

KG

11366

v. 953

LXXVI



3846

3856



Harvard Lunar Plates.
Measures and Reductions
Mary Fowler

Volume LXXXVI

Plate No.	Date	Page
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3846 Stars - Measures

	d	μ	d	μ
1	19457	17008	18502	18981
134	11864	14567	12500	14969
28.7	70	7877	94	69
	47	02	88	83
	<u>28.7583</u>	<u>7.567</u>	<u>13.4004</u>	<u>4013</u>
2	16841	17669	17657	16592
14.1	15541	8965	8491	15740
14.2	49	5660	90	28
	43	70	59	87
	<u>14.1298</u>	<u>.1290</u>	<u>14.0831</u>	<u>.0854</u>
3	13929	10029	16451	15930
30.4	13272	2030	9940	12370
24.1	71	9380	8183	70
		40	40	31
	<u>24.0658</u>	<u>.0646</u>	<u>30.3534</u>	<u>3858</u>

Grade 1.

3846

Stars - Measures

	d	μ	κ	
1	19457	17008	18502	18981
134	11864	14567	12500	14969
287	70	7877	9499	65
	47	02	88	83
	<u>287583</u>	<u>7567</u>	<u>134004</u>	<u>4013</u>
2	16841	17669	17657	16592
141	15541	8965	8491	15740
142	49	5660	90	287
	43	70	59	87
	<u>141298</u>	<u>1290</u>	<u>140831</u>	<u>0854</u>
3	13929	10089	16451	15930
204	13272	2030	9950	12370
241	71	9380	8183	7075
		40		31
	<u>240658</u>	<u>0646</u>	<u>303534</u>	<u>3858</u>

Grade 1.

3846

Moon Measures.

2

 α γ ν α κ ν

$$\begin{array}{r} 1 \\ 19.5 \\ 19.0 \end{array}$$

$$\begin{array}{r} 16319 \\ 12088 \\ 8084 \\ 6321 \\ \hline 19.5764 \end{array}$$

$$\begin{array}{r} 18521 \\ 1274238 \\ 40 \\ 25 \\ \hline 5783 \end{array}$$

$$\begin{array}{r} 2 \\ 18.5 \\ 18.6 \\ \text{min} \\ 2 \\ 8 \\ \hline 18.5565 \end{array}$$

$$\begin{array}{r} 17710 \\ 1325050 \\ 49 \\ 97 \\ \hline 5544 \end{array}$$

$$\begin{array}{r} 3 \\ 18.0 \\ 18.6 \\ \hline 18.5983 \end{array}$$

$$\begin{array}{r} 18700 \\ 1462973 \\ 71 \\ 92 \\ \hline 5978 \end{array}$$

$$\begin{array}{r} 4 \\ 17.2 \\ 19.0 \end{array}$$

$$\begin{array}{r} 14646 \\ 657970 \\ 69 \\ 25 \\ \hline 17.1944 \end{array}$$

$$\begin{array}{r} 19112 \\ 1715054 \\ 50 \\ 90 \\ \hline 1957 \end{array}$$

$$\begin{array}{r} 5 \\ 17.0 \\ 19.2 \\ \hline 19.1964 \end{array}$$

$$\begin{array}{r} 19883 \\ 1183510 \\ 16 \\ 85 \\ \hline 1935 \end{array}$$

$$\begin{array}{r} 6 \\ 16.7 \\ 20.0 \end{array}$$

$$\begin{array}{r} 19360 \\ 1539197 \\ 91 \\ 55 \\ \hline 166035 \end{array}$$

$$\begin{array}{r} 16368 \\ 1031511 \\ 15 \\ 59 \\ \hline 6049 \end{array}$$

3846

Moon Measures

2

d

4

v

d

w

$$\begin{array}{r} 1 \\ 19.5 \\ 19.0 \end{array}$$

$$\begin{array}{r} 16319 \\ 12088 \\ 8084 \\ 6321 \\ \hline 195764 \end{array}$$

$$\begin{array}{r} 18521 \\ 1274238 \\ 40 \\ 25 \\ \hline 5783 \end{array}$$

$$\begin{array}{r} 2 \\ 185 \\ 186 \\ 18.5 \\ 18.6 \\ \hline 18.5565 \end{array}$$

$$\begin{array}{r} 17710 \\ 1325050 \\ 49 \\ 97 \\ \hline 5546 \end{array}$$

$$\begin{array}{r} 3 \\ 185 \\ 186 \\ 18.5 \\ 18.6 \\ \hline 18.5983 \end{array}$$

$$\begin{array}{r} 18700 \\ 1467973 \\ 71 \\ 92 \\ \hline 5978 \end{array}$$

$$\begin{array}{r} 4 \\ 172 \\ 190 \end{array}$$

$$\begin{array}{r} 14646 \\ 657970 \\ 69 \\ 25 \\ \hline 171944 \end{array}$$

$$\begin{array}{r} 19112 \\ 1715054 \\ 50 \\ 90 \\ \hline 1917 \end{array}$$

$$\begin{array}{r} 5 \\ 170 \\ 172 \\ 1801001 \\ 02 \\ 61 \\ \hline 191964 \end{array}$$

$$\begin{array}{r} 19883 \\ 11835109 \\ 16 \\ 85 \\ \hline 1935 \end{array}$$

$$\begin{array}{r} 6 \\ 167 \\ 200 \end{array}$$

$$\begin{array}{r} 19360 \\ 1539197 \\ 91 \\ 55 \\ \hline 166035 \end{array}$$

$$\begin{array}{r} 16368 \\ 1031511 \\ 15 \\ 59 \\ \hline 6049 \end{array}$$

$\frac{7}{16}$
2 $\frac{8}{16}$
2 $\frac{9}{17}$
21 $\frac{10}{18}$
22

3846

Moon-Measures.

3

7
16.6
20.4
min
in
x

8
16.6
21.0

9
17.0
21.5
18766
1323039
3239
58
21.5518

10
18.0
22.2
17819
1626977
687
11
22.1547

17045
1257980
81
35-
.5539

17761
930201
0601
70
.1534

18339
1398374
81
45-
16.5637

18339
1507270
70
30
16.6735

17643
1199292
8592
51
5657

17670
1093031
38
52
.6725

possibly on
terminator

9
17
21
10
18
22

3846

Moon - Measures

3

7
166
20.4
mm
-
2

8
166
21.0

9 18766 17045
170 1323039 1257950
21.5 3239 81
58 35-
21.5518 5539

10 17819 17761
180 1626977 930201
22.2 687 06
11 70
22.1547 1534

18339
1398374
81
45-
16.5637

18339
1507270
70
30
16.6735

17643
1199292
85-92
51
5657

17670
1093031
38
52
.6725

possibly on
terminator

3846	Times etc						
Exp. to star	1913 Sept. 14	1 ⁿ	00 ^m		-1 ⁿ	12 ^m	
... moon		1	06	1205	-1	06	123 ^v
Clock fast			2	32.6			
W. Sid T.		1	03	39.55 ^v		0-4=+1 ⁿ	44 ^m
W. long		4	44	31.05 ^v			
G. Sid T.		5	48	1060 ^v			
Sid T. in horn		11	31	25.54 ^v			
Intervals		18	16	45.06 ^v			
Recl.			2	59.68 ^v			
G. M. T.		18	13	4538 ^v			

From Kant Alm.	R.A.	Decl.
From 18 ⁿ	23 ⁿ 19 ^m 21 ^s 02 ^v	-4° 55' 06'' ^v
Motion in 1 ^m = 1.7438 ^v		14.05-5 ^K
" " 13.7563 ^v	+ 23.99 ^v	+ 3 13.3 ^v
Tabular Place	23 19 45 01 ^v	-4 51 53.2 ^v

Moon's age 14 days

934 = 9.5	parallax	53' 58' 05 ^v
884 = 8.5	semidiameter	14 43.9 ^v
	R.	883.9
	Augmentation	+18.5
	Irradiation (1)	-0.3
	R	892.1
	R	11.9123
a = -999.8	a R	-910 ^v
-24.0	(1+a) R	1.8253
4758	R ²	3.3171

3846	Tanner etc						
Explosion	1913 Sept. 14	1" 00"		- 1" 12"			
Known		1 06	120-1	06	123		
Clock part		2	326				
H Sid T		1 03	3955	4-4-+1	44		
H long		4 44	3105				
G Sid T		5 48	1-060				
Sid T in hour		11 31	2554				
Interv		18 16	4506				
Recl.		2	5968				
G M T		18 13	4538				

From Hand Alm	R.A	Recl.			
Known 18"	23" 19" 21502	- 4" 55' 06"5			
Mohor 1" - 1.7438		14.055			
13.7563	+ 2399	+ 3	133		
Tabular Place	23 19 4501	- 4 51	532		

Known age 14 days

939-95	Parallax	53' 58'05"
889-85	Parallax	14 43.9
	R	8839
	Augmentation	+ 8.5
	In radiation (1)	- 0.3
	R	892.1
	R	119123
a - -499.8	a R	- 910
290	(11a) R	18213
4752	R	33171

+
+
-
18

-
+
-
2

3846

Plate Constants

5

x	y
13.4008	287575
14.0842	141294
30.3546	24.0652
<u>57.84</u>	<u>66.95</u>
19.28	2232
-18	-22
<u>1.28</u>	<u>32</u>
31	466
<u>40^s</u>	<u>150"</u>

$$\text{Mean R.A.} = 23^h 19^m 00^s$$

$$A = \frac{-}{40^s}$$

$$A = 23 \ 18 \ 20$$

$$\text{Mean S} = -5 \ 15 \ 39$$

$$D = \frac{-2 \ 30}{-5 \ 18 \ 09}$$

$$\text{Center of Plate} \begin{cases} A = 23^h 18^m 20^s \\ D = -5^0 18' 09'' \end{cases}$$

$$\begin{aligned} x-3 \quad +500x & \quad -101.64 & \quad -32 & \quad -7392 \\ +3617+6700 & = +10317-2922 = +7395-3 = +7392 = 0 \\ +1788+7042 & = +8830-1436 = +9394-3 = +7391 = -1 \\ -5334+15177 & = +9843-2445 = +7398-6 = +7392 = 0 \\ 18.3862+9193 & \quad -2070'' & \quad -4'' & \quad = 18.3589'' \end{aligned}$$

$$\begin{aligned} y-m \quad +500y & \quad +1041.2 & \quad +3.74 & \quad -13286 \\ -2594+14379 & = +11785+1395 = +13180+106 = +13286 = 0 \\ +4703+7065 & = +11768+1466 = +13234+52 = +13286 = 0 \\ -1995+12033 & = +10038+3160 = +13198+89 = +13287 = +1 \\ 20.3760+10188 & \quad +1914'' & \quad +75'' & \quad = 20.2651'' \end{aligned}$$

$$\begin{aligned} \text{Tables } a &= -0.5 & e &= -4.2 & a-e &= +3.7 & b+a &= -3.9 \\ \text{Obs } a &= -499.8 & e &= 503.7 & a-e &= +3.9 & b+a &= -2.5 \end{aligned}$$

$$\begin{aligned} 6-e & \quad -899.3 & \quad -499.5'' & \quad +1.4'' \end{aligned}$$

3346

Plate Constants

5

2	4
134008	287575
140842	141294
303546	240652
<u>15784</u>	<u>6695</u>
19.28	22.32
-18	-2
128	32
31	466
40	150

Mean R.A.: $23^h 19^m 00^s$ A - $23^h 18^m 20^s$ Mean S. = $-5^{\circ} 15' 39''$ D - $-5^{\circ} 18' 09''$

Center of Plate $\left\{ \begin{array}{l} A = 23^h 18^m 20^s \\ D = -5^{\circ} 18' 09'' \end{array} \right.$

$$\begin{array}{rclcl}
 2 - 3 & + 5002 & - 101.64 & - 22 & - 7392 \\
 + 3617 + 6700 & + 10317 - 2922 & + 7395 - 3 & + 7342 & = 0 \\
 + 1788 + 7042 & + 8830 - 1436 & + 7344 - 3 & + 7391 & = -1 \\
 - 5334 + 13177 & + 9843 - 2445 & + 7398 - 6 & + 7392 & = 0 \\
 183862 + 9193 & - 2070 & - 4 & & = 183589
 \end{array}$$

$$\begin{array}{rclcl}
 4 - 7 & + 5004 & + 1041.2 & + 3.74 & - 13286 \\
 - 2594 + 14379 & + 11785 + 1395 & + 13180 + 106 & + 13286 & = 0 \\
 - 7703 + 7065 & + 11768 + 1460 & + 13234 + 52 & + 13286 & = 0 \\
 - 1995 + 12033 & + 10038 + 3160 & + 13198 + 89 & + 13287 & = +1 \\
 203760 + 10188 & + 1914 & + 75 & & = 202651
 \end{array}$$

Tables a = -0.5 c = -4.2 a - c = +3.7 h + a = -3.9
 Obs a = -4.998 c = -5.037 a - c = +3.9 h + a = -2.5

C. of Plate

	ξ	η	$\Delta \xi$	-3.55	-2.21	$-7.$	
1	-4.96	+7.02	-9	+17	+8	-1	+7 0
2	-4.09	-8.37	-9	+14	+5	+2	+7 0
3	+12.88	+2.28	+53	-95	+8	-1	+7 0
M	+0.36	-1.73	0	-1	+0	-8	
			$\Delta \eta$	-2.4	-3.3	-1	
			+13	-17	-1	+1	= 0 -1
			-17	+17	0	+1	= +1 0
			+10	-5	+5	-7	= +1 0
			0	+3	-0	=	<u>+2</u>

3846 Standard Coordinates.

6

Cape W. 3254 mag 6.5 Cape W. 3255 mag 6.3 Cape W. 3284 mag 6.4

L											
L											
E											
mean											
Prac											
α	23	15	45.29	23	16	11.89	23	25	02.25		
Δ	23	18	20	23	18	20	23	18	20		
$\alpha - \Delta$	-	2	34.71	-	2	08.11		6	42.25		
$\sin(\alpha - t)$	-		154.71	-		128.11			402.19		
$\log \dots$	2.18952			2.10758			2.60443				
$\log S$	9.99872			9.99730			9.99834				
$\log \dots$	0.69548			0.61212			1.11001				
$\log \dots$	-4.9600			-4.0937			+1.28827				
$\log \dots$	-		9	-		9			53		
$\log \dots$	130391			139054			30.8880				
$\log \dots$	134008			140842			30.3546				
$\log \dots$	+3617.			+1788			-5334				

C											
L											
E											
mean											
Prac											
S	-4	23	34.9	-6	22	58.5	-5	00	24.8		
D	-5	18	09	-5	18	09	-5	18	09		
S-D	+54	34.1		-1	04	49.5		17	44.2		
$\sin(S-D)$		+3274.4			-3890.0			1064.2			
$\log \dots$	3.51513			3.58995			3.02702				
$\log \dots$	0.84628			0.92110			0.35817				
$\log \dots$	8.8854			9.0486			8.9427				
$\log \dots$	13910			12242			22200				
$\log \dots$	73298			73262			82161				
$\log \dots$	+7.0190			-8.3388			+2.2812				
$\log \dots$	-	21		-	21		-	165			
$\log \dots$	29.0169			13.6591			24.2647				
$\log \dots$	287575			14.1294			29.0652				
$\log \dots$	-2594			+4703			-1995				

3846 Standard Coordinates

Cape W. 3254 mag 6.5 Cape W. 3254 mag 6.3 Cape W. 3254 mag 6.4

L

L

E

mean

P. sec

α	23	15	4529	23	16	1189	23	25	022
A	23	18	20	23	18	20	23	18	20
$\alpha - A$	-	2	3471	-	2	0811	+	6	4225
$-(\alpha - A)$	-	-	15471	-	-	12811	+	4	0219
log	2	18952		2	10758		2	60443	
mag	9	99872		9	99730		9	99834	
η	0	69548		0	61212		1	11001	
η_1	-	49600		-	40937		+	128827	
η_2	-	9		-	9		+	53	
η_3	1	30391		1	39054		3	08880	
η_4	1	34008		1	40842		3	03546	
$\eta - \eta_1$	+	3617		+	1788		-	5334	

C

L

E

mean

P. sec

S	-4	23	349	-6	22	585	-5	00	248
D	-5	18	09	-5	18	09	-5	18	09
$S - D$	+	54	341	-1	04	495	+	17	442
$\log(S - D)$	+	32744		-	38900		+	10642	
log	3	51513		3	58995		3	02702	
η	0	84628		0	92110		0	35817	
$\log \eta$	8	8854		9	0486		8	9427	
η_1	1	3910		1	2242		2	2200	
η_2	7	3298		7	3262		8	2161	
η_3	+	70190		-	83388		+	22812	
η_4	-	21		-	21		-	165	
η_5	2	90169		1	36591		2	42647	
η_6	2	87575		1	41294		2	40682	
$\eta - \eta_1$	-	2594		+	4703		-	1995	

3846 Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	19.5774	+1.1914	-5	1.4183	3.3131	-40
2	18.3860	0.0000	-7	0.0000	3.3160	-11
3	18.0000	-0.3860	-6	0.1495	3.3129	-42
4	17.1950	-1.1910	-5	1.4197	3.3145	-26
5	17.0000	-1.3860	-4	1.9221	3.3178	+7
6	16.6042	-1.7818	-1	3.1752	3.3167	-4
-7	16.5647	-1.8213	0	3.3171	3.3171	0
8	16.6730	-1.7130	+2	2.9337	3.3233	+62
9	17.0000	-1.3860	+4	1.9199	3.3057	-114
10	18.0000	-0.3860	+6	0.1485	3.3119	-52

Comp $R^2 = 3.3171$

	y	$y - y_0$	Δy	$(y - y_0)^2$	
1	19.0000	-1.3760	-5	1.8948	140
-2	18.5556	-1.8204	-6	3.3160	180
3	18.5980	-1.7780	-6	3.1634	192
4	19.0000	-1.3760	-5	1.8948	222
5	19.1950	-1.1810	-4	1.3957	236
6	20.0000	-0.3760	-1	0.1415	258
7	20.3760	0.0000	0	0.0000	270
8	21.0000	+0.6240	+2	0.3896	290
9	21.5528	+1.1768	+4	1.3858	310
10	22.1540	+1.7780	+6	3.1634	348

Range 209

Approx Center

$x = 18.0$	$y = 18.5980$	$x = 17.0$	$y = 19.1950$	$x = 19.0$	$y = 19.5774$
	<u>22.1540</u>		<u>21.5528</u>		<u>17.1950</u>
	40.7520		40.7478		36.7724
$y_0 = 20.3760$		$y_0 = 20.3739$		$x_0 = 18.3862$	
$y_{\min} = 18.5556$		<u>18.5556</u>		$x_{\min} = 16.5647$	
$R = 1.8204$		1.8183		$R = 1.8215$	

Center $\left\{ \begin{array}{l} x_0 = 18.3860 \\ y_0 = 20.3760 \end{array} \right.$

3846 Orosius Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	19.5779	+1.1914	-5	1.4183	3.3131	-40
2	18.3860	0.0000	-7	0.0000	3.3160	-11
3	18.0000	-0.3860	-6	0.1495	3.3129	-42
4	17.1950	-1.1910	-5	1.4197	3.3145	-26
5	17.0000	-1.3860	-4	1.9221	3.3178	+7
6	16.6042	-1.7818	-1	3.1752	3.3167	-4
7	16.5647	-1.8213	0	3.3171	3.3171	0
8	16.6730	-1.7130	+2	2.9337	3.3233	+62
9	17.0000	-1.3860	+4	1.9199	3.3057	-114
10	18.0000	-0.3860	+6	0.1485	3.3119	-52

Comp Σ 3.3171

	y	$y - y_0$	Δy	$(y - y_0)^2$	
1	19.0000	-1.3760	-5	1.8948	139
2	18.5556	-1.8204	-6	3.3160	180
3	18.5980	-1.7780	-6	3.1634	192
4	19.0000	-1.3760	-5	1.8948	224
5	19.1950	-1.1810	-4	1.3957	229
6	20.0000	-0.3760	-1	0.1415	258
7	20.3760	0.0000	0	0.0000	290
8	21.0000	+0.6240	+2	0.3896	290
9	21.5528	+1.1768	+4	1.3858	310
10	22.1540	+1.7780	+6	3.1634	348

Range: 209

Approx Center

$\Sigma = 180$	$y = 18.5980$	$\Sigma = 170$	$y = 19.1950$	$\Sigma = 140$	$y = 19.5779$
	<u>22.1540</u>		<u>21.5556</u>		<u>17.1750</u>
	40.7520		40.7478		36.7720
$y = 20.3760$		$y = 20.3739$		$x = 18.3862$	
$y = 18.5556$		<u>18.5556</u>		$\Sigma = 16.5647$	
$x = 1.8204$		1.8183		$R = 1.4215$	

Center Σ
 $X_0 = 18.3860$
 $Y_0 = 20.3760$

Formation of Normals

	ab	ac	bc
1	- 1.64	- 47.6	+ 55.2
2	- 0.00	- 0.0	+ 20.0
3	+ 0.69	+ 16.4	+ 74.8
4	+ 1.64	+ 30.9	+ 35.9
5	+ 1.64	- 9.7	- 8.3
6	+ 0.68	+ 7.1	+ 1.5
7	- 0.00	- 0.0	+ 0.0
8	- 1.06	- 106.0	+ 38.4
9	- 1.64	+ 158.6	- 134.5
10	- 0.69	+ 20.3	- 92.6
	- 0.38	+ 70.0	- 9.6

	a	b	c	new c-c
	+ 9	- 6	+ 18	- 28
a	+ 8	0	+ 8	- 4
b	+ 4	- 3	+ 5	- 38
c	+ 15	- 9	0	- 22
	- 10	- 5	0	+ 12
	- 14	- 1	0	+ 4
	- 15	+ 0	0	+ 8
	- 14	+ 2	+ 3	+ 72
	- 11	+ 5	+ 9	- 98
	- 3	+ 7	+ 19	- 30

3846 Innois Center.

Conditional Equations

	a	b	c		c	0-c
1	+1.19	-1.38	= -40	+5+1	= +6	-46
2	0.00	-1.82	= -11	0+1	= +1	-12
3	-0.39	-1.78	= -42	-2+1	= -1	-43
4	-1.19	-1.38	= -26	-5+1	= -4	-22
5	-1.39	-1.18	= +7	-6+1	= -5	+12
6	-1.78	-0.38	= -4	-8+0	= -8	+4
7	-1.82	+0.00	= 0	-8-0	= -8	+8
8	-1.71	+0.62	= +62	-7-0	= -7	+69
9	-1.39	+1.18	= -114	-6-1	= -7	-107
10	-0.39	+1.78	= -52	-2-1	= -3	-49
						<hr/>
						+ 95 - 279
						Average = 37

Normal Equations

$$\begin{aligned}
 +16.40 - 00.38 &= +70 & -8.87 \\
 -0.38 + 16.74 &= -10 & -4.34 \\
 +0.38 - 0.01 &= +2 & -0.20 \\
 +16.73 &= -8 & -4.54 \\
 +16.40 &= +70
 \end{aligned}$$

$$b = -0.5 - 0.27$$

$$a = +4.3 - 0.55$$

$$In\ 3 \quad R \quad 1.82$$

$$-2RC = +0.73$$

$$Arc\ measured = 208 \quad Average(0-c) = -18.6$$

$$\frac{rc}{n} = 0.52$$

$$\frac{-18.6}{\sqrt{2}} = -0.36 \quad \Delta n = -0.4$$

$$-2RC = +0.73$$

$$Corr = -0.2$$

$$\Delta b = 0.20 \quad \Delta \delta = -0.1$$

$$\Delta a = 0.40 \quad \Delta \alpha = -0.01$$

$$\Delta R = -0.2$$

1
2
3
4
5
6
7
8
9
10

3846 Inverse Center.

8

Conditional Equations

	a	b	c		d	e - d
1	+1.19	-1.38	-40	+5+1	+6	-46
2	0.00	-1.82	-11	0+1	+1	-12
3	-0.39	-1.78	-42	-2+1	-1	-43
4	-1.19	-1.38	-26	-5+1	-4	-22
5	-1.39	-1.18	+7	-6+1	-5	+12
6	-1.78	-0.38	-9	-8+0	-8	+4
7	-1.82	+0.00	0	-8-0	-8	+8
8	-1.71	+0.62	+62	-7-0	-7	+69
9	-1.39	+1.18	-114	-6-1	-7	-107
10	-0.39	+1.78	-52	-2-1	-3	-49

$$+ 95 = 279$$

$$\text{Average} = 37$$

Normal Equations

$$+ 16.40 = 00.38 = + 70$$

$$- 0.38 + 16.74 = - 10$$

$$+ 0.38 = 00.1 = + 2$$

$$+ 16.73 = - 8$$

$$b = - 0.5$$

$$+ 16.40 = + 70$$

$$a = + 4.3$$

Arc measured = 20.8

Average (e - d) = -18.6

$$\frac{18.6}{.52} = 35.28$$

$$\frac{-18.6}{.52} = -0.36 \quad \Delta z = -0.7$$

$$\begin{array}{r} 2a + 2 \\ \hline 18.3862 \end{array} \quad \begin{array}{r} 1b = 0 \\ \hline 203760 \end{array}$$

Down Plate constants $\chi = 18.3589'$ $\psi = 20.2651'$
22. 18

$$z = -1.7349$$

$$\log \tan S = 8.9836^{57}$$

9 1 1 0 0 u
7 0 5 3 4
5 1 4 7 0 u

$$\log \eta_0 = 0.23928 \checkmark$$

2.90813 m

$$\therefore (d-D) = -13.293$$

D- -5 18 09

$$S_0 = -5 \quad 31 \quad 38.3$$

Red: + 20.9%

$$S' = -5 \quad 3 \quad 1 \quad 1 \quad 7 \quad 4$$

3846 Means Mean Position (1913.0)

$$X_0 = 18\ 38\ 60 \quad Y_0 = 20\ 37\ 60$$

$$\begin{array}{r} 18\ 38\ 60 \\ + \quad 2 \quad 0 \\ \hline 18\ 38\ 62 \end{array} \quad \begin{array}{r} 20\ 37\ 60 \\ + \quad 0 \\ \hline 20\ 37\ 60 \end{array}$$

From Plate constants $X = 18.3589 \quad Y = 20.2651$

$$z = +0.3589$$

$$\eta = -1.7349$$

$$\log 5 = 9.55497$$

$$\log 3 = 9.99797$$

$$8.50724$$

$$\log \tan S = 8.9836$$

$$9.1100$$

$$7.0534$$

$$5.1470$$

$$(x-A) = 1.04976$$

$$\log \eta_0 = 0.23928$$

$$7.33115$$

$$x-A + 1.121$$

$$A = 23\ 18\ 20$$

$$2.90813$$

$$q_0 = 23\ 18\ 31.21$$

$$(0-D) = -13\ 29.3$$

$$Red = +3.62$$

$$D = -5\ 18\ 09$$

$$d' = 23\ 18\ 34.83$$

$$S_0 = -5\ 31\ 38.3$$

$$Red = +20.9$$

$$S' = -5\ 31\ 17.4$$

3846 Red. ad locum aph.

$$S = -5^{\circ} 31' 38.3''$$

$$H + \alpha \quad 5^h 54.1^m = 88^{\circ} 32'$$

$$H \quad 6 \quad 35.6$$

$$\alpha \quad 23 \quad 18.5$$

$$G \quad 21 \quad 48.1$$

$$G + \alpha \quad 21 \quad 06.6 = 316^{\circ} 39'$$

$$\log \cos S \quad 9.9980$$

$$L_1 \quad 0.9065$$

$$(L) \quad 0.9045$$

$$\sin S \quad 8983.7m$$

$$\cos(H + \alpha) \quad 84082$$

$$h \quad 1.2745$$

$$\sin \quad 99999$$

$$\sec S \quad 0.0020$$

$$8.8239$$

$$\cos(G + \alpha) \quad 9.8616$$

$$g \quad 1.2504$$

$$\sin \quad 98366m$$

$$\tan S \quad 89857m$$

$$8.8239$$

$$g' \quad 1.1120$$

$$g \quad 88966$$

$$h' \quad 8.6664m$$

$$h \quad 01003$$

$$f \quad +2.28$$

$$g \quad +0.08$$

$$h \quad +1.26$$

$$+3.62 \checkmark$$

$$g' \quad +1294$$

$$h' \quad -00.05$$

$$L \quad +8.03$$

$$+20.92 \checkmark$$

3846 Red. ad. locum. ahr.

$$S = -5^{\circ} 31' 38''$$

$$H + \alpha \quad 5^h 54^m 1^s = 88^{\circ} 32'$$

$$H \quad 6 \quad 356$$

$$a \quad 23 \quad 181$$

$$G \quad 21 \quad 481$$

$$G + \alpha \quad 21 \quad 066 = 316^{\circ} 39'$$

$$\log \cos S \quad 99980$$

$$i \quad 09065$$

$$(1) \quad 09045$$

$$\sin S \quad 89837m$$

$$\cos(H + \alpha) \quad 89082$$

$$h \quad 12745$$

$$\sin \dots \quad 99999$$

$$\cos S \quad 00020$$

$$88239$$

$$f \quad 11120$$

$$g \quad 88966$$

$$f \quad +228$$

$$g \quad +0.08$$

$$h \quad +126$$

$$+362 \checkmark$$

$$h' \quad 86664m$$

$$h \quad 01003$$

$$g' \quad +1294$$

$$h' \quad -00.05$$

$$h \quad +803$$

$$+2092 \checkmark$$

Lunar Parallax.

$$\begin{array}{r}
 3846 \\
 \alpha = 23^h 15^m 34.83^s \\
 \odot = 1 \quad 03 \quad 39.55 \\
 + 1 \quad 45 \quad 04.72 \\
 = +26^0 16' 10.80
 \end{array}$$

$$+ \quad 8 \quad 52.05$$

$$+ 26 \quad 07 \quad 19$$

$$9.95727$$

$$0.00000$$

$$0.04679$$

$$00.0406$$

$$\delta = 45 \quad 16 \quad 05$$

$$- \quad 5 \quad 31 \quad 17$$

$$50 \quad 47 \quad 22$$

$$9.82640$$

$$8.19584$$

$$9.88921$$

$$0.14849$$

$$8.05994$$

$$\delta - \delta' = +39 \quad 27.9$$

$$\delta = -4 \quad 51 \quad 49.5$$

$$\text{Nautical } \delta = -4 \quad 51 \quad 53.2$$

$$O-C \quad +3.7$$

$$\text{Corr. of Plate} \quad +0.1$$

$$\text{Inv.} \quad -0.1$$

$$\text{2nd order ref.} \quad +0.1$$

$$\delta = -4 \quad 51 \quad 49.5$$

$$O-C = +3.7$$

$$\delta' = -5^0 31' 17.4$$

$$\pi = 53' 58.05$$

$$9.86913$$

$$8.19584$$

$$9.64601$$

$$0.00157$$

$$7.71255$$

$$\alpha - \alpha' = +17' 44.10$$

$$= +1 \quad 10.94$$

$$\alpha = 23 \quad 19 \quad 45.77$$

$$\alpha = 23 \quad 19 \quad 45.08$$

$$+0.76$$

$$\text{Corr.} \quad -0.03$$

$$\text{Inv. Corr.} \quad -0.01$$

$$\alpha = 23 \quad 19 \quad 45.76$$

$$O-C = +0.75$$

3846

Lunar Parallax

 $\alpha = 23^h 18^m 39.83$ $\delta = -5^\circ 31' 17.4$ $\theta = 1 \ 03 \ 39.55$ $+1 \ 45 \ 04.72$ $+26^\circ 16' 10''$ $+ \ 8 \ 52$ $+26 \ 07 \ 1.9$ 9.95727 0.00000 0.04679 0.00406 $\delta = 45 \ 16 \ 05$ $5 \ 31 \ .17$ $50 \ 47 \ 22$ 9.82640 8.19584 9.88921 0.14849 8.05994 $\delta - \delta' = +39 \ 27.9$ $\delta = -4 \ 51 \ 49.5$ Nautical S = $-4 \ 51 \ 53.2$ $\theta - C$ $+3.7$

Corr. of Plate

 $+0.1$

Dist

 -0.1

2nd Order ref.

 $+0.1$ $\delta = -4 \ 51 \ 49.5$ $\theta - C = +3.7$ 9.86913 8.19584 9.64601 0.00157 7.71255 $\alpha - \alpha' = +17 \ 44.10$ $+1 \ 10.94$ $\alpha = 23 \ 19 \ 45.77$ $\alpha = 23 \ 19 \ 45.08$ $+0.76$

Corr.

 -0.03

Dist Corr

 -0.01 $\alpha = 23 \ 19 \ 45.76$ $\theta - C = +0.75$

1913 Sept. 15.
3856

Stars - Measures -

1914 May 25

15

	d	4	"	d ²	"
1	15378	19648	8003	14861	
7.1	1288172	1214139	9801	145282	
22.3	71	4039	7665	29	
	81	40			
	<u>22.2504</u>	<u>.2498</u>	<u>7.0336</u>	<u>.0335</u>	
2	20061	17250	19459	19972	
16.7	16169	11135	1627123	1318590	
29.4	6973	3533	22	92	
	66	46	51	70	
	<u>29.3893</u>	<u>.3885</u>	<u>16.6765</u>	<u>.6782</u>	
3	18511	17548	18616	19092	
28.2	1622526	982528	1025041	1746067	
12.3	20	30	40	7167	
	00	49	05	99	
	<u>12.2289</u>	<u>.2279</u>	<u>28.1637</u>	<u>.1627</u>	

Grade 1

Star no. 2 evidently misidentified.
Extra star measured & replace it.

1				
2	16697	16582	16340	17170
29	14530	873026	1524048	825058
22	1920	31	43	6058
	87	60	15	63
	<u>222173</u>	<u>.2165</u>	<u>27.8907</u>	<u>.8908</u>

1913 Sept. 15
3856

Stars Measured

1914 May 25

15

	d	1	2
1	15378	19648	
71	1288172	1214139	
223	71	40	
	81	40	
	<u>22.2504</u>	<u>2498</u>	

2	20061	17250	
167	16169	11135	
1294	6973	3533	
	66	46	
	<u>29.3893</u>	<u>3885</u>	

3	18511	17148	
282	1622526	982528	
123	20	30	
	00	49	
	<u>12.2289</u>	<u>2279</u>	

	d	1	2
8003	14861		
9801	1452826		
7665	29		
	<u>7.0336</u>	<u>0335</u>	

19459	19972		
1622123	1318590		
22	92		
51	70		
<u>16.6765</u>	<u>6782</u>		

18616	19092		
1025041	17960		
40	7167		
05	99		
<u>28.1637</u>	<u>1621</u>		

Grade 1

Star 62 evidently misidentified
extra star measured & replaced

2	16697	16552	16340	17170
279	14530	873026	1524048	82503
272	1920	31	43	60
	87	60	27	63
	<u>22.2173</u>	<u>2165</u>	<u>27.8907</u>	<u>8908</u>

3856 Moon-Measures.

$$\begin{array}{r}
 1 \\
 20.0 \\
 18.7 \\
 18343 \\
 1028580 \\
 78 \\
 37 \\
 \hline
 18.8057
 \end{array}$$

$$\begin{array}{r}
 19740 \\
 1780099 \\
 8499 \\
 30 \\
 \hline
 8056
 \end{array}$$

$$\begin{array}{r}
 2 \\
 20.3 \\
 19.0
 \end{array}$$

$$\begin{array}{r}
 3 \\
 20.8 \\
 20.0
 \end{array}$$

$$\begin{array}{r}
 4 \\
 20.9 \\
 20.3 \\
 \text{max} \\
 \hline
 2
 \end{array}$$

$$\begin{array}{r}
 5 \\
 20.7 \\
 21.0
 \end{array}$$

$$\begin{array}{r}
 6 \\
 20.0 \\
 21.9 \\
 15110 \\
 577260 \\
 50 \\
 00 \\
 \hline
 21.9348
 \end{array}$$

$$\begin{array}{r}
 16485 \\
 1582419 \\
 29 \\
 70 \\
 \hline
 9340
 \end{array}$$

$$\begin{array}{r}
 18710 \\
 1146178 \\
 7070 \\
 09 \\
 \hline
 20.2761
 \end{array}$$

$$\begin{array}{r}
 17730 \\
 1625058 \\
 51 \\
 27 \\
 \hline
 20.8523
 \end{array}$$

$$\begin{array}{r}
 17727 \\
 1660011 \\
 09 \\
 19 \\
 \hline
 20.8881
 \end{array}$$

$$\begin{array}{r}
 16710 \\
 1449790 \\
 90 \\
 07 \\
 \hline
 20.7783
 \end{array}$$

$$\begin{array}{r}
 15378 \\
 12582 \\
 8796 \\
 81 \\
 \hline
 2791
 \end{array}$$

$$\begin{array}{r}
 15421 \\
 689783 \\
 91 \\
 20 \\
 \hline
 8530
 \end{array}$$

$$\begin{array}{r}
 16420 \\
 755336 \\
 3836 \\
 29 \\
 \hline
 8886
 \end{array}$$

$$\begin{array}{r}
 16402 \\
 866958 \\
 59 \\
 36 \\
 \hline
 7777
 \end{array}$$

3856 Moon Measures

	a	b	c	d	e
1	18343	19740			
200	1028580	1780099			
187	78	84			
	37	30			
	<u>18.8057</u>	<u>8056</u>			

2
w.3
170

18710
1146178
7070
09
20.2761

15378
12582
8796
81
2791

3
w.8
w.0

17730
1625058
51
27
20.8523

15421
689783
91
20
8530

4
w.9
w.3
w.4
2

17727
1660011
09
19
20.8881

16420
755330
38
29
8886

5
w.7
21.0

16710
1449790
90
07
20.7783

16452
866958
59
36
7777

6
w.0
21.9
577260
50
00
21.9348

16485
1582419
29
70
9340

1
7

19
20

9
8
21

3850

Moon-Measures

	α		δ	γ	ϵ	ζ
7	19703		17110			
19.0	1780096		899792			
222	00		95			
main	99		07			
4	<u>22.1903</u>		<u>1887</u>			

8 scratch

18.5	16112	13706	18935	19030
22.1	1529184	05-10	1345050	1447566
	75	12861	50	77
			25	11
	<u>220829</u>	<u>0846</u>	<u>184520</u>	<u>4548</u>

9	18490	18259
80	10066	1668070
21.8	75-68	16650
	00	49
	<u>21.8428</u>	<u>8420</u>

a little bit
on phase limb.

3850

Moon-Measures

	19703	17110
190	1780096	899292
222	00	91
man	99	07
4	<u>22.1903</u>	<u>1887</u>

8 scratch

18.5	16112	1370610
22.1	1529184	05-10
	71-54	12861

22.08290846

18935

19030

1341050

1447566

50

77

25

11

18.45204548

9	18490	18259
170	10066	1668070
21.8	71-68	16680
	00	49
	<u>21.8428</u>	<u>8420</u>

a little bit
on phase limb

3856 Times etc
 Sept 15, 21^h 37^m 49^s - 21^h 49^m
 Moon 21 43 25.5 - 21 43 25.8
 Clock fast 2 33.7

1st Sid Time 21 40 51.95 $\Theta - \alpha - 2^h 15^m$
 H. hour 4 44 31.05
 G. Sid T. 26 25 23.00
 Sid T. M. Moon 11 35 22.09
 Interval 14 50 00.91
 Reduction 2 25.81
 G. M. T. 14 47 35.10

From Transit Alm. R. A. Decl.
 Moon 15^h 23^m 55^s 47.65 + 0° 02' 31".4
 Mot. in 1.7317 14.236
 " " 12.415 - 21.570 - 2 56.7
 Tabular place 23 55 26.15 - 0 00 25.3

Moon's age 15 days. 14^h past full.
 parallax 53' 58".82
 semidiameter 14 44.1
 R 884.1
 Augmentation 8.6
 Inradiation (1) + 0.2
 R - 892.9
 R - 1.9140
 R - 916
 $c = -502.8$
 - 24
 - 4788
 $(1+a)R = 1.8224$
 $(1+a)R^2 = 3.3211$

3856 Times etc
 Sept 15 1913 Sept 11 21" 37" 57" - 21" 49"
 known 21 43 25.5 - 21 43 25.8
 look for 2 33.7

11. Lid In 21 4.0 519.5 6-11-2" 15"
 11. long 4 4.4 31.05
 11. Lid T. 26 2.5 23.00
 Sed T. to bottom 11 3.5 22.09
 Imbedded 14 5.0 00.91
 Reduction 2 25.51
 G. in T. 14 4.7 35.10

From Transit Alm R A Decl
 15" 23" 55" 47.65 +0° 02' 31".4
 motion 1.7317 14.236
 -12.415 - 21.50 - 2 56.7
 Tabular place 23 55 26.15 - 0 00 25.3

Moon's age 15 days. 14^h past full
 parallel as 53 58" 86
 perpendicular 14 44.1
 R 884.1
 Argument of 8.6
 Inclination (1) +0.2
 R 892.9
 R 1.91 +0
 R -91.6
 (1.76) R 1.8224
 (1.76) R 3.3211

Cerberus 3 mag 8.6

0^h 01^m 00^s 58

66

,58

0 01 00.61

+ 3994

0 01 40.55

23 56 30

+ 5 10.55

+ 31052

2.49209

9.99999

0.99932

+ 9.9844

+ 24

3 27.9868

x 27.8908

- 960

-0 26 06.3

06.7

06.5

-0 26 06.5

+ 4 20.6

-0 21 45.9

-0 24 50

+ 3 04.1

+ 184.1

2.26505

959520

78015^m

19986

68535^m

+ 0.3946

- 7

22.3939

22.2169

- 1770

 ξ η $\Delta\xi$ -2.95 +2.9ⁿ +9

1 -11.91 +0.30 -71 +35 +1 = -5 = -1

2 +10.33 -10.09 +50 -30 -29 = -9 = 0

3 +9.98 +0.39 +29 -29 +1 = -9 = 0

M +0.73 -1.60 0 -2 -9 = -2

 $\Delta\eta$ -5ⁿ -1

+1 -1 = 0 +1

-51 +50 = -1 0

+1 -2 = -1 0

0 +9 = +8

3856

Standard coordinates

Cape W. 3344 mag 6.0				Cape W. 3357 mag 9.9				Cape W. 4 mag 8.0			
C	23° 49'	39.51		23° 55'	26.98	0° 01'	11.49				
L		52			98		11.50				
E		.50			27.01		11.52				
Mean	23° 49'	39.51		23° 55'	26.99	0° 01'	11.50				
Prec		+ 39.88			+ 39.94		+ 39.94				
A	23° 50'	19.39		23° 56'	06.93	0° 01'	51.44				
A	23° 56'	30		23° 56'	30	23° 56'	30				
A-A	- 6	10.61		-	23.07	+	5-21.44				
A(A-A)		- 370.57			- 23.07		+ 321.41				
log "	2.56887m			1.36305m			2.50706				
"cos	9.99999			9.99998			9.99991				
"s	1.07610m			987027m			1.01411				
3 ₀	- 11.9151			+ 0.7418			+ 10.3302				
3 ₁	-	41		+	2		+	50			
3	6.0808			18.7420			28.3352				
3	7.0336			16.6774			28.1632				
2-3	+ .9528			- 20646			- 1720				
C -	0° 26'	48.6		+ 0° 30'	33.0	- 1° 47'	38.23				
L		49.0			33.3		38.7				
E		48.8			32.5		39.2				
Mean	0° 26'	48.8		+ 0° 30'	32.9	- 1° 47'	38.7				
Prec	+ 4	20.2		+ 4	20.6	+ 4	20.6				
S -	0° 22'	28.6		+ 0° 34'	53.5	- 1° 43'	18.1				
D -	0° 24'	50		- 0° 24'	50	- 0° 24'	50				
S-D	+ 2	21.4		+ 1° 09'	43.5	- 1° 18'	28.1				
tan(S-D)	+ 141.4			+ 4184.1		- 4708.9					
log "	2.15045			3.67160			3.67292m				
"m	948160			095275			1.00407m				
tan S	7.8153m			80064			8.4781m				
"E2	2.1522			9.7405			20282				
"m	7.0209m			4.8003			7.5597m				
m	+ 0.3031			+ 8.9692		- 10.0942					
m	- 10			+	0	-	36				
m	22.3021			30.9692			21.9022				
y	22.2501			28.3889			12.2284				
y-y	- 0.0520			- 1.5803			+ 0.3262				

3856 Standard Coordinates

Cape No. 3844 my 60	Cape No. 3857 my 9	Cape No. 4	80
C 23 49 39.51	23 55 26.98	0 01	11.49
L 52	98		11.50
E .50	27.21		11.52
mean 23 49 39.51	23 55 26.99	0 01	11.50
Prec + 39.88	+ 39.94	+ 39.94	
δ 23 50 19.39	23 56 06.93	0 01	51.44
μ 23 56 30	23 56 30	23 56 30	
α - 6 10.61	- 23.07	+ 5	21.44
$\mu(\alpha)$ - 370.57	- 25.27	+ 321.41	
log 2.56887	1.36305	2.50706	
log 9.99999	9.99998	9.99998	
ϵ 1.07610	9.87027	1.01411	
ϵ_0 - 11.9151	+ 10.7418	+ 10.3302	
ϵ_1 - 41	+ 2	+ 50	
ϵ 6.0808	18.7420	18.3352	
λ 7.0336	16.6774	28.1632	
$\lambda - \epsilon$ + .9528	- 206.46	- 1720	

C -	0	26	48.6	+ 0	20	33.0	- 1	47	38.23
L			49.0			33.3			38.7
E			48.5			32.5			42
mean	0	26	48.8	+ 0	30	32.9	- 1	47	38.7
Prec		+ 4	20.8		+ 4	20.6		+ 4	20.6
δ -	0	22	28.6	+ 0	14	53.5	- 1	43	19.1
D -	0	24	50	- 0	24	50	- 0	24	50
μ	+ 2	21.4		+ 1	09	43.5	- 1	18	28.1
$\mu(\delta)$		+ 141.4			+ 4	84.1			- 47089
log		2.15045			3.62160				3.67272
log		9.98160			0.95275				1.00407
log		7.8153			8.0064				8.4781
ϵ		2.1522			9.7405				20.282
η_1		7.0207			4.8003				7.5597
η_0		+ 0.3031			+ 8.9692				- 10.0942
η_1		- 10			- 0				- 36
η		22.3021			30.7692				11.9022
η		22.3501			29.3559				12.2284
$\eta - \eta_0$		- 0.0520			- 1.5803				+ 0.3262

27.8908 22.2169

3/5

1

7

+

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19

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20

3856

Plate Center

X	Y	R.A.			Decl.		
70336	222501	23 ^h	50 ^m	19 ^s	-0	22	29
+6.6174	29.3889		56	07	+0	34	54
28.1632	122284	0	01	51	-1	43	18
351.87	63.87	370	107	77	-1	30	53
17.29	21.29	23	56	06	-0	30	18
78	22		+	22	+	5	30
0.711	071	23	56	28	-0	24	48
31	465						
22.01	330"						

Center $\left\{ \begin{array}{l} A = 23^h 56^m 30^s \\ D = -0^\circ 24' 50'' \end{array} \right.$

$$\begin{array}{rclclclcl}
 2-3 & +500x & & -62.34 & & +2.8x & & -11.679 \\
 +95.28 & +3517 & = & +13045 & -1386 & +11659 & +120 & = +11679 = 0 \\
 -960 & +13945 & = & +12985 & -1384 & +11601 & +78 & = +11679 = 0 \\
 -1720 & +14082 & = & +12362 & -762 & +11600 & +79 & = +11679 = 0 \\
 19.0677 & +9534 & \cdot 12 & -1269 & & +53 & & = 18.7296
 \end{array}$$

$$\begin{array}{rclclclcl}
 4-7 & +500y & & +60.7x & & +5.4y & & -11.152 \\
 -520 & +11125 & = & +10605 & +427 & +11032 & +120 & = +11152 = 0 \\
 -1770 & +11108 & = & +9338 & +1693 & +11031 & +120 & = +11151 = -1 \\
 +3262 & +6114 & = & +9376 & +1710 & +11086 & +66 & = +11152 = 0 \\
 203685 & +10184 & & +1157 & & +110 & & = 20.3984
 \end{array}$$

Tables $a = -1.3$ $a = -3.5$ $a - e = +2.2$ $b + a = +4.5$
 Obs. $a = -502.8$ $a = -505.4$ $a - e = +2.6$ $b + a = +1.6$

$\theta - c$ $-501.5''$ $-501.9''$ -2.9

3856 Plate Center

X	Y	RA	Decl.
70336	222501	23 ^h 50 ^m 19 ^s	-0 22 29
166774	293889	56 07	+0 34 19
241632	122284	0 01 51	-1 43 18
5187	6387	70 107 77	-1 30 17
1729	2129	23 56 06	-0 30 18
18	22	+ 22	+ 5 30
0.71	0.71	73 56 28	-0 24 48
7201	330		

Center $\left\{ \begin{array}{l} A = 23^{\circ} 56' 20'' \\ D = -0^{\circ} 24' 50'' \end{array} \right.$

$$\begin{array}{rclcl}
 2-8 & +500x & -62.3y & +2.8z & -11.679 \\
 +9128 & +3517 & +13045 & -1586 & +11659 + 74 = 11679 \\
 -900 & +13945 & +12981 & -1584 & +11601 + 78 = 11679 \\
 -1720 & +14082 & +12362 & -762 & +11600 + 79 = 11679 \\
 19.0677 & +9534 & -1269 & +53 & = 18.7296
 \end{array}$$

$$\begin{array}{rclcl}
 4-7 & +120y & +60.7x & +5.4y & -11.152 \\
 -520 & +11125 & +10605 & +427 & +11032 + 120 = 11152 \\
 -1770 & +11108 & +9338 & +1693 & +11031 + 120 = 11151 \\
 +3262 & +6114 & +9376 & +1710 & +11086 + 66 = 11152 \\
 20.3685 & +10184 & +1157 & +110 & = 20.3984
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Turley } a = -1.3 & b = -3.5 & a = -2 & b = +2.2 & b + a = +4.5 \\
 \text{Obs. } a = -5028 & b = -5454 & a = -4 & b = +2.6 & b + a = +1.6
 \end{array}$$

10
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9

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9

3856

Moon's Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$O - C$
1	20.0000	+0.9310	+6	0.8679	3.3162	-49
2	20.2776	+1.2086	+5	1.4619	3.3392	+181 ^{1/2} wt
3	20.5526	+1.7836	+1	3.1816	3.3186	-25
+4	20.8884	+1.8194	0	3.3102	3.3102	-109
5	20.7780	+1.7090	-3	2.9197	3.3167	-44
6	20.0000	+0.9310	-6	0.8657	3.3140	-71
7	19.0000	-0.0690	-7	0.0049	3.3169	-42
8	18.4534	-0.6156	-7	0.3799	3.3180	-31
9	18.0000	-1.0690	-6	1.1441	3.3129	-82

$$R^2 = 3.3211$$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$	
1	18.8056	-1.5644	-3	2.4483	1.49
2	19.0000	-1.3700	-3	1.8777	1.39
3	20.0000	0.3700	-1	0.1370	1.02
4	20.3700	0.0000	0	0.0000	90
5	20.0000	+0.6300	+1	0.3970	1.70
6	21.9344	+1.5644	+3	2.4483	31
+7	22.1895	+1.8195	+4	3.3120	0.2
8	22.0838	+1.7138	+3	2.9381	3.40
9	21.8424	+1.4724	+3	2.1688	3.24

Range 185

Approx. Center

$$x = 200 \quad y = 18.8056$$

$$y = 21.9344$$

$$40.7400$$

$$Y_0 = 20.3700$$

$$y\text{-max} = 22.1895$$

$$R = 18.895$$

$$x\text{-max} = 20.8884$$

$$X_0 = 19.0689$$

$$\text{Center } \left\{ \begin{array}{l} X_0 = 19.0690 \\ Y_0 = 20.3700 \end{array} \right.$$

3
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3856

Known Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	20 0000	+0.9310	+6	0.8679	3.3162	-49
2	20.2776	+1.2086	+5	1.4619	3.3392	+181
3	20.8526	+1.7836	+1	3.1816	3.3186	-25
4	20.8884	+1.8194	0	3.3102	3.3102	-109
5	20.7780	+1.7090	+3	2.9177	3.3167	-44
6	20 0000	+0.9310	+6	0.8679	3.3140	-71
7	19 0000	-0.0690	-7	0.0049	3.3169	-42
8	18.4534	-0.6156	-7	0.3789	3.3180	-31
9	18 0000	-1.0690	-6	1.1441	3.3129	-82

$$R^2 = 33211$$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$	
1	18 8056	-1.5644	-3	2.4483	149
2	19 0000	-1.3700	+3	1.8777	139
3	20 0000	-0.3700	-1	0.1370	102
4	20.3700	0.0000	0	0.0000	90
5	20 0000	+0.6300	+1	0.3970	70
6	21.9344	+1.5644	+3	2.4483	131
7	22.1895	+1.8195	+4	3.3120	0
8	22.0838	+1.7138	+3	2.9381	340
9	21.8424	+1.4724	+3	2.1688	324

Range 185

Approx. Center

$$x = 200 \quad y = 185056$$

$$219344$$

$$40.7400$$

$$Y_0 = 20.3700$$

$$y_{\text{max}} = 22.1895$$

$$R = 1.8695$$

$$x_{\text{max}} = 20.8884$$

$$X_0 = 19.0690$$

$$\text{Center } \left\{ \begin{array}{l} X_0 = 19.0690 \\ Y_0 = 20.3700 \end{array} \right.$$

Formation of harmonals.

	ab	ac	bc
1	- 1.45	- 43.7	+ 73.4
$\frac{1+2}{2}$	- 0.41	+ 54.7	- 62.0
3	- 0.66	- 44.5	+ 9.3
4	+ 0.00	- 19.84	- 0.0
5	+ 1.08	- 75.3	- 27.8
6	+ 1.45	- 66.0	- 110.8
7	- 0.13	+ 3.0	- 76.5
8	- 1.06	+ 19.2	- 53.0
9	- 1.57	+ 87.7	- 120.5
	- 2.75	- 263.3	- 367.9

	a	b	c	new b-c
	- 40	+ 44	+ 77	+ 7
a	- 73	- 52	+ 38	+ 59
b	- 28	- 77	+ 10	+ 6
c	+ 73	- 78	- 0	- 5
	- 74	- 18	- 19	+ 2
	- 90	- 44	- 11	- 9
	+ 3	- 51	+ 25	+ 37
	+ 27	- 48	+ 52	+ 57
	+ 46	- 91	+ 78	+ 12

3856

Conditional Equations

	a	b	c	$0-c$	
1	+0.93	-1.56	= -47	-25 + 48 = +23	-70
2	+1.21	-1.37	= +181	-32 + 42 = +10	+191
3	+1.78	-0.37	= -25	-48 + 11 = -37	+12
4	+1.82	+0.00	= -109	-49 - 0 = -49	-60
5	+1.71	+0.63	= -44	-46 - 19 = -65	+21
6	+0.93	+1.56	= -71	-25 - 48 = -73	+2
7	-0.07	+1.82	= -42	-2 - 56 = -54	+12
8	-0.62	+1.71	= -31	+17 - 53 = -36	+5
9	-1.07	+1.47	= -82	+29 - 45 = -16	-66
				+243 - 196	

Average = 49

Normal Equations

+13.04	-2.75	= -263	+6.62	
-2.75	+14.32	= -368	+3.89	
+2.75	-0.58	= -55	+1.39	
	+13.74	= -423	+5.28	$b = -30.8$
+13.04	-263	-85	= -348	$a = -26.7$
				+0.59

Arc measured = $1^\circ 5'$ Average = $+5.2$

$$\frac{pc}{m} = 37$$

$$\frac{+5.2}{37} = +0.14$$

$$\Delta a = +0.2$$

$$\text{Corr.} = -1.0$$

$$\Delta R = +1.2$$

$$-2 RC = +3.64$$

$$\Delta b = +1.38$$

$$\Delta \delta = +0.7$$

$$\Delta a = +2.15$$

$$\Delta \alpha = +0.07$$

3856

Conditional Equations

	a	b	c	d
1	+0.93 - 1.56 = -47	-25 + 48 = +23	-70	
2	+1.21 - 1.37 = +181	-32 + 42 = +10	+191	
3	+1.78 - 0.37 = -25	-48 + 11 = -37	+12	
4	+1.82 + 0.00 = -109	-49 - 0 = -49	-60	
5	+1.71 + 0.62 = -44	-46 - 49 = -65	+21	
6	+0.93 + 1.56 = -71	-25 - 48 = -73	+2	
7	-0.07 + 1.82 = -42	-2 - 56 = -54	+12	
8	-0.62 + 1.71 = -31	+17 - 53 = -36	+5	
9	-1.07 + 1.47 = -82	+29 - 45 = -16	-66	
		+243 - 196		

Normal Equations

$$+13.04 - 2.75 = -263$$

$$-275 + 1432 = -368$$

$$+275 - 0.58 = -55$$

$$+1374 = -423$$

$$+13.04 - 263 - 85 = -348$$

$$b = -30.8$$

$$a = -26.7$$

3856 Moon's Mean Position (1913.0)

$$X_0 = 19.0690$$

$$Y_0 = 20.3700$$

$$\frac{1}{2}a = \underline{\quad -13 \quad}$$

$$\frac{1}{2}b = \underline{\quad -15 \quad}$$

$$19.0677$$

$$20.3685$$

From plate constants $X = 18.7296$ $Y = 20.3984$

$$z = +0.7296$$

$$\eta = -1.6016$$

$$\log z = 9.86308$$

$$\cos \delta \quad 9.99997$$

$$8.50724$$

$$\log \tan \delta$$

$$\log \eta = 0.20455 m$$

$$7.33115$$

$$(x-A) \quad 1.35587$$

$$(y-D) = 2.87340 m$$

$$x-A \quad + \quad 22.69$$

$$\delta-D = -12 \quad 27.1$$

$$A = 23 \quad 56 \quad 30$$

$$D = -0 \quad 24 \quad 50$$

$$\alpha_0 = 23 \quad 56 \quad 52.69$$

$$S_0 = -0 \quad 37 \quad 17.1$$

$$\text{Red. add. app.} \quad + \quad 3.54$$

$$\text{Red.} \quad + \quad 22.9$$

$$\alpha' = 23 \quad 56 \quad 56.23$$

$$S' = -0 \quad 36 \quad 54.2$$

$$\begin{array}{rcl}
 3856 & \text{known} & \text{Mean Position (1913.0)} \\
 X_0 = 19.0690 & & Y_0 = 20.3700 \\
 \begin{array}{r} 19.0690 \\ -1.3 \\ \hline 19.0677 \end{array} & & \begin{array}{r} 20.3700 \\ -1.5 \\ \hline 20.3685 \end{array}
 \end{array}$$

$$\text{Template Constant } X = 18.7296 \quad Y = 20.3984$$

$$\begin{array}{rcl}
 \delta = +0.7296 \\
 \log \delta = 9.86308 \\
 \text{mod} & 9.99997 \\
 & 8.50724
 \end{array}$$

$$(X-A) = 1.35587$$

$$X-A = + 22.69$$

$$A = 2.35630$$

$$\alpha_0 = 23.5652.69$$

$$\text{Red. adl. app.} + 3.54$$

$$\alpha' = 23.5656.23$$

$$\eta = -1.6016$$

$$\begin{array}{rcl}
 \log \eta & 0.20455 \\
 & 7.33115
 \end{array}$$

$$(Y-D) = 28.7340$$

$$Y-D = - 12.27.1$$

$$D = -0.2450$$

$$S_0 = -0.3717.1$$

$$\text{Red.} = - 22.9$$

$$S' = -0.3654.2$$

3856 Red. and Proxima spp.

8 - 0 37 17

$$\begin{array}{rcl}
 H + \alpha & 6 & 28.8 = 97^{\circ} 12'' \\
 H & 6 & 31.9 \\
 \alpha & 23 & 56.9 \\
 \delta & 21 & 48.0 \\
 \delta + \alpha & 21 & 44.9 = 326^{\circ} 14''
 \end{array}$$

$$\begin{array}{rcl}
 2 \cos(H + \alpha) & & 9.9198 \\
 " \delta & & 1.2506 \\
 " \sin " & & 9.7449 m \\
 " \tan \delta & & 8.0353 m \\
 & & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \delta' & & 1.1704 \\
 \delta & & 78547
 \end{array}$$

$$\begin{array}{rcl}
 f & + & 2.29 \\
 g & + & 0.01 \\
 h & + & 1.24 \\
 \hline
 & = & 3.54 \checkmark
 \end{array}$$

$$\begin{array}{rcl}
 2 \cos \delta & & 9.9999 \\
 i & & 0.9074 \\
 (i) & & 0.9073
 \end{array}$$

$$\begin{array}{rcl}
 2 \cos \delta & & 8.0352 m \\
 " \cos(H + \alpha) & & 9.0981 m \\
 " h & & 1.2743 \\
 " \sin " & & 9.9966 \\
 " \sec \delta & & 0.0000 \\
 & & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 h' & & 84076 \\
 h & & 00948
 \end{array}$$

$$\begin{array}{rcl}
 g' & + & 14.81 \\
 h' & + & 003 \\
 i & + & 808 \\
 \hline
 & = & 2292 \checkmark
 \end{array}$$

3856 Red. and brown of p.

8 - 0 37 17

$$H+x \quad 6 \quad 28.5 = 97^{\circ} 12'$$

$$H \quad 6 \quad 31.9$$

$$a \quad 23 \quad 56.9$$

$$g \quad 2.1 \quad 48.0$$

$$g+x \quad 21 \quad 44.9 = 326^{\circ} 14'$$

$$2 \cos(H+x) \quad 99.198$$

$$g \quad 1.2506$$

$$\sin \dots \quad 97.449$$

$$\tan S \quad 80.353$$

$$8.8239$$

$$g' \quad 1.1704$$

$$g \quad 78547$$

$$f \quad + 2.29$$

$$g \quad + 0.01$$

$$h \quad + 1.24$$

$$- 3.54$$

$$2 \cos S \quad 9.9999$$

$$i \quad 0.9074$$

$$(i) \quad 0.9073$$

$$2 \cos S \quad 8.0352$$

$$\cos(H+x) \quad 9.0981$$

$$h \quad 1.2743$$

$$\sin \dots \quad 9.9966$$

$$\tan S \quad 0.0000$$

$$8.8239$$

$$h' \quad 84076$$

$$h \quad 0.0948$$

$$g' \quad + 1.481$$

$$h' \quad + 0.03$$

$$i \quad + 8.08$$

$$+ 2.292$$

3856

Lunar Parallax.

$$\begin{array}{r}
 \alpha' : 23^h 56^m 56^s 22 \\
 \delta : 21 \quad 40 \quad 51.95 \\
 -2 \quad 16 \quad 04.28 \\
 -34^{\circ} 01' 04''
 \end{array}$$

$$- \quad \quad \quad 11 \quad 10$$

$$-33 \quad 49 \quad 54$$

$$9.95727$$

$$0.00000$$

$$0.08057$$

$$0.03784$$

$$\gamma = 47 \quad 29 \quad 35$$

$$- \quad 0 \quad 36 \quad 54$$

$$48 \quad 06 \quad 29$$

$$9.82640$$

$$8.19594$$

$$9.87181$$

$$0.13242$$

$$802657$$

$$\delta - \delta' = + 36' 32.8$$

$$\delta = -0 \quad 00 \quad 21.4$$

$$\text{Nautical } \delta = -0 \quad 00 \quad 25.3$$

$$O-C \quad \quad \quad + \quad 3.9$$

$$\text{Cur. of Plate} \quad \quad \quad + 0.4$$

$$\text{Dev.} \quad \quad \quad + 0.1$$

$$\text{2nd ord. ref.} \quad \quad \quad + 0.0$$

$$\delta = -0 \quad 00 \quad 20.7$$

$$O-C_2 \quad \quad \quad + \quad 4.6$$

$$\delta' = -0^{\circ} 36' 54.2$$

$$\mu. \quad 53' 58.82$$

$$9.86913$$

$$8.19594$$

$$9.74776$$

$$0.00000$$

$$7.81283$$

$$\alpha - \alpha' = - \quad 22 \quad 20.47$$

$$= - \quad \quad 1 \quad 29.36$$

$$\alpha = 23 \quad 55 \quad 26.87$$

$$\alpha = 23 \quad 55 \quad 26.15$$

$$+ 0.72$$

$$- 0.01$$

$$\text{Dev.} \quad \quad \quad + 0.07$$

$$\alpha = 23 \quad 55 \quad 26.94$$

$$O-C_2 \quad \quad \quad + 0.79$$

3856 Lunar Parallax

$$\begin{array}{r}
 \alpha' - 23^{\circ} 56' 56.22 \\
 0 - 21 \quad 40 \quad 51.95 \\
 - 2 \quad 16 \quad 04.28 \\
 - 34^{\circ} 01' 04''
 \end{array}$$

$$- \quad \quad \quad 11 \quad 10$$

$$- 33 \quad 49 \quad 54$$

$$995727$$

$$0.000000$$

$$0.08057$$

$$0.03784$$

$$\delta - 47 \quad 29 \quad 35$$

$$- \quad 0 \quad 36 \quad 54$$

$$48 \quad 06 \quad 29$$

$$982640$$

$$819594$$

$$987181$$

$$013242$$

$$802657$$

$$\delta - S = + 36' 32.8$$

$$S = -0 \quad 00 \quad 21.4$$

$$\text{Nautical S} = -0 \quad 00 \quad 25.3$$

$$O-C \quad + \quad 3.9$$

$$\text{Cur of Plate} \quad + 0.9$$

$$\text{Dev.} \quad + 0.7$$

$$\text{2nd ord. ref.} \quad + 0.0$$

$$S = -0 \quad 00 \quad 20.7$$

$$O-C = + 4.6$$

$$S' = -0^{\circ} 36' 54.2$$

$$\text{N.} \quad 53' 58.82$$

$$9.86913$$

$$8.19594$$

$$9.74776$$

$$0.00000$$

$$7.81283$$

$$\alpha - \alpha' = -22 \quad 20.47$$

$$- \quad \quad \quad 1 \quad 29.36$$

$$\alpha = 23 \quad 55 \quad 26.87$$

$$\alpha = 23 \quad 55 \quad 26.15$$

$$+ 0.72$$

$$- 0.01$$

$$\text{Dev.} \quad + 0.07$$

$$\alpha = 23 \quad 55 \quad 26.94$$

$$O-C = + 0.79$$

