

KG

11366

4932

Vol. LVI



Plates



2173

2180

2181

Harvard Lunar Plates

Measurements and Reductions

Mary Fowler.

Volume LVI.

Plate No.	Date	Page
2173	1912 Nov. 20	1
2180	1912 Nov. 21	10
2180	1912 Nov. 21	21

2173

Star-measures

1914 Jan. 12

1

	d	4	n	d	7c	n
1	20073	19877		8370	75	13160
6.0	15725	14220	26	70		1260060
17.5	24	20		7817		91
	69	62				
	<u>17.4348</u>	<u>4353</u>		<u>6.0555</u>		<u>.0563</u>
2	18448	16641		18450		18369
25.4	12386	12680	80	11228		11549
9.6	8588	8480		2528		4049
	12	41		20		60
	<u>9.6040</u>	<u>.6040</u>		<u>25.2798</u>		<u>.2820</u>
3	16989	17230		17610		16428
28.2	1213044	1207568		932521		1466975
26.5	3940	70		20		8175
	79	30		98		15
	<u>26.4846</u>	<u>.4841</u>		<u>28.1722</u>		<u>.1751</u>

space 3 or 2

2173

Star-measures

1914 Jan 12

	d	y	z	d	z
1	20073	19877	8370	13160	
60	15725	14220	70	12600	
17.5	24	20	7817	91	
	69	62			
	<u>17.4348</u>	<u>4353</u>	<u>6.0555</u>	<u>0563</u>	
2	18448	16641	18450	18369	
254	12386	12680	11228	11549	
96	85	84	2528	4049	
	12	41	20	60	
	<u>9.6040</u>	<u>6040</u>	<u>25.2798</u>	<u>2820</u>	
3	16989	17230	17610	16428	
282	1213044	12075	932521	14669	
26.5	3940	70	20	81.75	
	79	30	98	15	
	<u>26.4846</u>	<u>4841</u>	<u>28.1722</u>	<u>1751</u>	

Grades 3 or 2

2173

moon-measures.

2

$\begin{array}{r} 1 \\ 18.5 \\ 16.1 \\ \text{min} \\ \text{in} \\ 4 \end{array}$
 $\begin{array}{r} d \\ 14312 \\ 13650 \\ 6052 \\ 00 \\ 16.0657 \end{array}$

$\begin{array}{r} n \\ 18910 \\ 957280 \\ 7580 \\ 96 \\ .0679 \end{array}$

$\begin{array}{r} 2 \\ 18.0 \\ 16.1 \end{array}$
 $\begin{array}{r} d \\ 19364 \\ 1801125 \\ 3305 \\ 50 \\ 16.1344 \end{array}$

$\begin{array}{r} n \\ 19870 \\ 1120097 \\ 8110 \\ 67 \\ .1330 \end{array}$

$\begin{array}{r} 3 \\ 17.0 \\ 16.7 \end{array}$
 $\begin{array}{r} d \\ 19420 \\ 1176055 \\ 47 \\ 10 \\ 16.7658 \end{array}$

$\begin{array}{r} n \\ 19838 \\ 1750900 \\ 94 \\ 34 \\ .7664 \end{array}$

$\begin{array}{r} 4 \\ 16.8 \\ 17.0 \end{array}$

$\begin{array}{r} 19350 \\ 1760005 \\ 10 \\ 29 \\ 168259 \end{array}$

$\begin{array}{r} 14010 \\ 574034 \\ 37 \\ 00 \\ .8265 \end{array}$

$\begin{array}{r} 5 \\ 16.6 \\ 18.0 \\ \text{min} \\ \text{in} \\ 2 \end{array}$

$\begin{array}{r} 19278 \\ 1454030 \\ 41 \\ 50 \\ 165273 \end{array}$

$\begin{array}{r} 15057 \\ 976860 \\ 63 \\ 55 \\ .5292 \end{array}$

$\begin{array}{r} 6 \\ 16.7 \\ 19.0 \end{array}$

$\begin{array}{r} 18150 \\ 1583041 \\ 48 \\ 67 \\ 16.7663 \end{array}$

$\begin{array}{r} 15123 \\ 792029 \\ 30 \\ 05 \\ 7683 \end{array}$

2173

known - measured

d

y

w

d

2

w

1 14312
 185 13650
 161 6052
 00
160657

15910
 957280
 7580
 96
0679

2 19364
 180 1801125
 161 3305
 50
16.1344

19870
 1120097
 8110
 67
1330

3 19420
 170 1176055
 167 47
 10
16.7658

19838
 1750900
 79
 34
7664

4
 168
 170

19350
 1760005
 10
 29
16.8259

14010
 574039
 37
 00
8265

5
 166
 180
 16
 16

19278
 1454030
 41
 50
16.5273

15057
 976860
 63
 55
5292

6
 167
 190

18150
 1583041
 48
 67
16.7663

15123
 792029
 30
 05
7683

3 6 5 1
5 7 0 3
1 0 1
1 3 4 5

2173

moon-measures.

d

4

n

d

26

n

7

18165

14989

17.0

1476255

8340

19.4

50

2535

51

75

19.3405.3353remeasure(n) = 3378

8 scratch.

17.5

17181

16198

16701

15570

19.6

959895

13778

11620

1066540

95

6580

18

41

75

91

90

58

19.7581.757817.49224945

2173

Moon - measures

3

	cl	4	n	d	n
7	18165		14989		
170	1976255		8340		
194	50		2535		
	51		75		
	<u>19.3405</u>		<u>3353</u>		remains n: <u>3378</u>

8 Scratch.

175	17181	16198	16701	15570
196	959895	13778	11620	1066540
	95	6580	1815	41
	75	91	90	58
	<u>19.7581</u>	<u>7578</u>	<u>174922</u>	<u>4915</u>

2473

Trices etc.

4

Expt to Jan 1912 Nov. 20

23^h 2.8^m ✓- 23^h 40^m ✓

known

23

33

43.9 ✓

23

33

44.3 ✓

clock fast

0 02.6 ✓

H. Sid T.

23

33

41.5 ✓

6-2 = -1^m 16^m

H. long

4

44

31.0 ✓

G. Sid T.

28

18

12.5 ✓

Sid T. known

15

56

31.67 ✓

Interval

12

21

40.88 ✓

Reduction

2

01.51 ✓

G. in T.

12

19

39.37 ✓

From hant. alum

R. h.

N. h.

known 12^m0^h48^m

46.11 ✓

+5

24

19.1 ✓

motion in 1^m = 1.8694 ✓

14.862 ✓

196562 ✓

+ 36.75 ✓

+ 4

52.1 ✓

Tabular place

0

49

2286 ✓

+5

29

11.2 ✓

Moon's age

12 days

parallax

55

56.1 ✓

secundum

15

16.1 ✓

934 = 11.9 ✓

R

916.1 ✓

916 = 11.5

Augmentation

+ 11.5 ✓

Irradiation (2) or (3)

- 0.6

R

927.0 ✓

R

1.9871 ✓

a = +1.4

(1+a) R

1.9874 ✓

R²

3.9498 ✓

1273

Times etc

4

Exp. to Sun 1912 Nov. 20	23 ^h	28 ^m	-23 ^h	40 ^m
known	23	33	439	-23 33 443
clock fast		0	026	
H. J. d. T.	23	33	41.5	6-1.-1 ^m 16 ^m
H. long	4	44	31.05	
G. J. d. T.	28	18	12.55	
South in known	15	56	31.67	
Interval	12	21	4088	
Reduction		2	01.51	
G. in T.	12	19	39.37	

from hour alt	R. A.	Decl.
known 12 ^m	0 ^h 48 ^m	46 ^s 11
known 12 ^m - 1.8694		+5 29 19.1
19.6562	+3675	14.862
Tabular place	0 49	2286 +5 29 11.2

known as 12 days.

parallel	55	56.1
secundum	15	16.1
R	9	16.1
Augmentation	+11.5	
Irradiation (W. T.)	-0.6	
R	9	27.0
R	1	9871
(1+R) R	1	9874
R ²	3	9498

a = +1.4

2173

Plate Constant

5

x	6.0559	25.2809	28.1736
y	6.6552	25.9004	28.7432
z	-5.993	-6.195	-5.696
u	17.4350	9.6040	26.4844
v	18.1437	10.3660	27.2577
$u-v$	-7.087	-7.620	-7.733

$$\begin{array}{rclclcl}
 z & - & 2.934 & & -1.42 & & +6.511 \\
 -5.993 & - & 5.11 & = & -6.504 & - & 8 = -6.512 & = & -1 \\
 -6.195 & - & 2.81 & = & -6.476 & - & 3.5 = & -6.511 & = & 0 \\
 -5.696 & - & 7.76 & = & -6.472 & - & 3.9 = & -6.511 & = & 0 \\
 18.5141 & - & 5.29 & & -2.6 & & & = & 19.1097 \checkmark
 \end{array}$$

$$\begin{array}{rclclcl}
 u & + & 2.852 & & +1.84 & & +6.882 \\
 -7.087 & + & 1.73 & = & -6.914 & + & 3.1 = & -6.883 & = & -1 \\
 -7.620 & + & 7.21 & = & -6.899 & + & 1.7 = & -6.882 & = & 0 \\
 -7.733 & + & 8.03 & = & -6.930 & + & 4.8 & = & -6.882 & = & 0 \\
 18.0531 & + & 5.28 & & +3.2 & & & = & 18.7973 \checkmark
 \end{array}$$

Tables	$a = +0.6$	$e = -1.6$	$a - e = +2.2$	$b + a = +1.3$
Obs	$a = +1.4$	$e = -1.8$	$a - e = +3.2$	$b + a = +0.5$

Plate Constant

2173			
α	6 0 5 5 9	2 5 2 8 0 9	2 8 1 7 3 6
δ	6 6 5 5 2	2 5 9 0 0 4	2 8 7 4 3 2
$\alpha - \delta$	- 5 9 9 3	- 6 1 9 5	- 5 6 9 6
γ	1 7 4 3 5 0	9 6 0 4 0	2 6 4 8 4 4
η	1 8 1 4 3 7	1 0 3 6 6 0	2 7 2 5 7 7
$\gamma - \eta$	- 7 0 8 7	- 7 6 2 0	- 7 7 3 3

$\alpha - \delta$	- 2 9 3 4	- 1 4 2	+ 6 5 1 1
- 5 9 9 3	- 5 1 1	- 6 5 0 4	- 8 = - 6 5 1 2
- 6 1 9 5	- 2 8 1	- 6 4 7 6	- 3 5 = - 6 5 1 1
- 5 6 9 6	- 7 7 6	- 6 4 7 2	- 3 9 = - 6 5 1 1
1 8 1 4 1	- 5 2 9	- 2 6	= 1 9. 1. 0 9 7

$\gamma - \eta$	+ 2 8 5 2	+ 1 8 4	+ 6 8 8 2
- 7 0 8 7	+ 1 7 3	- 6 9 1 4	+ 3 1 = - 6 8 8 3
- 7 6 2 0	+ 7 2 1	- 6 8 9 9	+ 1 7 = - 6 8 8 2
- 7 7 3 3	+ 8 0 3	- 6 9 3 0	+ 4 8 = - 6 8 8 2
1 8 0 5 3 1	+ 5 2 8	+ 3 2	= 1 8 7 9 7 3

Tables.	$\alpha = + 0.6$	$\delta = - 1.6$	$\alpha - \delta = + 2.2$	$\gamma + \alpha = + 1.3$
Obs	$\alpha = + 1.4$	$\delta = - 1.8$	$\alpha - \delta = + 3.2$	$\gamma + \alpha = + 0.5$

pt.	pos. μ	resid.
1	180.0	-3.3
2	195.0	-7
3	229.7	-12
4	238.0	+8.2
5	268.6	-3.3
6	298.5	-14
7	310.3	-4.0
8	329.1	+3.3

2173

Lunar Center

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	18.5120	0.0000	+3	0.0000	3.9462	-3.6
2	18.0000	-0.5120	+3	0.2618	3.9467	-3.1
3	17.0000	-1.5120	+2	2.2855	3.9421	-2.7
4	16.8262	-1.6858	+1	2.8416	3.9508	+1.0
5	16.5282	-1.9838	+0	3.9355	3.9383	-1.15
6	16.7673	-1.7447	-1	3.0443	3.9413	-8.5
7	17.0000	-1.5120	-2	2.2867	3.9397	-1.01
8	17.9918	-1.0202	-2	1.0412	3.9492	-6

Comp R^2 : 3.9498

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.0668	-1.9862	-3	3.9462
2	16.1337	-1.9193	-3	3.6849
3	16.7661	-1.2869	-2	1.6566
4	17.0000	-1.0530	-2	1.1092
5	18.0000	0.0530	-0	0.0028
6	19.0000	+0.9470	+1	0.8970
7	19.3385	+1.2855	+2	2.6530
8	19.7580	+1.7050	+3	2.9080

Apfr. Center

$$x = 17.0 \quad y = 16.7661$$

$$19.3385$$

$$361046$$

$$y_0 = 18.0523$$

$$y_{\text{min}} = 16.0668$$

$$R = 1.9855$$

$$x_{\text{min}} = 16.5270$$

$$x_0 = 18.5125$$

$$\text{Center } \begin{cases} x_0 = 18.5120 \\ y_0 = 18.0530 \end{cases}$$

2173

Lunar Center

6

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$(y - y_0)^2$	$O - C$
1	185120	0.0000	0.0000	0.0000	3.9462	-36
2	180000	-0.5120	0.2621	0.2621	3.9467	-21
3	170000	-1.5120	2.2855	2.2855	3.9421	-77
4	168262	-1.6858	2.8416	2.8416	3.9508	+10
5	165282	-1.9838	3.9355	3.9355	3.9383	-115
6	167673	-1.7447	3.0443	3.0443	3.9413	-85
7	170000	-1.5120	2.2855	2.2855	3.9397	-101
8	174918	-1.0202	1.0408	1.0408	3.9492	-6

Comp R^2 3.9498

	y	$y - y_0$	$(y - y_0)^2$
1	160668	-1.9862	3.9462
2	161337	-1.9193	3.6844
3	167661	-1.2869	1.6566
4	170000	-1.0530	1.1092
5	180000	0.0530	0.0028
6	190000	0.9470	0.8970
7	193385	1.2855	2.6530
8	197580	1.7050	2.9080

Alpha Center

$$X = 170 \quad y = 167661$$

$$193385$$

$$361046$$

$$y_0 = 180523$$

$$y_{\text{min}} = 160668$$

$$R = 19855$$

$$x_{\text{min}} = 165270$$

$$X_0 = 185125$$

$$\text{Center } \begin{cases} X_0 = 185120 \\ Y_0 = 180530 \end{cases}$$

Formation of Normals.

	ab	an	
1	- 0.00	- 0.0	+ 71.7
2	+ 0.98	+ 15.8	+ 59.5
3	+ 1.95	+ 116.2	+ 99.5
4	+ 1.77	- 16.9	- 10.5
5	+ 0.10	+ 228.0	+ 5.7
6	- 1.65	+ 147.9	- 80.8
7	- 1.95	+ 152.8	- 130.5
8	- 1.74	+ 61	- 10.3
	- 0.54	+ 649.9	+ 4.3

2173

Moon's Center

7

Conditional Equations:

	a	b	O.		c	b-c
1	0.00	-1.99	-36	0-3	-3	-33
2	-0.51	-1.92	-31	-21-3	-24	-7
3	-1.51	-1.29	-77	-63-2	-65	-12
4	-1.69	-1.05	+10	-70-2	-72	+82
5	-1.98	-0.05	-115	-82-0	-82	-33
6	-1.74	+0.95	-85	-72+1	-71	-14
7	-1.51	+1.29	-101	-63+2	-61	-40
8	-1.02	+1.71	-6	-42+3	-39	+33
Average						32

Normal Equations

$$\begin{aligned}
 +15.70 - 0.54 &= +650 \\
 -0.54 + 16.86 &= +4
 \end{aligned}$$

$$\begin{aligned}
 +0.54 - 0.02 &= +22 \\
 +16.84 &= +26
 \end{aligned}$$

$$+15.70 = +650 + 1 + 651$$

$$b = +1.5$$

$$a = +41.5$$

2173

Moons Center
Conditional Equations

7

	a	b	0	c	b-c
1	0 0 0 - 1 9 9 =	- 3 6	0 - 3 =	- 3	- 3 3
2	- 0 5 1 - 1 9 2 =	- 3 1	- 2 1 - 3 =	- 2 4	- 7
3	- 1 5 1 - 1 2 9 =	- 7 7	- 6 3 - 2 =	- 6 5	- 1 2
4	- 1 6 9 - 1 0 5 =	+ 1 0	- 7 0 - 2 =	- 7 2	+ 8 2
5	- 1 9 8 - 0 0 5 =	- 1 1 5	- 8 2 - 0 =	- 8 2	- 3 3
6	- 1 7 9 + 0 9 1 =	- 8 5	- 7 2 + 1 =	- 2 1	- 1 4
7	- 1 5 1 + 1 2 9 =	- 1 0 1	- 6 3 + 2 =	- 6 1	- 4 0
8	- 1 0 2 + 1 7 1 =	- 6	- 4 2 + 3 =	- 3 9	+ 3 3
Average					3 2

Normal Equations

$$\begin{aligned}
 &+ 1570 - 0.54 = + 650 \\
 &- 0.54 + 1686 = + 4 \\
 &+ 0.54 - 0.02 = + 22 \\
 &\quad + 1684 = 26 \\
 &+ 1570 + 650 + 14651 \\
 &\quad b = + 15 \\
 &\quad a = - 41.5
 \end{aligned}$$

Red ad. C. aph

$$\begin{array}{rcl}
 H + \alpha & 2 & 47 = 48^{\circ} 45' \\
 H & 1 & 57 \\
 \alpha & 0 & 50 \\
 G & 22 & 05 \\
 G + \alpha & 22 & 55 = 343^{\circ} 45'
 \end{array}$$

$$\begin{array}{rcl}
 \cos(G + \alpha) & = & 9.9823 \\
 g & = & 1.2638 \\
 \sin & = & 9.4469 \\
 \tan S & = & 8.9346 \\
 h & = & 8.8237
 \end{array}$$

$$\begin{array}{rcl}
 \log(g') & = & 1.2461 \\
 (g) & = & 84692m
 \end{array}$$

$$\begin{array}{rcl}
 p & + & 2.48 \\
 h & - & 0.03 \\
 h & + & 0.89 \\
 \hline
 & + & 3.34
 \end{array}$$

$$S_0 = +4^{\circ} 55'$$

$$\begin{array}{rcl}
 \log \cos S & = & 9.9984 \\
 i & = & 0.6285 \\
 (i) & = & 0.6269
 \end{array}$$

$$\begin{array}{rcl}
 \sin S & = & 8.9330 \\
 \cos(H + \alpha) & = & 9.8728 \\
 h & = & 1.3015 \\
 \sin & = & 9.8234 \\
 \sec S & = & 0.0016 \\
 h & = & 8.8237
 \end{array}$$

$$\begin{array}{rcl}
 \log(h') & = & 0.0073 \\
 (h) & = & 99504
 \end{array}$$

$$\begin{array}{rcl}
 g' & + & 17.62 \\
 h' & + & 1.28 \\
 z & + & 4.23 \\
 \hline
 & = & 23.13
 \end{array}$$

2173 Moon's mean position (1912.0)

8

$$\begin{array}{r} Y_0 = 18.5120 \\ + 21 \\ \hline 18.5141 \end{array}$$

$$\begin{array}{r} Y_0 = 18.0530 \\ + 1 \\ \hline 18.0531 \end{array}$$

From plate constants $X = 19.1097$ $Y = 18.7973$

$$\bar{z} = +1.1097$$

$$\eta = -3.2027$$

$$\log \bar{z} = 0.04520$$

$$\cos S = 9.99840$$

$$8.50724$$

$$\log(\delta - A) = 1.53956$$

$$\alpha - A = +34.64$$

$$A = 0.9940$$

$$\alpha_0 = 0.501464$$

$$Red = +3.34$$

$$\delta' = 0.501798$$

$$\log \tan S = 8.9418$$

$$z^2 = 0.0904$$

$$\eta_0 = 6.0856$$

$$\eta_1 = +1$$

$$\eta_0 = -3.2028$$

$$\log \eta_0 = 0.50553$$

$$7.33115$$

$$(\delta - D) = 3.17438$$

$$\delta - D = -24.541$$

$$D = +5.1945$$

$$S = +4^{\circ} 54' 50.9$$

$$Red = +23.1$$

$$S' = +4.55140$$

2173 known mean Position (1912.0)

8

$$Y_0 = 18\ 51\ 20$$

$$+ 21$$

$$18\ 51\ 41$$

$$Y_0 = 18\ 05\ 30$$

$$+ 1$$

$$18\ 05\ 31$$

From plate constants $X = 19.1097$ $Y = 18.7973$

$$\bar{z} = +1.1097$$

$$\eta = -3.2027$$

$$\log \bar{z} = 0.04520$$

$$\cos \bar{z} = 999840$$

$$850724$$

$$\log \tan \delta = 8.9418$$

$$\dots \delta^2 = 00904$$

$$\eta_0 = 60856$$

$$\log(q \cdot A) = 1.53956$$

$$\eta_1 = +1$$

$$\alpha - A = +34.64$$

$$\eta_0 = -32028$$

$$A = 0\ 49\ 40$$

$$\log \eta_0 = 0.50553$$

$$733115$$

$$\alpha_0 = 0\ 50\ 14.64$$

$$(\alpha - D) = 3.17438$$

$$\text{Red.} = +334$$

$$\delta - D = -24\ 54.1$$

$$\alpha' = 0\ 50\ 17.98$$

$$D = +5\ 19\ 45$$

$$S = +4\ 54\ 50.9$$

$$\text{Red.} = +23.1$$

$$S = +4\ 55\ 14.0$$

Lunar Parallax

$$\begin{array}{r}
 2173 \\
 \alpha' = 0^h 50^m 17.98 \\
 \delta = 23 \quad 33 \quad 41.5 \\
 \alpha - \alpha' = -1 \quad 16 \quad 36.5 \\
 \delta - \delta' = -19^\circ 09' 08''
 \end{array}$$

$$\begin{array}{r}
 - \quad 6 \quad 49 \\
 -19 \quad 02 \quad 19
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.02443 \\
 \hline
 9.98170
 \end{array}$$

$$\delta = 43 \quad 47 \quad 36$$

$$\delta = 4 \quad 55 \quad 14$$

$$38 \quad 52 \quad 22$$

$$\begin{array}{r}
 9.82640 \\
 8.21139 \\
 9.79768 \\
 015986 \\
 \hline
 799533
 \end{array}$$

$$\delta - \delta' = +34 \quad 00.6$$

$$\delta = +5 \quad 29 \quad 14.6$$

$$\text{Amph} \delta = +5 \quad 29 \quad 11.2$$

$$O-C \quad + \quad 3.4$$

$$\delta' = +4^\circ 55' 14.0$$

$$T_1 = 55' 56.1$$

$$\begin{array}{r}
 9.86913 \\
 8.21139 \\
 9.51598 \\
 0.00199 \\
 \hline
 7.59849
 \end{array}$$

$$\alpha - \alpha' = -13' \quad 38.30$$

$$= -54.55$$

$$\alpha = 0 \quad 49 \quad 23.43$$

$$\alpha = 0 \quad 49 \quad 22.86$$

$$+0.57$$

Lunar Parallax

$$\begin{array}{r}
 2173 \\
 \alpha = 0^h 50^m 17.98 \\
 \delta = 23 \quad 33 \quad 41.5 \\
 \alpha - \alpha' = 1 \quad 16 \quad 36.5 \\
 \delta - \delta' = 19^{\circ} 09' 08''
 \end{array}$$

$$- \quad \quad \quad 6 \quad 49$$

$$- 19 \quad 02 \quad 19$$

$$9.95727$$

$$0.00000$$

$$0.02443$$

$$9.98170$$

$$\gamma = 43 \quad 47 \quad 36$$

$$\delta = 4 \quad 55 \quad 14$$

$$38 \quad 52 \quad 22$$

$$9.82640$$

$$8.21139$$

$$9.79768$$

$$0.15986$$

$$7.99533$$

$$S - S' = +34 \quad 00.6$$

$$S = +5^{\circ} 29' 14.6''$$

$$\text{Sun Eph } S = +5^{\circ} 29' 11.2''$$

$$O - C \quad \quad \quad + 3.4$$

$$S' = +9^{\circ} 55' 14.0''$$

$$\Pi = 55' 56.1''$$

$$9.86913$$

$$8.21139$$

$$9.51598$$

$$0.00199$$

$$7.59849$$

$$\alpha - \alpha' = -13' 38.30''$$

$$- 54.5$$

$$\alpha = 0 \quad 49 \quad 23.43$$

$$\alpha = 0 \quad 49 \quad 22.86$$

$$+0.57$$

2180

Star - headwind

1914 Jan. 14.

10

d	N
1 173 09	18290
64-1280808	1279080
120 08	8591
07	88
<u>12.4500</u>	<u>.4498</u>

d	N
16530	17430
981505	14529
0920	2930
30	14
<u>6.3281</u>	<u>.3296</u>

3 19940	17020
283 14177	1283030
146 21	21
09	29
<u>14.5803</u>	<u>.5805</u>

14910	16520
967890	1323018
7790	20
97	27
<u>28.3283</u>	<u>.3299</u>

3 18630	15631
291 11649	1260089
326 52	92
18	28
<u>32.6972</u>	<u>.6964</u>

18513	15360
989880	1396070
8986	70
97	60
<u>29.1389</u>	<u>.1393</u>

Grade 3 or 4.

2
1
17
3
29
14
3
29
37

2180

Star head

1914 Jan. 14.

10

	d	N
1	17309	18290
14	1280808	1279080
125	08	8591
	07	58
	<u>124500</u>	<u>4498</u>

	d	N
	16532	17830
	981505	1452930
	0920	29
	30	14
	<u>63281</u>	<u>3296</u>

3	19940	17020
283	1417725	1283030
140	21	21
	09	24
	<u>145803</u>	<u>5805</u>

	16910	16520
	967890	1323018
	7790	20
	97	27
	<u>283283</u>	<u>3299</u>

3	18630	15631
291	1164950	1260089
326	52	92
	18	28
	<u>326972</u>	<u>6964</u>

	18513	15360
	989880	1396070
	8986	70
	97	60
	<u>291389</u>	<u>1393</u>

Grade 3 or 4

2180 Lyman measures.

	d	n	d	n
1	17146	18873		
19.3	1385040	12175		
17.4	41	7971		
min	32	93		
8	<u>193295</u>	<u>3289</u>		
2	16172	19865		
19.0	12579	1342931		
17.5	8085-	31		
	65-	75-		
	<u>173588</u>	<u>3558</u>		
3	16611	19820		
18.0	830920	1811020		
17.8	20	07		
	28	33		
	<u>178309</u>	<u>8289</u>		

4
17.8
18.0

15709
1399081
75
92
178276

14311
603030
40
30
8293

5
17.4
19.0

14643
8140
5038
39
173502

15370
1186160
60
70
3510

6
17.4
19.3
min
in
25

14600
779091
92
00
173191

15381
1220090
90
95
3192

2180 *Hydrogen - frequencies*

$$\begin{array}{r}
 17146 \\
 1385040 \\
 174 \quad 41 \\
 32 \\
 143295 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 18873 \\
 12175 \\
 7971 \\
 93 \\
 3289 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 16172 \\
 12579 \\
 175 \quad 8085 \\
 65 \\
 173588 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 19865 \\
 1342931 \\
 31 \\
 75 \\
 3558 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 16611 \\
 180 \quad 830920 \\
 178 \quad 20 \\
 28 \\
 178309 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 19820 \\
 1811020 \\
 07 \\
 33 \\
 8289 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 17.8 \\
 18.0
 \end{array}$$

$$\begin{array}{r}
 15709 \\
 1399081 \\
 75 \\
 92 \\
 178276 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 1431.1 \\
 603030 \\
 40 \\
 30 \\
 8293 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 17.4 \\
 19.0
 \end{array}$$

$$\begin{array}{r}
 14643 \\
 8140 \\
 5038 \\
 39 \\
 173502 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 15370 \\
 1186160 \\
 60 \\
 70 \\
 3510 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 17.9 \\
 19.3
 \end{array}$$

$$\begin{array}{r}
 14600 \\
 779091 \\
 92 \\
 00 \\
 173191 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 15381 \\
 1220090 \\
 90 \\
 95 \\
 3192 \\
 \hline
 \end{array}$$

2180

d

q

lunar-lunars.

n

d

N

12

$$\begin{array}{r} 2 \\ 17.5 \\ 20.0 \end{array}$$

$$\begin{array}{r} 19525 \\ 1381000 \\ 10 \\ 18 \\ 17.4286 \end{array}$$

$$\begin{array}{r} 16451 \\ 1212015 \\ 3811 \\ 21 \\ 4294 \end{array}$$

$$\begin{array}{r} 8 \\ 18.0 \\ 20.8 \end{array} \quad \begin{array}{r} 17815 \\ 922122 \\ 25 \\ 23 \\ 20.8600 \end{array} \quad \begin{array}{r} 15776 \\ 1433536 \\ 40 \\ 80 \\ 8560 \end{array}$$

q scratch

$$\begin{array}{r} 18.5 \\ 21.2 \end{array} \quad \begin{array}{r} 17120 \\ 1524241 \\ 42 \\ 29 \\ 21.1880 \end{array}$$

$$\begin{array}{r} 16057 \\ 788588 \\ 99 \\ 49 \\ 1840 \end{array}$$

$$\begin{array}{r} 19328 \\ 1461010 \\ 1010 \\ 38 \\ 18.5277 \end{array}$$

$$\begin{array}{r} 17445 \\ 1218075 \\ 75-75 \\ 51 \\ 5271 \end{array}$$

2150

d

q

known - line numbers

n

d

n

$$\begin{array}{r} 2 \\ 175 \\ 200 \end{array}$$

$$\begin{array}{r} 19525 \\ 1381000 \\ 10 \\ 18 \end{array}$$

$$\begin{array}{r} 16481 \\ 1212010 \\ 3811 \\ 21 \end{array}$$

$$\underline{174256}$$

$$\underline{4294}$$

$$\begin{array}{r} 180 \\ 208 \\ 17815 \\ 922122 \\ 2522 \\ 23 \\ 208600 \end{array}$$

$$\begin{array}{r} 15776 \\ 1433536 \\ 40 \\ 80 \\ 8360 \end{array}$$

$$\frac{4}{5} \text{ scratch}$$

$$\begin{array}{r} 185 \\ 212 \\ 17120 \\ 1524241 \\ 4241 \\ 29 \\ 211880 \end{array}$$

$$\begin{array}{r} 16057 \\ 788588 \\ 99 \\ 49 \\ 1840 \end{array}$$

$$\begin{array}{r} 19328 \\ 1461010 \\ 1010 \\ 38 \\ 185297 \end{array}$$

$$\begin{array}{r} 17495 \\ 1218075 \\ 7575 \\ 51 \\ 5271 \end{array}$$

2180 Times etc.

Eph. tables	1912 Nov. 21	0 ^h	1 ^m	14.3 ^v	- 0 ^h	23 ^m	14.5 ^v
known		0	17	14.3 ^v	- 0	17	14.5 ^v
clock fast			0	03.2 ^v			
H. Sid. T.		0	17	11.2 ^v	G - A = - 1 ^h	20 ^m	
H. time		4	44	31.05 ^v			
G. Sid. T.		5	01	42.25 ^v			
Sid. T. - known		16	00	28.22 ^v			
Interval		13	01	14.03 ^v			
Reduction			2	07.99 ^v			
G. M. T.		12	59	06.04 ^v			

From Grant Alman.	R. A.	Decl.
known 13 ^h	1 ^h 36 ^m	49 ⁵ .54 + 11° 31' 22".7 ^v
known in 1 ^m = 1.9844 ^v		14.382 ^v
" - 0.8993 ^v		- 1.78 - 12.9 ^v
Tabular place	1 36	4776 ^v + 11 31 098 ^v

Moon's age	13 days
parallax	56' 39".4 ^v
semidiameter	15' 27.9 ^v
R	927.9 ^v
Augmentation	+ 12.6 ^v
Irradiation (3)	- 0.7 ^v
R	939.8 ^v
R	20146 ^v
(1+a) R	20147 ^v
R ²	40590 ^v
a = + 0.4	

2180 *Taurus etc.*

Hydrotan 1912 Nov. 21	0 ^h	11 ^m	- 0 ^h	23 ^m
known	0	17	143	- 0 17 14.5
local fast		0	03.2	
H. Sid T.	0	17	112	G-X - 1 ^h 20 ^m
H. long	4	44	31.05	
+ Sid T.	5	01	42.25	
Sid T. known	16	00	28.22	
Interval	13	01	14.03	
Reduction		2	07.99	
G in T.	12	59	06.04	

From Vant Alm.	R. G.	W. C. C.
known 13 ^m	1 ^h 36	49 ^s 54 + 11 ^h 31' 22"
within 1 ^m	1.9844	14.382
- 0.8993	- 1.78	- 12.9
Tabular place	1 36	49.76 + 11 31 09.8

known age 13 days

parallel	56	39.4
semidiameter	15	27.9
R		927.9
Amplification		+ 12.6
Irradiation (13)		- 0.7
R		939.8
R		2.0146
R		2.0147
(1+2) R		4.0590
R ²		

934 - 12.7
926 - 12.6

a = + 0.4

[Faint pencil sketch of a curved line]

2180

Plate Constants.

14

x	y	$R.A.$	Decl.
6.3288	12.4499	$1^h 30^m 54^s + 10^0 06' 42''$	
28.3291	14.5804	42 29 + 10 24 18	
29.1391	32.6968	42 54 + 12 45 05	
3 63.80	59.73	114 137 32 75 65	
21.27	19.91	1 38 46 + 11 05 22	
- 18	- 22	- 1 42 + 16 15	
327	209	1 37 04 + 11 21 37	
31	465		
1025	975	$A = 1^h 37^m 04^s$	
		$D = +11^0 21' 37''$	

$$\begin{array}{rclclcl}
 x-5 & -6 & 1.34 & -0.4x & +391 & \\
 +375 & - & 763 & = -388 & -3 & = -391 = 0 \\
 +515 & - & 894 & = -379 & -11 & = -390 = +1 \\
 +1625 & - & 2004 & = -379 & -12 & = -391 = 0 \\
 193331^v & - & 1186^v & - & 8^v & = 19.2528^v
 \end{array}$$

$$\begin{array}{rclclcl}
 y-7 & +5 & 8.42 & -0.8y & -965 & \\
 +605 & + & 370 & = +978 & -10 & = +968 = 0 \\
 -678 & + & 1654^v & = +976 & -12 & = +964 = -1 \\
 -710 & + & 1702^v & = +992 & -26 & = +966 = +1 \\
 193428^v & + & 1129^v & - & 15^v & = 19.3577^v
 \end{array}$$

$$\begin{array}{llll}
 \text{Tables } a = +0.4 & c = -1.2 & a-c = +1.6 & b+d = +1.0 \\
 \text{Obs } a = +0.4 & c = +0.8 & a-c = -0.4 & b+d = +2.9
 \end{array}$$

2180

Plate Constants

14

x	y	R	G	H	K
63288	124999	1 ^h 30 ^m 54 ^s	+10° 06' 42"		
283291	145809	42 29	+10 29 18		
291391	326968	42 54	+12 45 05		
3) 6380	5973	114 137	32 75 65		
2127	1991	1 38 46	+11 05 22		
-18	-22	-1 42	+16 15		
327	209	1 37 04	+11 21 37		
31	465				
102 ^s	975"				
		A = 1 ^h 37 ^m 04 ^s			
		D = +11 ^h 21' 37"			

$x - 5$	-6134	-042	$+391$
$+375$	-763	-388	-391
-515	894	-379	-390
$+1625$	-2004	-379	-391
143331	-1186	-8	19.2528

$y - 7$	$+5842$	-0.84	-965
$+605$	-370	$+975$	-10
-678	$+1654$	$+976$	-12
-710	$+1702$	$+992$	-26
193428	$+1129$	-15	19.3577

Tables	$a = +0.4$	$c = -1.2$	$a - c = +1.6$	$b + d = +1.0$
Obs	$a = +0.4$	$c = +0.8$	$a - c = +0.4$	$b + d = +2.9$

Standard Coordinates

Cape No. 220 mag 8.6				Cape No. 253 mag 7.0				Cape No. 254 mag 8.6			
L	1 ⁿ	30 ^m	16 ^s 28	1 ⁿ	41 ^m	50 ^s 72		1 ⁿ	42 ^m	15 ^s 38	
L			36			70				46	
B			30			69				38	
Mean	1	30	16.31	1	41	50.70		1	42	15.41	
Procc		+	37.97		+	38.15			+	38.44	
R	1	30	54.28	1	42	28.85		1	42	53.85	
A	1	37	04	1	37	04		1	37	04	
A-A	-6		09.72	+	5	24.85		+	5	49.85	
sin(B-A)		-	369.68		+	324.82			+	349.81	
log ..			2.56783m			2.51168				2.54383	
log ..			9.99320			9.99280				9.98916	
3.			1.06827m			1.01172				1.04023	
3.		-	11.7022		+	10.2736			+	10.9705	
3.		-	65		+	40			+	61	
3			6.2913			28.2776				28.9766	
3			6.3288			28.3291				29.1391	
2-3			+375			+515				+1625	
C	+10°	02'	59".9	+10°	20'	40".3		+12	41	28.4	
L			59.9			40.8				27.9	
B			58.8			39.8				27.4	
Mean	+10	02	59.5	+10	20	40.3		+12	41	27.9	
Procc		+	3		+	3			+	3	
S	+10	06	41.5	+10	24	17.6		+12	45	04.8	
D	+11	21	37	+11	21	37		+11	21	37	
S-D	-1	14	55.5	-	57	19.4		+1	23	27.8	
tan(B-b)		-	44.96.2		-	34.39.7				50.08.8	
log ..			3.65285m			3.53652m				3.69973	
log ..			0.98400m			0.86767m				1.03088	
tan 6			9.2512			9.2639				9.3547	
3 ²			21365			20234				20805	
3 ¹			84411			83407				84886	
m ₀		-	9.6382			-7.3737			+	10.7370	
m ₁		+	276			219			+	308	
m			123894			146482				327678	
y			124499			145804				32.6968	
y-z		+	605			-678				-710	

2180

Standard Coordinates

15

Cape No. 220 mag 8.6				Cape No. 253 mag 7.0				Cape No. 254 mag 8.6			
6	1	30	16.28	1	41	50.72		1	42	15.38	
6			36			70				46	
2			30			69				38	
Mean	1	30	16.31	1	41	50.70		1	42	15.41	
Prec		+	37.97		+	38.15			+	38.44	
λ	1	30	54.28	1	42	288.5		1	42	538.5	
λ	1	37	04	1	37	04		1	37	04	
$\lambda - A$		-6	09.72		+	5	24.85		+	5	49.85
$\sin(\lambda - A)$		-	369.68		+	329.82			+	349.81	
$\log$			2.56783m			2.51168				2.54383	
$\log$			9.99320			9.99280				9.98916	
$\log$			1.06827m			1.01172				1.04023	
$\log$			-11.7022		+	102.736			+	10.9705	
$\log$			-		+	40			+	61	
$\log$			6.2913			282.776				284.766	
$\log$			6.3248			283.291				29.1391	
$\log$			+3.75		+	51.5			+	162.5	
$\log$			1.0° 02' 59.9		+	10° 20' 40.3			+	12 41 28.4	
$\log$			59.9			40.8				27.9	
$\log$			58.8			39.8				27.4	
Mean	+	10	02 59.5		+	10 20 40.3			+	12 41 27.9	
Prec		+	3 42.0			3 37.3			+	3 36.9	
$\log$	+	10	06 41.5		+	10 24 17.6			+	12 45 04.8	
$\log$	+	11	21 37		+	11 21 37			+	11 21 37	
$\log$	-	1	14 58.5		-	57 14.4			+	1 23 27.8	
$\sin(\lambda - A)$		-	44.96.2			-34.39.7				5008.8	
$\log$			3.65285m			3.53652m				3.69973	
$\log$			0.98400m			0.86767m				1.03088	
$\log$			9.2512			9.2639				9.3547	
$\log$			21365			20234				20805	
$\log$			84411			83407				84886	
$\log$			-9.6382			-7.3737			+	10.7370	
$\log$			+		+	219			+	308	
$\log$			123894			14.6482				327678	
$\log$			124499			145804				32.6968	
$\log$			+605			-678				-710	

pt	pos. L	resid.
1	180.0	-39
2	189.5	-49
3	221.5	+70
4	228.0	+83
5	260.2	-111
6	270.0	-32
7	289.0	-12
8	318.5	+147
9	336.4	-115

2180

Lunar Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$0 - c$
1	19.3340	0.0000	+2	0.0000	4.0598	+ 8
2	19.0000	-0.3340	+2	0.1115	4.0593	+ 3
3	18.0000	-1.3340	+2	1.7791	4.0719	+129
4	17.8284	-1.5056	+1	2.2665	4.0731	+121
5	17.3506	-1.9834	0	3.9339	4.0522	-68
6	17.3192	-2.0148	0	4.0594	4.0594	+ 4
7	17.4290	-1.9050	-1	3.6294	4.0597	+ 7
8	18.0000	-1.3340	-2	1.7801	4.0726	+136
9	18.5274	-0.8066	-2	0.6509	4.0446	-144

Comp $R^2 = 4.0590$

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	19.3293	-2.0147	-2	4.0598
2	17.3573	-1.9867	-2	3.9478
3	17.8299	-1.5141	-1	2.2928
4	18.0000	-1.3440	-1	1.8066
5	19.0000	-0.3440	0	0.1183
6	19.3440	0.0000	0	0.0000
7	20.0000	+0.6560	0	0.4303
8	20.8580	+1.5140	+1	2.2925
9	21.1860	+1.8420	+2	3.3937

App. Center $x = 18.0$ $y = 17.8299$ 20.8580

386879

 $y_0 = 19.3440$ $y - \text{min} = 17.3293$ $R = 20147$ $x - \text{min} = 17.3192$ $x = 19.3339$

Center $\left\{ \begin{array}{l} x_0 = 19.3340 \\ y_0 = 19.3440 \end{array} \right.$

2180

Innovs Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	19.3340	0.0000	+2	0.0000	4.0598	+4
2	19.0000	-0.3340	+2	0.1115	4.0593	+3
3	18.0000	-1.3340	+2	1.7791	4.0719	+12.9
4	17.8284	-1.5056	+1	2.2665	4.0731	+12.1
5	17.3506	-1.9834	0	3.9339	4.0522	-6.6
-6	17.3192	-2.0148	0	4.0594	4.0594	+4
7	17.4290	-1.9050	-1	3.6294	4.0597	+7
8	18.0000	-1.3340	-2	1.7801	4.0726	+13.6
9	18.5274	-0.8066	-2	0.6509	4.0446	-14.4

Comp $R^2 = 4.0590$

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	19.3293	-2.0147	-2	4.0598
2	17.3573	-1.9867	-2	3.9478
3	17.8299	-1.5141	-1	2.2928
4	18.0000	-1.3440	-1	1.8000
5	19.0000	-0.3440	0	0.1183
6	19.3440	0.0000	0	0.0000
7	20.0000	+0.6560	0	0.4303
8	20.8580	+1.5140	+1	2.2925
9	21.1860	+1.8420	+2	3.3937

Appl Center $x = 18.0$ $y = 17.8299$ 20.8580

386879

 $y_0 = 19.3440$ $y - y_0 = 17.3293$ $R^2 = 20.147$ $z - z_0 = 17.3192$ $x = 19.3339$

Center } $x = 19.3340$
 { $y = 19.3440$

Formation of Normal

	ab	an	bn
1	- 0.00	+ 0.0	- 16.1
2	+ 0.66	- 1.0	- 6.0
3	+ 2.01	- 171.5	- 195.0
4	+ 2.02	- 213.0	- 189.0
5	+ 0.67	+ 134.8	+ 23.1
6	- 0.00	- 8.0	+ 6.0
7	- 1.26	- 13.4	+ 4.6
8	- 2.01	- 181.0	+ 205.8
9	- 1.49	+ 116.5	- 265.0
	+ 0.60	- 336.6	- 437.6

2180

Moon's Center

17

Conditional Equation

	a	b	0	c	0-c
1	0.00	-2.01	+8	-0 + 47 = +47	-39
2	-0.33	-1.99	+3	+6 + 46 = +52	-49
3	-1.33	-1.51	+129	+24 + 35 = +59	+70
4	-1.51	-1.34	+141	+27 + 31 = +58	+83
5	-1.98	-0.34	-68	+35 + 8 = +43	-111
6	-2.01	+0.00	+4	+36 - 0 = +36	-32
7	-1.91	+0.66	+7	+34 - 15 = +19	-12
8	-1.33	+1.51	+136	+24 - 35 = -11	+147
9	-0.81	+1.84	-144	+14 - 43 = -29	-115

Average = 73

Normal Equations

$$\begin{aligned}
 +18.21a + 0.60b &= -337 \\
 +0.60a + 18.34b &= -438 \\
 -0.60a - 0.02b &= +11 \\
 +18.32b &= -427
 \end{aligned}$$

$$b = -23.3$$

$$+18.21a = -337 + 14 = -323$$

$$a = -17.7$$

2180

Unknown Center

17

Conditional Equations

	a	b	c	d	e	f	g	h
1	0.00	-2.01	+	8	-	0	+47	+47
2	-0.33	-1.99	+	3	-	6	+46	+52
3	-1.33	-1.51	+	1.29	-	24	+35	+59
4	-1.51	-1.34	+	1.41	+	27	+31	+58
5	-1.98	-0.34	+	6.8	+	35	+	8
6	-2.01	+0.00	+	4	-	36	-	0
7	-1.91	+0.66	+	7	+	34	-15	+19
8	-1.33	+1.51	+	1.36	+	24	-35	-11
9	-0.81	+1.89	-	1.44	-	19	-43	-29

Answer = 73

Normal Equations

$$\begin{aligned}
 +18.21a + 0.60b &= -337 \\
 +0.60a + 18.34b &= -438 \\
 -0.60a - 0.02b &= +11 \\
 +18.32b &= -427
 \end{aligned}$$

$$b = -23.3$$

$$+18.21a = -337 + 14. = -323$$

$$a = -17.7$$

2180 Moon's mean Position (1912.0)

$$\begin{array}{rcl} X_0 = 19.3340^\circ & Y_0 = 19.3440^\circ \\ \frac{1}{2}a = -9^\circ & \frac{1}{2}b = -12^\circ \\ \hline 19.3331^\circ & 19.3428^\circ \end{array}$$

From Plate Constants $X = 19.2528^\circ$ $Y = 19.3577^\circ$

$$z = +1.2528^\circ$$

$$\eta = -2.6423^\circ$$

$$\begin{array}{rcl} \log z = 0.09788^\circ \\ \dots \log s = 9.99192^\circ \\ 8.4^\circ 0724^\circ \end{array}$$

$$\begin{array}{rcl} \log \tan \delta = 9.2920^\circ \\ 0.1958^\circ \\ \eta_1 = 6.5412^\circ \end{array}$$

$$(\alpha - A) = 1.59872^\circ$$

$$\eta_2 = +3^\circ$$

$$\alpha - A = +39.69$$

$$\eta_0 = -2.6426^\circ$$

$$A = 1^\circ 37' 04.5^\circ$$

$$\begin{array}{rcl} \log \eta_0 = 0.42203^\circ \\ 7.33115^\circ \end{array}$$

$$\alpha_0 = 1^\circ 37' 43.69$$

$$(\alpha - D) = 3.09088^\circ$$

$$\text{Red} = +3.56^\circ$$

$$s - D = -20.32.8^\circ$$

$$\alpha' = 1^\circ 37' 47.25^\circ$$

$$D = +11^\circ 21' 37^\circ$$

$$s_0 = +11^\circ 01' 04.2^\circ$$

$$\text{Red} = +24.7^\circ$$

$$s' = +11^\circ 01' 28.9^\circ$$

2180 Woonsocket Position (1912.0)

18

$$\begin{array}{r}
 X_0 = 193340 \\
 \text{wa} = \quad - 9 \\
 \hline
 193331
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 193440 \\
 \text{wa} = \quad - 12 \\
 \hline
 193428
 \end{array}$$

From Plate C. Trans X = 192528 Y = 193577

$$z = +1.2538$$

$$\eta = -2.6423$$

$$\begin{array}{l}
 \log z = 0.09788 \\
 \text{wa} = 9.99192 \\
 8.50724
 \end{array}$$

$$\begin{array}{l}
 \log \tan \delta = 9.2920 \\
 0.1963 \\
 \eta = -6.5417
 \end{array}$$

$$(x-A) = 1.59872$$

$$\eta = +3$$

$$x-A = 39.72$$

$$\eta = -2.6426$$

$$A = 1^{\circ} 37' 04''$$

$$\begin{array}{l}
 \log \gamma_0 = 0.42203 \\
 7.33115
 \end{array}$$

$$x_0 = 1^{\circ} 37' 43.72''$$

$$(d-1) = 3.09.088$$

$$\text{Red} = 3.56$$

$$S-D = -20.328$$

$$a = 1^{\circ} 37' 47.24''$$

$$D = +11.21.37$$

$$S_0 = +11.01.04.2$$

$$\text{Red} = 24.7$$

$$S' = +11.01.28.9$$

2180

Red ad l. ahh.

19

$$\begin{aligned}
 H + \alpha &= 2 \quad 31 = 52^\circ 45' \\
 H &= 1 \quad 54 \\
 \alpha &= 1 \quad 37 \\
 G &= 22 \quad 06 \\
 G + \alpha &= 23 \quad 43 = 355^\circ 45'
 \end{aligned}$$

$$\begin{aligned}
 \cos(G + \alpha) & 9.9988 \\
 q & 1.2641 \\
 \sin & 8.8699 m \\
 \tan S & 9.3091 \\
 \frac{1}{\tan} & = 8.8239
 \end{aligned}$$

$$\begin{aligned}
 \log(g') & 1.2629 \\
 \log(g) & 8.2670 m
 \end{aligned}$$

$$\begin{aligned}
 f & + 2.49 \\
 & - 0.02 \\
 g & + 1.09 \\
 \hline
 & + 3.56
 \end{aligned}$$

$$S' = + 11^\circ 31'$$

$$\begin{aligned}
 \log \cos S & 9.9912 \\
 & 0.6178 \\
 \hline
 (L) & 0.6090
 \end{aligned}$$

$$\begin{aligned}
 \sin S & 9.2813 \\
 \cos(H + \alpha) & 9.7820 \\
 h & 1.3020 \\
 \sin & 9.9009 \\
 \sec S & 0.0088 \\
 \frac{1}{\tan} & = 8.8239
 \end{aligned}$$

$$\begin{aligned}
 \log(h') & 0.3653 \\
 \log(h) & 0.0356
 \end{aligned}$$

$$\begin{aligned}
 g' & + 1.832 \\
 h' & + 2.32 \\
 i & + 4.06 \\
 \hline
 & + 24.70
 \end{aligned}$$

2180

Red ad. l. ahh

19

$$S' = +11^{\circ} 31'$$

$$H + \alpha = 2 \quad 31 = 52^{\circ} 45'$$

$$H = 1 \quad 54$$

$$\alpha = 1 \quad 37$$

$$G = 22 \quad 06$$

$$H + \alpha = 23 \quad 43 = 355^{\circ} 45'$$

$$\cos(G + \alpha) \quad 99988$$

$$q \quad 1.2641$$

$$\sin \quad 8.8699m$$

$$\tan S \quad 9.3091$$

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

$$\log(g') \quad 1.2629$$

$$(g) \quad 8.2670m$$

$$f \quad +2.49$$

$$-0.02$$

$$g \quad +1.09$$

$$+3.56$$

$$\log \cos S \quad 99912$$

$$\frac{1}{\cos} \quad 06178$$

$$(c) \quad 06090$$

$$\sin S \quad 9.2813$$

$$\cos(H + \alpha) \quad 97820$$

$$h \quad 1.3020$$

$$\sin \quad 9.9009$$

$$\sec S \quad 0.0088$$

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

$$\log(h') \quad 0.3653$$

$$(h) \quad 00356$$

$$g' \quad +18.32$$

$$h' \quad +2.32$$

$$\frac{1}{h'} \quad +4.06$$

$$+24.90$$

Lunar Parallax

$$\begin{array}{rcl}
 2180 & & \\
 \alpha' = & 1^{\circ} & 37' 47.25'' \\
 \delta = & 0 & 17' 11.2'' \\
 \theta - \alpha' = & -1 & 20' 36'' \\
 & & -20' 09' 00'' \\
 & & -7' 7' 22'' \\
 & & -20' 01' 40''
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 000500 \\
 0.02709 \\
 \hline
 9984.36
 \end{array}$$

$$f = 43 \quad 58 \quad 07''$$

$$11 \quad 01 \quad 29$$

$$32 \quad 56 \quad 38''$$

$$\begin{array}{r}
 9.82640 \\
 8.21696 \\
 97354 \\
 015848 \\
 \hline
 7.93729
 \end{array}$$

$$S - S' = +29 \quad 45.3''$$

$$\delta = +11 \quad 31 \quad 14.2''$$

$$\text{Ann Eph } S = +11 \quad 31 \quad 09.8''$$

$$O - C \quad +4.4''$$

$$S' = +11^{\circ} \quad 01' \quad 28.9''$$

$$\pi = 56' \quad 39.4''$$

$$\begin{array}{r}
 9.86913 \\
 82169.6 \\
 9.53716 \\
 0.00883 \\
 \hline
 763208
 \end{array}$$

$$\alpha - \alpha' = -14' \quad 44.10''$$

$$= -58.94''$$

$$\alpha = 1 \quad 36 \quad 48.31''$$

$$\alpha = 1 \quad 36 \quad 47.76''$$

$$+0.55''$$

Lunar Parallax

$$\begin{array}{r}
 21.80 \\
 \alpha' = 1 \quad 37 \quad 47.28 \\
 \delta = 0 \quad 17 \quad 11.2 \\
 G - \alpha' = -1 \quad 20 \quad 36 \\
 \quad \quad -20 \quad 09 \\
 \quad \quad -7 \quad 22 \quad 22 \\
 \quad \quad -20 \quad 08 \quad 40
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 600000 \\
 002709 \\
 \hline
 998436
 \end{array}$$

$$f = 43 \quad 58 \quad 07$$

$$11 \quad 01 \quad 29$$

$$32 \quad 56 \quad 38$$

$$\begin{array}{r}
 982690 \\
 821696 \\
 973545 \\
 015848 \\
 \hline
 793729
 \end{array}$$

$$S - S' = +29 \quad 45.3$$

$$\delta = +11 \quad 31 \quad 14.2$$

$$\text{Ann Eph S} = +11 \quad 31 \quad 09.8$$

$$O - C \quad \quad \quad +4.4$$

$$S = +11^{\circ} \quad 01' \quad 28.9$$

$$m = 56' \quad 39.4$$

$$\begin{array}{r}
 486913 \\
 821696 \\
 953716 \\
 000883 \\
 \hline
 7632082
 \end{array}$$

$$\alpha - \alpha' = -14' \quad 44.10$$

$$= -58.94^s$$

$$\alpha = 1 \quad 36 \quad 48.34$$

$$\alpha = 1 \quad 36 \quad 47.76$$

$$+0.58$$

2

1

54

11.4

2

27

18

3

28

37

2181

Stars - Measures.

1914 January 15.

21

	d	v	d	v
✓	19245	17170	18910	19250
58	1046068	1593942	1710209	1106070
118	7971	39	00	69
	40	65	09	54
	<u>11.8772</u>	<u>.8771</u>	<u>58194</u>	<u>.8187</u>
2	1217070	11670	18658	18470
278	77	1116963	1690813	1022010
139	11656	4860	10	0514
			40	86
	<u>13.9484</u>	<u>.9490</u>	<u>27.8256</u>	<u>.8271</u>
3	13710	1109904	16390	16240
286	1308087	15939902	1324548	9370
321	8687	10470	45	7370
			86	38
	<u>32.0626</u>	<u>.0630</u>	<u>28.6857</u>	<u>.6868</u>

Grade 4 or 3.

2181

Stars - Measures.

1914 January 15.

21

	d	v
✓	19245	17170
58	1046068	1593942
11.8	7971	39
	40	65
	<u>11.8772</u>	<u>8771</u>

	d	v
	18910	19250
	1710209	1106070
	0009	69
	09	54
	<u>5.8194</u>	<u>6187</u>

3	1217070	11670
278	77	1116963
139	11656	4860
	<u>13.9484</u>	<u>9490</u>

	18658	18470
	1690813	1022010
	10	0514
	40	86
	<u>27.8256</u>	<u>8271</u>

3	13710	1199904
286	1308087	11939902
321	8687	104702
		65
	<u>32.0626</u>	<u>0630</u>

	16390	16240
	1324548	9370
	4548	7370
	86	38
	<u>28.6857</u>	<u>6868</u>

Grade 4 or 3.

21

14

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moon-measures

2181

d	y	N
19.4	14347	18406
17.3	12720	1005050
min	30	61
in	57	24
†	17.1625	.1633

possibly on terminator

2	14365	19381
19.0	12266	1148790
17.3	52	81
	67	91
	17.2106	.2097

3	19255	19349
19.0	11682	1694018
17.7	80	4018
	55	61
	17.7574	.7577

4	19616
17.7	1756050
19.0	50
	12
	17.7938

13925
600812
00
30
.7922

5	18598
17.5	1275040
19.0	40
min	00
in	00
†	17.4144

16060
1190000
00
68
.4163

6	18580
17.6	1447680
20.0	71
	90
	17.5892

16095
1018090
80
05
.5918

2181

brown - measures

22

	d	y	N	d	N
1/4	14347		18406		
174	12720	22	10050	50	
173	30		61		
min	57		24		
1	17.1625		1633		

possibly on luminator.

2	14365		19381		
190	12266	60	11487	90	
173	52		81		
	67		91		
	17.2106		2097		

3	19255		19349		
177	11682	80	16940	18	
	80		4018		
	55		61		
	17.7574		7577		

4			19616		
177			17560	50	
180			50		
			12		
			17.7938		

13925		
6008	12	
00		
30		
7922		

5			18598		
175			12750	40	
191			40		
			00		
			17.9144		

16060		
11900	00	
00		
68		
4163		

6			18580		
176			14476	80	
200			71		
			90		
			17.5892		

16095		
10180	90	
80		
05		
5918		

2181

Moon. measures.

23

	d	4	N
7	15956	15070	
18.0	997070	1105057	
20.6	70	6557	
	60	80	
	<u>20.5988</u>	<u>15983</u>	
8/	scratch		
18.4	16655	15525	
20.9	7539	14650	
	3132	4441	
	60	31	
	<u>20.9126</u>	<u>9189</u>	

d	2L	N
18480	17325	
1254140	1327063	
48	62	
79	41	
<u>184064</u>	<u>4066</u>	

2181

Moon - measures

23

	d	4	N
2	15956	15070	
18.0	997070	1105057	
W.6	70	6557	
	60	80	
	<u>20.5988</u>	<u>15983</u>	

8/ scratch

84	16655	15525	18480	17325
209	7539	14650	1254140	1327063
	3132	4441	48	6263
	60	31	79	41
	<u>20.9126</u>	<u>9119</u>	<u>184064</u>	<u>4066</u>

2
exp
C
H
G
S
J

w
w
T

2181

Times etc.

24

eph. to stars 1912 Nov. 21	0 ^h	25 ^m	- 0 ^h	37 ^m
... Moon	0	31	0 22 ^m	- 0 31 0 24 ^m
close fast		0	0 32 ^m	
H. Sid T.	0	30	59.1 ^m	$\theta - \alpha = -1^{\circ} 06'$
Phong	4	44	31.05 ^m	
Q Sid T.	5	15	30.15 ^m	
Sid T. to Moon	16	00	28.22 ^m	
Intervals	13	15	01.93 ^m	
Reduction		2	10.25 ^m	
G. hr. T.	13	12	51.68 ^m	

From Kant. Alm.	R. 4.	Alm.	
moon 13 ^m	1 ^h 36 ^m	49.54 ^m	+ 11 ^h 31 ^m 22.7 ^m
Motion in 1 ^m = 1.9850			14.378 ^m
" " 12.8613 ^m		+ 25.53 ^m	+ 3 04.9 ^m
Tabular place.	1 37	15.07 ^m	+ 11 34 27.6 ^m

Moon's age 13 days

" parallax

" semidiam

R

Augmentation

Irradiation (a)

R

R

(1+a)/R

R²

934 = 13.0^m
 928 = 12.8^m

a = +1.2

56' 39.8^m
 15 28.0^m
 928.0^m
 + 12.8^m
 - 0.8^m
 940.0^m
 2015.0^m
 2015.2^m
 4.0610^m

2181

Times etc.

24

Sept. 15 Jan 1912 Nov. 21 0^h 25^m - 0^h 37^m
 Moon 0 31 0 22 - 0 31 0 24
 close part 0 0 32

H. J. d. T. 0 30 59.1 6-X - 1^h 06^m
 Whong 4 44 31.05
 B. L. d. T. 5 15 30.15
 Sid. T. in Moon 1.6 00 28.22
 Antares 13 15 01.93
 Radiation 2 10.25
 G. M. T. 13 12 51.68

From Hunt. Alman. R. 4 Aloud
 Moon 13^h 1 36 49.54 + 11^h 31 22.7
 Moon in 1^m 19850 14378
 12.8613 - 25.53 + 3 04.9
 Tabular place 1 37 15.07 + 11 34 27.6

Moon's age 13 days

parallax

sundian

R

Augmentation

Irradiation (4)

R

R

(1+a)R

R²

934.130

922.128

a = +1.2

56' 39.8

15 28.0

928.0

21.78

- 0.8

940.0

2015.0

2015.2

4.0610

2
3
4
5
6

Plate Constants

	1	2	3
x	5.8190	278264	28.6862
y	62913	282776	289766
$x-3$	-4723	-4512	-2904

y	11.8772	13.9487	32.0628
y	12.3894	14.6482	32.7678
$y-y$	-5122	-6995	-7050

$x-3$	-88.74	-1.2x	+5783
-4723	-1054	-5777	-7 = -5784 = -1
-4512	-1237	-5749	-33 = -5782 = +1
-2904	-2844	-5748	-34 = -5782 = +1
19.4299	-1701	-23	= 19.8358

$y-y$	+85.2x	-y	+4638
-5122	+496	-4626	-12 = -4638 = 0
-6995	+2371	-4624	-14 = -4638 = 0
-7050	+2444	-4606	-32 = -4638 = 0
19.1777	+1655	-19	= 19.8051

Tables. $a = +0.4$ $e = -1.1$ $a - e = +1.5$ $b + a = +0.9$
 (cc) $a = +1.2$ $e = +1.0$ $a - e = +0.2$ $b + a = +3.5$

Plate Constants

	1	2	3
2	5.8190	27.8264	28.6862
3	6.2913	28.2776	28.9766
$\lambda - 3$	-4.723	-4.512	-2.904

4	11.8772	13.9447	32.0628
5	12.3894	14.6442	32.7678
$\lambda - 4$	-5.122	-6.995	-7.050

$\lambda - 3$	-88.74	-1.22	+5.783
-4.723	-10.54	-5.777	-7 = -5.784
-4.512	-12.37	-5.749	-33 = -5.782
-2.904	-28.44	-5.748	-34 = -5.782
19.4299	-1.701	-2.3	19.8568

$\lambda - 4$	+85.22	-4	+4.638
-5.122	+4.96	-4.626	-12 = -4.638
-6.995	+2.371	-4.624	-14 = -4.638
-7.050	+2.444	-4.606	-32 = -4.638
19.1777	+1.655	-1.9	19.8051

Tables: $a = +0.4$ $a = -1.1$ $a = -0.2$ $b + a = +0.9$
 (also) $a = +1.2$ $a = +1.0$ $a - e = +0.2$ $b + a = +3.5$

2181

Moon's Center.

26

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$u - c$
1	19.4300	0.0000	+2	0.0000	4.0614	+4
2	19.0000	-0.4300	+2	0.1847	4.0577	-33
3	18.0000	-1.4300	+1	2.0446	4.0624	+14
4	17.7930	-1.6370	+1	2.6795	4.0674	+64
-5	17.4154	-2.0146	0	4.0586	4.0586	-24
6	17.5905	-1.8395	-6	3.3841	4.0600	-10
7	18.0000	-1.4300	-1	2.0452	4.0636	+26
8	18.4065	-1.0235	-2	1.0480	4.0562	-48

Comp $R^2 = 4.0610$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
-1	17.1629	-2.0151	-2	4.0614
2	17.2102	-1.9678	-2	3.8730
3	17.7576	-1.4204	-1	2.0178
4	18.0000	-1.1780	-1	1.3879
5	19.1780	0.0000	0	0.0000
6	20.0000	+0.8220	+1	0.6759
7	20.5986	+1.4206	+1	2.0184
8	20.9122	+1.7342	+2	3.0082

Approx Center:

$$z = 18 \quad y = 17.7576$$

$$20.5986$$

$$38.3562$$

$$Y_0 = 19.1781$$

$$y - \min = 17.1629$$

$$R = 2.0152$$

$$z - \min = 17.4154$$

$$X = 19.4306$$

$$\text{Center } \begin{cases} X_0 = 19.4300 \\ Y_0 = 19.1780 \end{cases}$$

2181

Innovative Center

26

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$0 - c$
1	194300	0.0000	+2	0.0000	4.0614	+4
2	190000	-0.4300	+2	0.1847	4.0577	-33
3	180000	-1.4300	+1	2.0446	4.0624	+14
4	177930	-1.6370	+1	2.6795	4.0674	+64
5	174154	-2.0146	0	4.0586	4.0586	-24
6	175905	-1.8395	-1	3.3841	4.0600	-10
7	180000	-1.4300	-1	2.0452	4.0636	+26
8	184065	-1.0235	-2	1.0480	4.0562	-48

Comp R: 40610

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
-1	171629	-2.0151	-2	4.0614
2	172102	-1.9678	-2	3.8730
3	177576	-1.4204	-1	2.0178
4	180000	-1.1780	-1	1.3879
5	191780	0.0000	0	0.0000
6	200000	+0.8220	+1	0.6759
7	205986	+1.4206	+1	2.0184
8	209122	+1.7342	+2	3.0082

Approx Center

$$z = 18 \quad y = 17.7576$$

$$20.5986$$

$$38.3562$$

$$Y_0 = 19.1781$$

$$y = 17.1629$$

$$R = 20.152$$

$$z = 17.4154$$

$$X = 19.4306$$

$$\text{Center } \begin{cases} X_0 = 19.4300 \\ Y_0 = 19.1780 \end{cases}$$

Formation of Humus

	ab	ac	bc
1	- 0.00	+ 0.0	- 8.1
2	+ 0.85	+ 14.3	+ 65.0
3	+ 2.03	- 20.0	- 19.9
4	+ 1.94	- 105.0	- 75.5
5	- 0.00	+ 48.3	- 0.0
6	- 1.51	+ 18.4	- 8.2
7	- 2.03	- 37.2	+ 36.9
8	- 1.77	+ 49.0	- 83.0
	- 0.49	- 32.2	- 92.8

2181

Moon's Center

27

Conditional Equations

	a	b	c		C	0 - C
1	0.00	-2.02	=	+4	0 + 11 = +11	-7
2	-0.43	-1.97	=	-33	+1 + 11 = +12	-45
3	-1.43	-1.42	=	+14	+3 + 8 = +11	+3
4	-1.64	-1.18	=	+64	+4 + 6 = +10	+54
5	-2.01	+0.00	=	-24	+5 - 0 = +5	-29
6	-1.84	+0.82	=	-10	+4 - 5 = -1	-9
7	-1.43	+1.42	=	+26	+3 - 8 = -5	+29
8	-1.02	+1.73	=	-48	+2 - 10 = -8	-40

Average = 27

Normal Equations

$$+15.44 - 0.49 = -32$$

$$-0.49 + 17.04 = -93$$

$$+0.49 - 0.01 = -1$$

$$+17.03 = -94$$

$$b = -5.5$$

$$+15.44 = -32 - 3 = -35$$

$$a = -2.3$$

$$\text{Arc measured} = 150^\circ \quad \text{Arc angle } (b-c) = -5.5$$

$$\frac{rc}{n} = .15$$

$$- \frac{5.5}{.15} = -0.37 \quad \Delta n = -0.4$$

2181

Moon's Center

27

Conditional Equations

	a	b	c		C	0 - C
1	0.00	-2.02	=	+4	0 + 11 = +11	-7
2	-0.43	-1.97	=	-33	+1 + 11 = +12	-45
3	-1.43	-1.42	=	+14	+3 + 8 = +11	+3
4	-1.64	-1.18	=	+64	+4 + 6 = +10	+54
5	-2.01	+0.00	=	-24	+5 - 0 = +5	-29
6	-1.84	+0.82	=	-10	+4 - 5 = -1	-9
7	-1.43	+1.42	=	+26	+3 - 8 = -5	+29
8	-1.02	+1.73	=	-48	+2 - 10 = -8	-40

Average: 27

Normal Equations

$$+15.44 - 0.49 = -32$$

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$$+17.03 = -94$$

$$b = -5.5$$

$$+15.44 = -32 - 3 = -35$$

$$a = -2.3$$

2181 Moon's Mean Position (1912.0)

28

$$\begin{array}{r} X_0 = 194300 \checkmark \quad Y_0 = 191780 \checkmark \\ \text{ha} = \underline{-1} \checkmark \quad \text{lb} = \underline{-3} \checkmark \\ 194299 \checkmark \quad 191777 \checkmark \end{array}$$

from Plate Constants $X = 19.8358 \checkmark \quad Y = 19.8051 \checkmark$

$$\bar{z} = +1.8358 \checkmark$$

$$q = -2.1949 \checkmark$$

$$\begin{array}{r} \log \bar{z} = 0.26382 \checkmark \\ \quad \quad 9.99183 \checkmark \\ \quad \quad 8.50724 \checkmark \end{array}$$

$$\begin{array}{r} \log \tan S = 9.3020 \quad 9.2913 \\ \quad \quad \quad 0.5276 \\ \quad \quad \quad \eta_1 = 6.8929 \checkmark \end{array}$$

$$(\alpha - A) = 1.76475 \checkmark$$

$$\eta_1 = +7$$

$$\alpha - A = +58.18 \checkmark$$

$$\eta_0 = -2.1956$$

$$A = 1.3704 \checkmark$$

$$\begin{array}{r} \log \eta_0 = 0.34155 \checkmark \\ \quad \quad \quad 7.33115 \checkmark \end{array}$$

$$\alpha_0 = 1.380218 \checkmark$$

$$(\delta - D) = 3.01040 \checkmark$$

$$\text{Red} = +3.56 \checkmark$$

$$\delta - D = -17.042 \checkmark$$

$$\alpha' = 1.380574 \checkmark$$

$$D = +11.2137 \checkmark$$

$$\delta_0 = +11.04328 \checkmark$$

$$\text{Red} = +2.47 \checkmark$$

$$\delta' = +11.04575 \checkmark$$

2181 Moon's Mean Position (1912.0).

28

$$\begin{array}{r}
 X = 194300 \quad Y = 191780 \\
 \hline
 \text{corr.} \quad -1 \quad \quad -3 \\
 \hline
 194299 \quad 191777
 \end{array}$$

from Plate Constant $X = 19.8358 \quad Y = 198051$

$$z = +1.8358$$

$$\eta = -2.1949$$

$$\begin{array}{r}
 \log z = 0.26382 \\
 999183 \\
 850729
 \end{array}$$

$$\begin{array}{r}
 \log \tan S = 9.3020 \\
 05276 \\
 \eta_1 = 68830
 \end{array}$$

$$(x-A) = 1.76475$$

$$\eta_2 = +8$$

$$x-A = +5818$$

$$\eta_0 = -2.1956$$

$$A = 13704$$

$$\begin{array}{r}
 \log \eta_0 = 0.34157 \\
 733115
 \end{array}$$

$$x_0 = 1380218$$

$$(d-D) = 3.01042$$

$$\text{Red.} = +356$$

$$S-D = -17043$$

$$x' = 1380574$$

$$D = +112137$$

$$S_0 = +1104327$$

$$\text{Red.} = +247$$

$$S = +1104574$$

2181 Red. ad. l. app.

29

$$H + \alpha \quad 3^h \quad 32^m = 53^\circ$$

$$H \quad 1 \quad 54$$

$$K \quad 1 \quad 38$$

$$G \quad 22 \quad 06$$

$$G + K \quad 23 \quad 44 = 356^\circ$$

$$\cos(G + \alpha) \quad 9.9989$$

$$q \quad 1.2641$$

$$\sin \quad 8.8436m$$

$$\tan S \quad 9.2920$$

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

$$\log(g') \quad 1.2630$$

$$\log(g) \quad 82236m$$

$$b \quad +2.49$$

$$c \quad -0.02$$

$$h \quad +1.09$$

$$+3.56$$

$$S \quad +11 \quad 05$$

$$\cos S \quad 9.9918$$

$$L \quad 0.6178$$

$$(L) \quad 0.6096$$

$$\sin S \quad 9.2835$$

$$\cos(H + \alpha) \quad 9.7795$$

$$h \quad 1.3020$$

$$\sin \quad 9.9024$$

$$\sec S \quad 0.0082$$

$$\frac{1}{\sec} \quad 8.8239$$

$$\log(h') \quad 0.3650$$

$$\log(h) \quad 0.0365$$

$$g' \quad +18.32$$

$$h' \quad +232$$

$$L \quad +4.07$$

$$+24.71$$

2235 Red ad e. app.

29

$$H+A \quad 3 \quad 32 = 53^\circ$$

$$H \quad 1 \quad 54$$

$$X \quad 1 \quad 38$$

$$G \quad 22 \quad 06$$

$$G+X \quad 23 \quad 44 = 356^\circ$$

$$\cos(G+A) \quad 9.9989$$

$$q \quad 1.2641$$

$$\sin \quad 8.8436$$

$$\tan S \quad 9.2920$$

$$\frac{1}{\sin} \quad 8.8239$$

$$\log(g') \quad 1.2630$$

$$(g') \quad 82236$$

$$f \quad +2.49$$

$$c \quad -0.02$$

$$h \quad +1.09$$

$$+3.56$$

$$S \quad +11 \quad 05$$

$$\cos S \quad 9.9918$$

$$i \quad 0.6178$$

$$(i) \quad 0.6096$$

$$2 \sin S \quad 9.2835$$

$$\cos(H+X) \quad 9.7795$$

$$h \quad 1.8020$$

$$\sin \quad 9.9024$$

$$\sec S \quad 0.0082$$

$$h \quad 8.8239$$

$$\log(h') \quad 0.3650$$

$$(h') \quad 0.0365$$

$$g' \quad +18.32$$

$$h' \quad +2.32$$

$$i \quad +4.07$$

$$+24.71$$

2181

Lunar Parallax.

30

$$\begin{array}{r}
 \alpha' = 1 \quad 38 \quad 05.74' \\
 \delta = 0 \quad 30 \quad 59.1'' \\
 \delta - \alpha = -1 \quad 07 \quad 06.6'' \\
 = -16^\circ \quad 46' \quad 39''
 \end{array}$$

$$\begin{array}{r}
 -6 \quad 11 \\
 -16 \quad 40 \quad 28
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.01866 \\
 \hline
 9.97593
 \end{array}$$

$$\gamma = 43 \quad 24 \quad 48$$

$$\delta = 11 \quad 04 \quad 57$$

$$\gamma - \delta = 32 \quad 19 \quad 51$$

$$\begin{array}{r}
 9.82640 \\
 8.21701 \\
 9.72820 \\
 0.16288 \\
 \hline
 7.93449
 \end{array}$$

$$\delta - \delta' = +29 \quad 33 \quad 9$$

$$\delta = +11 \quad 34 \quad 31.4$$

$$\text{Ann Eph } \delta = +11^\circ \quad 34' \quad 27.6''$$

$$0 - 0 \quad + \quad 3.8$$

$$\delta' = +11 \quad 04 \quad 57.5$$

$$\pi = 56' \quad 39.8''$$

$$\begin{array}{r}
 9.86913 \\
 8.21701 \\
 9.46038 \\
 0.00892 \\
 \hline
 7.55544
 \end{array}$$

$$\alpha - \alpha' = 12' \quad 21.08''$$

$$= -49.40''$$

$$\alpha = 1 \quad 37 \quad 16.34$$

$$\alpha = 1^\circ \quad 37' \quad 15.07''$$

$$+1.27$$

2181

Lunar Parallax.

30

$$x' = 1 \quad 38 \quad 05.74$$

$$G = 0 \quad 30 \quad 59.1$$

$$G - x = -1 \quad 07 \quad 06.6$$

$$-16^{\circ} \quad 46' \quad 39''$$

$$- \quad 6 \quad 11$$

$$-16 \quad 40 \quad 28$$

$$9.95727$$

$$0.00000$$

$$0.01866$$

$$9.97593$$

$$y = 43 \quad 24 \quad 48$$

$$S = 11 \quad 04 \quad 57$$

$$y - S = 32 \quad 19 \quad 51$$

$$9.82640$$

$$8.21701$$

$$9.72820$$

$$0.16288$$

$$7.93449$$

$$S - S' = +29 \quad 33.9$$

$$S = +11 \quad 34 \quad 31.3$$

$$\text{Ann Eph. } S = +11'' \quad 34' \quad 27.6$$

$$O - C \quad + \quad 3.7$$

$$S' = +11 \quad 04 \quad 57.9$$

$$17 = 56 \quad 39.8$$

$$9.86913$$

$$8.21701$$

$$9.46038 \sim$$

$$0.00892$$

$$7.55544 \sim$$

$$x - x' = 12' \quad 21.07$$

$$= -49.40$$

$$x = 1 \quad 37 \quad 15.34$$

$$x = 1^{\circ} \quad 37'' \quad 15.07$$

