

KG

11366

n.955

Vol. LXXVIII



4097

4239



Harvard Lunar Plates
Measures and Reductions
Mary Fowler

Volume LXXVIII

Plate No.	Date	Page
4097	1913 Oct. 21	1
4239	1913 Nov. 6	15

1955 Astrophys. J. 121:101-102

4097

Stars Measured

1914 May 28

1

α	δ	μ	ν
1	1236968	14280	17169
7.8	59	1421015	1566664
29.0-	12320	18	6864
			69
			7.8497
			8501
2	19850	18958	12890
20.9	1618999	1241001	1259090
9.9	89	061	89
	59	60	
	9.3460	13447	20.9700
			9704
3	19713	16585	19290
24.2	1390088	12410	1097680
27.5	90	1009	8080
	16	91	60
	27.5822	5822	24.1681
			1694

Grade 4.

4097	Star measures	1914 May 28	1
$\frac{1}{d}$	$\frac{1}{N}$	$\frac{1}{d}$	$\frac{1}{N}$
1 2 3 6 9 68	14280	17169	18189
78	14210 15-	15666 64	969189
29.0- 12320	18	68	8889
		69	90
<u>289955</u>	<u>9934</u>	<u>7.8497</u>	<u>8501</u>
$\frac{2}{20.9}$	18958	12890	1335049
1618999	1241001	1259090	5049
89	061	8990	13054
59	60		
<u>9.3460</u>	<u>.3447</u>	<u>20.9700</u>	<u>9704</u>
$\frac{3}{242}$	16585	19290	17319
1390088	12410	1097680	1563025-
275	1009	8080	2525-
90	91	60	31
16	5822	24.1681	<u>1694</u>
<u>27.5822</u>			
	Grade 4		

4097 *Johnson's Measures*

d 2

1

2

1 18578
 18.0 115154
 18.7 14
 min 90
 in 18.7072
 8

19868
 1694048
 4048
 70
 7074

2 13093
 19.0 7087
 18.9 12467

9129
 851721
 20

189383

9390

3
 19.1
 19.0

1353139
 31
 12462

11630
 1055967
 5867

19.1072

11069

4
 19.9
 20.0

13177
 12330
 2930

1041080
 8995-
 9555-

19.9153

9161

5-
 20.0
 20.5
 max
 in
 26

1247070
 6970
 12142

9610
 928180
 80

20.0328

10330

6
 20.0
 21.0

11149
 4142
 11125

10650
 1061500
 01

20.0019

0045

4097 *Shubin's Measures*

2

18574
180 1151574
187 14
m 90

187072
8

13093
180 7057
18912467

189383

19868
1694048
40
70

7074

9129
851721
20

9390

3
191
19.0

4
199
20.0

5-
20
20.5
max
m
6

6
200
21.0

1353139
31
12462

19.1072

13177
12330
29 30

19.9113

1247070
69
12142

20.0328

1114942
41
11125

20.0019

11630
1055967
587

1069

1041080
8995-
9555-

9161

9610
928180
80

0330

10650
1061500
01

0045

4097

Moon-Measures

3

a 4

n

a 22

n

$$\begin{array}{r} 7 \\ 19.5 \\ 220 \end{array}$$

16740

15430

1181109

1032944

11

40

45

30

19.50665089

$$\begin{array}{r} 8 \\ 19.0 \\ 224 \end{array}$$

17076

16417

1317975

1036347

80

5040

92

36

22.39043921

4097

Moon-Measures

d

4

~

d 72

~

7

16740

15430

195

1181109

1033944

220

11

40

48

30

19.5066.50898

17076

16417

190

1317975

1036347

224

80

5040

92

36

2239043921

4097 Times etc.
 Exp. to class 1913 Oct 21. $7^h 06^m$ $- 7^h 18^m$
 Moon $7 12 29.0 - 7 12 29.2$
 Clock fast $3 05.8$

H. Sid T $7 09 23.3$ $- 0^h 27.2$
 Khong $4 44 31.0$
 S. Sid T. $11 53 54.3$
 Sid T. in Horn $13 57 18.0$
 Interval $21 56 36.3$
 Red $3 35.6$
 S. in T. $21 53 00.6$

Tromba Antares
 Moon 22^h $7^h 36^m 49.89$ $+ 26^m 14^s 37.2$
 Motion in $1^m = 2.4460$ 6.907
 $- 6.99$ $- 17.10$ $+ 48.3$
 Tabular places $7 36 32.79$ $+ 26 15 25.5$

Moon's age 22 days

Parallax $57 47.08$
 Semidiameter $15 46.3$

$934 = 15.0$
 $946 = 15.4$

R 946.3
 Augmentation $+ 15.4$
 Irradiation (4) $- 0.6$

$a = -499.6$
 $- 24$
 475.6

R 961.1
 R 2.0602
 a R $-980.$
 $(1+a)$ R 1.9622
 R² 3.8502

4097 Times etc.
 Exp. station 1913 Oct 21 7 06 - 7 18
 Moon 7 12 29.0 7 12 29.2
 Clock fast 3 0.58

H. Sea T. 7 09 23.3 - 0 27.2
 Wharf 4 44 31.0
 S. Sea T. 11 53 54.35
 Sea T. in T. 13 57 18.03
 Interval 21 56 36.32
 Recd 3 35.69
 S. M. T. 21 53 00.63

From Kant Allen
 Moon 22 7 36 49.89 + 26 14 37.2
 Moon in T. 24460 6907
 - 6.99 - 17.10 7 48.3
 Tabular place 7 26 32.79 + 26 15 25.5

Moon in Sea 22 days

parallelax 57 47.08
 semidiam 15 46.3
 R 94.63

Augmentation - 1.54
 Irradiation (4) - 0.6
 R 96.11
 R 2.0602
 a R - 980
 (1-a) R 19622
 R 38502

18
-1
-7
-5
x

4097

Plato constants.

5

	1	2	3
x	7.8499	209702	24.1688
y	8.3734	224877	25.5319
x-y	-5235	-15175	-13631

y	28.9944	93454	27.5822
y	29.0883	86797	27.8850
y-y	-939	+6657	-3028

$x - 3$	$+ 1004$	$- 17234$	$- 0.4x$	$+ 6308$	
$- 5235 + 3925$	$= - 1310$	$- 4996$	$- 6306$	$- 3 = - 6309$	$= - 1$
$- 15175 + 10485$	$= - 4690$	$- 1610$	$- 6300$	$- 8 = - 6308$	$= 0$
$- 13631 + 12084$	$= - 1547$	$- 4752$	$- 6299$	$- 9 = - 6308$	$= 0$
$18.0697 + 9035$	$= 3561$		$- 7$		$= 19.2482$

$y - y + 1224$	$+171.3x$	$+4$	$+14931$
$-939 + 14497 = +13558$	$+1345 = +14903$	$+29 = +14932$	$= +1$
$+6657 + 4673 = +11330$	$+3592 = +14922$	$+9 = +14931$	$= 0$
$-3028 + 13791 = +10763$	$+4140 = +14903$	$+28 = +14931$	$= 0$
$20.6659 + 10333$	$+3095$	$+21$	$= 20.5177$

Tables $a = -1.0$ $e = -1.0$ $a-e = 0.0$ $b+a = 0.0$
 Obs $a = +499.6$ $e = -501.0$ $a-e = +1.4$ $b+a = +1.0$
 $0-c$ -498.6 -500.0 $+1.0$

4097

Plate Constants

5

	1	2	3
x	7.2499	2097.02	24.1688
y	8.3734	3248.77	25.5319
z	-5.235	-1517.5	-1363.1

4	2899.44	9345.4	27.5822
5	29.0883	8679.7	27.8850
6-7	-939	7.6657	-3028

2-3	+0.04	-172.37	-0.4x	+620.8			
-5235	+3925	-1310	-4946	-6306	-3	-6309	-1
-15175	-10485	-4690	-1610	-6300	8	-6308	0
-13631	+12084	-1547	-4712	-6299	9	-6308	0
180697	+9035	-3561	-7				2192472

4-7	+12.24	+171.22	154	+149.31			
-939	-14447	+13558	+13415	+14903	+29	+14932	+1
+6657	4673	+11330	+3572	+14922	9	+14931	0
-9028	+13791	+10763	+4140	+14903	128	+14931	0
206659	+10333	+3095	+21				2205177

Tables a = -4.0 b = -4.0 c = 0.0 d + a = 0.0
 Obs. a = 4996 b = 5010 c = 2 d + a = +1.0

1
2
3
4
5
6
7
8

-1
2
3
4
5
6
7
8

4097

Gaussian Center

6

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	O - C
1	18.0000	-0.0740	0.0055	3.8420	-82
2	19.0000	+0.9260	0.8575	3.8414	-88
3	19.1070	+1.0330	1.0671	3.8427	-75
4	19.9157	+1.8417	3.3919	3.8355	-147
5	20.0329	+1.9589	3.8373	3.8373	-129
6	20.0032	+1.9292	3.7218	3.8334	-168
7	19.5078	+1.4338	2.0558	3.8354	-148
8	19.0000	+0.9260	0.8575	3.8338	-164

$$R^2 = 3.8502$$

	y	$y - y_0$	$(y - y_0)^2$	
1	18.7073	-1.9587	3.8365	1.77° 180
2	18.9386	-1.7274	2.9839	1.52°
3	19.0000	-1.6660	2.7756	1.47° 178
4	20.0000	-0.6660	0.4436	1.10°
5	20.6660	0.0000	0.0000	90°
6	21.0000	+0.3340	0.1116	80°
7	22.0000	+1.3340	1.7796	47°
8	22.3912	+1.7252	2.9763	28°

Range 149

$$x = 19.0 \quad y = 18.9386$$

$$22.3912$$

$$41.3298$$

$$y = 20.6649$$

$$y_{\text{min}} = 18.7073$$

$$R = 1.9576$$

$$y_{\text{max}} = 20.0329$$

$$x = 18.0753$$

Center

$$x_0 = 18.0740$$

$$y_0 = 20.6660$$

4097

Mean Center

6

	x	$x - x_0$	$(x - x_0)^2$	$(y - y_0)^2 - (x - x_0)^2$	$0 - 6$
1	18.0000	-0.0740	0.0055	3.8420	-82
2	19.0000	+0.9260	0.8575	3.8414	-82
3	19.1070	+1.0330	1.0671	3.8427	-75
4	19.9157	+1.8417	3.3919	3.8355	-147
5	20.6329	+1.9589	3.8373	3.8373	-129
6	20.0032	+1.9292	3.7218	3.8334	-164
7	19.5078	+1.4338	2.0558	3.8354	-148
8	19.0000	+0.9260	0.8575	3.8335	-164

$$R^2 = 3.8502$$

	y	$y - y_0$	$(y - y_0)^2$	
1	18.7073	-1.9587	3.8365	177°
2	18.9386	-1.7274	2.9839	152°
3	19.0000	-1.6660	2.7756	147
4	20.0000	-0.6660	0.4436	110
5	20.6660	0.0000	0.0000	90
6	21.0000	+0.3340	0.1116	80
7	22.0000	+1.3340	1.7796	47
8	22.3912	+1.7252	2.9763	28
				Range 149

$$\begin{aligned}
 x &= 19.0 & y &= 18.9386 \\
 & & & \underline{+ 2.3912} \\
 & & & 41.3298 \\
 & & y &= 20.6649 \\
 y - x &= 18.7073 \\
 R &= 19.576 \\
 y - R &= 20.6329 \\
 x &= 18.0753
 \end{aligned}$$

$$\begin{aligned}
 \text{Center} \left\{ \begin{aligned} X &= 18.0740 \\ Y &= 20.6660 \end{aligned} \right.
 \end{aligned}$$

Formation of Normals

	ab	an	bn
1	+ 0.14	+ 5.8	+ 160.8
2	- 1.61	- 8.1.9	+ 152.2
3	- 1.72	- 77.2	+ 125.2
4	- 1.23	- 270.5	+ 98.5
5	+ 0.00	- 253.0	- 0.0
6	+ 0.64	- 324.0	- 55.5
7	+ 1.90	- 211.5	- 197.0
8	+ 1.61	- 152.3	- 283.5
	- 0.27	- 1364.6	+ 0.7

	a	b	c	new 0-c
a	+ 9	- 1	+ 4 - 13	- 109°
b	- 2	+ 8	+ 3 - 5	- 16°
c	- 16	+ 9	+ 3 - 4	+ 8°
		+ 17	+ 1 + 2	+ 13°
		+ 18	+ 0 + 2	+ 42°
		+ 17	- 1 0	- 1°
		+ 13	- 3 - 6	- 28°
		+ 8	- 3 - 11	- 92°

+097

Moon's Center
Conditional Equations.

7

	o	c	$o-c$
1	$-0.07 - 1.96 = -82$	$+6 + 3 = +9$	-91
2	$+0.93 - 1.73 = -88$	$-80 + 3 = -77$	-11
3	$+1.03 - 1.67 = -75$	$+89 + 2 = -87$	$+12$
4	$+1.84 - 0.67 = -147$	$-159 + 1 = -158$	$+11$
5	$-1.96 + 0.00 = -129$	$-169 - 0 = -169$	$+40$
6	$-1.93 + 0.33 = -168$	$-167 - 0 = -167$	-1
7	$+0.43 + 1.33 = -148$	$-12 - 2 = -126$	-22
8	$+0.93 + 1.73 = -164$	$-80 - 3 = -83$	-81
Σ			$+63 - 206$
			Average -34

Normal Equations

$$\begin{aligned}
 +15.79 - 0.27 &= -1365 & +9.18 \\
 -0.27 + 14.91 &= & +1 - 2.57 \\
 +0.27 - 0.00 &= & 23 + 0.16 \\
 +14.91 &= & -22 - 2.41 & b = -1.5 - 0.16 \\
 +15.79 &= -1365 & a = -86.5 + 0.57
 \end{aligned}$$

Arc Measured = 154° Average $(o-c) = -18$

$$\begin{aligned}
 \frac{pc}{m} &= 0.16 & \frac{-18}{16} &= -1.12 & \Delta z &= -12 \\
 -2 RC &= -0.78 & & & & -1.4 \\
 \Delta B &= +0.12 & \Delta \delta &= +0.1 & \text{Corr.} &= +0.2 \\
 \Delta a &= -0.45 & \Delta \alpha &= -0.02 & \Delta R &= -1.6
 \end{aligned}$$

+097

Moon's Center

Conditional Equations

	0	c	$0-c$
1	$-007 - 196 = -82$	$+6 + 3 = +9$	-91
2	$+093 - 173 = -80$	$-80 - 3 = -77$	-11
3	$+103 - 167 = -75$	$-89 - 2 = -87$	$+12$
4	$+144 - 067 = -147$	$-159 + 1 = -158$	$+11$
5	$-196 + 000 = -196$	$-149 - 0 = -149$	$+40$
6	$-193 - 033 = -168$	$-167 - 0 = -167$	-1
7	$+143 + 133 = -148$	$-121 - 2 = -126$	-22
8	$+093 + 173 = -164$	$-80 - 3 = -83$	-81
			$+63 - 206$
			$average = 37$

Normal Equations

$$+15.79 - 0.27 = -1365$$

$$-0.27 + 14.91 = +1$$

$$-0.27 - 0.00 = -23$$

$$+14.91 = -22$$

$$+15.79 = -1365$$

$$b = -1.5$$

$$a = -865$$

Arc Measurements: 154° Average $0-c = -18$

$$\frac{pc}{2} = 0.16$$

$$\frac{-18}{10} = -1.12$$

$$\Delta = -12$$

4097 Moon's Mean Position (1913.0)

$$\begin{array}{r} X = 18.0740'' \\ 20'' - 43 \\ \hline 18.0697'' \end{array}$$

$$\begin{array}{r} Y_0 = 206660'' \\ 16'' - 1 \\ \hline 206659'' \end{array}$$

From Plate Constants $X = 19.2472$ $Y = 20.5177$

$$z = +1.2472''$$

$$z = -1.4823''$$

$$\begin{array}{r} \log z = 0.09594'' \\ \log 5 = 9.95371'' \\ \hline 8.50727'' \\ 1.63499'' \end{array}$$

$$\begin{array}{r} \log \tan S = 9.6879'' \\ 0.1919'' \\ \hline 7.0534'' \\ 6.9332'' \end{array}$$

$$\alpha - A = + 43.15''$$

$$\eta_1 = +9''$$

$$A = 7 \quad 36 \quad 10 \quad \angle$$

$$\eta_0 = -1.4832''$$

$$\alpha_0 = 7 \quad 36 \quad 53.15''$$

$$\begin{array}{r} \log \eta_0 = 0.17120'' \\ 7.33115'' \end{array}$$

$$\text{Red. aab. app.} \quad + 334''$$

$$S - D = 284005''$$

$$\alpha' = 7 \quad 36 \quad 56.42''$$

$$S - D = - 11 \quad 31.9''$$

$$D = + 26 \quad 10 \quad 42 \quad \angle$$

$$S_0 = + 25 \quad 59 \quad 10.1''$$

$$\text{Red.} \quad - 0.3$$

$$S' = + 25 \quad 59 \quad 09.8''$$

4097

Crossed Mean Position (1913.0)

$$X = 18.0740''$$

$$Y = 20.6660''$$

$$-43$$

$$-1$$

$$18.0697''$$

$$20.6659''$$

From Plate Constant $X = 19.2482$ $Y = 20.5177$

$$\delta = +12482''$$

$$\gamma = -14823''$$

$$\log \delta = 0.09594''$$

$$-0.55 = 99.5371''$$

$$2.2727''$$

$$1.63499''$$

$$+0.5 = 96.892''$$

$$0.1928''$$

$$70.534''$$

$$6.9392''$$

$$\gamma = +9''$$

$$\delta - \mu = +43.15''$$

$$\gamma = -14832''$$

$$A = 7 \quad 36 \quad 10$$

$$X = 7 \quad 36 \quad 53.15''$$

$$\log \gamma = 0.17120''$$

$$735.115''$$

$$\text{Red. calc. app.} + 334''$$

$$\delta - \mu = 28400.5''$$

$$X = 7 \quad 36 \quad 56.49''$$

$$\delta - \mu = 11 \quad 31.9''$$

$$D = +26 \quad 10 \quad 42''$$

$$D = +25 \quad 59 \quad 10.1''$$

$$\text{Red.} = 0.3$$

$$\delta = +25 \quad 59 \quad 09.8''$$

4097

Reduction to dhh place.

9

$$S = +25^{\circ} 59' 10''$$

$$H + \alpha \quad 11^{\circ} \quad 32.2 = 173^{\circ} 3'$$

$$H \quad 3 \quad 55.3$$

$$\alpha \quad 7 \quad 36.9$$

$$\delta \quad 22 \quad 3.8$$

$$h + \alpha \quad 5 \quad 40.7 = 85^{\circ} 10'$$

$$\cos S \quad 9.9537$$

$$i \quad 0.8526$$

$$(i) \quad 0.8063$$

$$\cos(S + \alpha) \quad 8.9256$$

$$\sin \delta \quad 1.2811$$

$$\cos \delta \quad 9.9985$$

$$\tan S \quad 9.6879$$

$$8.8239$$

$$\sin \delta' \quad 0.2067$$

$$\cos \delta' \quad 9.7914$$

$$\sin S \quad 9.6416$$

$$\cos(H + \alpha) \quad 9.9968$$

$$\sin h \quad 1.2831$$

$$\cos h \quad 9.0828$$

$$\sec \delta \quad 0.0463$$

$$8.8239$$

$$\sin h' \quad 0.9215$$

$$\cos h' \quad 9.2361$$

$$f \quad +2.55$$

$$g \quad +0.62$$

$$m \quad +0.17$$

$$3.34$$

$$g' \quad +1.61$$

$$h' \quad -8.35$$

$$i \quad +6.40$$

$$-0.34$$

+097

Reduction to app. place

9

$$S = +25^{\circ} 59' 10''$$

$$H + X \quad 11 \quad 32.2 = 173^{\circ} 3'$$

$$H \quad 3 \quad 55.3$$

$$\alpha \quad 7 \quad 36.9$$

$$\delta \quad 22 \quad 3.8$$

$$S + X \quad 5 \quad 40.7 = 85^{\circ} 10'$$

$$\cos S$$

$$\alpha$$

$$(i)$$

$$9.91537$$

$$0.85226$$

$$0.80663$$

$$2$$

$$\sin S$$

$$\cos(H + X)$$

$$\alpha$$

$$\sin \alpha$$

$$\cos S$$

$$9.64416$$

$$9.91687$$

$$1.2831$$

$$9.2828$$

$$0.0463$$

$$8.8239$$

$$\cos(S + X) \quad 8.9256$$

$$\sin \quad 1.2811$$

$$\cos \quad 9.9985$$

$$\sin S \quad 9.6479$$

$$8.8239$$

$$\delta' \quad 0.2067$$

$$\delta \quad 9.7914$$

$$\alpha'$$

$$\alpha$$

$$0.9215$$

$$9.2361$$

$$+255$$

$$+0.62$$

$$+0.17$$

$$334$$

$$\delta'$$

$$\delta$$

$$i$$

$$+1.61$$

$$-8.35$$

$$+6.40$$

$$-2.34$$

4097

Lunar Parallax.

$$\begin{array}{r}
 \alpha' = 7^h 36^m 56.49^s \\
 \delta = 7 \quad 09 \quad 23.3^s \\
 \alpha - \alpha' = -27 \quad 33.49^s \\
 = -6 \quad 54 \quad 1.89^s \\
 = 6 \quad 53 \quad 22.3^s \\
 = 2 \quad 52^s \\
 = -6 \quad 50 \quad 30^s
 \end{array}$$

$$\begin{array}{r}
 9.95727^s \\
 0.000000^s \\
 0.000310^s \\
 \hline
 9.96039^s
 \end{array}$$

$$\begin{array}{r}
 \delta = 42 \quad 23 \quad 21.0 \\
 25 \quad 59 \quad 09.8 \\
 16 \quad 24 \quad 17.2
 \end{array}$$

$$\begin{array}{r}
 9.82640^s \\
 8.22552^s \\
 9.45085^s \\
 0.17124^s \\
 \hline
 7.67403^s
 \end{array}$$

$$\delta - \delta' = +16 \quad 13.7^s$$

$$\delta = +26 \quad 15 \quad 23.5^s \alpha \quad 7 \quad 36 \quad 33.62^s$$

$$\text{true Eph. } \delta = +26 \quad 15 \quad 25.5^s \alpha = 7 \quad 36 \quad 32.79^s$$

$$\begin{array}{r}
 \alpha - \alpha' = -2.0^s \\
 \text{Curv.} \quad +0.5^s \\
 \text{2nd ord. ref.} \quad 0.0 \\
 \text{Lun.} \quad +0.1 \\
 \delta = +26 \quad 15 \quad 23.6
 \end{array}$$

$$\alpha - \alpha' = -1.9$$

$$\delta' = +25^{\circ} 59' 09.8''$$

$$\Pi = 57' 47.08''$$

$$\begin{array}{r}
 9.86913^s \\
 8.22552^s \\
 9.07902^s \\
 0.04730^s \\
 \hline
 7.22097^s
 \end{array}$$

$$\begin{array}{r}
 \alpha - \alpha' = -5 \quad 43.08^s \\
 = -22.87^s
 \end{array}$$

$$\begin{array}{r}
 +0.83^s \\
 \text{Curv.} \quad -0.01 \\
 \text{Lun.} \quad -0.02
 \end{array}$$

$$\begin{array}{r}
 \alpha = 7 \quad 36 \quad 33.60 \\
 \alpha - \alpha' = +0.81
 \end{array}$$

4097

Human Parallax.

$$\begin{array}{r}
 \alpha' - 7^h 36^m 56.99^s \\
 \delta - 7 \quad 09 \quad 23.3 \\
 \alpha - 27 \quad 33.42 \\
 - 6 \quad 54 \quad 18.11 \\
 \quad \quad 52 \quad 22.3 \\
 - \quad \quad 2 \quad 52 \\
 - 6 \quad 50 \quad 30
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.00312 \\
 \hline
 9.96039
 \end{array}$$

$$\begin{array}{r}
 \delta - 42 \quad 23 \quad 21.5 \\
 25 \quad 19 \quad 09.8 \\
 16 \quad 24 \quad 11.2
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.22552 \\
 9.45085 \\
 0.17124 \\
 \hline
 7.67401
 \end{array}$$

$$S - \delta = +16 \quad 13.8$$

$$\delta = +26 \quad 15 \quad 23.5 \quad \alpha \quad 7 \quad 36 \quad 33.62$$

$$\text{true Eph. } \delta = +26 \quad 15 \quad 25.5 \quad \alpha \quad 7 \quad 36 \quad 32.79$$

$$\begin{array}{r}
 O-C \quad - \quad 2.9 \\
 \text{Curv.} \quad + \quad 0.5 \\
 \text{2nd ord. rep} \quad 0.0 \\
 \text{Inv.} \quad + \quad 0.1 \\
 \delta \quad +26 \quad 15 \quad 23.6
 \end{array}$$

$$O-C \quad - \quad 1.9$$

$$S = +25^\circ 19' 09''$$

$$\Pi \quad 57' 47.08''$$

$$\begin{array}{r}
 9.86913 \\
 8.22552 \\
 9.07909 \\
 0.04730 \\
 \hline
 7.22099
 \end{array}$$

$$\alpha - \alpha' = -5 \quad 43.88$$

$$-22.47$$

$$7 \quad 36 \quad 33.62$$

$$7 \quad 36 \quad 32.79$$

$$\begin{array}{r}
 \text{Curv.} \quad + \quad 0.83 \\
 - \quad 0.01
 \end{array}$$

$$\text{Inv.} \quad - \quad 0.02$$

$$\alpha = 7 \quad 36 \quad 33.60$$

$$O-C = +0.81$$

1
6
10
22

2
15
9

3
2
3

1913 Oct Nov. 6

4239

Stars - Measures

1914 May 29.

	d	n
1	19886	19620
103	12400	1710909
227	96	10
	98	09
	<u>227483</u>	<u>7492</u>

	d	n
3	17775	20030
151	15200	1260006
9.4	01	00
	55	29
	<u>19.2569</u>	<u>12573</u>

	d	n
3	18955	17805
29.8	12455	14275
336	60	8085
	32	98
	<u>23.6482</u>	<u>6478</u>

or

	d	n
	17980	17852
	13840	12001
	39	03
	50	66
	<u>23.4130</u>	<u>4144</u>

Grade 3

	d	n
	19140	20049
	11098	18072
	00	69
	30	41
	<u>10.1967</u>	<u>1980</u>
	18690	19300
	955246	18414
	58	11
	83	10
	<u>15.0868</u>	<u>6887</u>

	d	n
	18044	18772
	15555	11220
	45	22
	05	80
	<u>29.7532</u>	<u>7554</u>

	d	n
	16395	19220
	9810	15772
	1409	75
	72	30
	<u>29.3431</u>	<u>3447</u>

1
10
22
3
13
9
3
2
2

1913 ~~Nov 6~~

+239

Stars. Measures

1914 May 29.

15

	d	n
1	19886	19620
103	12400	1710909
127	96	10
	78	09
	<u>22.7483</u>	<u>7492</u>

2	17775	20030
151	15200	1260006
99	01	00
	55	29
	<u>19.2569</u>	<u>2573</u>

3	18955	17805
298	12455	14275
236	60	8085
	32	98
	<u>23.6482</u>	<u>6478</u>

or

17980	17852
13840	12001
2935	0307
50	66
<u>23.4130</u>	<u>4144</u>

Grades

	d	n
	19140	20049
	11098	18072
	0000	6961
	30	41
	<u>10.1967</u>	<u>1980</u>
	18690	19300
	955246	18419
	58	11
	83	10
	<u>15.0868</u>	<u>0887</u>

18044	18772
15555	1122029
41	22
05	80
<u>29.7532</u>	<u>7554</u>
16395	19220
9810	1577750
1409	75
7.2	30
<u>29.3431</u>	<u>3497</u>

4239

Moon - measures

$$\begin{array}{r}
 1286161 \\
 180 \quad 61 \\
 168 \quad 11824 \\
 \hline
 8168963
 \end{array}$$

$$\begin{array}{r}
 9569 \\
 852129 \\
 19 \\
 \hline
 8954
 \end{array}$$

$$\begin{array}{r}
 175 \\
 170
 \end{array}$$

$$\begin{array}{r}
 14710 \quad 14805 \\
 85010 \quad 1100900 \\
 04 \quad 20 \\
 11 \quad 08 \\
 \hline
 173794 \quad 3796
 \end{array}$$

$$\begin{array}{r}
 170 \quad 19989 \\
 172 \quad 1809109 \\
 \quad 08 \\
 \quad 85 \\
 \hline
 17.1885
 \end{array}$$

$$\begin{array}{r}
 15167 \\
 703850 \\
 4841 \\
 67 \\
 \hline
 1877
 \end{array}$$

$$\begin{array}{r}
 164 \\
 180
 \end{array}$$

$$\begin{array}{r}
 19841 \\
 1284642 \\
 46 \\
 50 \\
 \hline
 163100
 \end{array}$$

$$\begin{array}{r}
 15926 \\
 12850 \\
 4148 \\
 29 \\
 \hline
 13081
 \end{array}$$

$$\begin{array}{r}
 162 \\
 188
 \end{array}$$

$$\begin{array}{r}
 18810 \\
 1039000 \\
 89 \\
 29 \\
 \hline
 16.1567
 \end{array}$$

$$\begin{array}{r}
 16029 \\
 1444850 \\
 41 \\
 30 \\
 \hline
 1583
 \end{array}$$

$$\begin{array}{r}
 163 \\
 190
 \end{array}$$

$$\begin{array}{r}
 18820 \\
 1060698 \\
 0198 \\
 48 \\
 \hline
 16.1759
 \end{array}$$

$$\begin{array}{r}
 17046 \\
 1529391 \\
 8991 \\
 68 \\
 \hline
 1759
 \end{array}$$

4
1
16
20
17/8
17
20

4239 moon - measures.

a⁴ n2
16.7
20.0

8
17.0 19620
20.3 1690919
20
69
20.2754

17044
980000
87
30
2762

a²
17785
1447169
72
00
166681

N
17150
10459
41
49
6696

4
2
16
2
5
17
20

4239 moon - measures

a⁴ ~2
167
w.d
$$\begin{array}{r} 8 \\ 170 \\ w3 \end{array} \begin{array}{r} 19670 \\ 1690919 \\ 20 \\ 69 \\ \hline 202754 \end{array}$$

$$\begin{array}{r} 17044 \\ 980000 \\ 87 \\ 30 \\ \hline 2762 \end{array}$$

$$\begin{array}{r} a^2 \quad N \\ 17785 \quad 17150 \\ 1947169 \quad 10459 \\ 72 \quad 41 \\ 00 \quad 49 \\ \hline 166681 \quad 6696 \end{array}$$

4239	Times etc					
Exp. to stars	1913 Nov. 6	21 ^h 44 ^m		- 21 ^h 56 ^m		
" " moon		21 50	24.3	- 21 50	24.6	
clock fast		3	15.6			
H. Sid T.		21 47	08.85	$\theta + \alpha =$	- 0 ^h 13 ^m 8	
H. long.		4 44	31.05			
G. Sid T.		26 31	39.9			
Sid T. in hour		15 00	22.92			
Interval		11 31	16.98			
Reduction			1 53.25			
G. M. T.		11 29	23.73			

from hant Alm	R-A	Decl.		
moon 11 ^h	22 ^h 00 ^m	04 ^s 78	- 14° 37'	55"
Motion in α -1.8675			12.550	
" " 29.3955	+ 5490		+ 6	10.0
Tabular place.	22 00	59 68	- 14 31	457

Moon's age 8 days.	
parallax	54' 29" 39
semidiam.	14 5-2.4
R	8924
Augmentation	+ 7.9
Irradiation (31)	- 0.3
R	9000
R	1.9293
ak	- 916
(1+a)R	1.8377
R ²	33771

$$934 = 8.6$$

$$892 = 7.9$$

$$a = 498.6$$

$$+ 24$$

$$474.6$$

4239	Trimmer etc.								
Exp. to stars	1913 Nov. 6	21 ⁿ	44 ⁿ			-21 ⁿ	56 ⁿ		
moon		21	50	24.3	-21	50	24.6		
clock fast			3	15.6					
H. Sid. T.		21	47	08.85	6+6	-0 ⁿ	13.5		
H. long.		4	44	31.05					
G. Sid. T.		26	31	39.9					
Sid. T. h. hor.		15 ⁿ	00	22.92					
Int. moon		11	31	16.98					
Reduction			1	53.25					
& by T		11	29	23.73					

from hand Ales		R. A		Hecl.					
Moon 11 ⁿ		22 ⁿ	00 ⁿ	04.78	-14 ⁿ	37'	55.7		
Motion by 1.8675					12.550				
29.3955				+54.90		+6	10.0		
Tabular place		22	00	59.68	-14	31	45.7		

Moon's acc. 8 days.

	parallax	54' 29.39			
	semidiam.	14	52.4		
	R		89.24		
934.8.6	Augmentation		+7.9		
892.7.9	Irregularity (3)		-0.3		
	R		900.0		
	R		1.9293		
a = 498.6	ak		-91.6		
24	(1+a)R		183.77		
474.6	R ²		337.71		

4239

x

10.1974

15.0878

29.7543

29.3439

54.83

18.28

-18

28

31

93

Plate constants.

y

227488

92571

23.6450

23.4137

55.54

18.51

-22

349

465

1628

27' 8"

R.A.

21 56 44

59 28

22 07 45

64 122 117

22 01 19

-

22 01 10

Decl.

-14 44 39

-16 34 59

-14 37 22

-44 11 5 120

-15 19 00

+27 08

-14 51 52

Center { A = 22^h 01^m 10^s
 D = -14° 51' 50"

2-3 +500x

+14.44

-1.4x

-9994

+4582 + 5099 = +9681 + 328 = +10009 -14 = +9995 = +1

+2338 + 7544 = +9882 + 1332 = +10015 -21 = +9994 = 0

-5183 + 14877 = +8694 + 3412 = +10035 -42 = +9993 = -1

17.9949 + 8997 +270 -25 = 17.9197

4-7 +5004

-16x

+8.94

-9874

-1539 + 11374 = +9835 -163 = +9672 +202 = +9874 = 0

+5404 + 4629 = +10033 -241 = +9792 +82 = +9874 = 0

-1685 + 11824 = +10139 -476 = +9663 +210 = +9873 = -1

18.7313 + 9366 -288 +167 = 18.6684

Tables a = + 1.0 b = -6.0 a-e = +7.0 b+a = +1.0
 obs. a = -498.6 b = -508.9 a-b = +10.3 b+a = +1.6

0-e = + 04 - 2.9 + 33 +0.4

0-e = -499.6 -502.9 +0.6

4239

x

10.1974

15.0878

29.7543

29.3439

54.83

18.28

28

31

9

Plate constants

y

22.7428

9.2571

23.6480

23.4139

55.54

18.51

349

465

1628

27' 8"

R. A.

21 56 44

55 28

22 07 45

64 122 117

22 01 19

9

22 01 14

Decl.

-14 44 29

-16 34 55

-14 37 22

-44 115 120

-15 19 00

+27 02

-14 51 52

Center { A = 22^h 01^m 10^s
 B = -14^o 51' 50"

2-3 + 500x

+4582 + 5099 = 9681 + 338 + 10009 = 14 + 9995 = 1

+2338 + 7544 = 9882 + 1337 + 10015 = 21 + 9994 = 0

-5183 + 14877 = 8694 + 3412 + 10035 = 42 + 9993 = -1

17.9949 + 8997 = 225 = 17.9197

y - 3 + 500y

-1539 + 11378 + 9835 = 103 + 9672 = 202 + 9874 = 0

+5404 + 4629 + 10033 = 241 + 9792 = 42 + 9874 = 0

-1685 + 11824 + 10139 = 476 + 9663 = 210 + 9873 = -1

18.7313 + 9366 = 258 + 167 = 18.6684

Tables a = + 1.0 4.0 - 6.0 a = 2.0 + 7.0 a = 3.0 + 1.0

obs. a = + 98.6 - 508.9 a = 2.0 + 10.3 a = 3.0 + 1.6

C - C = + 04 33 01

	ξ	η	$\Delta \xi$	-2.93	-4	-8
1	-8.26	+0.92	-19	+29 ~	+10 - 1 ~	+9 +1
2	-3.19	-13.28	-19	+9 ~	-5 +13 ~	+8 0
3	+12.27	+1.86	+96	-36 ~	+10 - 2 ~	+8 0
M	-0.08	-3.33	0	0	-3	<u>-11</u>

	$\Delta \eta$	-9.72	+124	+2
+2	-4	=	-2 = 0 ~	-2 0
-60	+62	~	+2 -5 ~	-3 -1
+7	-9	~	-2 0 ~	-2 0
0	+16		-1	<u>+17</u>

4239

Standard Coordinates

Cape W. 3052 mag 8.0

Cape W. 3059 mag 8.0

3078 mag 6.2

C	21	56	02.05	21	58	45.36	22	07	02.25
L			08			44			.26
E			09			43			.30
Mean	21	56	02.07	21	58	45.41	22	07	02.27
Prec			+ 42.30			+ 42.55			+ 42.08
X	21	56	44.37	21	59	27.96	22	07	44.35
A	22	01	10	22	01	10	22	01	10
1-A	-	4	25.63	-	1	42.04	+	6	34.35
1-(1-A)			- 26.56			- 102.04			+ 394.30
log ₁₁	2	4	242.5	2	0	087.7	2	5	958.3
cos δ	9	9	854.6	9	9	815.5	9	9	857.0
30	0	9	169.5	0	4	975.6	1	0	887.7
30	-	8	259.4	-	3	144.6	+	1	226.8
31	-		14	-		14	+		46
3		9	739.2		1	485.4		3	027.2
2		1	019.7		1	508.7		2	975.4
2-3	+	4	58.2	+	2	33.8	-	5	18.3
C	-	1	40 48' 22.9	-	1	6 38 48.1	-	1	4 41 10.9
L			22.2			47.7			10.8
E			23.8			49.3			11.5
Mean	-	1	4 48 23.0	-	1	6 38 48.4	-	1	4 41 11.1
Prec			+ 3 43.6			+ 3 45.2			+ 3 49.3
δ	-	1	4 44 39.4	-	1	6 35 03.2	-	1	4 37 21.8
D	-	1	4 51 50	-	1	4 51 50	-	1	4 51 50
δ-D	+		7 10.6	-		1 43 13.2	+		1 4 28.2
1-(δ-D)			+ 430.6			- 6195.1			+ 868.2
log ₁₁	2	6	340.7	3	7	920.5	2	9	386.2
40	9	9	652.2	1	1	232.0	0	2	697.7
40	9	4	202	9	4	739	9	4	165
32	1	8	340	0	9	951	2	1	775
31	8	3	076	7	5	224	8	6	474
40	+	0	923.0	-	1	328.0	+	1	861.1
31	-		20.3	-		33	-		44.6
3		2	290.2		8	716.9		2	381.6
4		2	274.8		9	257.1		2	364.8
4-3	-	1	53.9	+	5	40.4	-	1	68.5

4239

Standard Coordinates.

Cape W. 3052 mag 8.0				Cape W. 3059 mag 8.0				3078 mag 6.2			
C	21	56	02.05	21	58	45.36	22	07	02.25		
L			08			44			26		
B			09			43			30		
Mean	21	56	02.07	21	58	45.41	22	07	02.27		
Proc			+ 42.30			+ 42.55			+ 43.03		
X	21	56	44.37	21	59	27.96	22	07	45.30		
A	22	01	10	22	01	10	22	01	10		
x-A	-	4	25.63	-	1	42.04			+ 6	35.30	
ln(x-A)			-265.61			-102.04			+395.25		
log	2.42	42.5		2.00	877				2.59	688	
cos	99	85	46	99	81	55			99	85	70
30	0.91	69	5	0.49	75	6			1.08	98	2
30	-8	25	94	-3	14	46			+12	29	75
31	-		14	-		14			-		46
3			9.73	14	85	40			20	30	21
20			10.19	15	08	78			29	75	43
2-3			+ 45	+ 23	38				-	54	78

C	-14	48	22.9	-16	38	48.1	-14	41	10.9		
L			22.2			47.7			10.8		
B			23.8			49.3			11.5		
Mean	-14	48	23.0	-16	38	48.4	-14	41	11.1		
Proc			+ 3	+ 3		45.2			+ 3	49.3	
B	-14	44	39.4	-16	34	59.2	-14	37	2.18		
D	-14	51	50	-14	51	50	-14	51	50		
S-D			+ 7	-1	43	09.2			+ 14	28.2	
ln(S-D)			+ 430.6			-6190.1			+ 868.2		
log	2.63	40.7		3.79	170				2.93	862	
70	99	65	22	11	22	85			0.26	977	
70	9.42	02		9.47	39				9.41	65	
72	1.83	40		0.99	51				2.17	96	
71	8.30	76		7.52	24				8.64	95	
70	+0.92	30.6		-13.2	69.4				+1.86	11	
71	-	20.3		-	33				-	44.6	
72	22.9	02.7		8.72	73				23.8	16.5	
73	22.7	48.8		9.25	71				23.6	45.2	
74	-	53.9		+5.29	8				-	16.8	5

42 39

Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$0 - C$
1	16.0000	+0.0050	+1	0.0000	3.3764	-7
2	17.3795	-0.6155	+1	0.3787	3.3827	+56
3	17.0000	-0.9950	+1	0.9898	3.3768	-3
4	16.3090	-1.6860	0	2.8426	3.3792	+21
5	16.1575	-1.8375	0	3.3764	3.3764	-7
6	16.1759	-1.8191	0	3.3092	3.3811	+40
7	16.6688	-1.3262	-1	1.7591	3.3692	-79
8	17.0000	-0.9950	-1	0.9902	3.3769	-2

$$R^2 = 3.3771$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	
-1	16.8958	-1.8362	-13	3.3764	180"
2	17.0000	-1.7320	-12	3.0040	198 200
3	17.1881	-1.5439	-11	2.3870	213"
4	18.0000	-0.7320	-5	0.5366	247"
5	18.7320	0.0000	0	0.0000	270"
6	19.0000	+0.2680	+2	0.0719	278"
7	20.0000	+1.2680	+9	1.6101	313"
8	20.2758	+1.5438	+11	2.3867	327"

Range 147

Approx. Center

$$\begin{aligned}
 x &= 17.0 & y &= 17.1881 \\
 & & & \underline{20.2758} \\
 & & & 37.4639 \\
 y_0 &= 18.7320 \\
 y_{\text{min}} &= 16.8958 \\
 R &= 1.8362 \\
 x_{\text{min}} &= 16.1575 \\
 x_0 &= 17.9937
 \end{aligned}$$

$$\text{Center } \left\{ \begin{aligned} x_0 &= 17.9950 \\ y_0 &= 18.7320 \end{aligned} \right.$$

42 39

Approx Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(-y) - 0 - C$
1	180000	+0.0050	+1	0.0000	3.3764 - 7
2	173795	-0.6155	+1	0.3787	3.3827 + 56
3	170000	-0.9950	+1	0.9898	3.3748 - 3
4	163090	-1.6860	0	2.8426	3.3792 + 21
-5	161575	-1.8375	0	3.3764	3.3764 - 7
6	161759	-1.8191	0	3.3092	3.3811 + 40
7	166688	-1.3262	-1	1.7591	3.3692 - 79
8	170000	-0.9950	-1	0.9902	3.3769 - 2

 $R^2 = 3.3771$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$	
-1	168958	-1.8362	-13	3.3764	180-
2	170000	-1.7320	-12	3.0040	198
3	171881	-1.5439	-11	2.3870	213
4	180000	-0.7320	-5	0.5366	247
5	187320	0.0000	0	0.0000	270
6	190000	+0.2680	+2	0.0719	278
7	200000	+1.2680	+9	1.6101	313
8	202758	+1.5438	+11	2.3867	327

Range 147

Approx Center

$x = 17000$	171881
	<u>202758</u>
	374639
$y =$	18.7320
$y =$	16.8958
$R =$	1.8362
$x =$	16.1575
$x =$	17.9937

Center $\bar{x} = 17.9950$
 $\bar{y} = 18.7320$

Formation of Normals.

1	- 0.00	-	0.0	+	12.9
2	+ 1.17	-	34.8	-	96.9
3	+ 1.54	+	3.0	+	4.6
4	+ 1.23	-	35.4	-	15.3
5	- 0.00	+	12.9	-	0.0
6	- 0.49	-	72.8	+	10.8
7	- 1.69	+	105.0	-	100.2
8	- 1.54	+	2.0	-	3.1
	<u>+ 0.22</u>	<u>-</u>	<u>20.1</u>	<u>-</u>	<u>- 187.2</u>

		a	b	c	new 0-c
		+ 0	- 5'	+ 10'	- 23'
a	+ 10	- 6	- 5'	+ 4'	+ 35'
b	+ 3	- 10	- 5'	0'	- 26'
c	+ 13'	- 17	- 2	- 4'	+ 3'
		- 18	+ 0	- 3'	- 12'
		- 18	+ 1	- 2'	+ 40'
		- 13	+ 7	+ 6'	- 58'
		- 10	+ 5'	+ 10'	+ 29'

4239

Moon's Center Conditional Equations.

	a	b	0	C	0-C
1	+0.00	-1.84	= -7	-0 + 26 = +26	-33
2	-0.62	-1.73	= +56	+1 + 24 = +25	+31
3	-1.00	-1.54	= -3	+1 + 22 = +23	-26
4	-1.69	-0.73	= +21	+2 + 10 = +12	+9
5	-1.84	+0.00	= -7	+2 - 0 = +2	-9
6	-1.82	+0.27	= +40	+2 - 4 = -2	+42
7	-1.33	+1.27	= -79	+3 - 18 = -15	-64
8	-1.00	+1.54	= -2	+1 - 22 = -21	+19

+101 - 132
Average = 29

Normal Equations.

$$\begin{aligned}
 +13.65 + 0.22 &= -20 & -9.30 \\
 +0.22 + 13.37 &= -187 & -2.76 \\
 -0.22 - 0.00 &= +0 & +15 \\
 +13.37 &= -187 & -2.61 \quad b = -14.0 - 0.19 \\
 +13.65 &= -20 + 3 = -17 & a = -1.2 - 0.68
 \end{aligned}$$

Arc measured: 147° Average (0-c) = -4

$$\frac{pc}{m} = 0.14$$

$$\frac{-4}{14} = -0.29 \quad \Delta z = -0.3$$

$$-2RC = +0.73$$

$$\text{corr} = 0.2$$

$$\Delta B = -0.14 \quad \Delta \delta = -0.1$$

$$\Delta R = -0.1$$

$$\Delta a = -0.50 \quad \Delta \alpha = -0.02$$

4239

Moon's Centre Conditional Equations

	O	C	O-C
1	+0.00 - 1.84 = -7	-0 + 2.6 = +2.6	-3.3
2	-0.62 - 1.73 = +5.6	+1.7 2.4 = +2.5	+3.1
3	-1.00 - 1.54 = +3	+1 + 2.2 = +2.3	-2.6
4	-1.69 - 0.73 = +2.1	+2 + 1.0 = +1.2	+9
5	-1.84 + 0.00 = -7	+2 - 0 = +2	-9
6	-1.82 + 0.27 = +4.0	+2 - 4 = -2	+4.2
7	-1.33 + 1.27 = -7.9	+3 - 1.8 = -1.5	-6.4
8	-1.00 + 1.54 = -2	+1 - 2.2 = -2.1	+1.9

+10.1 - 13.2
Average = -2.9

Normal Equations.

$$+1.365 + 0.22 = -2.0$$

$$+0.22 + 1.337 = -1.87$$

$$-0.22 - 0.00 = +0$$

$$+1.337 = -1.87$$

$$b = -14.0$$

$$+1.365 = -2.0 + 3 = -1.7$$

$$a = -1.2$$

Arc measured: 147° Average (O-C) = -4

$$\frac{PC}{n} = 0.14$$

$$\frac{-4}{14}$$

$$= -0.29$$

$$\Delta \alpha = -0.3$$

4239 moon's mean Position (1913.0)

$$X_0 = 17.9950$$

$$Y_0 = 18.7320$$

$$\Delta\alpha = \frac{-1}{17.9949}$$

$$\Delta\delta = \frac{-7}{18.7313}$$

$$17.9949$$

$$18.7313$$

From Plate Constants $X = 17.9157$ $Y = 18.6684$

$$\xi = -0.0803$$

$$\eta = -3.3316$$

$$\log \xi = 8.90472$$

$$\dots \cos \xi = 9.98434$$

$$8.50724$$

$$\log \tan \delta = 9.4280$$

$$7.8094$$

$$7.0534$$

$$4.2908$$

$$\alpha - A = 040314$$

$$\alpha - A = 2.59$$

$$A = 220110$$

$$q = 220107.41$$

$$\text{Red} = 3.30$$

$$q' = 220110.71$$

$$\log m_0 = 0.52265$$

$$7.33115$$

$$\alpha - (d - D) = 3.19150$$

$$S - D = -2554.2$$

$$D = -145150$$

$$S = -151744.2$$

$$\text{Red} = 11.4$$

$$S' = -151732.8$$

4239 moving mean Position (1913.0)

$$X_0 = 17.9950$$

$$Y_0 = 18.7320$$

$$\Delta X = \frac{-1}{17.9949}$$

$$\Delta Y = \frac{-7}{18.7313}$$

True Plate Constant $X = 17.9157$ $Y = 18.6684$

$$\beta = -0.0803$$

$$\gamma = -3.3316$$

$$\log \beta = 8.90472$$

$$\log \gamma = 9.98434$$

$$8.50724$$

$$\log \tan \delta = 9.4280$$

$$7.8094$$

$$7.0534$$

$$4.2908$$

$$\log A = 0.40314$$

$$\alpha - A = 2.59$$

$$\log m = 0.52265$$

$$7.33115$$

$$A = 22.01.10$$

$$(J-D) = 3.19150$$

$$q = 22.01.07.41$$

$$S-D = 2.5.54.2$$

$$Red + 3.30$$

$$D = 1.4.51.50$$

$$q' = 22.01.10.71$$

$$S = 1.5.17.44.2$$

$$Red + 11.4$$

$$S = 1.5.17.32.8$$

$$\begin{array}{r} 21 \quad 48 \quad 36.48 \\ \quad \quad 33.25 \\ \hline + \quad 3.23 \end{array}$$

$$\begin{array}{r} -13 \quad 57 \quad 32.0 \\ \quad \quad 42.8 \\ \hline + \quad 10.8 \end{array}$$

$$\begin{array}{r} 22 \quad 01 \quad 21.97 \\ \quad \quad 18.97 \\ \hline + \quad 3.00 \end{array}$$

$$\begin{array}{r} -0 \quad 44 \quad 18.0 \\ \quad \quad 34.3 \\ \hline + \quad 16.3 \end{array}$$

$$\begin{array}{r} 22 \quad 01 \quad 47.68 \\ \quad \quad 44.39 \\ \hline + \quad 3.29 \end{array}$$

$$\begin{array}{r} -14 \quad 17 \quad 20.2 \\ \quad \quad 31.9 \\ \hline + \quad 11.7 \end{array}$$

$$\begin{array}{r} 22 \quad 29 \quad 59.74 \\ \quad \quad 56.16 \\ \hline + \quad 3.58 \end{array}$$

$$\begin{array}{r} -21 \quad 08 \quad 64.2 \\ \quad \quad 75.6 \\ \hline + \quad 11.4 \end{array}$$

$$\begin{array}{r} 21 \quad 42 \quad 17.69 \\ \quad \quad 14.44 \\ \hline + \quad 3.25 \end{array}$$

$$\begin{array}{r} -16 \quad 31 \quad 12.1 \\ \quad \quad 21.2 \\ \hline + \quad 9.1 \end{array}$$

45 50 55 0.2 5 10 15 20 25 0

-5

-10

-15

-20

4

-25

+ 239

Red. ad. locum sph.

$$S = -15^{\circ} 17' 44''$$

H + a

$$0^h 55.2 = 13^{\circ} 48'$$

H

$$2 \quad 54.1$$

x

$$22 \quad 01.1$$

g

$$22 \quad 10.8$$

g + x

$$20 \quad 11.9 = 302^{\circ} 58'$$

$$2 \cos(g + a) \quad 9.7357$$

8

$$1.2963$$

sin "

$$9.9238 \text{ m}$$

tan S

$$9.4374 \text{ m}$$

$$8.8239$$

8'

$$1.0320$$

9

$$9.4814$$

f

$$+ 2.68$$

g

$$+ 30$$

h

$$+ 0.32$$

$$\hline 3.30$$

$$2 \cos S \quad 9.9843$$

L

$$\hline 0.7680$$

(L)

$$0.7523$$

L sin S

$$9.4213 \text{ m}$$

- cos(H + x)

$$9.9873$$

L

$$1.2925$$

sin "

$$9.3776$$

sec S

$$0.0157$$

$$8.8239$$

L'

$$0.7011 \text{ m}$$

L

$$9.5097$$

8'

$$+ 10.76$$

g'

$$- 5.02$$

(L)

$$+ 5.65$$

$$\hline + 10.39$$

H 237

Red. ad locum app.

$$S = -15^{\circ} 17' 44''$$

H + a

$$0^{\circ} 55' 2'' - 13^{\circ} 48'$$

H

$$2 \quad 54.1$$

a

$$22 \quad 0.11$$

g

$$22 \quad 10.8$$

g + a

$$20 \quad 119 = 302^{\circ} 58'$$

$$\text{Lens } S \quad 99843$$

$$a \quad \underline{07650}$$

$$(2) \quad 07523$$

$$\text{Lens (g+a)} \quad 97357$$

$$8 \quad 12963$$

$$\text{sun} \quad 99238^m$$

$$\text{Tan } S \quad 94374^m$$

$$88239$$

$$8' \quad 1.0320$$

$$9 \quad 94814$$

$$\frac{1}{6} \quad +2.62$$

$$8 \quad +0.30$$

$$h \quad -0.32$$

$$\underline{\quad 3.32 \quad}$$

$$\text{Lens } S$$

$$94213^m$$

$$\text{ws (H+K)}$$

$$99873$$

$$h$$

$$12925^m$$

$$\text{sun}$$

$$93776$$

$$\text{Tan } S$$

$$00157$$

$$88239$$

$$h'$$

$$07011^m$$

$$h$$

$$95097$$

$$8'$$

$$+10.76$$

$$8$$

$$-5.02$$

$$h$$

$$+5.65$$

$$\underline{\quad +14.39 \quad}$$

4239

Lunar parallel

$$\begin{array}{r}
 \alpha' - 22^{\circ} 01' 10.71 \\
 \ominus \quad 21 \quad 47 \quad 08.85 \\
 \quad - 14 \quad 01.86 \\
 \quad - 3^{\circ} 30' 28'' \\
 \quad - \quad \quad 1 \quad 16 \\
 \quad \quad \quad 3 \quad 29 \quad 12
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 \hline
 0.00080 \\
 9.95807
 \end{array}$$

$$f = 42 \quad 14 \quad 20$$

$$- 15 \quad 17 \quad 33$$

$$57 \quad 31 \quad 53$$

$$\begin{array}{r}
 9.82640 \\
 8.20002 \\
 0.17248 \\
 \hline
 9.92618 \\
 8.12508
 \end{array}$$

correc
mid. S

$$S - S' = + \quad 45 \quad 51.2$$

$$S \quad - 14 \quad 31 \quad 41.6$$

$$\text{Ann Eph S} = - 14 \quad 31 \quad 45.7$$

$$\begin{array}{r}
 O - C \quad + \quad 4.1 \\
 \text{Cur. of Plate} \quad + \quad 0.8 \\
 \text{2nd ord. ref} \quad + \quad 0.1 \\
 \quad - \quad 0.1 \\
 S - \quad - 14 \quad 31 \quad 41.6 \\
 O - C \quad + \quad 4.1
 \end{array}$$

$$S' = - 15^{\circ} 17' 32.8$$

$$\pi \quad 54' 29.39$$

$$\begin{array}{r}
 9.86913 \\
 8.20002 \\
 8.78671 \\
 \hline
 0.01410 \\
 6.86996
 \end{array}$$

$$\alpha - \alpha' = - 2' 32.89$$

$$- \quad 10.19$$

$$\alpha \quad 22 \quad 01 \quad 00.52$$

$$\alpha = 22 \quad 00 \quad 59.68$$

$$\begin{array}{r}
 + 0.84 \\
 - 0.07 \\
 - 0.02 \\
 \alpha = 22 \quad 01 \quad 00.50 \\
 O - C \quad + 0.82
 \end{array}$$

4239

human parallel

$$\begin{array}{r}
 \alpha' - 22^{\circ} 01' 10.71 \\
 \odot \quad 21 \quad 47 \quad 08.85 \\
 \quad - 14 \quad 01.86 \\
 \quad - 3^{\circ} 30' 28'' \\
 \quad - \quad \quad 1 \quad 16 \\
 \quad \quad \quad 3 \quad 29 \quad 12
 \end{array}$$

$$\begin{array}{r}
 995727 \\
 000000 \\
 000080 \\
 \hline
 995807
 \end{array}$$

$$\begin{array}{r}
 \delta - 42 \quad 14 \quad 20 \\
 \quad 15 \quad 17 \quad 33 \\
 \quad 57 \quad 31 \quad 53
 \end{array}$$

$$\begin{array}{r}
 982640 \\
 820002 \\
 017248 \\
 \hline
 992618 \\
 812508
 \end{array}$$

$$S-S - + \quad 45 \quad 51.2$$

$$S \quad -14 \quad 31 \quad 41.6$$

$$\text{Ann Eph S} : -14 \quad 31 \quad 45.7$$

$$\begin{array}{r}
 O-C \quad + \quad 4.1 \\
 \text{Cur. of Plate} + 0.8 \\
 \text{2nd. red. ref} \quad + 0.1 \\
 \quad \quad \quad - 0.1 \\
 O. \quad -14 \quad 31 \quad 41.6 \\
 O-C \quad + 4.1
 \end{array}$$

$$S' = -15^{\circ} 17' 32.8$$

$$\pi \quad 54' 29.39$$

$$\begin{array}{r}
 9.86913 \\
 8.20002 \\
 8.78671 \\
 001410 \\
 \hline
 6.86996
 \end{array}$$

$$\begin{array}{r}
 \alpha - \alpha' = 2' 32.89 \\
 \quad \quad \quad - \quad 10.19
 \end{array}$$

$$\alpha \quad 22 \quad 01 \quad 00.52$$

$$\alpha \quad 22 \quad 00 \quad 59.68$$

$$\begin{array}{r}
 + 0.84 \\
 - 0.07 \\
 - 0.02 \\
 \alpha \quad 22 \quad 01 \quad 00.50 \\
 O-C \quad + 0.82
 \end{array}$$

