \\ 16 \\ 2728 \end{array}$

$\begin{array}{r} 264 \\ 109 \end{array}$
 $\begin{array}{r} 1478181 \\ 80 \\ 13912 \\ 109131 \end{array}$
 $\begin{array}{r} 13045 \\ 1219089 \\ 8889 \\ 9149 \end{array}$

$\begin{array}{r} 19666 \\ 1334538 \\ 4038 \\ 71 \\ 263672 \end{array}$
 $\begin{array}{r} 17649 \\ 1398380 \\ 8280 \\ 60 \\ 3671 \end{array}$

Grade 5.

calc 720
 1000000
 Addition of 500000

$\begin{array}{r} 110 \\ 204 \end{array}$
 $\begin{array}{r} 18910 \\ 1559186 \\ 90 \\ 14 \\ 203322 \end{array}$
 $\begin{array}{r} 18159 \\ 1149290 \\ 8290 \\ 62 \\ 3327 \end{array}$

$\begin{array}{r} 12641 \\ 1235050 \\ 50 \\ 129709 \end{array}$
 $\begin{array}{r} 1298998 \\ 92 \\ 12722 \\ 9729 \end{array}$

$\begin{array}{r} 264 \\ 306 \end{array}$
 $\begin{array}{r} 16319 \\ 1483329 \\ 294 \\ 05 \\ 301479 \end{array}$
 $\begin{array}{r} 16359 \\ 781921 \\ 2321 \\ 57 \\ 1963 \end{array}$

$\begin{array}{r} 17429 \\ 1131208 \\ 11 \\ 20 \\ 263886 \end{array}$
 $\begin{array}{r} 16590 \\ 127200 \\ 10 \\ 91 \\ 3875 \end{array}$

2752 Moon's Measures.

1 16100
200 12499
185 80

min in γ = about 18.3570

1 scratch

19.6 16317
184 1217070
64
21
18.4150

20030
14186
8288
40
4149

16540
12905
1010
44
19.6369

19773
13400
0378
75
.6373

2 14730
19.0 777962
18.7 60
27
18.6961

14480
11420
0912
00
.6928

3
18.6
19.0

15440
11830
30
35
18.6390

15731
9375
6380
38
.6362

4
18.1
20.0

14367
547069
70
70
18.1100

15809
14710
1098
20
.1104

5
18.1
20.5
min
in
s

14335
0499097
91
43
18.0651

15852
1518190
81
50
.0668

2752 known measures

$\begin{array}{r} 16100 \\ 200 - 12999 \\ 185 \end{array}$

min γ = about 18.3570

1 scratch

$\begin{array}{r} 19.6 \\ 154 \\ 185 \end{array}$
 $\begin{array}{r} 16317 \\ 1217070 \\ 64 \\ 21 \\ 18.4150 \end{array}$

$\begin{array}{r} 20030 \\ 14186 \\ 5288 \\ 40 \\ 4149 \end{array}$

$\begin{array}{r} 16540 \\ 12905 \\ 1010 \\ 44 \\ 19.6369 \end{array}$

$\begin{array}{r} 19773 \\ 13400 \\ 0398 \\ 75 \\ 6373 \end{array}$

$\begin{array}{r} 2 \\ 190 \\ 187 \end{array}$
 $\begin{array}{r} 14730 \\ 777962 \\ 60 \\ 27 \\ 18.6961 \end{array}$

$\begin{array}{r} 14480 \\ 11420 \\ 0912 \\ 00 \\ 6928 \end{array}$

$\begin{array}{r} 3 \\ 18.6 \\ 19.0 \end{array}$

$\begin{array}{r} 15440 \\ 1143025 \\ 30 \\ 35 \\ 18.6390 \end{array}$

$\begin{array}{r} 15731 \\ 937550 \\ 6380 \\ 38 \\ 6362 \end{array}$

$\begin{array}{r} 4 \\ 18.1 \\ 20.0 \end{array}$

$\begin{array}{r} 14367 \\ 547069 \\ 70 \\ 70 \\ 18.1100 \end{array}$

$\begin{array}{r} 15809 \\ 1471098 \\ 1098 \\ 20 \\ 1104 \end{array}$

$\begin{array}{r} 5 \\ 18.1 \\ 20.5 \\ \text{min} \\ \text{max} \\ \text{mean} \end{array}$

$\begin{array}{r} 14331 \\ 0499097 \\ 91 \\ 43 \\ 18.0651 \end{array}$

$\begin{array}{r} 15852 \\ 1518190 \\ 81 \\ 50 \\ 0668 \end{array}$

27.82 moon-measures.

23

	d	n	d	n
6			13300	16890
18.2			4748	15440
21.0			4.040	3030
			00	93
			<u>18.1443</u>	<u>1457</u>
2			13890	17976
18.8			1173030	1013255
22.0			0122	4530
			85	82
			<u>18.7832</u>	<u>7840</u>

8	19492	18240
19.0		
22.2	1289085	985060
	82	55
	00	50
	<u>22.1607</u>	<u>1607</u>

9	scratch.		
19.7	19980	19310	19149
22.4	1540080	1384940	1582920
	8079	30	2020
	85	20	45
	<u>22.4497</u>	<u>4524</u>	<u>19.6675</u>
			18480
			1180090
			00
			74
			<u>6679</u>

2782 moon measures

d	n	d	n
6	13300	16890	
18.2	4748	15440	
21.0	4.040	3030	
	00	93	
	<u>181443</u>	<u>1457</u>	
2	13890	17976	
18.8	1173030	1013255	
22.0	0122	4530	
	85	52	
	<u>187832</u>	<u>7840</u>	

8	19492	18240
19.0	1789085	985060
22.2	82	55
	00	50
	<u>221607</u>	<u>1607</u>

9 scratch			
19.7	19980	19310	19149
22.4	1540080	1384940	1582920
	8079	30	20
	85	20	45
	<u>224497</u>	<u>4524</u>	<u>196675</u>
			<u>18480</u>
			1180090
			0090
			74
			<u>6679</u>

2282

Times etc.

exp to stars. 1913 Feb 15. $6^h 08^m$ ✓ $-6^h 20^m$ ✓
 " " moon $6 14 28.1$ ✓ $-6 14 28.3$ ✓
 clock fast $0 48.0$ ✓

H lid T. $6 13 40.2$ ✓ $\Theta - \alpha = +1^h 09^m$
 H long $4 44 31.05$
 G lid T. $10 58 11.25$ ✓
 Sid T. un known $21 39 32.22$ ✓
 Interval $13 18 39.03$ ✓
 Reduction $2 10.84$ ✓
 G in T. $13 16 28.19$ ✓

From Kant Allen. R.A. Decl.
 known 13^h $5^h 03^m 39.76$ ✓ $+27^\circ 50' 00.5$ ✓
 known $21^m 2.5579$ ✓ 4.158 ✓
 " 16.4698 ✓ 42.13 ✓ $+68.5$ ✓
 Tabular place $5 04 21.89$ ✓ $+27 51 09.0$ ✓

Moon's age 10 days.

parallax $58' 16.45$ ✓
 semidiameter $15' 54.3$ ✓
 R 954.3 ✓
 Augmentation $+15.9$ ✓
 Irradiation (5) -1.0 ✓
 R = 968.7 ✓
 R = 2076.5 ✓
 (1+a) R = 2076.1 ✓
 R² = 43102 ✓

$934 = 14.75$ ✓
 $954 = 15.4$ ✓

$a = -1.9$

2782 Times etc.
 exp. to stars 1913 Feb 11^h 6^m 08^s - 6^m 20^s
 moon 6 14 28.1 - 6 14 28.3
 clock fast 0 480

H lid T 6 13 40.2 6^m 20^s + 1^m 09^s
 H wing 4 44 31.05
 G lid T 10 58 11.25
 Sid T in moon 21 39 32.22
 In lunar 13 18 39.03
 Reduction 2 10.84
 G in T 13 16 28.19

From Kant Allen R A. Decl.
 known 13^h 5^m 03^s 39^s 76 + 27^m 50^s 00.5
 unknown 2.5579 42.13 4.158
 16.4698 42.13 + 68.5
 Tabular places 5 04. 2.189 + 27 51 09.0

Moon's age 1.0 days

parallax 58' 16" 45
 semidiam 15' 54" 3
 R 9 54 3
 Augmentation + 15.9
 Irradiation - 1.0
 R₁ 9 68.7
 R₂ 2.0765
 (1+2) R₂ 2.0761
 R₂ 4.3102
 a = -1.9
 734 = 1.471
 759 = 1.64

Plate Constants

δ	α	$2-3$	$4-m$
$+7.09 + 33.02 + 1 =$	-3	$+7$	
$+15.18 + 10.60 + 1 =$	-11	$+7$	
$+24.27 + 30.48 + 1 =$	-14	$+7$	
$+26.37 + 10.96 + 1 =$	-12	-30	
$+12.97 + 20.37 + 1 =$	$+20$	-13	
$+26.39 + 30.18 + 1 =$	$+7$	$+24$	

Preliminary
constants

were

$$\begin{aligned} a &= -1.8 & c &= 0 \\ b &= -0.2 & d &= -3.0 \\ e &= +44 & f &= -319 \end{aligned}$$

Mean Equation

$+11.75 + 21.33 + 1 =$	$+2.00$	$+0.33$
$+25.68 + 23.57 + 1 =$	-6.33	$+0.33$
$+18.17 + 13.98 + 1 =$	-7.00	-12.00
$+19.25 + 31.23 + 1 =$	-3.33	$+12.67$
$-13.93 - 2.24 =$	$+8.33$	0.00
$-1.08 - 17.25 =$	$+2.33$	-24.67
$+1.08 + 0.17 =$	-0.65	0.00
$-17.08 =$	$+1.68$	-24.67
$b =$	-0.10	$+1.45$
$-13.93a + 8.33 - 6.22 + 8.11$	$0.00 + 32.4$	
$a =$	-0.58	-0.23

$+2.0$	-6.3	-1.0	-3.3	$+0.3$	$+0.3$	-12.0	$+12.7$
$+6.8$	$+15.0$	$+10.6$	$+11.2$	$+2.7$	$+6.0$	$+4.2$	$+4.5$
$+2.1$	$+2.4$	$+1.4$	$+3.1$	-30.8	-34.1	-20.2	-45.1
$+10.9$	$+11.1$	$+11.0$	$+11.0$	-27.8	-27.8	-28.0	-27.9

$-4 - 3 + 11 = +4$	$-3 =$	-7	$-2 + 48 - 28 =$	$+18$	$+7$	-11
$-9 - 1 + 11 = +1$	$-11 =$	-12	$-4 + 15 - 28 =$	-17	$+7$	$+24$
$-14 - 3 + 11 = -6$	$-14 =$	-8	$-6 + 44 - 28 =$	$+10$	$+7$	-3
$-15 - 1 + 11 = -5$	$-12 =$	-7	$-6 + 16 - 28 =$	-18	-30	-12
$-8 - 2 + 11 = +1$	$+20 =$	$+19$	$-3 + 29 - 28 =$	-2	-13	-11
$-15 - 3 + 11 = -7$	$+7 =$	$+14$	$-6 + 44 - 28 =$	$+10$	$+24$	$+14$

Final plate
constants from six stars

$$\begin{aligned} a &= -2.4 & c &= +1.5 \\ b &= -0.3 & d &= -3.2 \\ e &= +5.5 & f &= -34.2 \end{aligned}$$

2782 -

Plate Constant.

α	δ	R.A.	Decl.
7.0962	32.9828	4 55 40	+29 12 23
15.1794	10.5636	5 00 30	26 18 40
24.2730	30.4416	5 05 51	28 53 04
26.3672	10.9138	5 06 58	26 21 11
47.292	8.990	19 66 179	19 10 4 78
18.23	21.23	5 02 15	+27 41 20
-18	-22	-	+ 6 00
23	077	5 02 08	+27 47 20
3.1	4662		
7 ^s	359 ^u		

$$A = 5^h 02^m 08^s$$

$$D = +27^\circ 47' 20''$$

α	δ
12.9682	20.3690
26.3884	30.1840

$$2 - 3 + 0.34 + 2.42$$

$$+20 + 10 = +30 + 17 = +47$$

$$+1 + 3 = +4 + 36 = +40$$

$$-19 + 9 = -10 + 58 = +48$$

$$-17 + 3 = -14 + 63 = +49$$

$$+37 + 6 = +43 + 31 = +74$$

$$-2 + 9 = +7 + 63 = +70$$

Using original 4 stars.

$$2 - 3 + 1.92 - 31$$

$$+20 + 13 = +33 = +2$$

$$+1 + 29 = +30 = -1$$

$$-19 + 46 = +27 = -4$$

$$-17 + 50 = +33 = +2$$

$$20.1419^u + 38^v = 20.1426^v$$

$$4 - 7 + 4.32 - 0.54 + 302$$

$$-328 + 31 = -297 - 16 = -313 = -11$$

$$-352 + 65 = -287 - 5 = -292 = +10$$

$$-380 + 104 = -276 - 15 = -291 = +11$$

$$-423 + 114 = -309 - 5 = -314 = -12$$

$$20.4290^u + 87^v - 10^v = 20.4669^v$$

$$\text{Tables } a = +0.8 \quad c = +0.8 \quad a - c = 0.0 \quad b + a = 0.0$$

$$4 \text{ stars } a = -1.9 \quad c = +0.5 \quad a - c = -2.4 \quad b + a = -4.3$$

$$6 \text{ stars } a = -2.4 \quad c = +1.5 \quad a - c = -3.9 \quad b + a = -3.5$$

2782 -

Plate Constant

	4	RH	Dec.
7.0962	32.9828	4 55 40	+29 12 23
15.1794	10.5636	5 00 30	26 18 40
24.2730	30.4416	5 05 51	28 53 04
26.3672	10.9138	5 06 58	26 21 11
72.92	8.990	19 66 179	29 104 78
18.83	2123	5 02 15	+27 41 20
18	22	- 7	+ 6 00
23	77	5 02 08	+27 47 20
31	466		
7	359		

$$A = 5^h 02^m 08^s$$

$$D = +27^\circ 47' 20''$$

$$\begin{aligned}
 & 2.3 + 0.34 = +2.42 \\
 & +20 + 10 = +30 + 17 = +47 \\
 & +1 + 3 = +4 + 36 = +40 \\
 & -1.9 + 9 = -10 + 58 = +48 \\
 & -1.7 + 3 = -14 + 63 = +49 \\
 & +3.7 + 6 = +43 + 31 = +74 \\
 & -1.2 + 9 = +7.7 + 63 = +70
 \end{aligned}$$

Using original 4 stars.

$$\begin{aligned}
 & 2.3 + 1.92 = -3.1 \\
 & +20 + 13 = +33 = +2 \\
 & +1 + 29 = +30 = -1 \\
 & -1.9 + 46 = +27 = -4 \\
 & -1.7 + 50 = +33 = +2 \\
 & W. 1419 + 38 = 20.1426
 \end{aligned}$$

$$\begin{aligned}
 & 4.7 + 9.32 = -0.54 + 30.2 \\
 & -3.28 + 31 = -2.97 - 16 = -31.3 = -1.1 \\
 & -3.52 + 6.5 = -2.87 - 5 = -29.2 = +1.0 \\
 & -3.80 + 10.4 = -2.76 - 15 = -29.1 = -1.1 \\
 & -4.23 + 11.4 = -3.09 - 5 = -31.4 = -1.2 \\
 & W. 4290 + 87 = -1.0 = 20.4669
 \end{aligned}$$

$$\text{Tabular } a = +0.8 \quad b = +0.8 \quad a - b = 0.0 \quad b + a = 0.0$$

$$(4) \text{ stars } a = -1.9 \quad c = +0.5 \quad a - c = -2.4 \quad b + c = -4.3$$

$$(6) \text{ stars } a = -2.4 \quad c = +1.5 \quad a - c = -3.9 \quad b + c = -3.5$$

2782

Standard Coordinates

Cape W. 721 m 8.7

Cape W. 731 m 6.6 Cape W. 726 m 6.5

C A 54 50.32

4 59 41.93 4 58 22.77

L 36

96 80

E 33

91 76

mean 4 54 50.34

4 59 41.93 4 58 22.78

Prec + 49.26

+ 48.24 + 48.69

K 4 55 39.60

5 00 30.17 4 59 11.47

A 5 02 08

5 02 08 5 02 08

K-A - 6 28.40

- 1 37.83 - 2 56.53

Sun (K-A) - 388.35

- 97.83 - 176.53

log. 2.58922m

1.99047m 2.24682m

log. 9.94095

9.95250 9.94763

30 1.03741m

0.45021m 0.70169m

30 - 10.8995

- 2.8197 - 5.0314

31 - 63

- 10 - 4

3 7.0942

15.1793 12.9682

3 7.0962

15.1794 12.9719

2-3 + 20

+ 1 + 37

C +29° 11' 09.6"

+26° 17' 33.6" +27° 33' 23.0"

L 1.03

33.2 23.6

E 09.8"

32.9" 23.5"

mean +29 11 09.9

+26 17 33.2 +27 33 23.4

Prec +1 12.7

+ 1 07.3 + 1 08.8

S +29 12 22.6

+26 18 40.5 +27 34 32.2

D +27 47 20

+27 47 20. 20.

S-D +1 25 02.6

- 1 28 39.5 - 12 47.8

tan (S-D) +5103.7

- 5320.7 - 767.8

log. 3.70789

3.72597m 2.88525m

log. 1.03904

1.05712m 0.21640m

tan 9.7474

9.6941 9.71179

32 2.0748

0.9004 1.4034

log. 8.8756

7.6479 8.1747

log. +10.9405

- 11.4056 - 1.6459

log. + 751

+ 44 + 149

log. 33.0156

10.5988 20.3690

log. 32.9828

10.5636 20.3324

log. - 328

- 352 - 366

27 & 2

Standard Coordinates

Cape W. 721 m 8.7

Cape W. 731 m 9.6 6 Cape W. 726 m 6.5

C 4" 54 50.32

4" 59 41.93 4 58 22.77

L 36

96 80

E 33

91 76

Mean 4 54 50.34

4 59 41.93 4 58 22.78

Prec + 49.26

+ 48.24 + 48.69

X 4 55 39.60

5 00 30.17 4 59 11.47

A 5 02 08

5 02 08 5 02 08

X-A - 6 28.40

- 1 37.83 - 2 56.53

S (H-A) - 388.35

- 97.83 - 176.53

Avg. 2.58922

1.99047 2.24682

WSS 994095

9.95250 9.94763

30 1.03741

0.45021 0.70169

30 - 10.8995

- 2.8197 - 5.0314

31 - 63

- 10 - 4

32 7.0942

15.1793 12.9682

2 7.0962

15.1794 12.9719

2-3 + 20

+ 1 + 37

C +29° 11' 09.6"

+26° 17' 33.6" +27° 33' 23.0"

L 10.3

33.2 23.6

E 09.8

32.9 23.5

Mean +29 11 09.9

+26 17 33.2 +27 33 23.4

Prec +1 12.7

+ 1 07.3 + 1 08.8

J +29 12 22.6

+26 18 40.5 +27 34 32.2

D +27 47 20

+27 47 20 +27 47 20

J-D +1 25 02.6

- 1 28 39.5 - 12.478

Tan(H-D) +5103.7

- 5320.7 - 7678

Avg. 3.70789

3.72597 2.88525

30 1.03904

1.05712 0.21690

WSS 9.7474

9.6941 9.71179

32 20748

09004 14034

30 88756

76479 81747

30 +10.9405

- 11.4056 - 1.6459

31 + 7.51

+ 44 - 1.419

32 33.0156

10.5988 20.3690

3 32.9828

10.5636 20.3324

3-3 - 328

- 352 - 366

2782

Standard Coordinates

Cape (Cambridge) m. 2337 mgl Cape W. 745 mgl 6.8

C.B. 2345 mgl 8.7

α 5^h 03^m 26^s 88^v ϵ 5^h 06^m 10^s 05^v α 5^h 04^m 41^s 80^v

ϵ 10 06^v

ϵ 09 99^v

ϵ mean 5 06 10.03^v

α + 2 23 94^v α + 4 8.31^v + 2 23 94

α 5^h 05 50.82^v α 5^h 06 58.34^v 5^h 07 05.74^v

α 5^h 02 08^v 5^h 02 08^v 5^h 02 08^v

$\alpha - A$ + 3 42.82^v + 4 50.34^v + 4 57.74^v

$\Delta(\alpha - A)$ + 222.81^v + 290.32^v + 297.72^v

$\log$ 2.34794^v 2.46288^v 2.47381^v

$\log$ 9.94231^v 9.95235^v 9.94248^v

$\log$ 0.79744^v 0.92247^v 0.92353^v

$\log$ + 6.2732^v + 8.3650^v + 8.3856^v

$\log$ + 1.7^v + 3.9^v + 2.8^v

$\log$ 24.2749^v 26.3689^v 26.3884^v

$\log$ 24.2730^v 26.3672^v 26.3882^v

$\log$ - 1.9^v - 1.7^v - 2^v

α + 28° 50' 01" 5^v ϵ + 26 20 10.5^v + 28° 47' 38" 8^v

ϵ 10.9^v

ϵ 10.3^v

ϵ mean + 26 20 10.6^v

α + 3 02.2^v + 1 00.2^v + 2 58.2^v

α + 28 53 03.7^v + 26 21 10.8^v + 28 50 37.0^v

α + 27 47 20^v + 27 47 20^v + 27 47 20^v

$\alpha - D$ + 1 05 43.7^v - 1 26 09.2^v + 1 03 17.0^v

$\Delta(\alpha - D)$ + 3944.2^v - 5170.3^v + 3797.4^v

$\log$ 3.59596^v 3.71351^v 3.57948^v

$\log$ 0.92711^v 1.04466^v 0.91063^v

$\log$ 9.7417^v 9.6949^v 9.7409^v

$\log$ 1.5950^v 1.8449^v 1.8471^v

$\log$ 8.3901^v 8.5932^v 8.6414^v

$\log$ + 8.4550^v - 11.0831^v + 8.1402^v

$\log$ + 24.6^v + 3.92^v + 4.38^v

$\log$ 30.4796^v 10.9561^v 30.1840^v

$\log$ 30.4416^v 10.9138^v 30.1471^v

$\log$ - 3.80^v - 4.23^v - 3.69^v

2782

Standard Cordinal

Cambridge (ing) no. 2327 mgl Cape W. 745 mgl 6.8

C 2345 mgl 8.7

Q. 5" 03" 26' 88"	C	5" 06" 10' 05"	5" 04" 41' 80"
-------------------	---	----------------	----------------

L	10 06
---	-------

L	09.99
---	-------

mean	5 06 10.03
------	------------

Prec	+ 2	2394	Prec	+ 4.8.31	+ 2	2394
------	-----	------	------	----------	-----	------

α	5" 05	50.82	α	5" 06	58.34	5" 07	05.74
----------	-------	-------	----------	-------	-------	-------	-------

Δ	5" 02	08	5" 02	08	5" 02	08
----------	-------	----	-------	----	-------	----

$\alpha - A$	+ 3	42.82	+ 4	50.34	+ 4	57.74
--------------	-----	-------	-----	-------	-----	-------

$\Delta - A$	+ 222.81	+ 290.32	+ 297.72
--------------	----------	----------	----------

log.	2.34794	2.46288	2.47381
------	---------	---------	---------

cos	9.94230	9.95235	9.94248
-----	---------	---------	---------

" 3	0.79748	0.92247	0.92353
-----	---------	---------	---------

$\frac{3}{2}$	+ 6.2730	+ 8.3650	+ 8.3856
---------------	----------	----------	----------

$\frac{3}{2}$	+ 17	+ 39	+ 28
---------------	------	------	------

$\frac{3}{2}$	24.2749	26.3689	26.3884
---------------	---------	---------	---------

$\frac{3}{2}$	24.2730	26.3672	26.3882
---------------	---------	---------	---------

$\frac{3}{2}$	- 19	- 17	- 2
---------------	------	------	-----

C	+ 28° 50' 01" 5	C	+ 26 20 10.5	+ 28° 47' 38" 8
---	-----------------	---	--------------	-----------------

L	10.9
---	------

L	10.3
---	------

mean	+ 26 20 10.6
------	--------------

Prec	+ 3	022	+ 1	00.2	- 2	582
------	-----	-----	-----	------	-----	-----

α	+ 28	53	03.7	+ 26	21	10.8	+ 28	50	37.0
----------	------	----	------	------	----	------	------	----	------

Δ	+ 27	47	20	+ 27	47	20	+ 27	47	20
----------	------	----	----	------	----	----	------	----	----

$\alpha - \Delta$	+ 1	05	43.7	- 1	26	09.2	+ 1	03	17.0
-------------------	-----	----	------	-----	----	------	-----	----	------

$\Delta - \Delta$	+ 39	44.8	- 51	70.3	+ 37	97.4
-------------------	------	------	------	------	------	------

log.	3.59596	3.71351	3.57948
------	---------	---------	---------

$\frac{3}{2}$	0.92711	1.04466	0.91063
---------------	---------	---------	---------

tan	9.7417	9.6949	9.7409
-----	--------	--------	--------

$\frac{3}{2}$	1.5950	1.8449	1.8471
---------------	--------	--------	--------

$\frac{3}{2}$	8.3901	8.5932	8.6414
---------------	--------	--------	--------

$\frac{3}{2}$	+ 8.4550	- 11.0831	+ 8.1402
---------------	----------	-----------	----------

$\frac{3}{2}$	+ 29.6	+ 39.2	+ 43.8
---------------	--------	--------	--------

$\frac{3}{2}$	30.4796	10.9551	30.1840
---------------	---------	---------	---------

$\frac{3}{2}$	30.4916	10.9138	30.1471
---------------	---------	---------	---------

$\frac{3}{2}$	- 280	- 423	- 369
---------------	-------	-------	-------

	P	p-c			Q	corr.
1	166.0	171.0	-1.2	+6.3	-7.2	-2.1
2	146.6	151.6	-3.7	+5.6	-9.0	?
3	133.5	138.5	-5.1	+4.8	-9.6	?
4	102.0	107.0	-7.3	+1.9	-8.9	?
5	90.0	95.0	-7.7	+0.6	-8.0	?
6	74.0	79.0	-7.6	-1.2	-6.1	
7	40.8	45.8	-5.5	-4.5	-0.7	-0.3
8	33.5	38.5	-4.8	-5.0	+0.5	+0.3
9	13.2	18.2	-2.4	-6.1	+4.0	+0.4

$$\lambda = -7.73$$

$$\beta = -6.40$$

$$C = 355.0$$

	P	p-c	$\lambda \sin(p-c)$	$\beta \cos(p-c)$	Q	Hayn	C	Q	O-C
1	194.0	199.0	+2.5	+6.1	-3.3	+0.4	+37	+8	-29
2	213.4	218.4	+4.8	+5.0	+0.1	+0.4	+37	+26	-11
3	226.5	231.5	+6.0	+3.9	+2.4	-0.7	-44	-52	+12
4	258.0	263.0	+7.7	+0.8	+7.2	0.0	0	+16	+16
5	270.0	275.0	+7.7	-0.6	+8.6	+0.4	+37	-9	-46
6	286.0	291.0	+7.2	-2.3	+9.8	+0.6	+55	+33	-22
7	319.2	324.2	+4.6	-5.2	+10.1	-0.6	-55	+27	+82
8	326.5	331.5	+3.6	-5.6	+9.5	-0.5	-46	-75	-29
9	346.8	351.8	+1.1	-6.4	+7.8	0.0	0	+31	+31

Old (O-C)	Hayn	New (O-C)
+29	+37	-8
+17	+37	-20
-81	-64	-17
-52	0	-52
-87	+37	-124
-53	+55	-108
-55	-55	0
-152	-46	-106
-27	0	-27

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Moon's Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	19.6371	-0.5029	0.2529	4.3131	+29
2	19.0000	-1.1400	1.2996	4.3119	+17
3	18.6376	-1.5024	2.2572	4.3021	-81
4	18.1102	-2.0298	4.1201	4.3050	-52
5	18.0660	-2.0740	4.3015	4.3015	-87
6	18.1450	-1.9950	3.9800	4.3049	-53
7	18.7836	-1.3564	1.8398	4.3047	-55
8	19.0000	-1.1400	1.2996	4.2950	-152
9	19.6677	-0.4723	0.2231	4.3075	-27

Comp. $R^2 = 4.3102$

	y	$y - y_0$	$(y - y_0)^2$
1	18.4150	-2.0150	4.0602
2	18.6944	-1.7356	3.0123
3	19.0000	-1.4300	2.0449
4	20.0000	-0.4300	0.1849
5	20.4300	0.0000	0.0000
6	21.0000	+0.5700	0.3249
7	22.0000	+1.5700	2.4649
8	22.1607	+1.7307	2.9954
9	22.4510	+2.0210	4.0844

Apfr. Center

$$\begin{aligned}
 x &= 19.0 & y &= 18.6944 \\
 & & & \underline{22.1607} \\
 & & & 40.8551 \\
 y_0 &= 20.4276 \\
 y_{\text{min}} &= 18.3570 \\
 R &= 2.0706 \\
 y_{\text{p-min}} &= 18.0660 \\
 X &= 20.1366
 \end{aligned}$$

$$\begin{aligned}
 \text{Center } \left\{ \begin{aligned} X_0 &= 20.1400 \\ Y_0 &= 20.4300 \end{aligned} \right.
 \end{aligned}$$

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Lunar Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	19.6371	-0.5029	0.2529	4.3131	+2.9
2	19.0000	-1.1400	1.2996	4.3119	+1.7
3	18.6376	-1.5024	2.2572	4.3021	-0.1
4	18.1102	-2.0298	4.1201	4.3050	-5.2
5	18.0660	-2.0740	4.3015	4.3015	-5.7
6	18.1450	-1.9950	3.9800	4.3049	-5.3
7	18.7836	-1.3564	1.8398	4.3047	-5.5
8	19.0000	-1.1400	1.2996	4.2950	-1.2
9	19.6677	-0.4723	0.2231	4.3075	-2.7

Comp. $R^2 = 4.3102$

	y	$y - Y_0$	$(y - Y_0)^2$
1	18.9150	-2.0150	4.0602
2	18.6944	-1.7356	3.0123
3	19.0000	-1.4300	2.0449
4	20.0000	-0.4300	0.1849
5	20.4300	0.0000	0.0000
6	21.0000	+0.5700	0.3249
7	22.0000	+1.5700	2.4649
8	22.1607	+1.7307	2.9954
9	22.4510	+2.0210	4.0844

Upper Center

 $x = 19.0$ $y = 18.6944$ 221607

40.8551

 $Y_0 = 20.4276$ $y_{min} = 18.3570$ $R = 2.0706$ $y_{max} = 18.0660$ $X = 20.1346$ Center of $X_0 = 20.1400$ 7.6 $Y_0 = 20.4300$

Formation of Urumah

	ab	an			
1	+ 1.01	- 14.5	- 58.6	+ 4.0	+ 16.2
2	+ 1.98	- 19.4	- 29.6	+ 22.4	+ 34.8
3	+ 2.14	+ 121.5	+ 116.0	+ 25.5	+ 24.3
4	+ 0.87	+ 105.5	+ 22.4	+ 105.5	+ 22.4
5	- 0.00	+ 180.0	- 0.0	+ 256.6	- 0.0
6	- 1.14	+ 106.0	- 30.2	+ 216.0	- 61.5
7	- 2.14	+ 74.8	- 86.4	+ 0.0	- 0.0
8	- 1.98	+ 173.2	- 263.0	+ 121.0	- 183.2
9	- 0.95	+ 12.7	- 54.6	+ 12.7	- 54.6
	- 0.21	+ 739.8	- 384.0	+ 763.7	- 201.6

Resid. from Hayami's solution

	O	C	O - C
1	-8	-20 + 20 = 0	-8
2	-20	-44 + 18 = -26	+6
3	-17	-59 + 14 = -45	+28
4	-12	-79 + 4 = -75	+23
5	-124	-81 - 0 = -81	-43
6	-108	-78 - 6 = -84	-24
7	0	-53 - 16 = -69	+69
8	-106	-44 - 17 = -61	-45
9	-27	-18 - 20 = -38	+11

+137 - 120

Average = 29.

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Moon's Center

Conditional Equations

	a	b	0	c	0-c
1	-0.50	-2.02	+29	-19 + 40 = +21	+8
2	-1.14	-1.74	+17	-43 + 34 = -9	+26
3	-1.50	-1.43	-81	-57 + 28 = -29	-52
4	-2.03	-0.43	-52	-76 + 8 = -68	+16
5	-2.07	+0.00	-87	-78 - 0 = -78	-9
6	-2.00	+0.57	-53	-75 - 11 = -86	+33
7	-1.36	+1.57	-55	-51 - 31 = -82	+27
8	-1.14	+1.73	-152	-43 - 34 = -77	-75
9	-0.47	+2.02	-27	-18 - 40 = -58	+31

+141 - 136

Average = 31

Normal Equations

$$\begin{aligned}
 &+19.57 - 0.21 = +740 \quad (+764) \\
 &-0.21 + 19.17 = -384 \quad (-202) \\
 &+0.21 - 0.00 = +8 \quad (+8) \\
 &+19.17 = -376 \quad (-194) \quad b = -19.6 \quad (-10.1) \\
 &+19.57 = +740 - 4 = +736 \quad a = +37.7 \quad (+39.0) \\
 & \quad (+764 - 2 = +762)
 \end{aligned}$$

Solution with Haig's Correction in parentheses

Arc measured: 153 Average (0-c) = +1

$$\frac{pc}{m} = 0.16$$

$$\frac{pc}{16} = +0.06 \quad \Delta = +0.1$$

2782 Moon's Mean Position (1913.0)

$$\begin{array}{rcl}
 X_0 = 20.1400 \checkmark & Y_0 = 204300 \checkmark \\
 \frac{1}{2} \delta = +19 \checkmark & \frac{1}{2} \delta = -10 \checkmark \quad (-5) \\
 \hline
 20.1419 \checkmark & 204290 \checkmark \\
 & (204295)
 \end{array}$$

From Plate Constants $X = 20.1426 \checkmark$ $Y = 204669 \checkmark$
 (20.4674)

$$\bar{z} = +2.1426 \checkmark$$

$$\eta = -1.5331 \checkmark \quad (1.5326)$$

$$\log \bar{z} = 0.33094 \checkmark$$

$$\log \tan S = 9.7196 \checkmark$$

$$\dots \text{wss} \quad 9.94757 \checkmark$$

$$\bar{z}^2 = 0.6619 \checkmark$$

$$8.50724 \checkmark$$

$$7.0534 \checkmark$$

$$7.4349 \checkmark$$

$$\dots (X-A) \quad 1.87613 \checkmark$$

$$\eta_1 = +27 \checkmark$$

$$X-A \quad +1 \quad 1.518 \checkmark$$

$$\eta_0 = -1.5358 \checkmark \quad (-1.5353)$$

$$A \quad 5 \quad 02 \quad 08 \checkmark$$

$$\log \eta_0 = 0.18633 \checkmark \quad (1.8719)$$

$$D_0 \quad 5 \quad 03 \quad 23.18 \checkmark$$

$$7.33115 \checkmark$$

$$\text{Red at apph} \quad + \quad 0.90 \checkmark$$

$$(S-D) = 2.85518 \checkmark \quad (2.85509)$$

$$S' = 5 \quad 03 \quad 24.08 \checkmark$$

$$S-D = - \quad 11 \quad 56.4 \checkmark \quad (56.2)$$

$$D = +27 \quad 47 \quad 20 \checkmark$$

$$S_0 = +27 \quad 35 \quad 23.6 \checkmark \quad (23.8)$$

$$\text{Red} = +11.8 \checkmark$$

$$S = +27 \quad 35 \quad 35.4 \checkmark \quad (35.6)$$

2782 Red. ad locum aph.

$$\begin{array}{rcl}
 H + \alpha & 1^{\text{m}} & 25^{\text{m}} = 21^{\circ} 15' \\
 H & 20 & 22 \\
 \alpha & 5 & 03 \\
 G & 18 & 58 \\
 G + \alpha & 0 & 01 = 0^{\circ} 15'
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos (G + \alpha) & 0 & 0000 \\
 q & 0 & 9775 \\
 \sin & 7 & 6398 \\
 \tan & 9 & 7180 \\
 \frac{1}{\tan} & 8 & 8239
 \end{array}$$

$$\begin{array}{rcl}
 \sim (8') & 0 & 9775 \\
 (8) & 7 & 1592
 \end{array}$$

$$\begin{array}{rcl}
 f & + & 0.37 \\
 g & + & 0.00 \\
 h & + & 0.53 \\
 \hline
 & + & 0.90 \checkmark
 \end{array}$$

$$S + 27^{\circ} 35'$$

$$\begin{array}{rcl}
 \log \cos S & 9 & 9476 \\
 - i & 0 & 8340 \\
 \hline
 \therefore (i) & 0 & 7816
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S & 9 & 6656 \\
 - \cos (H + \alpha) & 9 & 9694 \\
 - h & 1 & 2855 \\
 - \sin & 9 & 5592 \\
 \sec S & 0 & 0524 \\
 \frac{1}{\tan} & 8 & 8239
 \end{array}$$

$$\begin{array}{rcl}
 (h') & 0 & 9205 \\
 (h) & 9 & 7210
 \end{array}$$

$$\begin{array}{rcl}
 g' & + & 9.50 \\
 h' & + & 8.33 \\
 i & - & 6.05 \\
 \hline
 & + & 11.78 \checkmark
 \end{array}$$

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Lunar Parallax

$$\alpha' = 5^h 03^m 24.08^s \checkmark$$

$$\delta = 6 \quad 13 \quad 40.2 \checkmark$$

$$\theta - \alpha' = +1 \quad 10 \quad 16.1 \checkmark$$

$$= + \quad 17^\circ \quad 34^\circ \quad 02'' \checkmark$$

$$+ \quad \quad \quad 7 \quad 21 \checkmark$$

$$+ \quad 17 \quad 26 \quad 41 \checkmark$$

$$9.95727 \checkmark$$

$$0.00000 \checkmark$$

$$0.02045 \checkmark$$

$$\underline{9.97772 \checkmark}$$

$$\delta = 43 \quad 31 \quad 51 \checkmark$$

$$27 \quad 35 \quad 35 \checkmark$$

$$+ \quad 15 \quad 56 \quad 16 \checkmark$$

$$9.82640 \checkmark$$

$$8.22919 \checkmark$$

$$9.43869 \checkmark$$

$$0.16194 \checkmark$$

$$\underline{7.65622 \checkmark}$$

$$S - S' = +15 \quad 34.7 \checkmark$$

$$S = +27 \quad 51 \quad 10.1 \checkmark$$

(10.3)✓

$$\alpha = 5 \quad 04 \quad 22.95 \checkmark$$

$$\text{Shant Allen } S = +27 \quad 51 \quad 09.0 \checkmark$$

(10.3)✓

$$\alpha = 5 \quad 04 \quad 21.89 \checkmark$$

$$O - C \quad + \quad 1.1 \checkmark$$

$$+1.06 \checkmark$$

$$\text{With Haynes Correction (+1.3)}$$

$$(+1.06)$$

$$\delta' = +27^\circ \quad 35' \quad 35.4 \checkmark$$

(35.6)✓

$$\pi = 5.8' \quad 16.45 \checkmark$$

$$9.86913 \checkmark$$

$$8.22919 \checkmark$$

$$9.47975 \checkmark$$

$$\underline{0.05347 \checkmark}$$

$$7.63154 \checkmark$$

$$\alpha - \alpha' = +14' \quad 43.02 \checkmark$$

$$= +58.87 \checkmark$$

