

KG

11366

v. 920

Vol. XLIV

Plate

1808

1809

1826

Harvard Lunar Plates.

Measurements and Reductions,

Mary Fowler.

Volume XLIV

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MC1808

1913 Nov. 7.

Star - measures.

	d	n	d	n
1	17167	19801	14915	18910
11.1	12780	14180	623038	1756976
14.5	83	7170	40	70
mg	50	10	00	27
6.5	14.4379	4371	11.1334	1340
3				
14.9	19736	18684	18555	18186
27.9	11331	1708183	1699086	974151
mg	30	77	9086	37
6.3	40	98	48	98
	27.8409	8393	19.8435	8453
3				
21.2	10640	11185	18328	17740
29.0	50	10905	998088	1607580
mg	10352	9502	80	78
6.3	289705	9716	18	60
			21.1663	1665
4				
23.0	12288	15732	9030	928000
20.7	9223	13800	885055	9000
	15	94	48	9135
	78	47		
	20.8061	8064	22.9821	9842

Grade 2.

M61808

1913 Nov. 7.

Stars - measures

	d	n	d	n
1	17167	19801	14915	18910
11.1	12780	14180	623038	1756976
14.5	3	7170	49	70
15	50	10	00	27
	<u>14.4379</u>	<u>4371</u>	<u>11.1334</u>	<u>1340</u>
3				
19.9	19736	18684	18555	18186
7.9	1133129	1708183	1699886	974151
15	30	77	90	37
6.3	40	98	48	98
	<u>27.8409</u>	<u>8393</u>	<u>19.8435</u>	<u>8453</u>
3				
21.2	1064052	11185	18328	17740
29.0	50	10905	998088	1607550
19	10352	9102	50	78
6.3			18	60
	<u>28.9705</u>	<u>9.716</u>	<u>21.1663</u>	<u>1665</u>
4				
23.0	17288	15732	9030	928000
20.7	922320	1380002	885055	9000
	15	94	48	9135
	78	47		
	<u>20.8061</u>	<u>8064</u>	<u>22.9821</u>	<u>9842</u>

Grade 2.

moon - measures

2

	d	y	n	d	n
✓	18934		19660		
180	13300	04	15301	10	
17.5	15		10		
min	19		62		
h	17.5618		5646		
y					
2	18885		19710		
19.0	10195	40	18420	18	
17.8	99		20		
	60		30		
	17.8669		8706		

3
19.2
18.0

19480	20145
11352	18260
65	80
52	55
19.1899	1876

4
19.8
19.0

18360	19190
16750	10790
50	88
66	05
19.8389	8413

5
19.9
19.0
max
h
26

17310	18205
16420	9080
20	70
25	25
19.9106	9147

6
19.8
20.0

17250	18238
15761	9700
79	00
64	52
19.8515	8552

moon - huc series

2

	α	δ
1	18934	19660
180	13300	15301
17.5	1504	1010
min	19	62
	17.5618	5646
2	18885	19710
190	10195	18420
17.8	99	2018
	60	30
	17.8669	8706

3
192
180

19480	20145
11352	18260
65	8072
52	55
19.1899	1876

4
198
190

18360	19190
16750	10790
50	8890
66	05
19.8389	8413

5
199
19.5
max
26

17310	18205
16420	9080
20	7078
25	25
19.9106	9147

6
198
200

17250	18238
15761	9700
81	95
7960	00
64	52
19.8515	8552

1508

Moon - measures.

3

7
19.3
21.0

16180	17300
8640	14825
31	3930
00	14
<u>19.2441</u>	<u>2470</u>

8
19.0 19430
21.3 1759006
00
44
21.1834

16718
852030
2230
18
1806

Indistinct image of moon.

1808

Moon + Measures.

3

1193
210819.0 19430
21.3 1759006
00

44

21183416718
852030
22

18

1806

16180

8640

31

00

192441

17300

1482930

39

14

2470

Indistinct image of moon.

1808

Times etc.

4

2 ^h f. to stars 1912 May 2	17 ^m	04 ^m	-17 ^m	16 ^m
moon	17	10	14.6 ^m	10 14.8 ^m
clock slow		1	39.8 ^m	
H. Sid T.	17	11	54.5 ^m	
H. long	4	44	31.05 ^m	
G. Sid T.	21	56	25.55 ^m	
Sid. T. in moon	2	40	07.31	3.09.43
Interval	19	16	18.24 ^m	
Reduction		3	09.43 ^m	
G. in T.	19	13	08.81 ^m	-x- +1 ^m 04 ^m

From Mount. Aln			R. A.		Decl.
Moon 19 ^m	16 ^m	07 ^m	02.94 ^m	-24°	33' 26.3 ^m
Motion 2 ^h 22.69 ^m				7.91.7 ^m	
13.1468 ^m			+29.28 ^m	-1	44.6 ^m
Tabular place	16	07	32.22 ^m	-24	35 10.9 ^m

Moon's age 15.5 days

- f. small 55' 37.3^m- semi diam 15' 11.0^mC = 911.6^mAmplification +5.5^mIrradiation (2) -0.5^mR = 916.0^mR = 1.9636^m(1+a)R = 1.9623^mR² = 3.8506^m

$$a \pm 4 = 5.8^m$$

$$a \pm 2 = 5.5^m$$

$$a = -6.5$$

1808

Times etc

4

21/11/1912 May 2 17^h 04^m - 17^h 16^m
 moon 17 10 14.6 - 17 10 14.8
 clock slow 1 39.8

H. Sid T. 17 11 54.5
 H. hour 4 44 31.05
 B. Sid T. 21 56 25.55
 Sid. in hour 2 40 07.31
 Indirect 19 16 18.24
 Reductive 3 03 09.43
 G. in T. 19 13 08.81 - 17 16 04

From Mant. Alm. R. C. Neel.
 Moon 16^h 07^m 02.94 - 24^h 23^m 26.3
 Motion 2^h 21.3849 7.9177
 1639008 + 29.28 - 1 44.6
 Tabular place 16 07 32.22 - 24 35 10.9

moon's age 15.5 days.

Parallax 55' 37.3

Semi-diam 15' 12.0

934 = 58

912 = 55

C 912.0

Augmentation +55

Irradiation 21 -05

R 916.0

R 1963.6

(1+a)R 1962.3

R² 3850.6

a = 65

1808

Plate center

5

x	y	$R.A.$	$Decl.$
11.1337	144875	16 02 46	-26 05 30
148444	278401	04 52	-24 21 03
21.1664	289710	08 28	-24 11 51
229832	208062	09 33	-25 15 16
4 70.13	92.05	23 15.9	19 52 100
17.53	23.01	16 06 25	-24 58 25
-18	-22	15	7 50
0.47	1.01	16 06 40	-25 06 15
-11.5	-7' 50"		

$$\text{Center} \begin{cases} A = 16^h 06^m 40^s \\ D = -25^{\circ} 06' 15'' \end{cases}$$

$$\begin{aligned} x-3-71.54 & +6.5x & +1897 \\ -935-1032 & = -1967 + 72 = -1895 & = +2 \\ -6-1991 & = -1997 + 96 = -1901 & = -4 \\ +39-2071 & = -2032 + 138 = -1894 & = +3 \\ -561-1488 & = -2049 + 149 = -1900 & = -3 \\ 17.9073^{\circ} - 1396^{\circ} & +117^{\circ} & = 18.0131^{\circ} \end{aligned}$$

$$\begin{aligned} y-4 & +79x & +18\frac{1}{2}y & -1992 \\ +846+880 & = +1726 + 267 = +1993 & = +1 \\ +303+1173 & = +1476 + 515 = +1991 & = -1 \\ -216+1672 & = +1456 + 535 = +1991 & = -1 \\ -207+1816 & = +1609 + 385 = +1994 & = +2 \\ 19.5263^{\circ} + 1418^{\circ} & +361^{\circ} & = 19.5050^{\circ} \end{aligned}$$

$$\begin{aligned} \text{Tables } a &: -12 & b &: -18.1 & a-b &: +17.0 & b+a &: -6.2 \\ \text{Obs } a &: -6.5 & & -18.5 & & +12.0 & & -7.5 \\ C-O & +5.3 & +0.4 & & +4.9 & & -0.7 \end{aligned}$$

1808

Plate Counter

5

	2	4		R	G		Red
11.13.37	14.43.75	16	02	46	-26	05	30
19.84.44	27.84.01		04	52	-24	21	03
21.16.64	28.97.10		08	28	-24	11	51
22.98.32	20.80.62		09	33	-25	15	16
4 70.13	92.05		23	15.9		19	52.100
17.53	23.01	16	06	25	-24	58	25
-18	-22			15		7	50
0.47	1.01	16	06	40	-25	06	15
+15	= -7' 50"						

$$\begin{aligned} A &= 16^{\circ} 06' 40'' \\ \text{Center } D &= -25^{\circ} 06' 15'' \end{aligned}$$

$$\begin{aligned} 2-3 &= 7154 & +652 & & +1897 \\ -935-1032 &= -1967 & +72 &= -1895 & = +2 \\ -6-1991 &= -1997 & +96 &= -1901 & = -4 \\ +39-2071 &= -2032 & +138 &= -1894 & = +3 \\ -561-1488 &= -2049 & +149 &= -1900 & = -3 \\ 179073-1396 & & +117 & & = 180131 \end{aligned}$$

$$\begin{aligned} 4-4 &+792 & +18\frac{1}{2}4 & & -1992 \\ +846+880 &= +1726 & +267 &= +1993 & = +1 \\ +303+1173 &= +1476 & +515 &= +1991 & = -1 \\ -216+1672 &= +1456 & +535 &= +1991 & = -1 \\ -207+1816 &= +1609 & +385 &= +1994 & = +2 \\ 175263+1918 & & +361 & & = 195050 \end{aligned}$$

$$\begin{aligned} \text{Tables } a &= -13 & b &= -17.5 & a-b &= +16.3 & b+a &= -8.0 \\ \text{Obs } a &= -6.5 & & -18.5 & & +12.0 & & -7.5 \\ C-U & & & & & +43 & & -3.5 \end{aligned}$$

1808

Standard Coordinates - Comp. Stars

Cape No. 2201 mag 5.5 Cape No. 2203 mag 6.6 Cape No. 2214 mag 6.3
 C 16° 02' 01.81 16° 04' 09.08 16° 07' 44.60
 L 1.80 1.0 5.7
 Z

Mean 16 02 01.80 16 04 09.09 16 07 44.58
 Proc + 43.71 + 43.22 + 43.23
 S 16 02 45.51 16 04 52.31 16 08 27.81
 A 16 06 40 16 06 40 16 06 40
 -A - 3 54.49 - 1 47.69 + 1 47.81
 tan(A-A) - 23448 - 10769 + 107.81
 log 2.37010 2.03218 2.03266
 cos 995332 995954 996006
 S 083066 0.49896 0.49996
 S -6.7711 - 3.1547 + 3.1620
 S - 17 - 3 + 5
 S 11.2272 14.8450 21.1625
 S 11.1337 14.8444 21.1664
 S - 935 - 6 + 39

C - 26° 03' 31.9 - 24° 19' 05.9 - 24° 09' 57.7
 L 32.2 07.0 58.5
 Z
 Mean - 26 03 32.0 - 24 19 06.4 - 24 09 58.1
 Proc - 1 58.1 - 1 56.2 - 1 52.8
 S - 26 05 30.1 - 24 21 02.6 - 24 11 50.9
 D - 25 06 15 - 25 06 15 - 25 06 15
 S-D - 59 15.1 + 45 12.4 + 54 24.1
 tan(S-D) - 3555.5 + 2712.6 + 3264.4
 log 3.55090 3.43339 3.51380
 log 0.88205 0.76454 0.84495
 tan S 9.6899 9.6557 9.6526
 S 16613 0.9979 0.9999
 S 84046 7.7070 9.7059
 S - 7.6217 + 5.8149 + 6.9977
 S - 254 - 51 - 51
 S 14.3529 27.8098 28.9926
 S 14.4375 27.8401 28.9710
 S - 846 + 303 - 216

1808

Standard Coordinates - Comb. Stars

Cape W. 2201 mag 5.1				Cape W. 2203 mag 6.6				Cape W. 2214 mag 6.3			
C	16°	02'	01.81	16°	04'	09.08	16°	07'	44.60		
L			1.80			1.0			5.7		
B						6.5					
mean	16	02	01.80	16	04	09.09	16	07	44.58		
Parallax			+ 43.71			+ 43.22			+ 43.23		
δ	16	02	45.51	16	04	52.31	16	08	27.81		
α	16	06	40	16	06	40	16	06	40		
$\lambda - A$			- 3 54.49			- 1 47.69			+ 1 47.81		
$m(\lambda - A)$			- 234.48			- 107.69			+ 107.81		
mag.	2.37	0.10	m	2.03	2.18	m	2.03	2.66			
W.S.	9.95	3.32		9.95	9.54		9.96	0.06			
Σ	0.83	0.66	m	0.49	8.96	m	0.49	9.96			
Σ	- 6.77	1.1		- 3.15	9.7		+ 3.16	2.0			
Σ	-	1.7		-	3		+	5			
Σ	11.22	7.2		19.84	5.0		21.16	2.5			
Σ	11.13	3.7		14.84	4.9		21.16	6.4			
$\Sigma - 3$	-	9.35		-	6		-	3.9			
C	- 26°	03'	31.9	- 24°	19'	05.9	- 24°	09'	57.7		
L			3.22			0.70			5.85		
B											
mean	- 26	03	32.0	- 24	19	06.4	- 24	09	58.1		
Parallax			1 58.1			1 56.2			1 52.8		
δ	- 26	05	30.1	- 24	21	02.6	- 24	11	50.9		
α	- 25	06	15	- 25	06	15	- 25	06	15		
$\lambda - A$			- 5.9 15.1			+ 4.5 12.4			+ 5.4 24.1		
$m(\lambda - A)$			- 355.5			+ 271.26			+ 326.44		
mag.	3.55	0.90	m	3.43	3.39	m	3.55	1.38	0		
Σ	0.88	2.05	m	0.76	4.54		0.84	4.95			
W.S.	9.65	9.9	m	9.65	5.7	m	9.65	2.6	m		
Σ	1.66	1.3		0.99	7.9		0.99	9.9			
Σ	8.40	4.6	m	7.70	7.0	m	7.70	5.9	m		
Σ	- 7.62	1.7		+ 5.85	4.9		+ 6.99	7.7			
Σ	-	2.54		-	5.1		-	5.1			
Σ	19.35	2.9		27.80	9.8		28.99	2.6			
Σ	14.43	7.5		27.84	0.1		28.97	1.0			
$\Sigma - 3$	-	8.46		-	3.03		-	2.6			

808 Standard Coords.

Cafcho. 2218 m 6.0

C 16 08 49.74

L 78

E

mean 16 08 49.76

Pace + 43.51

S 16 09 33.27

A 16 06 40

S-A + 2 53.27

(S-A) + 173.27

log 2.23872

mod 9.95637

3. 070233

S. +5.0389

S. + 4

S 23.0393

x 27.9832

x -3 - 561

C - 25° 13' 24.0

L 29.1

E

mean - 25 13 24.0

Pace - 1 51.9

S - 25 15 15.9

D - 25 06 15

S-D - 09 00.9

S-D - 540.9

log 2.73312

mod 0.06427

tan 9.6737

S 14047

n 8.1318

mo - 1.1595

n - 136

n 20.8269

u 20.8062

y - 207

y - 207

y - 207

y - 207

y - 207

y - 207

y - 207

1808 Standard Counts

Cafe hr.	2218	mg 60
C	16	08 4974
L		78
E		
mean	16	08 4976
Proc		+ 43.51
A	16	09 3327
A	16	06 40
S-A		+ 2 53.27
(S-A)		+ 1 73.27
log.		2.23872
mod		9.95637
Σ		0.70233
Σ		+ 3.5898
Σ		+ 4
Σ		23.0393
Σ		27.9832
$\Sigma - \frac{1}{3}$		- 561

C	- 25°	13' 24"0
L		29.1
E		
mean	- 25	13 24.0
Proc		- 1 51.9
S	- 25	15 15.9
D	- 25	06 15
S-D		- 0.9 00.9
(S-D)		- 540.9
log.		2.73312
Σ		0.06427
trans		9.6737
Σ		- 1.4049
Σ		8.1318
Σ		- 1.1595
Σ		- 1.86
Σ		20.8268
Σ		20.8062
Σ		- 207

kt.		revs. $\times$	resid.
1	$\frac{1}{2}$ wt.	178.5	-113
2		147.6	+22
3		141.0	+158
4		105.5	-87
5		90.0	-37
6		76.0	-54
7		41.3	+71
8		32.4	+31

1808

Lagoon Center.

8

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)^3 + (y - y_0)^2$	$0 - c$
1	18.0000	+0.0496	-15	0.0023	3.8359	-147
2	19.0000	+1.0496	-13	1.0977	3.8517	+11
3	19.1888	+1.2384	-12	1.5307	3.8658	+152
4	19.8401	+1.8897	-4	3.5672	3.8442	-64
5	19.9126	+1.9622	0	3.8502	3.8502	-4
6	19.8535	+1.9031	+4	3.6233	3.8492	-14
7	19.2456	+1.2952	+11	1.6804	3.8625	+119
8	19.0000	+1.0496	+13	1.1044	3.8584	+78
				Comp R ²	3.8506	

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.5632	-1.9622	-34	3.8336
2	17.8688	-1.6566	-29	2.7540
3	18.0000	-1.5254	-27	2.3351
4	19.0000	-0.5254	-9	0.2770
5	19.5254	0.0000	0	0.0000
6	20.0000	+0.4746	+7	0.2259
7	21.0000	+1.4746	+26	2.1821
8	21.1820	+1.6566	+29	2.7540

$$x = 19.0 \quad y = 17.8688$$

$$\underline{21.1820}$$

$$39.0508$$

$$y_0 = 19.5254$$

$$y = \text{min} = 17.5632$$

$$R = 1.9622$$

$$x = \text{max} = 19.9126$$

$$x_0 = 17.9504$$

$$\text{Center} \begin{cases} x_0 = 17.9504 \\ y_0 = 19.5254 \end{cases}$$

1808 *known Center*

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	180000	+0.0496	-15	0.0023	3.8359	-1.47
2	190000	+1.0496	-13	1.0977	3.8517	+1.1
3	191888	+1.2384	-12	1.5307	3.8658	+1.52
4	198401	+1.8897	-4	3.5672	3.8442	+1.64
5	199126	+1.9622	0	3.8502	3.8502	+1.4
6	198535	+1.9031	+4	3.6233	3.8492	+1.4
7	192456	+1.2952	+11	1.6804	3.8625	+1.19
8	190000	+1.0496	+13	1.1044	3.8584	+1.78
				Comp R^2	3.8506	

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.5632	-1.9622	-34	3.8336
2	17.8688	-1.6566	-29	2.7540
3	180000	-1.5254	-27	2.3351
4	190000	-0.5254	-9	0.2770
5	19.5254	0.0000	0	0.0000
6	20.0000	+0.4746	+7	0.2259
7	21.0000	+1.4746	+26	2.1821
8	21.1820	+1.6566	+29	2.7540

$$x = 190 \quad y = 17.5688$$

$$\frac{21.1820}{39.0508}$$

$$y_0 = 19.5254$$

$$y = \text{min} \quad 17.5632$$

$$R = 1.9622$$

$$x = \text{max} \quad 19.9126$$

$$x_0 = 17.9504$$

$$\text{Center} \begin{cases} x_0 = 17.9504 \\ y_0 = 19.5254 \end{cases}$$

Formation of Normals

ab au bu

1	- 0.10	-	7.4	+ 288.1
2	- 1.75	+	11.6	- 183
3	- 1.90	+	188.5	- 232.6
4	- 1.00	-	121.0	+ 339
5	+ 0.00	-	7.8	- 0.0
6	+ 0.89	-	266	- 6.6
7	+ 1.91	+	154.7	+ 174.9
8	- 1.75	+	81.9	+ 129.5
	- 0.15	+	277.5	+ 224.8

1808

Moon's Center
Conditional Equations

9

#	a	b	0	c	0-c
1	+0.05	-1.96	= -1.47	+1-35 = -34	-113
2	+1.05	-1.66	= +11	+18-29 = -11	+22
3	+1.24	-1.53	= +152	+21-27 = -6	+158
4	+1.89	-0.53	= +64	+32-9 = +23	-87
5	+1.96	+0.00	= -4	+33+0 = +33	-37
6	+1.90	+0.47	= -14	+32+8 = +40	-54
7	+1.30	+1.47	= +119	+22+26 = +48	+71
8	+1.05	+1.66	= +78	+18+29 = +47	+31

Average = 72

Normal Equations

$$\begin{array}{rcl}
 +16.45 - 0.15 & = & +278 \\
 -0.15 + 12.45 & = & +225
 \end{array}$$

$$\begin{array}{rcl}
 +0.15 - 0.01 & = & +25 \\
 +12.44 & = & +250
 \end{array}$$

$$b = +20.1$$

$$\begin{array}{rcl}
 -0.02 + 0.15 & = & +27 \\
 +16.43 & = & +305
 \end{array}$$

$$a = +18.6$$

$$\begin{array}{rcl}
 +16.45 - 0.15 & = & +278 \\
 -0.15 + 12.45 & = & +225
 \end{array}$$

$$\begin{array}{rcl}
 +0.15 - 0.00 & = & +3 \\
 +12.45 & = & +222
 \end{array}$$

$$b = +17.75$$

$$\begin{array}{rcl}
 -0.00 + 0.15 & = & +3 \\
 +16.45 & = & +281
 \end{array}$$

$$a = +17.1$$

1808

moons Center Conditional Equations

9

	a	b	0	c	0-c
1	+0.05	-1.96	= -447	+1-35 = -34	-1.13
2	+1.05	-1.66	= +41	+18-29 = -11	+22
3	+1.24	-1.53	= +152	+21-27 = -6	+158
4	+1.89	-0.53	= +64	+32-19 = +23	-87
5	+1.96	+0.00	= -4	+33+0 = +33	-37
6	+1.90	+0.47	= -14	+32+8 = +40	-54
7	+1.30	+1.47	= +129	+22+26 = +48	+71
8	+1.05	+1.66	= +78	+18+29 = +47	+31

Average = 22

Normal Equations

$$\begin{aligned}
 +16.45 - 0.15 &= +278 \\
 -0.15 + 12.45 &= +225
 \end{aligned}$$

$$\begin{aligned}
 +0.15 - 0.01 &= +25 \\
 +12.44 &= +250
 \end{aligned}$$

$$\begin{aligned}
 -0.02 + 0.15 &= +27 \\
 +16.43 &= +305
 \end{aligned}$$

$$b = +29.1$$

$$a = +38.8$$

$$\begin{aligned}
 +16.45 - 0.15 &= +278 \\
 -0.15 + 12.45 &= +225
 \end{aligned}$$

$$\begin{aligned}
 +0.15 - 0.00 &= +3 \\
 +12.45 &= +222
 \end{aligned}$$

$$b = +17.75$$

$$\begin{aligned}
 -0.00 + 0.15 &= +3 \\
 +16.45 &= +281
 \end{aligned}$$

$$a = +17.1$$

1808 Moon's mean Position (1912.0)

$$\begin{array}{r}
 X_1 = 17.9504 \\
 \frac{1}{2}a = \quad + 9 \\
 \hline
 17.9513
 \end{array}
 \quad
 \begin{array}{r}
 Y_1 = 19.5254 \\
 \frac{1}{2}b = \quad + 9 \\
 \hline
 19.5263
 \end{array}$$

From Plate Constants $X = 18.0131$ $Y = 19.5050$

$$\begin{array}{r}
 \xi = +0.0131 \\
 \log \xi = 8.11727 \\
 \log S = 9.95575 \\
 \log \text{const} = 8.50724
 \end{array}$$

$$(k-A) = 9.65428$$

$$X-A = \quad + \quad 0.45$$

$$A = 16^h 06^m 40^s$$

$$X_0 = 16^h 06^m 40.45^s$$

$$\text{Red} = \quad + 1.96$$

$$X' = 16 \quad 06 \quad 42.41$$

$$\eta = -24950$$

$$\begin{array}{r}
 \log \tan S = 9.6752 \\
 \log \xi^2 = 62.345 \\
 \log \eta = 29.631
 \end{array}$$

$$\begin{array}{r}
 \log \eta_0 = 0.39707 \\
 \log \text{const} = 7.33115
 \end{array}$$

$$(J-D) = 3.06592$$

$$S-I = \quad - \quad 19 \quad 23.9$$

$$D = -25 \quad 06 \quad 15$$

$$S_1 = -25^0 25' 38.9''$$

$$\text{Red} = \quad - 12.4$$

$$S = -25 \quad 25 \quad 51.3$$

1808 known mean Position (1912.0)

$$\begin{array}{r} X = 179504 \\ \hline \quad \quad + 9 \\ \hline 179513 \end{array} \quad \begin{array}{r} Y = 195254 \\ \hline \quad \quad + 9 \\ \hline 195263 \end{array}$$

From Plate constants $X = 180131$ $Y = 195050$

$$\begin{array}{r} S = +00131 \\ \log 3 = 8.11727 \\ \log 5 = 9.95575 \\ \log 10 = 8.50729 \\ (H-A) = 9.65428 \end{array}$$

$$X-A = +0.45$$

$$A = 16^h 06^m 40^s$$

$$X = 16^h 06^m 40^s 45$$

$$\text{Red} = +1.96$$

$$X = 16^h 06^m 42^s 41$$

$$\eta = -24950$$

$$\begin{array}{r} \log 1005 = 9.6752 \\ \log 5 = 62345 \\ \log 10 = 29631 \end{array}$$

$$\begin{array}{r} \log \eta = 0.39707 \\ \log 10 = 733115 \end{array}$$

$$(J-D) = 3.06592$$

$$D = -19 23.9$$

$$D = -25 06 15$$

$$S = -25^0 25' 38'' 9$$

$$\text{Red} = -124$$

$$S = -25 25 51.3$$

1808 Reduction to Apparent Place.

11

$$\begin{array}{rcl}
 \alpha_0 = & 16^h & 06^m & 40.4^s \\
 G = & 19 & 37 & 18 \\
 \alpha + \alpha_0 = & 11^h & 43 & 58.4^s \\
 = & & 175^\circ & 59' 37''
 \end{array}
 \qquad
 \begin{array}{rcl}
 \delta_0 = & -25^\circ & 25' & 38.9'' \\
 H = & 14^h & 59^m & 54^s \\
 H + \alpha_0 = & 7 & 06 & 34.4^s \\
 = & & 106^\circ & 38' 37''
 \end{array}$$

$$\begin{array}{rcl}
 \log \frac{1}{r} = & 8.8239 \\
 \log r = & 0.9721 \\
 \sin(G + \alpha_0) = & 8.8443 \\
 \tan S_0 = & 9.6771^m \\
 (g) = & 8.3174^m
 \end{array}$$

$$\begin{array}{rcl}
 \log \frac{1}{r} = & 8.8239 \\
 \log h = & 1.2916 \\
 \sin(H + \alpha) = & 9.9814 \\
 \sec S_0 = & 0.0443 \\
 (h) = & 0.1412
 \end{array}$$

$$\begin{array}{rcl}
 \log i = & 0.7787^m \\
 \cos S_0 = & 9.9557^m \\
 (i) = & 0.7344^m
 \end{array}$$

$$\begin{array}{rcl}
 \log g = & 0.9721 \\
 \cos(G + \alpha_0) = & 9.9989^m \\
 (g') = & 0.9710^m
 \end{array}$$

$$\begin{array}{rcl}
 \log h = & 1.2916 \\
 \cos(H + \alpha) = & 9.4570^m \\
 \sin S_0 = & 9.6328^m \\
 (h') = & 0.3814
 \end{array}$$

$$\begin{array}{rcl}
 f = & + & 0.60 \\
 (g) = & - & 0.02 \\
 (h) = & + & 1.38 \\
 \text{Reduction in } \alpha = & + & 1.96^s
 \end{array}$$

$$\begin{array}{rcl}
 (g') = & - & 9.35 \\
 (h') = & + & 24.1 \\
 (i) = & - & 5.92 \\
 \text{Red. in } \delta = & - & 12.36''
 \end{array}$$

$$\alpha' = 16^h 06^m 42.4^s$$

$$\delta' = -25^\circ 25' 51.3''$$

1808 Reduction to Apparent Place

11

$$\begin{aligned}
 \alpha_0 &= 16^{\circ} 06' 40.45'' \\
 G &= 19 \quad 37 \quad 18 \\
 G + \alpha_0 &= 11^{\circ} 43' 58.45'' \\
 &= 175^{\circ} 59' 37''
 \end{aligned}$$

$$\begin{aligned}
 \delta_0 &= -25^{\circ} 25' 38.9'' \\
 H &= 14^{\circ} 59' 54'' \\
 H + \alpha_0 &= 7^{\circ} 06' 34.45'' \\
 &= 106^{\circ} 38' 37''
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{r} &= 8.8239 \\
 \log \frac{1}{h} &= 0.9721 \\
 \log(G+H) &= 8.8443 \\
 \tan S_0 &= 9.6771 \\
 (g) &= 8.3174
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{r} &= 8.8239 \\
 \log \frac{1}{h} &= 1.2916 \\
 \sin(H+H) &= 9.9814 \\
 \sec S_0 &= 0.0943 \\
 (h) &= 0.1412
 \end{aligned}$$

$$\begin{aligned}
 \log i &= 0.7787 \\
 \cos S_0 &= 9.9157 \\
 (i) &= 0.7344
 \end{aligned}$$

$$\begin{aligned}
 \log g &= 0.9721 \\
 \cos(G+H) &= 9.9989 \\
 (g') &= 0.9710
 \end{aligned}$$

$$\begin{aligned}
 \log h &= 1.2916 \\
 \sin(H+H) &= 9.4570 \\
 \sin S_0 &= 9.6328 \\
 (h') &= 0.3814
 \end{aligned}$$

$$\begin{aligned}
 f &= + 0.60 \\
 (g) &= - 0.02 \\
 (h) &= + 1.38 \\
 \text{Reduction } \alpha &= + 196''
 \end{aligned}$$

$$\begin{aligned}
 (g') &= - 93.4'' \\
 (h') &= + 24.4'' \\
 (i') &= - 5.93'' \\
 \text{Red } \delta &= - 12.36''
 \end{aligned}$$

$$\alpha' = 16^{\circ} 06' 42.41''$$

$$\delta' = -25^{\circ} 25' 51.3''$$

η	η^2
- 7.64	58.37
+ 5.81	33.76
+ 6.99	48.86
- 1.17	1.37
	4142.36
	3559
	61

$\times 0.3 = +0.17$

1808

Lunar Parallax.

12

$$\begin{aligned}\alpha' &= 16^h 06^m 42.41^s \\ \theta &= 17 \quad 11 \quad 54.5 \\ \delta - \alpha &= +1 \quad 05 \quad 12.1 \\ &= +16 \quad 18 \quad 02\end{aligned}$$

$$\delta' = -25 \quad 25' \quad 51.3''$$

$$\pi = 55' \quad 37.3''$$

$$\frac{1}{2}(\alpha - \alpha') = 06 \quad 21''$$

$$\delta - \alpha' - \frac{1}{2}(\alpha - \alpha') = +16 \quad 11 \quad 41''$$

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

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

$$\dots \cos(\delta - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.98241$$

$$\dots \tan \phi = 9.97486$$

$$\phi = 43 \quad 20 \quad 33.1''$$

$$\delta' = -25 \quad 25' \quad 51.3''$$

$$\delta - \delta' = 68 \quad 46 \quad 24.4''$$

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

$$\dots \sin \pi = 8.20895$$

$$\dots \sin(\delta - \delta') = 9.96949$$

$$\dots \sin \phi = 9.83655$$

$$\dots \sin(\delta - \delta') = 8.16829$$

$$\delta - \delta' = +50 \quad 39.0''$$

$$\delta = -24 \quad 35' \quad 12.3'' \quad \alpha = 16 \quad 07 \quad 33.21''$$

$$\text{Ann. Eph. } \delta = -24^\circ \quad 35' \quad 10.9'' \quad \alpha = 16^h \quad 07^m \quad 32.22^s$$

$$O - C = -1.4'' \quad +0.99''$$

$$\text{Correction to } \delta \text{ due to second order refr.} \quad +0.2''$$

1808

Lunar Parallax

12

$$\begin{aligned}
 \alpha' &= 16^{\text{h}} 06^{\text{m}} 42.41 \\
 \delta' &= 17 \quad 11 \quad 54.5 \\
 \alpha - \alpha' &= +1 \quad 05 \quad 12.1 \\
 &= +16 \quad 18 \quad 02
 \end{aligned}$$

$$\begin{aligned}
 \delta' &= -25^{\circ} 25' 51.3 \\
 \pi &= 55' 37.3
 \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = 06 \quad 21$$

$$5(\delta - \delta') = +16 \quad 11 \quad 41$$

$$\begin{aligned}
 \log \sec \phi &= 9.86913 \\
 \log \pi &= 8.20895 \\
 \log(\delta - \delta') &= 9.94820 \\
 \log \cos \delta &= 9.95872 \\
 \log(\delta - \delta') &= 7.56756
 \end{aligned}$$

$$\begin{aligned}
 \log \tan \phi &= 9.95727 \\
 \cos(\delta - \delta') &= 0.00000 \\
 - \log(\delta - \delta') - \log \cos(\delta - \delta') &= 9.98241 \\
 \log \tan \phi &= 9.97486
 \end{aligned}$$

$$\begin{aligned}
 \alpha - \alpha' &= +12' 42.05 \\
 &= +50.40
 \end{aligned}$$

$$\delta = 43 \quad 20 \quad 33.1$$

$$\delta' = -25 \quad 25 \quad 51.3$$

$$\delta - \delta' = 68 \quad 46 \quad 24.4$$

$$\begin{aligned}
 \log \sec \phi &= 9.82640 \\
 \log \pi &= 8.20895 \\
 \log(\delta - \delta') &= 9.96949 \\
 - \log \gamma &= 9.83655 \\
 \log(\delta - \delta') &= 8.16829
 \end{aligned}$$

$$\delta - \delta' = +50 \quad 39.0$$

$$\delta = -24 \quad 35 \quad 12.3 \quad \alpha = 16 \quad 07 \quad 33.21$$

$$\text{Ann. Eph. } \delta = -24^{\circ} 35' 10.9 \quad \alpha = 16^{\text{h}} 07^{\text{m}} 32.22$$

$$O - C = 1.4 \quad + 0.99$$

1
1
9.8
9.7
2
13
28
3
9.8
9.9
4
2.1
2.1

1809 stars - measures
d y n
1 18312 17635
2.8 11377 14570
4.7 85 75
15 30
14.6933 .6934

2 14098 11363
13.6 13101 66
28.1 06 10
28.0992 50993

3 15533 15080
9.8 13178 74
9.3 78 50
51 90
29.2360 .2359

4 10990 15539
21.6 10270 48
21.1 80 88 37
21.0711 0717

1913 Nov. 7.
d n
1 17472 18940
15788 10615
80 17
77 50
9.8310 .8334

16765 15980
11792 10720
91 10
78 78
13.5220 .5263

16498 16180
19947 7710
49 12
18 00
19.8447 .8453

14512 19750
11225 13904
10 10 06
14 58
21.6702 .6749

Grade 2 or 3

Remeasure d n

1. 9.8296 9.8338

2 13.5228 13.5266

3 19.8449 19.8468

4 21.6707 21.6724

very fr.

1809 stars - measures

1913 Nov. 7.

	d	y	z	d	y	z
1	18312			17472		18940
18	11377 ⁵⁰			15788 ⁵⁰		10611 ¹¹
47	81			80		17
	15			77		50
	<u>14.6933</u>			<u>9.8310</u>		<u>8534</u>
2	14098			16765		15960
136	13101 ¹⁰			11992 ¹⁰		10770
281	06			91		10 ¹⁹
				79		78
	<u>280992</u>			<u>13.5220</u>		<u>5263</u>
3	15533			16498		16180
98	13178 ⁷⁶			14947 ⁵³		7710
13	78			49		12 ¹⁴
	51			18		00
	<u>29.2360</u>			<u>19.8447</u>		<u>8483</u>
4	10990			14512		19750
16	10270 ⁸⁸			11225 ¹⁰		1300906
11	80			10		86
				19		58
	<u>210711</u>			<u>21.6702</u>		<u>6749</u>

Grade 2 or 3.

Remeasure x direct

	d	z
1.	9.8296	9.8338
2	13.5228	13.5266
3	19.8449	19.8468
4	21.6707	21.6729
very fine		

1809

moon-measures

14

	d	y	n	d	n
$\frac{1}{17.3}$	13420		19240		
17.6	729.000		15361		
min	90		5560		
$\frac{1}{17.7}$	17		60		
	<u>17.6125</u>		<u>.6111</u>		
$\frac{2}{18.0}$	19362		19268		
17.7	1185046		1680900		
	62		10		
	65		85		
	<u>17.7511</u>		<u>.7534</u>		

possibly in
termination

$\frac{3}{18.4}$		20374	17516
18.0		1487505	1297780
		87	5180
		70	32
		<u>18.4517</u>	<u>.4555</u>

$\frac{4}{19.0}$	18988	16150
18.6	1268000	1244010
	90	20
	95	68
	<u>18.6302</u>	<u>.6266</u>

18439	16838
998000	1528070
98	7670
42	53
<u>19.1551</u>	<u>1565</u>

$\frac{5}{19.2}$		16410	15853
19.0		878095	1342514
		00	18
		20	75
		<u>19.2374</u>	<u>.2439</u>

1809

moon - measures

14

	d	y	n	d ^x	n
1	13420		19240		
173	7290	00	15361	possibly a	
176	90		5560	terminator	
mm	17		60		
1	<u>17.6125</u>		<u>6111</u>		
2	19362		19268		
180	11850	46	1680900		
177	62		10		
	65		85		
	<u>177511</u>		<u>7534</u>		

3
184
180

20374	17516
1487500	1297780
87	51
70	32
<u>184517</u>	<u>4555</u>

4		
190	18988	16150
186	12680	1244010
	90	20
	95	68
	<u>166302</u>	<u>6266</u>

18439	16838
998000	1528070
98	76
42	53
<u>19.1551</u>	<u>1565</u>

5
12
95
ex

16410	15853
878095	1342514
00	18
20	75
<u>192374</u>	<u>2439</u>

1809

log u - measures

15

2
19.2
20.0

15410
7310
0309
00
19.1905

15882
13979
7480
11
1910

8
18.5
21.0

16070
12350
6258
80
18.6283

15539
925950
60
60
6296

9
18.0
21.4

19856
1590000
07
75

21.3962

19890
1385046
40
82
3960

1809.

hydrogen - measure

15

$$\begin{array}{r} 2 \\ 192 \\ 200 \end{array}$$

$$\begin{array}{r} 15410 \\ 7310 \\ 0309 \\ 00 \end{array}$$

$$\underline{19.1905}$$

$$\begin{array}{r} 16070 \\ 12350 \\ 6258 \\ 80 \end{array}$$

$$\underline{18.6283}$$

$$\begin{array}{r} 15882 \\ 13979 \\ 7980 \\ 11 \end{array}$$

$$\underline{1910}$$

$$\begin{array}{r} 15539 \\ 925950 \\ 60 \\ 60 \end{array}$$

$$\underline{6296}$$

$$\begin{array}{r} 8 \\ 185 \\ 21.0 \end{array}$$

9

18.0

21.9

19856

15900

07

75

$$\underline{21.3962}$$

19890

13850

4046

82

$$\underline{3960}$$

1809	Times etc.							
Syst. time	1912 May 2	17 ^h	19 ^m		- 17 ^h	31 ^m		
" " Moon		17	25	03.6 ^v	17	25	04.0 ^v	
clock slow			1	39.8 ^v				
W. Sid. T.		17	26	43.6 ^v				
H. long		4	44	31.05 ^v				
G. Sid. T.		22	11	14.65 ^v				
Sid. T. m. h.		2	40	07.31 ^v				
Interval		19	31	07.34 ^v				
Reduction			3	11.86 ^v				
G. m. T.		19	27	55.48 ^v	G-X = +1 ^h	18 ^m	39.5 ^v	

from hant. Allen.	R. A.	Decl.			
Moon 19 ^h	16 ^h	07 ^m	02.94 ^v	- 24°	33' 26.3 ^v
Mercur. 1 ^m 22272 ^v			7.941 ^v		
" " 27.9247 ^v		+1	02.19 ^v	- 2	41.8 ^v
Tabular place	16	08	05.13 ^v	- 24	37 08.1 ^v

Moon's age 15.5 days.

934 = 5.6 ^v	fractilex	55'	37.0 ^v
211 = 5.3 ^v	secundum	15	10.9 ^v
	R =	910.9 ^v	
	Augmentation	+5.3 ^v	
	Irradiation	-0.6 ^v	
	R =	915.6 ^v	
	K =	7.9627 ^v	
a = -6.5 ^v	(1+a) R =	1.9614 ^v	
	R =	3.8471 ^v	

1809	Times	ch						
Exhibition	1912 May 2	17 ^h	19 ^m		- 17 ^h	31 ^m		
known		17	25	0.56	- 17	25	0.40	
clock show			1	39.8				
H. S. T.		17	26	43.6				
H. Wong		4	44	31.05				
G. S. T.		22	11	14.65				
Set in M.		6	40	07.31				
Interval		19	31	07.34				
Reduction			3	11.86				
G. M. T.		19	27	55.48	0-X-+1 ^h	18 ^m	39 ^s	

From Hunt. Allen.	R. A.	Decl.
moon 19 ^h	16 ^h 07 ^m 02 ^s 94	- 24° 33' 26".3
moon 1 ^h 2.2272		7941
.. 279247	1 07.19	- 3 418
Tabular place	16 08 05.13	- 24 37 08.1

Incubation 15.5 days.

fraxinella	55'	37"	0
scutellum	15	10	9
$R:$	9	10	9
Augmentation		+5	3
Triadialin 203		-0	6
$R:$	9	15	6
$K:$	7	9	6
$(1+a)R:$	1	9	6
$R:$	3	8	4

Rate Constants

17

x	y
9.8320	14.6934
13.5244	28.0992
19.8462	29.2360
21.6720	21.0714

	1	2	3	4
x	9.8320	13.5244	19.8462	21.6720
3	11.2272	14.8450	21.1625	23.0393
2-3	-1.3952	-1.3206	-1.3163	-1.3673

y	14.6934	28.0992	29.2360	21.0714
m	14.3529	27.8098	28.9926	20.8269
y-m	+3405	+2894	+2434	+2445

$x-3$	-5.874	$+6.52$	$+1.4759$
-1.3952	-863	$= -1.4815 + 64$	$= -1.4751 = +8$
-1.3206	-1649	$= -1.4855 + 88$	$= -1.4767 = -8$
-1.3163	-1716	$= -1.4879 + 129$	$= -1.4750 = +9$
-1.3673	-1237	$= -1.4910 + 141$	$= -1.4769 = -10$
17.2805	-1149	$+112$	$= 18.6527$

y-n	+70.776	+18.14	-43.62		
+3405	+695	+4100	+266	+4366	= +4
+2894	+956	+3850	+509	+4359	= -3
+2434	+1403	+3837	+529	+4366	= +4
+2445	+1532	+3977	+381	+4358	= -4
19.5732	+1222	+354			= 19.2946

Tables	a = -1.7	e = -19.5	a - e = +17.3	b + a = -10.6
Obs	-6.5	-18.1	+11.6	-12.0
C-O	+4.8	-1.4	+6.2	+1.4

	1	2	3	4
2	9.8320	14.6934		
3	13.5244	28.0992		
4	19.8462	29.2360		
5	21.6720	21.0714		
1	9.8320	13.5244	19.8462	21.6720
2	11.2272	14.8450	21.1625	23.0393
3	-1.3952	-1.3206	-1.3163	-1.3673
4	14.6934	28.0992	29.2360	21.0714
5	14.3529	27.8098	28.9926	20.8269
6	+3405	+2894	+2434	+2445
7	-5	-5.874	+652	+1.4759
8	-1.3952	-8.63	-1.4815	+64
9	-1.3206	-1.649	-1.4855	+88
10	-1.3163	-1.716	-1.4879	+129
11	-1.3673	-1.237	-1.4910	+1.41
12	17.2805	-1.149	+1.12	=1.86527
13	4-2	+7.072	+18.14	-43.62
14	+3405	695	+4100	+266
15	+2894	+956	+3856	+509
16	+2434	+1403	+3537	+529
17	+2445	+1532	+3977	+381
18	19.5732	+1.222	+354	

pt.	mag. $\angle$	residual
1	150.0	+138
2	158.4	-39
3	143.2	+90
4	118.8	+23
5	107.0	-30
6	90.0	-52
7	77.5	-135
8	43.5	+178
9	21.6	+81

1804 Moon's Center.

18

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$0 - C$
1	17.2782	0.0000	-20	0.0000	3.8648	+177
2	18.0000 + 0.7218	-18		0.5184	3.8501	+30
3	18.4536 + 1.1754	-16		1.3778	3.8647	+176
4	19.0000 + 1.7218	-9		2.9615	3.8593	+122
5	19.1558 + 1.8776	-6		3.5231	3.8539	+68
6	19.2406 + 1.9624	0		3.8510	3.8510	+39
7	19.1908 + 1.9126	+4		3.6596	3.8416	-55
8	18.6290 + 1.3508	+14		1.8284	3.8684	+213
9	18.0000 + 0.7218	+18		0.5236	3.8549	+78

Comp. 10: 3.8471

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.6118	-7.9624	-35	3.8648
2	17.7522	-1.8220	-33	3.3317
3	18.0000	-1.5742	-28	2.4869
4	18.6284	-0.9458	-17	0.8978
5	19.0000	-0.5742	-10	0.3308
6	19.5742	0.0000	0	0.0000
7	20.0000	+0.4258	+8	0.1820
8	21.0000	+1.4218	+25	2.0400
9	21.3961	+1.8219	+33	3.3313

Approximate Center

$$x = 18.0 \quad y = 17.7522$$

$$21.3961$$

$$39.1483$$

$$Y_0 = 19.5742$$

$$y = \min = 17.6118$$

$$R = 1.9624$$

$$x = \max = 19.2406$$

$$X_0 = 17.2782$$

$$\text{Center } \begin{cases} X_0 = 17.2782 \\ Y_0 = 19.5742 \end{cases}$$

1809

Moon's Center

18

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	17.2782	0.0000	-20	0.0000	3.8648	+1.77
2	18.0000	+0.7218	-18	0.5184	3.8501	+3.0
3	18.4536	+1.1754	-16	1.3778	3.8647	+1.76
4	19.0000	+1.7218	-9	2.9615	3.8593	+1.22
5	19.1558	+1.8776	-6	3.5231	3.8539	+6.8
6	19.2406	+1.9624	0	3.8510	3.8510	+3.9
7	19.1908	+1.9126	+4	3.6596	3.8416	-5.5
8	18.6290	+1.3508	+14	1.8284	3.8684	+2.13
9	18.0000	+0.7218	+18	0.5236	3.8549	+7.8

Comp. 16: 3.8471

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.6118	-7.9624	-35	3.8648
2	17.7522	-1.8220	-33	3.3317
3	18.0000	-1.5742	-28	2.4869
4	18.6284	-0.9458	-17	0.8938
5	19.0000	-0.5742	-10	0.3308
6	19.5742	0.0000	0	0.0000
7	20.0000	+0.4258	+8	0.1820
8	21.0000	+1.4258	+25	2.0400
9	21.3961	+1.8219	+33	3.3313

Approximate Center

$$x = 18.0 \quad y = 17.7522$$

$$\underline{21.3961}$$

$$39.1483$$

$$Y_0 = 19.5742$$

$$y - \text{min} = 17.6118$$

$$R = 1.9624$$

$$x - \text{min} = 19.2406$$

$$X_0 = 17.2782$$

$$\text{Center } \begin{cases} X_0 = 17.2782 \\ Y_0 = 19.5742 \end{cases}$$

Formation of Normals.

	ab	an	on
1	0.00	+ 0.0	- 346.9
2	- 131	+ 21.6	- 54.6
3	- 185	+ 207.7	- 276.3
4	- 163	+ 209.8	- 115.9
5	- 107	+ 127.8	- 38.8
6	+ 000	+ 76.4	+ 0.0
7	+ 082	- 105.0	- 23.6
8	+ 193	+ 287.6	+ 304.6
9	4131	+ 562	+ 1420
	- 1.80	+ 882.1	- 409.5

1809

Moon's center

19

Conditional Equations

	a	b	0	c	0-c
1	0.00	-1.96	= +1.77	0 + 39 = +39	+138
2	+0.72	-1.82	= +30	+33 + 36 = +69	-39
3	+1.18	-1.57	= +1.76	+55 + 31 = +86	+90
4	+1.72	-0.95	= +1.22	+80 + 19 = +99	+23
5	+1.88	-0.57	= +68	+87 + 11 = +98	-30
6	+1.96	+0.00	= +39	+91 - 0 = +91	-52
7	+1.91	+0.43	= -55	+89 - 9 = +80	-135
8	+1.35	+1.43	= +213	+63 - 28 = +35	+178
9	+0.72	+1.82	= +78	+33 - 36 = -3	+81

Average = 83

Normal Equations

$$\begin{aligned}
 +18.24 - 1.80 &= +882 \\
 -1.80 + 16.47 &= -410
 \end{aligned}$$

$$\begin{aligned}
 +1.80 - 0.18 &= +87 \\
 +16.29 &= -323
 \end{aligned}$$

$$b = -19.8$$

$$\begin{aligned}
 -0.20 + 1.80 &= -45 \\
 +18.04 &= +837
 \end{aligned}$$

$$a = +46.4$$

1809

Huron's Center

19

Correlational Equations

	a	b	0	c	0-c
1	0.00	-1.96	= +1.77	0 + 39 = +39	+138
2	+0.72	-1.82	= +30	+33 + 36 = +69	-39
3	+1.18	-1.57	= +1.76	+55 + 31 = +86	+40
4	+1.72	-0.95	= +1.22	+80 + 19 = +99	+23
5	+1.88	-0.57	= +68	+87 + 11 = +98	-30
6	+1.96	+0.00	= +39	+91 - 0 = +91	-52
7	+1.91	+0.43	= -1.5	+89 - 9 = +80	-135
8	+1.35	+1.43	= +213	+63 - 28 = +35	+178
9	+0.72	+1.82	= +78	+33 - 36 = -3	+81

Average = 83

Normal Equations

$$+18.24 - 1.80 = +882$$

$$- 1.80 + 16.47 = -410$$

$$+ 1.80 - 0.18 = +87$$

$$+ 16.29 = -323$$

$$b = -198$$

$$- 0.20 + 1.80 = -45$$

$$+ 18.04 = +837$$

$$a = +464$$

Red.

1809 moons mean position (1912.0)

$$\begin{array}{rcl}
 X_0 & = & 17.2782^{\circ} \quad Y_0 = 19.5742^{\circ} \\
 \Delta a & = & +23^{\circ} \quad \Delta b = -10^{\circ} \\
 \hline
 & & 19.2805^{\circ} \quad 19.5732^{\circ}
 \end{array}$$

Sun Plate constants $X = 18.6527^{\circ} \quad Y = 19.2946^{\circ}$

$$\begin{array}{rcl}
 \bar{z} & = & +0.6527^{\circ} \quad \eta = -2.7054^{\circ} \\
 \log & = & 9.81471^{\circ} \quad 70534^{\circ} \\
 \log \delta & = & 9.95565^{\circ} \quad \log \tan \delta = 9.6785^{\circ} \\
 \log \text{const} & = & 8.50724^{\circ} \quad \bar{z} = 9.6294^{\circ} \\
 (X-A) & = & 1.35182^{\circ} \quad \eta = 6.3613^{\circ} \\
 & & \eta_1 = -2^{\circ}
 \end{array}$$

$$X-A = +22.45^{\circ} \quad \eta_0 = -2.7052^{\circ}$$

$$A = 16 \quad 06 \quad 40^{\circ} \quad \log \eta_0 = 0.43220^{\circ}$$

$$X_0 = 16 \quad 07 \quad 02.48^{\circ} \quad \log \text{const} = 7.33115^{\circ}$$

$$\text{Red. to app place} +1.96^{\circ} \quad (H-D) = 3.10105^{\circ}$$

$$X' = 16 \quad 07 \quad 04.44^{\circ} \quad \delta - D = -21 \quad 02 \quad 0^{\circ}$$

$$D = -25 \quad 06 \quad 15^{\circ}$$

$$\delta_0 = -25 \quad 27 \quad 17.0^{\circ}$$

$$\text{Red. to app place} -1.24^{\circ}$$

$$\delta' = -25 \quad 27 \quad 29.4^{\circ}$$

1809 moons mean Position (1912.0)

$$X_0 = 17.2782$$

$$Y_0 = 19.5742$$

$$+23$$

$$-10$$

$$17.2805$$

$$19.5732$$

From Plate constants $X = 18.6527$ $Y = 19.2996$

$$Z = +0.6527$$

$$\eta = -2.7054$$

$$\log = 9.81471$$

$$\text{ws} = 9.95565$$

$$\text{wnt} = 8.50724$$

$$(X-A) = 1.35182$$

$$\log \tan \delta = 9.67855$$

$$Z = 9.6294$$

$$\eta = 6.3613$$

$$\eta_1 = -2$$

$$X-A = +22.48$$

$$\eta_0 = -2.7052$$

$$A = 16 \quad 06 \quad 40$$

$$\log \eta_0 = 0.43220$$

$$\text{wnt} = 7.33115$$

$$X_0 = 16 \quad 07 \quad 02.48$$

$$(S-D) = 3.10105$$

Red. to place $+1.96$

$$S-D = -21 \quad 02 \quad 0$$

$$X' = 16 \quad 07 \quad 04.44$$

$$D = -25 \quad 06 \quad 15$$

$$S_0 = -25 \quad 27 \quad 17.0$$

Red. to place -12.4

$$S' = -25 \quad 27 \quad 29.4$$

3 2/150

1809

Lunar Parallax

21

$$\delta' = -25 \quad 27 \quad 29.4''$$

$$\alpha' = 16 \quad 07 \quad 04.44''$$

$$\theta = 17 \quad 26 \quad 43.6''$$

$$\mu = 55' \quad 37.0''$$

$$G - \alpha' = +1 \quad 19 \quad 39.2''$$

$$= 4 \quad 19^\circ \quad 54' \quad 48''$$

$$\log \cos \phi = 9.86913$$

$$\sin \pi = 8.20891''$$

$$\cos(\theta - \alpha') = 9.53224''$$

$$\cos \delta = 9.95862''$$

$$\sin(\theta - \alpha') = 7.65166''$$

$$\frac{1}{2}(\alpha - \alpha') = 7 \quad 42''$$

$$G - \alpha' - \frac{1}{2}(\alpha - \alpha') = +19 \quad 47 \quad 06''$$

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

$$\cos \frac{1}{2}(\alpha - \alpha') = 6.00000''$$

$$\cos(\theta - \alpha' - \frac{1}{2}(\alpha - \alpha')) = 9.97358''$$

$$\tan \phi = 9.98369''$$

$$\alpha - \alpha' = +15' \quad 29.88''$$

$$= +1'' \quad 01.66''$$

$$\gamma = 43 \quad 55' \quad 27.1''$$

$$\delta' = -25 \quad 27 \quad 29.4''$$

$$\gamma - \delta' = 69 \quad 22 \quad 56.5''$$

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

$$\sin \pi = 8.20891''$$

$$\cos(\gamma - \delta) = 1.97126''$$

$$\cos \gamma = 9.84118''$$

$$\sin(\gamma - \delta') = 8.16539''$$

$$\delta - \delta' = +50 \quad 18.8''$$

$$\delta = -24 \quad 37 \quad 10.6''$$

$$\alpha = 16 \quad 08 \quad 06.10''$$

$$\text{true } \delta = -24 \quad 37 \quad 08.1''$$

$$\alpha = 16 \quad 08 \quad 05.13''$$

$$O-C = -2.5''$$

$$+0.87''$$

1809

Lunar Parallax

21

$$\begin{aligned} \lambda &= 16^{\circ} 07' 04'' 44 \\ \theta &= 17^{\circ} 26' 43'' 6 \\ \theta - \lambda' &= + 1^{\circ} 19' 39'' 2 \\ &= + 19^{\circ} 54' 48'' \end{aligned}$$

$$\frac{1}{2}(\lambda - \lambda') = 7^{\circ} 42'$$

$$\theta - \lambda' - \frac{1}{2}(\lambda - \lambda') = 19^{\circ} 47' 06''$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \cos \frac{1}{2}(\lambda - \lambda') &= 0.00000 \\ - \cos \theta - \lambda' - \frac{1}{2}(\lambda - \lambda') &= 9.97358 \\ \tan \phi &= 9.98369 \end{aligned}$$

$$\phi = 43^{\circ} 55' 27.1''$$

$$\delta = -25^{\circ} 27' 29.4''$$

$$\phi - \delta = 69^{\circ} 22' 56.5''$$

$$\begin{aligned} \log \sin \phi &= 9.82640 \\ \sin \pi &= 8.20891 \\ \sin(\phi - \delta) &= 9.97126 \\ - \cos \gamma &= 9.84118 \\ \sin(\delta - \lambda') &= 8.16539 \end{aligned}$$

$$\delta - \lambda' = + 50^{\circ} 18.8''$$

$$\delta = -24^{\circ} 37' 10.6''$$

$$\text{am Eph } \delta = -24^{\circ} 37' 08.4''$$

$$O-C$$

$$= 2.5$$

$$\delta = -25^{\circ} 27' 29.4''$$

$$\lambda = 16^{\circ} 08' 05.1''$$

$$\begin{aligned} \log \cos \phi &= 9.86913 \\ \sin \pi &= 8.20891 \\ - (\theta - \lambda') &= 9.53224 \\ - \cos \delta &= 9.95862 \\ \sin(\lambda - \lambda') &= 7.65166 \end{aligned}$$

$$\lambda - \lambda' = + 15' 24.87''$$

$$= + 1^{\circ} 01.66''$$

$$\lambda = 16^{\circ} 08' 06.10''$$

$$\lambda = 16^{\circ} 08' 05.13''$$

$$+ 0.87$$

1
13.
29

2-
16
10

3
16
10

1826. Stars - measures

1913 Nov. 10.

22

d	4	N	d	N
$\frac{1}{13.8}$ 29.3	18860 16655 56 56 <u>29.2205</u>	17440 963837 40 25 <u>2210</u>	17095 1520090 9090 89 <u>13.8098</u>	16989 8585 8138 70 <u>8100</u>
$\frac{2}{16.7}$ 10.2	16382 1468275 77 69 <u>10.1702</u>	16422 811018 17 12 <u>1701</u>	16880 1487070 63 80 <u>16.7988</u>	16530 852925 22 22 <u>7999</u>
$\frac{3}{16.8}$ 23.6	15228 925360 60 11 <u>23.5960</u>	15965 1191109 07 50 <u>5950</u>	15031 1290910 05 20 <u>26.7879</u>	15269 737166 70 65 <u>7897</u>

Grade 2.

1826 Slown measures

1913 Nov. 10.

22

	d	N	d	N
1/8	18860	17440	17095	16989
138	16655	963837	1520090	8885
293	56	40	9090	8130
	56	25	89	70
	<u>292205</u>	<u>2210</u>	<u>138098</u>	<u>8100</u>
2	16382	16922	16880	16530
167	1468275	811018	1487070	852925
102	77	17	63	22
	69	12	80	22
	<u>101702</u>	<u>1701</u>	<u>167988</u>	<u>7999</u>
3	15228	15965	15031	15269
268	925360	1191109	1290910	739166
236	60	67	05	70
	11	50	20	65
	<u>235960</u>	<u>1950</u>	<u>267879</u>	<u>7897</u>

Grade 2.

(1) is an a mountain
~~scratch to be use instead~~

a	4	v	a	v
12125 ²⁷	11980	19040	15699	
27	11340 ²⁹	10-28087	9410 ⁰⁸	
11475	49	90	65	
		40	58	
<u>17.9349</u>	<u>.9363</u>	<u>176248</u>	<u>.6259</u>	

1826

Moon-measures

23

1
17.6
18.0

18500
13990
9799
01
17.5495

19210
1368900
0900
92
.5502

2 scratch

173 17092 17214
185 12095 12200 90
8892 92
78 06
18.4993 .4984

18431
1014950
40
31
17.1715

19230
1749208
99
16
1727

3
16.9
19.0

11722
1150397
0097

1185550
51
11645

16.9778.9793

4
16.9
19.5
min
in
20

11679
1083930
39

1152010
09
20691

16.9157.9178

5
16.9
20.0

11661
1150088
90

989091
91
9710

16.9831.9819

6
17.6
21.0

16484
1236160
7873
80

15920
10000
.1090
19

17.5886.5915

1820

Moon-measures

23

1
176
180

2 scratch

173	17092	17214
155	12091	1220090
	8892	92
	78	06
	<u>18.4993</u>	<u>.4984</u>

3
169
190

4
169
195
199
199
199

5
169
200

6
176
210

18500
13990
9799
01
17.5495

18431
1014950
40
31
17.1715

11722
1150397
00

16.9778

11679
1083930
39

16.9157

11661
1150088
70

16.9831

16484
1236160
7873
50
17.5886

19210
1368900
09100
92
.5522

19230
1749208
99
16
.1729

11855550
51
11645

9793

1152010
09
10691

9178

989091
91
9710

9819

15920
1000090
1090
19
.5915

1826 moon - measures.

29

$\begin{array}{r} 2 \quad 19129 \\ 18.0 \quad 1624040 \\ 21.4 \quad 2840 \\ \quad 14 \\ \hline 21.2889 \end{array}$
 $\begin{array}{r} 19689 \\ 1257076 \\ \quad 73 \\ \quad 61 \\ \hline 2904 \end{array}$

$\begin{array}{r} 19081 \\ 19.0 \quad 1378080 \\ 21.5 \quad 80 \\ \text{max} \quad 75 \\ \hline 21.5298 \end{array}$
 $\begin{array}{r} 18744 \\ 1404132 \\ \quad 30 \\ \quad 20 \\ \hline 5302 \end{array}$

$x = 18.0$

$y = 17.6780$

Trines etc.

Exp. to stars 1912 May 25 $13^h 05^m$ $-13^h 17^m$
 ... moon $13 \quad 11 \quad 07.1^m - 13 \quad 11 \quad 07.4^m$
 clock slow $1 \quad 28.7^m$
 H. sid. T. $13 \quad 12 \quad 35.95^m$
 H. long $4 \quad 44 \quad 31.05^m$
 G. sid. T. $17 \quad 57 \quad 07.00^m$
 S.T.M. noon $4 \quad 10 \quad 48.11^m$
 Interval $13 \quad 46 \quad 18.89^m$
 Reduction $2 \quad 15.37^m$
 G.M.T. $13 \quad 44 \quad 03.52^m \quad \theta - \alpha = +0^h 48^m 27.5^s$

From Van Allen

R.A

Decl

moon 14^h $12^h 24^m 40.58^s$ $-10^d 14' 26.9''$

Photolunim $= 1.9700^m$ 15.913^m

" 15.9413^m -31.40^m $+4 \quad 13.7^m$

Tabular place $12 \quad 24 \quad 09.18^m$ $-1 \quad 10 \quad 13.2^m$

moon's parallax $= 57' 38.6''$

semidiameter $= 15' 44.0'' = 944.0''$

$934 = 11.2^m$

$944 = 11.4^m$

Augmentation $+11.4$

Irradiation (2) -0.5

R = 954.9

R = 20469

$(+2) R = 20471$

$R^2 = 41906$

$a = +1.0$

1826	Unknown	Lucasnes
	d 4	
2	19129	19689
80	1624040	1257076
14	28	73
	14	61
	212889	2904

24

~~8~~	19081	18744
190	1378080	1404132
215	80	30
more	75	20
-		
8	<u>215298</u>	<u>5302</u>

$$25 - 18.0 \quad 4 - 17.6780$$

	1912 May 25	13 ^h	05 ^m	-13 ^h 17 ^m
known	13	11	07.1	-13 11 07.4
clock slow		1	28.7	
11 bed T.	13	12	35.95	
H. Hong	4	44	31.05	
6 bed T.	17	57	07.00	
S.T.M. known	4	10	48.11	
Interval	13	46	18.89	
Reaction		2	15.37	
6 M.T.	13	44	03.52	0-1-10 ^h 48 ^m 27 ^s

Brown Hamlet
 brown 14" 12 24 40.58 - 10 14' 26" 9
 Wholeness = 19700 15913
 159413 - 3140 + 4 137
 Tabulae plan 12 24 09.18 - 1 10 13.2
 brown's parallax: 57' 38" 6
 semidiameter: 15' 44" 0 = 944.0
 934 = 112
 940 = 114
 Augmentation + 11.9
 Irradiation 3 - 0.5
 R = 954.9
 R = 20469
 1 + R / R = 20471
 R = 41906
 R = +1.0

1826

Plate Constant

25

x	y	K	Q	h	k
13.8099	29.2208	12	20	48	-0
16.7994	10.1702	22	29	-3	02
26.7888	23.5955	27	34	-1	17
35.740	62.99	1	9	11	1
19.13	21.00	12	23	37	-1
-18	-22	-	35	-	+7
1.13	-1.00	12	23	02	-1
31	465				
35 ^s					

$$A = 12^h 23^m 02^s$$

$$D = -10^\circ 30' 32''$$

$$\begin{aligned}
 x - z &= -138.44 & -x & & +275.9 \\
 +129.9 - 404.4 & = -274.5 & -14 & = -275.9 & = 0 \\
 -133.3 - 140.8 & = -274.1 & -17 & = -275.8 & = +1 \\
 +53.3 - 326.6 & = -273.3 & -27 & = -276.0 & = -1 \\
 18.9644 - 269.7 & & -19 & & = 18.9687 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 y - z &= +139.92 & -14 & & -264.1 \\
 +71.2 + 19.32 & = +264.4 & -3 & = +264.1 & = 0 \\
 +29.2 + 235.0 & = +264.2 & -1 & = +264.1 & = 0 \\
 -110.4 + 374.8 & = +264.4 & -2 & = +264.2 & = +1 \\
 19.4836 + 265.3 & & -2 & & = 19.4846
 \end{aligned}$$

Tables	$a = +0.9$	$e = -1.9$	$a - z = +2.8$	$b + a = -1.1$
Obs	$a = +1.0$	$+0.1$	$+0.9$	$b + a = -1.5$
C-O	-0.1	-2.0	$+1.9$	$+0.4$

1826

Plate Constants

25

x	y	K	Q	K	Q	K	Q
13.8099	29.2208	12	20	48	-0	34	57
16.7994	10.1702		22	29	-3	02	43
26.7888	23.5955		27	34	-1	17	15
5740	6299		9	111	-4	53	115
19.13	2100	12	23	37	-1	38	18
-68	-22			35		+7	46
113	-100	12	23	02	-1	30	32
31	465						
35							

$$A = 12^h 23^m 02^s$$

$$D = -10^\circ 30' 32''$$

$$x - 1 = 138.44$$

$$+ 1299 - 4044 = -2745$$

$$- 1333 - 1408 = -2741$$

$$+ 533 - 3266 = -2733$$

$$189644 = 2697$$

$$- 2$$

$$+ 2759$$

$$= 0$$

$$= +1$$

$$= -1$$

$$= 189687$$

$$y - 1 = 1399x$$

$$+ 712 + 1932 = 2644$$

$$+ 292 + 2350 = 2642$$

$$- 1104 + 3748 = 2644$$

$$194886 + 2653$$

$$- 14$$

$$- 2641$$

$$= 0$$

$$= 0$$

$$= +1$$

$$= 194843$$

Tables $a = +0.9$ $a = -1.9$ $a - a = +2.8$ $b + a = -1.1$

$a = +1.0$ $+0.1$ $+0.9$ $b + a = -1.5$

$c = 0$ -0.1 -2.0 $+1.9$ $+0.4$

1826

Standard Coordinates

Cape No. 1679 Aug 8.9

Cape No. 1684 Aug 8.5

Cape No. 1701 Aug 7.7

C	12	20	10.80	12	21	51.78	12	26	56.80
L			78			82			
E			10.80			86			
mean	12	20	10.79	12	21	51.82			
Prece			+36.88			+36.95			+36.91
S	12	20	47.67	12	22	28.77	12	27	33.71
A	12	23	02	12	23	02	12	23	02
S-A	-	2	14.33	-	0	33.23	+	4	31.71
sin(S-A)			-134.33			-33.23			+271.69
log	2	12	81.8			1.52153			2.43407
cos	9.99998					9.99938			9.99989
3.	0.63540					0.02815			0.94120
3.	-4.3192					-1.0670			+8.7338
3.	-		8			3			+17
3	13.6800					16.9327			26.7355
3	13.8099					16.7994			26.7858
3-5	+12.99					-13.33			+533
C	-0°	30'	57.4	-2°	58'	43.4	-1°	13'	16.5
L			57.4			43.0			
E			57.2			43.7			
mean	-0	30	57.3	-2	58	43.4			
Prece	-	3	59.6	-	3	59.4	-	3	58.8
S	-0	34	56.9	-3	02	42.8	-1	17	15.3
D	-1	30	32	-1	30	32	-1	30	32
S-D	+	55	35.1	-1	32	10.8	+	13	16.7
tan(S-D)			+3335.4			-5532.1			+796.7
log	3.52315					3.74289			2.90129
log	0.85430					1.07404			0.23244
tan S	8.0072					8.7259			8.3517
3	12708					00563			18824
log	6.3214					5.8356			7.2875
30	+7.1498					-11.8589			+1.7078
31	-		2			1			-19
32	29.1496					10.1410			23.7059
33	29.2208					10.1702			23.5955
34	+7.12					+2.92			-11.04

18V6

Standard Coordinates

Cape W. 1679 mag 8.9				Cape W. 1684 mag 8.1				Cape W. 1701 mag 7.7			
C	12	20	10.80	12	21	51.78		12	26	56.80	
L			78			82					
B			10.80			86					
mean	12	20	10.79	12	21	51.82					
Proc			+36.88			+36.95				+36.91	
S	12	20	47.67	12	22	28.77		12	27	33.71	
A	12	23	02	12	23	02		12	23	02	
d-4	-	2	14.33	-	0	33.23		+	4	31.71	
sin(d-4)			-134.33			-33.23				+271.69	
log	2.12818			1.52153				2.43407			
cos	9.99998			9.99938				9.99989			
B	0.63540			0.02815				0.94120			
B	-4.3192			-1.0670				+8.7338			
B	-	8		-	3			+	17		
B	13.6800			16.9327				26.7355			
B	13.8099			16.7994				26.7848			
B-3	+12.99			-13.33				+5.33			
C	-0°	30'	57.4	-2°	58'	43.4		-1°	13'	16.5	
L			57.4			43.0					
B			57.2			43.7					
mean	-0	30	57.3	-2	58	43.4					
Proc	-	3	59.6	-	3	59.4		-	3	58.8	
S	-0	34	56.9	-3	02	42.8		-1	17	15.3	
D	-1	30	32	-1	30	32		-1	30	32	
d-A	+55	35.1		-1	32	10.8		+13	16.7		
tan(d-A)			+3335.4			-5532.1				+796.7	
log	3.52315			3.74289				2.90129			
log	0.85430			1.07404				0.23244			
log	8.0072			8.7259				8.3517			
B	12708			00563				18824			
B	63214			58356				72875			
B	+7.1498			-11.8589				+1.7078			
B	-	2		-	1			-	19		
B	291496			101410				237059			
B	292208			10.1702				23.5955			
B	+712			+292				-1104			

pt.	pos. $\angle$	residual
1'	220.8	+5
1	223.7	+134
2	241.2	-77
3	256.4	-129
4	270.0	+21
5	284.6	+77
6	317.9	-15
7	331.8	+21
8	1.1	+5

1826

Moon's Center

27

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.5498	-1.4132	-2	1.9977	4.2006	+100
2	17.1721	-1.7909	-1	3.2077	4.1783	-123
3	16.9786	-1.9844	-1	3.9382	4.1724	-182
4	16.9168	-2.0462	0	4.1869	4.1869	-37
5	16.9825	-1.9815	+1	3.9260	4.1926	+20
6	17.5900	-1.3730	+2	1.8846	4.1847	-59
7	18.0000	-0.9630	+2	0.9270	4.1893	-13
8	19.0000	+0.0370	+2	0.0014	4.1904	-2
1	17.6254	-1.3376	-2	1.7897	4.1879	-27
Comp R^2					4.1906	

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	18.0000	-1.4838	-4	2.2029
2	18.4988	-0.9850	-2	0.9706
3	19.0000	-0.4838	-1	0.2342
4	19.4838	0.0000	0	0.0000
5	20.0000	+0.5162	+1	0.2666
6	21.0000	+1.5162	+4	2.3001
7	21.2896	+1.8058	+4	3.2623
8	21.5300	+2.0462	+5	4.1890
1	17.9356	-1.5482	-4	2.3982

$$x = 180 \quad y = 17.6780$$

$$21.2896$$

$$3.89676$$

$$y_0 = 19.4838$$

$$y = \text{max} = 21.5300$$

$$R = 2.0462$$

$$x = \text{min} = 16.9168$$

$$x = 18.9630$$

$$\text{Center} \begin{cases} x_0 = 18.9630 \\ y_0 = 19.4838 \end{cases}$$

18-16

Moon's Center

27

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - C$
1	17.5498	-1.4132	-2	1.9977	4.2006	+100
2	17.1721	-1.7909	-1	3.2077	4.1783	-123
3	16.9786	-1.4844	-1	3.9382	4.1724	-182
4	16.9168	-2.0462	0	4.1869	4.1869	-37
5	16.9825	-1.9815	+1	3.9260	4.1926	+20
6	17.5900	-1.3730	+2	1.8846	4.1847	-59
7	18.0000	-0.9630	+2	0.9270	4.1893	-13
8	19.0000	+0.0370	+2	0.0014	4.1904	-2
	17.6254	-1.3376	-2	1.7897	4.1879	-27

Comp R^2

4.1906

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	18.0000	-1.4838	-4	2.2029
2	18.4988	-0.9850	-2	0.9706
3	19.0000	-0.4838	-1	0.2342
4	19.4838	0.0000	0	0.0000
5	20.0000	+0.5162	+1	0.2666
6	21.0000	+1.5162	+4	2.3001
7	21.2896	+1.8058	+4	3.2623
8	21.5300	+2.0462	+5	4.1890
	17.9356	-1.5482	-4	2.3982

$$x = 18.0 \quad y = 17.6780$$

$$\underline{21.2896}$$

$$3.89676$$

$$y_0 = 19.4838$$

$$y \text{ max} = 21.5300$$

$$R = 2.0462$$

$$x \text{ min} = 16.9168$$

$$x = 18.9630$$

$$\text{Center} \begin{cases} x_0 = 18.9630 \\ y_0 = 19.4838 \end{cases}$$

Formation of moments

	ab	an	bn
1	+ 208	+ 36.2	+ 41.9
1	+ 208	- 141.0	- 148.0
2	+ 1.77	+ 220.5	+ 121.8
3	+ 0.95	+ 360.0	+ 87.5
4	- 0.00	+ 75.9	- 0.0
5	- 1.03	- 39.6	+ 10.4
6	- 208	+ 80.8	- 89.6
7	+ 1.74	+ 12.5	- 23.6
8	+ 008	- 0.0	- 4.1
	+ 2.11	+ 605.3	- 3.7

Residuals from R. S. Sol.

	O		C	O - C
1	- 27	- 38 + 6 =	- 32	+ 5
1	+ 100	- 40 + 6 =	- 34	+ 134
2	- 123	- 50 + 4 =	- 46	- 77
3	- 182	- 55 + 2 =	- 53	- 129
4	- 37	- 58 - 0 =	- 58	+ 21
5	+ 20	- 55 - 2 =	- 57	+ 77
6	- 59	- 38 - 6 =	- 44	- 15
7	- 13	- 27 - 7 =	- 34	+ 21
8	- 2	+ 1 - 8 =	- 7	+ 5
Average = 5.4				

1826

Moon's Center

28

Conditional Equations

			c	0-c
1	-1.34	-1.55 =	-27 - 37 - 17 = -54	+27
1	-1.41	-1.48 =	+100 - 39 - 16 = -55	+155
2	-1.79	-0.99 =	-123 - 49 - 11 = -60	-63
3	-1.98	-0.48 =	-182 - 55 - 5 = -60	-122
4	-2.05	+0.00 =	-37 - 57 + 0 = -57	+20
5	-1.98	+0.52 =	+20 - 55 + 6 = -49	+69
6	-1.37	+1.52 =	-59 - 38 + 17 = -21	-38
7	-0.96	+1.81 =	-13 - 27 + 20 = -7	-6
8	+0.04	+2.05 =	-2 + 0 + 22 = +22	-24

Average = 58

Mean Equations

giving 1 + 3 (2 at)

$$-6.87 - 3.52 = -228$$

$$-4.27 + 5.90 = -54$$

$$+ 9.27 + 2.19 = +142$$

$$+ 8.09 = + 88$$

$$b = +10.9$$

$$-6.87 = -228 + 38 = -190$$

$$a = +27.6$$

Normal Equations

$$+ 21.86 + 2.11 = +605$$

$$+ 2.11 + 15.82 = -4$$

$$- 2.11 - 0.20 = -58$$

$$+ 15.62 = -62$$

$$b = -4.0$$

$$+ 21.86 = +605 + 8 = +613$$

$$a = +28.1$$

1826. known mean position (19120)

$$\begin{array}{r}
 X_0 = 18.9630 \\
 + 14 \\
 \hline
 189644
 \end{array}
 \quad
 \begin{array}{r}
 Y_0 = 194838 \\
 + 2 \\
 \hline
 194836
 \end{array}$$

Fundamental Constants $\lambda = 189687$ $Y = 19.4843$

$$\begin{array}{r}
 \bar{z} = +09687 \\
 \log 5 = 998619 \\
 \log 8 = 999978 \\
 \log 10 = 850724
 \end{array}$$

$$12-A = 147917$$

$$\lambda - A = +30.89$$

$$A = 12 \quad 23 \quad 02$$

$$X_0 = 12 \quad 23 \quad 32 \quad 14$$

$$\bar{z} = -25157$$

$$\begin{array}{r}
 \log \tan \delta = 850527 \\
 \log 5 = 997244 \\
 \log 10 = 553111
 \end{array}$$

$$\log \eta = 0.40064$$

$$\log \eta = 7.33115$$

$$(d-D) = 3.06944$$

$$S-D = -19.334$$

$$D = -1.3032$$

$$\delta_0 = -1.50054$$

1826

Moon's Center
Conditional Equations

1	-1.34	-1.55	-27	-37	-17	-54	$+27$		
1 $\frac{1}{2}$	-1.41	-1.48	$+100$	-39	-16	-55	$+155$		
2	-1.79	-0.99	-123	-49	-11	-60	-63		
3 $\frac{1}{2}$	-1.98	-0.48	-182	-55	-5	-60	-122		
4	-2.05	$+0.00$	-37	-57	0	-57	$+20$		
5	-1.98	$+0.52$	-20	-58	6	-49	$+69$		
6	-1.37	$+1.52$	-59	-38	-17	-21	-38		
7	-0.96	$+1.81$	-13	-27	-20	-7	-6		
8	$+0.04$	$+2.01$	-2	0	$+22$	$+22$	-29		

Average = 58

Linear Equations

$$-6.87 - 3.52 = -2.28$$

$$-4.27 + 5.90 = -5.4$$

$$-9.27 + 2.19 = +1.42$$

$$+8.09 = +8.8$$

$$62 + 10.9$$

$$-6.87 = -2.28 + 38 = -190$$

$$-a = +27.6$$

Normal Equations

$$+21.86 + 2.11 = +6.05$$

$$+2.11 + 15.82 = -4$$

$$-2.11 - 0.20 = -5.8$$

$$+15.62 = -6.2$$

$$62 = -4.0$$

$$+21.86 = +6.05 + 8 = +61.3$$

$$a = +28.1$$

1826. Hubert's Mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 = 18.9630^\circ & Y_0 = 19.4838^\circ \\
 \frac{1}{2}a = \frac{\quad + 14 \quad}{18.9644} & \frac{1}{2}b = \frac{\quad - 2 \quad}{19.4836}
 \end{array}$$

From Plate Constants $X = 18.9687^\circ$ $Y = 19.4846^\circ$

$$\begin{array}{rcl}
 \bar{z} = +0.9687^\circ \\
 \log \delta = 9.98619^\circ \\
 \dots \log \delta = 9.99978^\circ \\
 \dots \text{const} = 8.50724^\circ \\
 \dots (X-A) = 14.7917^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \bar{y} = -2.5154^\circ \\
 \log \tan \delta = 8.50527^\circ \\
 \dots \log \delta = 9.9724^\circ \\
 \dots \log \delta = 5.5311^\circ
 \end{array}$$

$$\begin{array}{rcl}
 X-A & + & 30.14^\circ \\
 \log \eta = 0.40061^\circ \\
 \dots \text{const} = 7.33115^\circ
 \end{array}$$

$$A \quad 12 \quad 23 \quad 02^\circ \quad \dots (S-D) \quad 3.06946^\circ$$

$$X_0 \quad 12 \quad 23 \quad 32.14^\circ \quad S-D \quad - \quad 19 \quad 33.4^\circ$$

$$\text{Red} = \quad + \quad 1.49^\circ \quad \delta \quad -1 \quad 30 \quad 32^\circ$$

$$\alpha' = 12 \quad 23 \quad 33.63^\circ \quad \delta_0 \quad -1 \quad 50 \quad 0.54^\circ$$

$$\begin{array}{rcl}
 \text{Red} & - & 10.3^\circ \\
 \delta' & -1^\circ & 50' 15.7''
 \end{array}$$

1826 Reduction to apparent place.

$$\begin{aligned}
 \alpha_0 &= 12^h 24^m \\
 G &= 20 \quad 11 \\
 G + \alpha_0 &= 8 \quad 35 \\
 &= 128^\circ 45' 12''
 \end{aligned}$$

$$\begin{aligned}
 \delta_0 &= -1^\circ 50' \\
 H + \delta_0 &= 13^h 35^m \\
 H + \alpha_0 &= 1 \quad 59 \\
 &= 29^\circ 45' 12''
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{r} &= 8.8239 \\
 \log \frac{1}{s} &= 0.9993 \\
 \sin(G + \alpha_0) &= 9.8920 \\
 \tan S_0 &= 8.5053m \\
 (g) &= 8.2205m
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{r} &= 8.8239 & \log i &= 0.5437m \\
 \log h &= 1.3047 & \cos S_0 &= 9.9998 \\
 \sin(H + \delta_0) &= 9.6957 & (L) &= 0.5435m \\
 \sec S_0 &= 0.0002 \\
 (h) &= 9.8245
 \end{aligned}$$

$$\begin{aligned}
 \log g &= 0.9993 \\
 \cos(G + \alpha_0) &= 9.7965m \\
 (g') &= 0.7958m
 \end{aligned}$$

$$\begin{aligned}
 \log h &= 1.3047 \\
 \cos(H + \delta_0) &= 9.9386 \\
 \sin S_0 &= 8.5050m \\
 (h') &= 9.7483m
 \end{aligned}$$

$$\begin{aligned}
 f &= +0.83 \\
 (g) &= -0.01 \\
 (h) &= +0.67 \\
 \text{Red. } \alpha &= +1.49''
 \end{aligned}$$

$$\begin{aligned}
 (g') &= -6.25'' \\
 (h') &= -0.56'' \\
 (i') &= -3.50'' \\
 \text{Red. } \delta &= -10.31''
 \end{aligned}$$

$$\alpha' = 12^h 23' 33.63''$$

$$\delta = -1^\circ 50' 15.7''$$

1826

Immer Parallax.

$$s' = -1^{\circ} 50' 15.7''$$

$$\alpha' = 12^{\circ} 23' 33.63''$$

$$\theta = 13' 12'' 35.95''$$

$$\pi = 57' 38.6''$$

$$s - \kappa = + 49' 02.32''$$

$$t = + 12' 15' 38''$$

$$\log p \cos \phi' = 9.86913''$$

$$\sin \pi = 8.22446''$$

$$\sin t = 9.32704''$$

$$\cos s = 9.99991''$$

$$\sin(\alpha - \alpha') = 7.42072''$$

$$\frac{1}{2}(\alpha - \alpha') = + 4' 32''$$

$$t - \frac{1}{2}(\alpha - \alpha') = + 12^{\circ} 14' 03''$$

$$\alpha - \alpha' = + 9' 03.44''$$

$$= + 36.23''$$

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

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

$$\cos(t - \frac{1}{2}(\alpha - \alpha')) = 9.99011''$$

$$\tan \phi = 9.96716''$$

$$\gamma = 142' 50.09.0''$$

$$s' = -1' 50' 15.4''$$

$$t - s' = 44' 40' 24.4''$$

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

$$\sin \pi = 8.22446''$$

$$\sin(\gamma - s') = 9.84700''$$

$$\sin \gamma = 9.83244''$$

$$\sin(\gamma - s') = 8.06542''$$

$$s - s' = + 39' 58.0''$$

$$s = -1' 10' 17.7''$$

$$\alpha = 12' 24' 09.85''$$

$$\text{Ann. Eph. } s = -1^{\circ} 10' 13.2''$$

$$\alpha = 12^{\circ} 24' 09.18''$$

$$O - C = - 4.5''$$

$$+ 0.68''$$

1826

Deneb Parallax

$$S' = -1^{\circ} 50' 15.7''$$

$$\alpha' = 12^{\circ} 23' 33.63''$$

$$\delta = 13^{\circ} 12' 35.95''$$

$$S - \alpha' = + 49^{\circ} 02' 32''$$

$$l = + 12^{\circ} 15' 35''$$

$$\frac{1}{2}(\alpha - \alpha') = + 4' 32''$$

$$c = \frac{1}{2}(\alpha - \alpha') = + 12^{\circ} 14' 03''$$

$$\log \tan \phi' = 9.91727$$

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

$$\cos(\alpha - \frac{1}{2}(\alpha - \alpha')) = 9.99011$$

$$\tan \phi = 9.96716$$

$$m = 57' 38.6''$$

$$\log \sin \phi = 9.86913$$

$$\sin \pi = 8.22446$$

$$\sin l = 9.32904$$

$$\cos S = 9.99991$$

$$\sin(\alpha - \alpha') = 7.42072$$

$$\alpha - \alpha' = + 9' 03.40''$$

$$= + 3623$$

$$Y = 142^{\circ} 50' 09.0''$$

$$S' = -1^{\circ} 50' 15.7''$$

$$S - S' = 44^{\circ} 40' 24.9''$$

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

$$\sin \pi = 8.22446$$

$$\sin(\alpha - \delta) = 9.84900$$

$$\sin \gamma = 9.83244$$

$$1 = \sin(\alpha - \delta) = 8.06542$$

$$S - S' = + 39^{\circ} 58.0''$$

$$S = -1^{\circ} 10' 17.4''$$

$$\text{Ann. Ecl. } S = -1^{\circ} 10' 13.2''$$

$$O - C = - 4.2$$

$$\alpha = 12^{\circ} 24' 09.86''$$

$$\alpha = 12^{\circ} 24' 09.18''$$

$$+ 0.68$$

