

KG
11366
v.994

CXLII

142

Plate	Date	Page
9860	Nov. 30, '15	1
9997	Dec 15, '15	11
9998	"	21

Harvard Lunar Plates
Measures and Reductions
Martha C. Borton

16

1
1
1
2
1
2
3
1
2
2
1
1
2
2
1

9860

Star Measures

y

1

d	x	z	d	y	z
1	20716	20002	18430	20090	
10.3	27352	13367	14511	13998	
17.4	52	63	09	98	
	12	00	22	92	
	<u>103363</u>	<u>10.3365</u>	<u>17.3918</u>	<u>173906</u>	

2	19162	19406	20172	200697	
18.4	14294	14282	17900	12966	
29.2	94	92	912	68	
	62	392	79	700	
	<u>18.4868</u>	<u>18.4890</u>	<u>29.2267</u>	<u>29.2267</u>	

3	19862	18132	19238	19128	
18.7	12828	15172	16503	11859	
6.2	30	72	01	57	
	60	38	32	30	
	<u>18.7032</u>	<u>18.7038</u>	<u>6.2735</u>	<u>6.2729</u>	

4	20156	20314	19978	20596	
29.2	17938	12592	13766	17078	
24.7	41	90	62	82	
	52	12	82	98	
	<u>29.2215</u>	<u>29.2229</u>	<u>24.6517</u>	<u>24.6483</u>	

Moon Measures

1	21.5	29898	19196	
18.6	-7	18602	18776	
		90	62	
		908	00	
		<u>17.5297</u>	<u>17.5271</u>	

2	22	19873	19286	
18.7		13988	15172	
		80	30	
		90	92	
		<u>17.5857</u>	<u>17.5847</u>	

7860

Star Measures

y

d	1	2	3	4
L	20716	20006	18930	20090
10.3	17352	13367	19511	13998
17.9	52	63	09	98
	12	00	22	92
	<u>10.3363</u>	<u>10.3365</u>	<u>17.2918</u>	<u>173906</u>

2	19162	19906	20172	20699
18.9	19299	19282	17990	12966
29.2	99	92	912	68
	62	392	79	700
	<u>18.9868</u>	<u>18.9890</u>	<u>29.2267</u>	<u>29.2267</u>

3	19862	18132	19238	19128
18.7	12828	15172	16503	11859
6.2	30	72	01	57
	60	38	32	30
	<u>18.7032</u>	<u>18.7038</u>	<u>6.2735</u>	<u>6.2729</u>

9	20156	20319	19928	20596
29.2	17938	12592	13866	17078
	41	90	62	82
	52	12	82	98
	<u>29.2215</u>	<u>29.2229</u>	<u>24.6517</u>	<u>20.6483</u>

Moon Measures

11.5	19896	19196
19.6	18602	19776
-7	1P	62
	908	00
	<u>19.5299</u>	<u>19.5271</u>

2	19893	19286
22	13988	13172
19.7	80	30
	90	92
	<u>19.5857</u>	<u>19.5897</u>

9860

Main Measures.

2

3

23

15.3

20048

18196

92

50

15.1854

18970

10787

82

64

15.1818

oblique

4

23.7

16

19298

14888

888

99

23.7411

19578

13960

64

68

23.73895

23.6

16.3

+X

19392

14361

51

48

16.4989

19530

14516

12

28

16.49856

23.7

17

19397

15116

08

406

23.7287

19992

13788

88

88

23.72987

23

17.7

19832

12124

26

38

17.7711

20212

17932

38

23

17.77198

22.7

18

20179

12580

72

86

22.7608

19608

27176

76

16

22.7566

19750

5018

08

48

oblique

9860

Moon Measures

2

3
22
12.3

20048	18970
18196	10789
92	82
50	69
<u>15.1858</u>	<u>15.1818</u>

diagonal

3	19298	19578
23.9	19888	13960
16	888	69
	99	68
	<u>23.8911</u>	<u>23.9389</u>

5	19392	19530
23.6	19361	19516
16.3	51	12
+X	98	28
	<u>16.9989</u>	<u>16.9985</u>

6	19399	19992
23.9	15116	13788
17	08	88
	906	88
	<u>23.9287</u>	<u>23.9298</u>

7	19832	20212
23	12129	17932
17.7	26	38
	38	23
	<u>17.7711</u>	<u>17.7719</u>

8	20179	19608	19750
22.7	12380	17176	15018
18	72	76	08
	86	16	98
	<u>22.7608</u>	<u>22.7566</u>	

off

9860

Junes

Etc.

3

Nov. 30 '13

Exp. to Stars	10	42	10	57
" " Moon	10	48	23.0	1.0 48 23.2
Clocks fast		4	37.0	
H. Sid. T.	10	43	46.1	$\theta - \alpha = -0^h 58^m$
H. Long	4	47	31.05	
G. Sid. T.	15	28	17.15	
Sid. T. M. N.	16	33	6.31	
Internals	22	55	10.87	
Reductions		3	5.27	
G. M. T.	22	51	25.55	

From Nant Alm.	R. A.	here.
Moon 22 ^h	11 39 32.35	-1 45 47.1
Motion int ^m		1.9818
" " 51.7258	1 41.92	-12 56.6
Tabular Place	11 41 14.27	-1 38 43.7

Moon's Age 24 days

Parallax	57' 37.05"
Semid.	15' 42.8"
P	9 42.8"
Ang	11.1"
Dir 4	-0.6"
R	9 53.3"
R.	2.0 43.5"
AR	-980"
(1+R)	19 75.5"
P ₂	3 785.0"

934 10.89

 $\alpha = -503.7$

$$\begin{array}{r} 24 \\ -479.7 \\ \hline \end{array}$$

9860

Series

Etc

Nov. 30 '15

Epp. to Stars	10	92		10	59	
" Moon	10	98	23.0 -	10	98	23.2 -
Clock fast		9	37.0 -			

H. Sid J	10	93	96.0 -	8.4 -	- 0 ^h 58 ^m	
H. Long	9	99	31.05 -			
Y. Sid J	15	28	17.15 -			
Sid J M. II	16	33	631 -			
Internal	22	55	1089 -			
Reduction		3	4529 -			
G. M. J.	22	51	2555 -			

From Mant Alm		R. G.		Rec.		
Moon 22	11	39	32.35 -	- 1	95	97.1
Motion int			19818 -			- 15 101
" 51.7258		1	91.92 -	- 12		56.6 -
Latular Place	11	91	19.27 -	- 1	58	93.7 -

Moon's Age 29 days

Parallax	57'	39.05
Semid	15'	92.8
R		972.8 -
Ang		11.1 ^h
Dir 1		- 0.6 -
R		9533 -
R		2.0935 -
AR		- 980 -
Half R		19755 -
R ²		37850 -

939 10 59

a = -503.7

29

- 4797

9860

Plate Constants

9

χ	10.3369	18.4879	18.7035	29.2222
ξ	10.5330	19.1035	19.3110	30.3736
χ_3	-1966	-6156	-6075	-11514

η	17.3912	29.2267	6.2732	21.6500
η	16.5818	29.0108	7.8891	21.0938
$\eta + 8099$		+2159	+13881	+6062

$\chi - \xi$	+5001	+8.264	+3.7X	-3391
-1966 + 5168	= +3202	+199 = +3396	+38 = +3387	-7
-6156 + 9299	= +3088	+271 = +3329	+68 = +3397	+6
-6075 + 9352	= +3277	+52 = +3329	+69 = +3398	+7
-11514 + 17611	= +3097	+179 = +3276	+108 = +3387	-7
215526 + 10776	+136	+80		22.3127

$\eta - \chi$	+5007	+7.15X	+8.94	-16885	
+8099 + 8676	= +16790	-79	= +16716	+155 = +16871	-19
+2159 + 14613	= 16772	-132	= 16670	+260 = +16900	+13
+13891 + 3137	= 16978	-137	= 16897	+56 = +16900	+16
+6062 + 10825	= 16887	-209	= 16678	+192 = +16870	-13
16.97597 8238	-154	+147			15.6105

Tables $a = -1.3$ $e = -3.7$ $a - e = +2.4$ $b + d = +1.5$
 Obs -503.7 -508.9 $+5.2$ $= -1.1$

O - C -502.4 -505.2 -2.6

9860

Plate Constants

9

λ	10.3369	18.4879	18.7035	29.2222
ξ	10.5330	19.1035	19.3110	30.3736
$\lambda\xi$	-1966	-6156	-6075	-11519

η	17.3912	29.2267	6.2732	21.6500
η	16.5818	29.0108	7.8891	21.0938
$\eta\eta$	+8099	+2159	+13891	+5962

$\lambda - \xi$	+5201		+8.264		+3.78		-3391
-1966 + 5168	= +3202	+199	= +3396	+38	= +3388		-7
-6156 + 9277	= +3088	+291	= +3329	+68	= +3397		+6
-6075 + 9352	= +3277	+52	= +3329	+69	= +3398		+7
-11519 + 17611	= +3097	+179	= +3276	+108	= +3389		-7
21.5526 + 10776		+136		+80		22.3127	

$\eta-\eta$	+5207	+7.154	+8.94	-16885	
+8099 + 8696	= +16790	-79	= +16716	+155 = +16871	-19
+2159 + 19613	= 16772	-132	= 16690	+260 = +16900	+13
+13891 + 3137	= 16978	-139	= 16899	+36 = +16900	+10
+6062 + 10825	= 16887	-209	= 16678	+192 = +16870	-15
16.9759 + 8238	-154	+197	15.6105		

Tables $a = -1.3$ $e = -3.7$ $a-e = +2.4$ $b+d = +1.5$
 Obs $= -503.7$ $= -508.9$ $= +5.2$ $= -1.1$

$A \sim -1.5$ $B \sim +2.5$

9860

Moon's Center

5

	x	$x-x_0$	Δx	$(x-x_0)^2$		$b-c$
1	21.5520	0.0000	+3	0.0000	3.7990	+190
2	22.0000	+0.4480	+3	0.2010	3.7818	-32
3	23.0000	+1.4480	+2	2.0976	3.7712	-138
4	23.9400	+1.8880	+1	3.5668	3.7944	+94
5	23.4987	+1.9467	0	3.7896	3.7896	+46
6	23.4292	+1.8772	+1	3.5235	3.7971	+121
7	23.0000	+1.4480	+2	2.0961	3.7726	-127
8	22.7587	+1.2067	+2	1.4556	3.7763	-87

	y	$y-y_0$	Δy	$(y-y_0)^2$	R	3.7850
1	14.5284	-1.9486	-5	3.7990		+180 ^v
2	14.5852	-1.8918	-5	3.5808		167 ^v
3	15.1836	-1.2934	-3	1.6736		132 ^v
4	16.0000	-0.4770	-1	0.2276		104 ^v
5	16.4770	0.0000	+0	0.0000		90 ^v
6	17.0000	+0.5230	+1	0.2736		74 ^v
7	17.7713	+1.2943	+3	1.6765		48 ^v
8	18.0000	+1.5230	+4	2.3207		38 ^v 1420

Approx. Center

$x = 23$	$y = 15.1836$
	17.7713
	32.9551
	$y_0 = 16.4775$
y_{min}	14.5284
R	1.9491
x_{max}	23.9987
x_0	21.5522

Moon's Center $\left\{ \begin{array}{l} x_0 = 21.5520 \\ y_0 = 16.4770 \end{array} \right.$

9860

Moon's Center

5

	x	$x - x_0$	Δx	$(x - x_0)^2$		$\sigma - e$
1	21.5520	0.0000	+3	0.0000	3.7990	+190
2	22.0000	+0.4480	+3	0.2010	3.7818	-32
3	23.0000	+1.4480	+2	2.0976	3.7712	-138
4	23.9900	+1.3880	+1	3.5668	3.7999	+99
5	23.9987	+1.7967	0	3.7896	3.7896	+96
6	23.9292	+1.8772	+1	3.5235	3.7971	+121
7	23.0000	+1.4480	+2	2.0961	3.7726	-129
8	22.7587	+1.2067	+2	1.9556	3.7763	-87

R 3.7850

	y	$y - y_0$	Δy	$(y - y_0)^2$		L
1	19.5289	-1.7986	-5	3.7990	+18.0	
2	19.5852	-1.8918	-5	3.5808	16.7	
3	15.1836	-1.2939	-3	1.6736	13.2	
4	16.0000	-0.9770	-1	0.2276	10.9	
5	16.9770	0.0000	+0	0.0000	9.0	
6	17.0000	+0.5230	+1	0.2736	7.9	
7	17.7715	+1.2945	+3	1.6765	9.8	
8	18.0000	+1.5230	+9	2.3207	38	1920

Approx. Center

 $x = 23$ $y = 15.1836$

17.7715

32.9351

 y_0 16.4775 y_{mean} 19.5289 R 1.9991 x_{mean} 23.9987 x_0 21.5522

Moon's Center

 x_0

21.5520

 y_0

16.9770

Formation of Normals.

1	- 0.0	+	0.0	-	273.0
2	- 0.85	-	14.4	+	60.5
3	- 1.87	-	200.0	+	178.0
4	- 0.90	+	178.0	-	45.0
5	0.0	+	90.0	+	0.0
6	+ 0.98	+	227.5	+	263.0
7	+ 1.87	-	180.0	-	160.0
8	+ 1.84	-	105.0	-	132.0
	+ 4.69	+	495.5	+	301.5
	- 3.62	-	499.4	-	610.0
	+ 1.07	-	3.9	-	308.5

$$\begin{aligned} -20\Delta a &= +9 \\ -20\Delta b &= -3 \\ 20c &= -16 \end{aligned}$$

	-a	-b	Δp_{res}
1	+ 0	+ 6	-10
2	+ 4	+ 6	- 6
3	+13	+ 4	+1
4	+17	+ 1	+2
5	+17	0	+1
6	+16	- 2	-2
7	+13	- 4	-7
8	+11	- 5	-10

0.69

$$\begin{aligned} + 1.07 + 13.55 &= -2.28 \\ + 1.3 + 1.07 &= +0.69 \\ + 13.98 &= -2.97 \end{aligned}$$

-1.58

$$16.73 = +10.28 + 0.23 = +10.51$$

9860

Conditional Equations

6

					b-c	new b-c
1	+ 0.0	- 1.95	= + 1.70	+ 0 + 75 = + 75	+ 95	+ 85
2	+ 0.95	- 1.89	= - 32	+ 5 + 43 = + 48	- 80	- 86
3	+ 1.75	- 1.29	= - 138	+ 18 + 30 = + 48	- 196	- 195
4	+ 1.89	- 0.98	= + 94	+ 23 + 11 = + 34	+ 60	+ 62
5	+ 1.95	0.00	= + 46	+ 27 0 = + 27	+ 22	+ 23
6	+ 1.88	+ 0.52	= + 121	+ 23 - 12 = + 11	+ 110	+ 108
7	+ 1.45	+ 1.29	= - 129	+ 18 - 30 = - 12	- 112	- 119
8	+ 1.21	+ 1.52	= - 87	+ 15 - 35 = - 20	- 67	- 77
				+ 187	- 759	

Average 91

$$16.73 + 1.07 = - 3.9 + 10.28$$

$$+ 1.07 + 13.55 = - 308.5 - 2.28$$

$$+ [] + 0.07 = - 0.2$$

$$- 0.22 \Delta$$

$$+ 13.48 = - 308.3$$

$$b = - 22.9$$

$$16.73 = - 3.9 + 27.5 = + 20.6$$

$$a = + 12.3$$

$$+ 0.63$$

Arc Measured 192°

$$\frac{P}{h} = 13$$

$$\frac{\pm V}{h} = + 33$$

$$\text{Im } q \quad R \quad 1.95$$

$$- 2 R e = - 0.78$$

$$- 33 = + 25.7$$

$$\Delta R = - 3.1$$

$$\Delta b = + 0.17$$

$$13$$

$$\Delta S = + 0.1 \quad \text{Corr} = + 0.2$$

$$\Delta a = - 0.49$$

$$\Delta q = - 0.02$$

$$\Delta R = - 3.3$$

9860

Conditional Equations

6

							W-C
1	+	0.0	-	1.95	=	+170	+0 + 95 = +95 +95
2	+	0.45	-	1.89	=	-32	+35 + 93 = +98 -80
3	+	1.75	-	1.29	=	-138	+18 + 30 = +98 +196
4	+	1.89	-	0.98	=	+94	+23 + 11 = +39 +60
5	+	1.95	-	0.00	=	+96	+29 0 = +29 +22
6	+	1.88	+	0.52	=	+121	+23 - 12 = +11 +110
7	+	1.95	+	1.29	=	-129	+18 - 30 = -12 -112
8	+	1.21	+	1.52	=	-87	+15 - 35 = -20 -67
							+987 -259
							Average 91

$$16.73 + 1.07 = -3.9$$

$$+1.07 + 13.55 = -308.5$$

$$+L \quad 3 + 0.07 = -0.2$$

$$+13.98 = -308.3$$

$$b = -22.9$$

$$16.73 = -3.9 + 27.5 = +20.6$$

$$a = +12.3$$

Arc measured 192.0

$$\frac{P}{h} = 12$$

$$\frac{2V}{h} = \pm 33$$

$$\frac{+33}{\sqrt{13}} = +25.9$$

$$\Delta \pi = +2.15$$

9860

Mean Position.

7

$$\begin{array}{r} \lambda_0 \quad 21.5520'' \\ \quad \quad +6'' \\ \hline 21.5526'' \end{array}$$

$$\begin{array}{r} \gamma_0 \quad 16.7770'' \\ \quad \quad -11'' \\ \hline 16.7660'' \end{array}$$

From Plate Constants

$$x \quad 22.3127''$$

$$y \quad 15.6105''$$

$$z \quad +.3127''$$

$$u \quad -2.3895''$$

$$\begin{array}{r} \log \zeta \quad 9.99513'' \\ \cos \zeta \quad 9.99954'' \\ \hline 8.50727'' \\ 0.98835'' \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 8.6627'' \\ \zeta \quad 8.9903'' \\ \hline 7.0539'' \\ 4.7064'' \end{array}$$

$$q-A \quad +9.7.35''$$

$$n_1 \quad -0.0005''$$

$$A \quad 11 \quad 41 \quad 45''$$

$$\log h_0 \quad 0.37837''$$

$$\gamma_0 \quad 11 \quad 41 \quad 54.78''$$

$$\begin{array}{r} 7.33115'' \\ \hline 3.04716'' \end{array}$$

Red

$$+3.18''$$

 $\delta-D$

$$-18 \quad 37.7''$$

$$q \quad 11 \quad 41 \quad 57.88''$$

$$D \quad -2 \quad 20 \quad 22''$$

$$\delta_0 \quad -2 \quad 38 \quad 56.7''$$

$$\text{Red} \quad -18.5''$$

$$\delta' \quad -2 \quad 39 \quad 15.2''$$

9860 Mean Position.

7

$$\begin{array}{r} \alpha_0 \quad 21.5520'' \\ \quad \quad + 6'' \\ \hline 21.5526'' \end{array}$$

$$\begin{array}{r} \gamma_0 \quad 16.9770'' \\ \quad \quad - 11'' \\ \hline 16.9759'' \end{array}$$

From Plate Constants

$$\chi \quad 22.3127''$$

$$\gamma \quad 15.6185''$$

$$\xi \quad +.3127''$$

$$\eta \quad -2.3893''$$

$$\log \xi \quad 0.49513''$$

$$\log \eta \quad 2.56627''$$

$$\log \xi \quad 99995.4''$$

$$\log \eta \quad 99990.3''$$

$$\quad \quad 8.50727''$$

$$\quad \quad 7.0539''$$

$$\quad \quad 1.98825''$$

$$\quad \quad 8.7069''$$

$$\alpha - A$$

$$+ 1.185''$$

$$\eta_0 - 0.0000''$$

$$A \quad 11 \quad 91 \quad 95''$$

$$\log \eta_0 \quad 0.37831''$$

$$\quad \quad 7.33115''$$

$$\alpha_0 \quad 11 \quad 71 \quad 57.78''$$

$$\quad \quad 3.09746''$$

$$\text{Red}$$

$$+ 1.18''$$

$$\delta - D$$

$$- 18 \quad 39.7''$$

$$\alpha \quad 11 \quad 71 \quad 57.88''$$

$$D \quad -2 \quad 20 \quad 22''$$

$$\delta_0 \quad -2 \quad 38 \quad 56.7''$$

$$\text{Red}$$

$$- 18.5''$$

$$\delta' \quad -2 \quad 39 \quad 15.2''$$

9860

Reduction to Apparent Place

8

$H + d \quad 13 \quad 02.3 = 195^{\circ} 39.5 \quad S - 2 \quad 38 \quad 56.0$
 $H \quad 1 \quad 20.4$
 $d \quad 11 \quad 73.9$
 $G \quad 23 \quad 03.4$
 $G + d \quad 10 \quad 75.3 = 161^{\circ} 12.5$

log Cos 9.9995 " 0.4801 " 0.4796 log Cos $G + d \quad 9.9765$ " 1.3746 Sin " 9.5059 tan S 8.6653 8.8239 log Sin S 8.6698 Cos Htd 9.9838 " 1.3063 Sin Htd 9.7289 Secs 0.0005 8.8239 log $q' \quad 1.3511$ $q \quad 8.3692$ log $h \quad 9.5557$ $h \quad 9.5596$ $f + 3.530$ $q + 0.023$ $h - 0.363$ $+3.194$ $q' - 22.55$ $h' + 0.903$ $u' + 3.017$ -18.530

9860

Reduction to Apparent Place

8

$H + L$ 13 02.3 = $195^{\circ} 39.5'$ $\delta - 2$ 38 36.5"
 H 1 20.4
 L 11 91.9 $\log \cos \delta$ 9.9953
 L 23 03.4 $\log \sin \delta$ 0.9801
 $G + L$ 14 95.3 = $161^{\circ} 12.5'$ $\log \tan \delta$ 0.9774

$\log \cos G + L$ 9.9765 n
 g 1.3796
 $\sin "$ 9.5059
 $\tan \delta$ 8.6653 n
 8.8239

$\log \sin \delta$ 8.6693 n
 $\cos H + L$ 9.9828 n
 h 1.3063
 $\sin H + L$ 9.9289 n
 $\sec \delta$ 0.0005
 8.8239

$\log g'$ 1.3541 n
 g 8.2682 n

$\log h$ 9.9557 n
 h 9.5694 n

$f' + 3.330$
 $g' + 0.023$
 $h - 0.363$
 +3.194

$g' - 22.95$
 $h' + 0.908$
 $i' + 8.017$
 - 19.530

9860

Lunar Parallax

9

α 11 41 57.88^v
 δ 10 43 46.10^v
 $\delta - \alpha$ -0 58 17.78^v
 $=$ -14° 32' 56.90^v
 $=$ - 5' 21.19^v
 $=$ -14 27 35.56^v

9,957.27^v
 0.00000^v
 0.01398^v
 9,971.25^v

γ 43 06 16.8^v

δ -2 39 15.2^v

$\delta - \gamma$ 45 45 32.0^v

9.82670^v
 8.22389^v
 9.85516^v
 0.16537^v
 8.07087^v

$\delta - \gamma$ + 40.28^v

δ -1 58 47.8^v

Ephd -1 58 43.7^v

$\delta - C$ -3.4^v

Corr. of Plate +0.3
 2nd Order Ref 0.0

In Corr +0.1

δ -1 58 47.0

$\delta - C$ -3.3

π 57' 34.05^v

9.86913^v

8.22389^v

9.40003^v

0.00026^v

7.49334^v

$\delta - \alpha$ -10 42.28^v

$=$ -42.82^v

α 11 41 15.06^v

Ephd 11 41 14.27^v

$\alpha - C$ +0.79^v

+0.02

-0.02

α 11 41 15.07

+0.77

9860

Lunar Parallax

9

α 11 41 57.88"
 δ 10 43 46.10"
 $\alpha - \delta$ - 0 58 11.78"
 $=$ -19° 34' 56.90"
 $=$ - 5' 21.19"
 $=$ -19 27 35.56"

9.95727"
 0.000000"
 0.01398"
 9.97125"

γ 93 06 168"

δ - 2 39 15.2"

$\gamma - \delta$ 95 45 32.0"

9.82670"
 8.22399"
 9.85016"
 0.16537"
 8.07082"

$\alpha - \delta$ + 90 128.4"

δ - 1 58 97.8"

$\alpha - \delta$ - 1 58 93.7"

$\alpha - \delta$ + 3.9"

Error of Plate +0.3
 2" slide, 144 00

α 57° 39.05"

9.86913"
 8.22289"
 9.90003"
 0.00026"
 7.98330"

$\alpha - \delta$ - 10 90.29"

$=$ - 92.82"

α 11 41 18.05"

$\alpha - \delta$ 11 41 19.27"

$\alpha - \delta$ +0.79"

+0.02

1
11
12
19
73
3
11
2
12
2
183
2
13

9997

Star Measures.

4

11

1	d	1	d	1	d	1	d
10519		20362		19793		20592	
11.9 12002		18898		13529		16760	
19.6 1998		88		31		68	
18		60		39		99	
<u>11.8518</u>		<u>11.8529</u>		<u>19.6210</u>		<u>19.6170</u>	

2	1	2	1	2	1	2	1
19839		19197		19962		20008	
19.8 11252		17398		13779		16188	
7.6 78		96		68		92	
32		202		68		12	
<u>19.8183</u>		<u>19.8199</u>		<u>7.6195</u>		<u>7.6181</u>	

3	1	3	1	3	1	3	1
18498		18302		19332		20018	
33.8 10086		16661		13758		15866	
19.6 82		61		62		88	
96		10		22		22	
<u>33.8362</u>		<u>33.8358</u>		<u>19.5866</u>		<u>19.5898</u>	

Moon Measures.

1	1	1	1
223		20163	
17.7		13318	
-7		12	
		70	
		<u>19.6852</u>	<u>19.6822</u>

2	1	2	1
22		19168	
17.8		12046	
		38	
		72	
		<u>19.7129</u>	<u>19.7131</u>

3	1	3	1
21		18787	
15.3		13366	
		68	
		90	
		<u>15.2718</u>	<u>15.2710</u>

9997

Star Measures

11

L	d	2	d	4	2
10.5	19	20362	19793	20592	
11.9	12002	18890	13329	16760	
19.6	1998	82	31	68	
	18	60	29	99	
	<u>11.8518</u>	<u>11.8529</u>	<u>19.6210</u>	<u>19.6170</u>	

2	19839	19197	19962	20008
19.8	11652	17398	13719	16188
7.6	98	96	68	92
	32	202	68	12
	<u>19.8183</u>	<u>19.8199</u>	<u>7.6195</u>	<u>7.6181</u>

3	18998	18302	19332	20018
23.8	10086	16666	13958	15866
19.6	82	61	62	88
	96	10	22	22
	<u>33.8362</u>	<u>33.8358</u>	<u>19.5866</u>	<u>19.5898</u>

Moon Measures

L	20163	19767
22.3	13318	16392
19.7	12	88
-4	70	79
	<u>19.6852</u>	<u>19.6822</u>

2	19168	19760
22	12096	16896
19.8	38	90
	72	66
	<u>19.7129</u>	<u>19.7131</u>

3	18787	20527
21	16366	12951
15.3	68	39
	90	36
	<u>15.2918</u>	<u>15.2910</u>

9997

Moon Measures

12

$$\begin{array}{r}
 9 \\
 20.6 \\
 16 \\
 \hline
 20.5553
 \end{array}
 \begin{array}{r}
 18644 \\
 14190 \\
 90 \\
 59 \\
 \hline
 20.5539
 \end{array}$$

$$\begin{array}{r}
 5 \\
 20.5 \\
 16.5 \\
 -X \\
 \hline
 20.4727
 \end{array}
 \begin{array}{r}
 18608 \\
 13322 \\
 08 \\
 19 \\
 \hline
 20.4703
 \end{array}$$

$$\begin{array}{r}
 6 \\
 20.6 \\
 17 \\
 \hline
 20.5303
 \end{array}
 \begin{array}{r}
 14592 \\
 13877 \\
 77 \\
 606 \\
 \hline
 20.5279
 \end{array}$$

$$\begin{array}{r}
 7 \\
 21 \\
 17.8 \\
 \hline
 18552 \\
 16969 \\
 64 \\
 69 \\
 \hline
 17.8462
 \end{array}
 \begin{array}{r}
 19599 \\
 11130 \\
 38 \\
 96 \\
 \hline
 17.8482
 \end{array}
 \begin{array}{r}
 19812 \\
 11330 \\
 522 \\
 08 \\
 \hline
 17.8411
 \end{array}$$

$$\begin{array}{r}
 8 \\
 21.6 \\
 18.2 \\
 50 \\
 \hline
 21.6651
 \end{array}
 \begin{array}{r}
 20238 \\
 16892 \\
 80 \\
 50 \\
 \hline
 21.6672
 \end{array}
 \begin{array}{r}
 20962 \\
 17592 \\
 82 \\
 62 \\
 \hline
 18.2875
 \end{array}
 \begin{array}{r}
 19700 \\
 12544 \\
 50 \\
 02 \\
 \hline
 18.2845
 \end{array}$$

7997

Moon Measures

12

9	26128	18649
20.6	19578	19170
16	72	90
	31	59
	<u>20.5553</u>	<u>20.5539</u>

5	20162	18608
20.5	15928	13322
16.5	32	08
-1	62	19
	<u>20.9727</u>	<u>20.9703</u>

6	19177	16596
20.6	13873	13877
17	74	77
	72	606
	<u>20.5303</u>	<u>20.5279</u>

I	18552	19599
21	16969	11130
17.8	69	38
	69	96
		<u>17.9962</u>

~~19812~~	20168
~~11350~~	18578
~~22~~	68
~~08~~	62
<u>17.8982</u>	<u>17.8911</u>

8	18802	20238
21.6	12198	16892
18.2	52	80
56	09	50
	<u>21.6651</u>	<u>21.6692</u>

20962	19700
17592	12599
82	50
62	02
<u>18.2875</u>	<u>18.2895</u>

9997 Times Etc

Dec 15, 1915

Exp to the Stars	7	02		7	17	
" Moon	7	07	47.0	7	07	47.3
Clock fast		5	10.5			

H. Sid J.	7	02	36.65	$\theta - \alpha = +2^h 72^m$
H. Lang	7	49	31.05	
g. Sid J.	8	47	07.70	
Sid J. M. H.	17	32	17.69	
Interval	15	14	53.01	
Reduction	2	02	29.88	
g. M. T.	15	12	23.13	

From Naut. Alman	R. A.	Dec.		
Moon 15 ^h	01	20	24.10	+13 49 03.9
Motion m/m			1.9312	+12.166
" " 12.3853			23.92	+2 30.7
Tabular Place	01	20	48.02	+13 51 34.6 39.55

Moon's age 9 days

Parallax	55'	07.77
Sund.	15	02.9
R.		902.9
Aug		10.7
Err 4		-0.6
R		912.7
R		1.9565
alt		-9.37
1/2 R		1.8628
R		3.4700

937 11.15

$a = -502.9$
 $\quad \quad 27$
 $- 478.9$

9997 Lenses Etc

Dec 15, 1910

Eyes to the Stars	9	02	-	9	19	-
Moon	9	07	97.0	9	07	97.3
Clocks fast		5	10.5			

H. Sid J.	7	02	36.65	B-X: + 2 ^h 72 ^m
H. Low g	1	49	31.05	
g. Sid g	8	47	07.70	
Sid J. M. H.	17	32	17.69	
Interval	15	14	53.01	
Reduction	2	02	29.88	
g. M. T.	15	12	23.13	

From North Alm.	H. A.	Dec.
Moon 15 ^h	01 20	29.10 + 13 49 03.9
Moon inf ^m		19312 + 12.166
" 12.3885		23.92 + 12 30.7
Tabular Place	01 20	48.02 + 13 51 29.6

Moon's age 7 days

Parallax	55'	07.9
Sund.	15'	02.7
R		902.9
Aug		10.4
Err.		- 0.6
R		912.7
R		1.9563
alt		- 9.37
1/4 R		1.8628
R		39700

939 11.15

9 = - 502.9
 29
 - 978.9

9997

Plate center & Constants

18

x	y	x	y
11.8521	19.6190	1 13 02.51	13 47 43.0
19.8191	7.6188	1 17 28.31	12 09 33.0
33.8360	19.5857	1 25 21.70	13 46 10.7
3 65.5072	46.8235	55 52.52	38 102 86.7
21.8357	15.6078	1 18 37.50	13 17 28.9
22	18	+ 5.08	+ 18 37.9
+ 0.1673	+ 2.3921	1 18 42.58	13 33 03.8
31 ³	466.5		
5.08	18' 37.9		

$$\text{Center } \left\{ \begin{array}{l} A = 1.1843 \\ B = +13.3307 \end{array} \right.$$

$$\begin{array}{rclcl} x-y & +500x & +67.8y & +2.9x & -12159 \\ +4869 + 5926 = +10795 & +1330 = +12125 & +39 = +12159 & = 0 \\ +1675 + 5910 = 11585 & +516 = +12101 & +58 = +12159 & \\ -6.185 + 16918 = 10733 & +1328 = +12061 & +98 = +12159 & 0 \\ 22.3347 + 11167 & +1121 & +60 & 22.3538 \end{array}$$

$$\begin{array}{rclcl} y-z & +500y & -68.8x & +2.6y & -6079 \\ -2967 + 9810 = +6843 & -815 = +6028 & +57 = +6079 & = 0 \\ +3614 + 3809 = +7423 & -1367 = +59 & +20 = 79 & 0 \\ -1737 + 9793 = +8356 & -2328 = 28 & +51 = 79 & 0 \\ 16.5735 + 8272 & -1537 & +43 & 16.6137 \end{array}$$

$$\begin{array}{rclcl} \text{Tables } a = -.6 & e = -.11 & a-e = +.5 & b+d = -2.8 \\ \text{Obs } & = -502.9 & = -502.6 & = -.3 & = +1.0 \end{array}$$

$$O-C \quad -502.3 \quad -501.5 \quad +3.8$$

9997

Plate center & constants

19

λ	γ	δ	δ			
11.8521	19.6190	1	13 0251	13	97	93.0
17.8191	7.6188	1	17 2431	12	09	33.0
33.8360	19.5857	1	25 2170	13	46	10.7
3) 65.2072	96.8235		55 5252	38	142	86.7
21.8357	15.6078	1	18 3750	13	17	28.9
22	15		5.08		118	39.9
+ 0.1693	+ 2.3922	1	18 4258	13	33	03.8
31	966.5					
5.08	18' 39.9	Center	A	1	18	93.

$$\begin{aligned}
 \lambda \cdot \gamma &+ 570.1 & +67.89 & +2.9x & -12109 \\
 +9869 + 5926 & +10795 + 1330 & +12125 + 39 & +12159 & = 0 \\
 +1675 + 5910 & +11585 + 516 & +12101 + 58 & +12159 & = 0 \\
 -6185 + 16918 & +10733 + 1328 & +12061 + 98 & +12159 & = 0 \\
 22.3399 + 11167 & +1121 & +60 & 22.3538 &
 \end{aligned}$$

$$\begin{aligned}
 \gamma \cdot \lambda &+ 570.7 & -68.8x & +2.6y & -6079 \\
 -2967 + 7810 & +6893 - 815 & +6025 + 51 & +6079 & = 0 \\
 +3619 + 3809 & +7923 - 1369 & +59 + 20 & 79 & = 0 \\
 -1737 + 9793 & +8356 - 2328 & +28 + 51 & 79 & = 0 \\
 10.5935 + 8272 & -7537 & +83 & 16.6139 &
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a &= -.6 & e &= -1.1 & a \cdot e &= +.5 & b+d &= -2.8 \\
 \text{Obs } &= -502.9 & &= -502.6 & &= -.3 & &= +1.0
 \end{aligned}$$

ξ	η	$\Delta\xi$	-3.85ξ	-1.7η	-5
1	-10.63	+1.88	-38	+37 ~ +6	-1 ~ +5 0
2	-2.35	-10.77	-7	+8 ~ +1	+9 ~ +5 0
3	+12.95	+1.69	+48	-43 ~ +5	-1 ~ +4 -1
M	+0.35	-1.39	-1	0	= -6

$\Delta\eta$	-3.2η	-2
+7	-6 ~ +1	-1
-32	+34 ~ +2	0
+7	-5 ~ +2	0
0	+4	<u>+2</u>

9997 Standard Coordinates				15-							
Cape 177-mq 7.7				Cape no 183-mq 7.0				Cape no-207-mq 9.1			
C	1	12	14.86	1	16	40.79	1	27	33.83		
L			14.99			40.81			33.86		
E			14.86			40.80			33.83		
Mean	1	12	14.89	1	16	40.80	1	27	33.87		
Proc			47.62			47.51			47.86		
x	1	13	02.51	1	17	28.31	1	25	21.70		
A	1	18	43	1	18	43	1	18	43		
A-A	-	5	40.79	-	1	19.67	+	6	38.70		
Sm(A-A)		-3	40.76		-7	4.69		+	39.8.67		
Log	2	53	20.7n	1	87	32.6n	2	60	05.8		
Log	9	98	7.29	9	99	0.14	9	98	7.39		
Σ_0	1	02	6.60n	0	37	0.67n	1	09	5.16		
Σ_0	-10	63	17	-2	37	7.7	+	12	77.97		
Σ_1		-31			-7			+	48		
Σ	11	36	5.2	19	65	1.6	37	75	8.5		
X	11	85	2.1	19	81	9.1	33	83	6.0		
X-Y	+	48	6.7	+	16	7.5	-	61	8.5		
C	+	13	42.57.6	12	07	49.7	+	13	41	34.4	
L			57.6			49.7				34.6	
E			56.7			48.7				34.2	
Mean	13	42	57.3	12	07	49.2	13	41		34.7	
Proc		+	4.45.7		+	4.43.8		+	4	40.3	
S	13	47	43.0	12	9	33.0	13	46		10.7	
D	13	33	07	13	33	07	13	33		07.	
S-D	+	14	39.0	-	1	23.31.0	+	13		06.7	
tand D		+	8.79.0		50	12.0n		+	7	86.7	
Log	2	94	37.9	3	70	00.1n	2	89	5.81		
HO	0	27	5.14	1	03	1.16n	0	22	6.96		
log tand	9	39	0.1	9	33	3.7	9	38	9.3		
Σ_0	2	05	3.2	0	74	1.3	2	19	0.3		
η_1	8	49	6.7	7	12	8.1	8	63	3.0		
η_0	+	1.88	7.3	-	10.77	3.9	+	1.68	6.9		
η_1	+	0.03	1.4	+	0.00	1.3	+	0.04	3.0		
η	19	91	5.7	7	25	7.4	19	72	9.4		
η	19	61	9.0	7	61	8.8	19	58	5.7		
$\eta-\eta$	-	2.96	7	+	3.61	4	-	1.43	7		

7797				Standard				Coordinates				15
Cape 177-mg 7.9				Cape 183-mg 7.0				Cape 184-mg 9.1				
C	1	12	19.86	1	16	90.79		1	29	33.83		
L			19.99			90.81				33.86		
E			19.86			90.80				33.83		
Mean	1	12	19.89	1	16	90.80		1	29	33.89		
Pre			97.62			97.51				97.86		
x	1	13	02.51	1	17	25.31		1	25	21.70		
A	1	18	93	1	18	93		1	18	93		
A-A	-	5	90.99	-	1	19.69		+	6	28.70		
Sum(A-A)			-390.96			-79.69				+398.69		
Cy	2	53	20.7h	1	57	32.6h		2	60	05.8		
End	9	98	7.29	9	99	0.19		9	98	7.39		
Σ	1	02	6.60h	0	37	0.69h		1	09	5.16		
Σ ₁₀	-	10	6.317	-	2	39.77		+	12	99.97		
Σ ₁			-31			-7				+78		
Σ	11	36	5.2	19	65	1.6		39	95	9.5		
x	11	85	2.1	19	81	9.1		33	83	6.0		
x-Σ			98.69			+1.675				-6.185		
C	+	13	92.57.6	12	09	99.9		+	13	91	39.9	
L			57.6			99.9				39.6		
E			56.7			95.7				39.2		
Mean	13	92	57.3	12	09	99.2		13	91	39.9		
Pre			+9.95.7			+9.93.8				+9.90.3		
Δ	13	97	93.0	12	9	33.0		13	96	10.7		
D	13	33	09	13	33	09		13	33	09		
Δ-D	+	19	39.0	-	1	23.31.0		+	13	06.7		
Sum Δ			+879.0			5012.0h				+786.7		
Cy	2	99	39.9	3	70	00.1h		2	89	58.1		
h ₀	0	27	5.19	1	03	1.16h		0	22	6.96		
Cy h ₀	9	39	0.1	9	33	3.9		9	38	9.3		
Σ ₁	2	05	3.2	0	79	1.3		2	19	0.3		
h ₁	8	99	6.7	7	12	8.1		8	63	3.0		
h ₀	+	18	89.3	-	10	77.39		+	16	8.69		
h ₁	+	00	3.19	+	00	0.13		+	00	9.30		
h	19	91	5.7	7	25	7.9		19	72	9.9		
h	19	61	9.0	7	61	8.8		19	58	5.7		
h-Σ	-	29	6.7	+	36	1.8		-	19	3.7		

$$M = 2.6$$
$$P = +2$$



270

9997

Moon's Center

		$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0 + (y - y_0)^2)$
1	22.3310	0.0000	-5	0.0000	3.4533 - 167
2	22.0000	-0.3310	-6	0.1099	3.4551 - 179
3	21.0000	-1.3310	-3	1.7724	3.4640 - 60
4	20.5596	-1.7764	-1	3.1559	3.4797 - 203
5	20.4715	-1.8595	0	3.4577	3.4577 - 123
6	20.5291	-1.8019	+1	3.2465	3.4563 - 137
7	21.0000	-1.3310	+3	1.7708	3.4650 - 50
8	21.6646	-0.6664	+5	0.4435	3.4850 + 150

$$R = 3.4700$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	L
1	14.6837	-1.8583	0	3.4533	180 ^v
2	14.7130	-1.8290	^v	3.3452	190 ^v
3	15.2414	-1.3006		1.6916	226 ^v 22 ^v
4	16.0000	-0.5420		0.2938	253 ^v
5	16.5420	0.0000		0.0000	270 ^v
6	17.0000	+0.4580		0.2098	289 ^v
7	17.8436	+1.3016		1.6942	315 ^v
8	18.2860	+1.7440		3.0415	339 ^v 15-90

Approx. Center

$$x = 21 \quad y = 15.2414$$

$$17.8436$$

$$33.0850$$

$$y_0 = 16.5425$$

$$y_{\text{min}} = 14.6837$$

$$R = 1.8588$$

$$x_{\text{min}} = 20.4715$$

$$x_0 = 22.3315$$

Moon's Center $\left\{ \begin{array}{l} x_0 = 22.3310 \\ y_0 = 16.5420 \end{array} \right.$

9997

Moon's Center

	$X - X_0$	ΔX	$(X - X_0)^2$	$(X - X_0)(Y - Y_0)$
1	22.3310	0.0000	0.0000	3.4533 - 1.67
2	22.0000	-0.3310	0.1099	3.4551 - 1.99
3	21.0000	-1.3310	1.7729	3.4640 - 60
4	20.5596	-1.7764	3.1559	3.4797 - 3.03
5	20.9715	-1.8595	3.4577	3.4577 - 1.23
6	20.5291	-1.8019	3.2465	3.4563 - 1.37
7	21.0000	-1.3310	1.7708	3.4650 - 30
8	21.6696	-0.6664	0.4435	3.4850 + 1.50

 $R = 3.4700$

Y	$Y - Y_0$	ΔY	$(Y - Y_0)^2$	L
1	19.6837	-1.8583	3.4533	180
2	19.7130	-1.8290	3.3452	190
3	19.2919	-1.3006	1.6916	226
4	16.0000	-0.2920	0.2938	253
5	16.5920	0.0000	0.0000	270
6	17.0000	0.4380	0.2098	289
7	17.8936	+1.3016	1.6942	315
8	18.2860	+1.7440	3.0412	329

15.90

Apogee Center

 $X = 21$ $Y = 19.2919$

17.8936

33.0850

 Y_0 16.5920 - = 65.21 + 18.0 -

ap. mean = 19.6837 - = 10.2 - [] +

 R 18.588 X mean = 20.9825 - = 58.21 + X_0 22.3315 $\Delta X - = 50. - 20.9 - = 29.21 +$ Moon's Center } X_0 22.3310{ Y_0 16.5920

Formation of Normals

1	- 0.00	- 0.00	+ 3.11.0
2	+ 0.60	+ 49.2	+ 272.5
3	+ 1.73	+ 80.0	+ 78.0
4	+ 0.96	+ 362.0	+ 140.0
5	0.0	+ 229.0	0.0
6	- 0.82	+ 276.5	- 63.0
7	- 1.73	+ 66.5	- 63.0
8	- 1.15	- 99.0	+ 261.0
	+ 3.29	+ 1033.2	+ 771.5
	- 3.70	- 99.0	- 389.0
	- 0.41	+ 934.2	+ 381.5

	Δa	Δb	ΔRes
1	0	+ 6	- 9
2	+ 3	+ 5	- 7
3	+ 13	+ 4	+ 1 (+2)
4	+ 18	+ 2	+ 5
5	+ 19	0	+ 4
6	+ 18	- 1	+ 2
7	+ 13	- 4	- 6
8	+ 4	- 5	- 13

$$-0.41 + 13.73 = -2.02$$

$$+ [] - 0.01 = -0.27$$

$$+ 13.72 = -2.30$$

$$+ 13.96 = -9.09 - 0.07 = -9.16$$

9997

Conditional Equations

17.
new
b-c

1	0.00	-1.86	=	-167	0	-55	=	-55	-112	-103(-121)
2	-0.33	-1.83	=	-179	-22	-55	=	-77	-72	-79
3	-1.33	-1.30	=	-60	-90	-39	=	-129	+69	+71
4	-1.78	-0.54	=	-203	-121	-46	=	-137	-66	-61
5	-1.86	0.00	=	-123	-126	0	=	-126	+3	+7
6	-1.80	+0.46	=	-137	-122	+14	=	-108	-29	-27
7	-1.33	+1.30	=	-50	-90	+39	=	-51	+1	-5
8	-0.66	+1.74	=	+150	-95	+52	=	+7	+193	+130

$$+246 - 279$$

Average 62

$$13.96 - 0.41 = +937.2 \quad -9.09$$

$$-0.41 + 13.73 = +382.5 \quad -2103$$

$$+E \quad] - 0.1 = +27.5$$

$$-0.17 \Delta$$

$$+13.74 = +940.0$$

$$b = +29.8$$

$$13.96 = +12.2 + 937.2 = 949.4$$

$$a = +67.8$$

$$-0.66 \Delta$$

Arc Measured 1590

$$p_h = .19$$

$$\frac{2V}{h} = -8$$

In 7. R 1.86

$$-2RC = -0.74$$

$$\Delta b = +0.13$$

$$\Delta b = +0.1, 19$$

$$-8 = -42$$

$$\Delta p = -0.5$$

$$+0.2$$

$$\Delta a = +0.49 \quad \Delta \gamma = +0.02$$

$$\Delta p = -0.7$$

9997

Conditional Equations

17

0=c

0-c

1	0.00	-1.86	-	147	0	-55	-	55	-112	-103
2	-0.33	-1.83	-	177	-22	-55	-	77	-72	-79
3	-1.33	-1.30	-	60	-90	-39	-	129	+69	+70
4	-1.78	0.59	-	203	-121	-46	-	157	-66	-61
5	-1.86	0.00	-	123	-126	0	-	126	+3	+7
6	-1.80	+0.46	-	137	-122	+19	-	103	-29	-27
7	-1.33	+1.30	-	30	-90	+39	-	51	+1	-5
8	-0.66	+1.79	-	150	-95	+52	-	7	+173	+130

+216 - 279

Average 62

$$13.96 - 0.91 = +939.2$$

$$-0.91 + 13.73 = +1382.3$$

$$+ [] - 0.1 = +21.5$$

$$+ 13.79 = +940.0$$

$$b = + 29.8$$

$$13.96 = +12.2 + 939.2 = 946.9$$

$$a = + 67.8$$

are measured 1590

$$\frac{P}{n} = 19$$

$$\frac{20}{4} = -8$$

$$\frac{-8}{19} = -4.2$$

$$\Delta R = -0.5$$

9997 Moon's Mean Position

18

$$\alpha^0 22.3310^{\circ}$$

$$+ 39^{\circ}$$

$$22.3349^{\circ}$$

$$\gamma^0 16.5420^{\circ}$$

$$+ 15^{\circ}$$

$$16.5435^{\circ}$$

From Plate Constants.

$$\lambda 22.3538^{\circ}$$

$$\gamma 16.6137^{\circ}$$

$$\xi +.3538^{\circ}$$

$$\eta -1.3866^{\circ}$$

$$\log \xi 9.54876^{\circ}$$

$$\cos \xi 9.98805^{\circ}$$

$$8.50727^{\circ}$$

$$1.05377^{\circ}$$

$$\log \tan \delta 9.3767^{\circ}$$

$$\xi 29.0975^{\circ}$$

$$7.0537^{\circ}$$

$$5.6273^{\circ}$$

$$\alpha - \lambda + 11.31^{\circ}$$

$$\eta_1 0^{\circ}$$

$$A 1 18 73^{\circ}$$

$$\log H_0 0.14195^{\circ}$$

$$7.33115^{\circ}$$

$$\alpha_0 1 18 54.31^{\circ}$$

$$2.81080^{\circ}$$

$$\text{Red } 7.36^{\circ}$$

$$\delta D - 10 676.8^{\circ}$$

$$\alpha_1 1 18 38.67^{\circ}$$

$$\delta 13 33 07^{\circ}$$

$$\delta_0 13 22 17.2^{\circ}$$

$$\text{Red } 29.7^{\circ}$$

$$\delta' 13 22 73.9^{\circ}$$

9997 Moon's Mean Position

18

$$x^0 \ 22.3310^-$$

$$+ 39^-$$

$$22.3349^-$$

From Plate Constants

$$x \ 22.3538^-$$

$$y \ +.3538^-$$

$$\log \xi \ 9.54876^-$$

$$\log \zeta \ 9.98805^-$$

$$8.50727^-$$

$$1.05397^-$$

$$y^0 \ 16.5920^-$$

$$+ 15^-$$

$$16.5435^-$$

$$y \ 16.6139^-$$

$$\eta \ -1.3866^-$$

$$\log \tan \delta \ 9.3764^-$$

$$\xi \ 9.0975^-$$

$$7.0537^-$$

$$5.5273^-$$

$$x-h \ +11.31^-$$

$$y_i \ 0^-$$

$$H \ 1 \ 18 \ 93^-$$

$$\log h_0 \ 0.19195^-$$

$$7.33115^-$$

$$h_0 \ 1 \ 18 \ 59.31^-$$

$$2.81090^-$$

$$696.8$$

$$Red \ 7.26^-$$

$$\delta D \ -10 \ 98.8^-$$

$$h' \ 1 \ 18 \ 58.67^-$$

$$h \ 13 \ 33 \ 09^-$$

$$h_0 \ 13 \ 22 \ 19.2^-$$

$$Red \ 29.7^-$$

$$h' \ 13 \ 22 \ 98.9^-$$

$$\begin{array}{r} 1 \quad 13 \quad 29.08 \\ 27.80 \\ \hline + 1.28 \end{array}$$

$$\begin{array}{r} 3 \quad 10 \quad 28.2 \\ 1.6 \\ \hline + 26.6 \end{array}$$

$$\begin{array}{r} 1 \quad 26 \quad 60.36 \\ 35.92 \\ \hline + 24.44 \end{array}$$

$$\begin{array}{r} 17 \quad 57 \quad 58.9 \\ 28.8 \\ \hline + 30.1 \end{array}$$

$$\begin{array}{r} 1 \quad 32 \quad 39.87 \\ 35.90 \\ \hline + 3.97 \end{array}$$

$$\begin{array}{r} 11 \quad 42 \quad 37.7 \\ 23.8 \\ \hline + 29.0 \end{array}$$

20

15

10

5

30 20

10

0

1400

9997 Reduction to Apparent Place

$$H + \alpha \quad 1 \quad 93.8 - 25^{\circ} 57.0 \quad S + 13 \quad 22 \quad 17$$

$$H \quad 0 \quad 24.9$$

$$\alpha \quad 1 \quad 18.9^{\circ}$$

$$G \quad 23 \quad 8.7$$

$$G + \alpha \quad 0 \quad 2.7.3.2 \quad 6^{\circ} \quad 49.5$$

$$\log \cos \delta \quad 9.98880$$

$$- \quad 9.9832$$

$$= \quad 9.9712$$

$$\log \cos (G + \alpha) \quad 9.9969$$

$$- \quad 1.3929$$

$$\sin \quad 9.0779$$

$$\tan \quad 8.93760$$

$$8.8239$$

$$\log \sin \delta \quad 9.3671$$

$$\cos (H + \alpha) \quad 9.9538$$

$$- \quad 1.3106$$

$$\sin (H + \alpha) \quad 9.6713$$

$$\sec \quad 0.0120$$

$$8.8239$$

$$\log q' \quad 1.3898$$

$$- \quad 8.6677$$

$$\log h' \quad 0.6285$$

$$- \quad 9.7878$$

$$f. + 37.01$$

$$- \quad 0.0465$$

$$h \quad 0.6135$$

$$+ \quad 7.3610$$

$$q' \quad 27.535$$

$$h' \quad + 7.252$$

$$n' \quad + 0.936$$

$$29.723$$

9997 Reduction To Apparent Place

H + α 1 93.8 - 25° 57.0 δ +13 22 17

H 0 29.9

α 1 18.9

α 23 8.7

G + α 0 27.3 = 6° 49.5

log cos δ 9.9880

α 9.9832

α 9.9712

log cos G + α 9.9969

α 1.3929

Sum " 9.0799

Time δ 9.3760

8.8239

log sin δ 9.3691

cos(H + α) 9.9538

α 1.3106

sin(H + α) 9.6913

Sec δ 0.0120

8.8239

log q 1.3898

q 8.6677

log h' 0.6285

h' 9.7878

f + 3.7 01

q 0.0965

h' 0.6132

+ 7.3610

q' 295.35

h' + 7.252

α 10.936

29.723

9997

Lunar

Parallax

20

 π 55 07.5"

α'	1	18	38.67"		
δ	9	02	36.65"	9.86913"	
$\delta - \alpha'$	2	43	37.98"	8.20505"	
$=$	700	54	29.70"	9.81618"	
		+13	75.18"	0.01283"	
	70	70	77.52"	7.90315"	

9.85727"

0.00000"

0.12012"

0.07739"

 $\alpha - \alpha'$ 27 30.37" $=$ 1 50.02" δ 50 7 71.5" δ 13 22 76.9" $\delta - \alpha$ 36 41 54.6"

9.82670"

8.20505"

9.77641"

0.11525"

7.92311"

 $\delta - \alpha'$ 28 48.0" δ 13 51 34.9" α

1 20 48.69"

Eph δ 13 51 34.6"Eph α 01 20 48.02" $\delta - \alpha$ +0.3" $\delta - \alpha$ +0.67"

Curv. of Plate +0.1

-0.02

2nd slider Ry 0.0

Imm Corr +0.1

+0.02

 $\delta + 13$ 51 35.0" α 1 20 48.71" $\delta - \alpha$ +0.9

+1.69

9997

Lunar

Parallax

20

55 07.5"

λ' 1 18 38.67"
 θ 9 02 36.65"
 $\theta - \lambda'$ 2 73 37.98"
 $= 90^\circ$ 39 29.70"
 $\quad \quad 113$ 95.18"
 90 90 99.52"

9.86913"
 8.20505"
 9.81617"
 0.01283"
 7.90315"

7.95727"

0.00000"

0.12092"

0.07739"

 $\lambda - \lambda'$ 27 30.37" $=$ 1 30.02" γ 50 7 91.5" δ 13 22 96.9" $\gamma - \delta$ 36 91 58.6"

9.82490"

8.20505"

9.77691"

0.11525"

7.92311"

 $\delta - \delta'$ 28 98.0" δ 13 51 39.9"

1 20 98.69"

 $\gamma - \delta$ 13 51 39.6" $\gamma - \delta$ 01 20 98.02" $\theta - \theta$ -0.3" $\theta - \theta$ +0.67"

corr. of plate +0.1
 2nd Miller Ref 0.0

-0.02

9998₇

Star Measures

21

d	μ	d	μ	d	μ	d	μ
1	17902	20412	18850	17968			
11.2	15523	12792	15591	17238			
17.4	27	90	601	32			
	88	08	98	70			
	<u>11.2374</u>	<u>11.2382</u>	<u>19.3253</u>	<u>19.3265</u>			
2	20668	20348	19988	19276			
19.2	18318	12692	16556	12709			
7.7	10	86	50	96			
	62	42	80	76			
	<u>19.2352</u>	<u>19.2346</u>	<u>7.3441</u>	<u>7.3427</u>			
3	19972	10396	20228	19508			
33.2	17782	12590	16758	12972			
19.4	78	00	52	68			
	66	82	16	02			
	<u>33.2191</u>	<u>33.2213</u>	<u>19.3469</u>	<u>19.3467</u>			

Moon Measures

1	19380	18872
22.5	12162	16086
17.8	82	76
4	72	76
	<u>14.7212</u>	<u>14.7208</u>
2	19902	18852
22	11962	16283
17.8	68	82
	12	59
	<u>14.7447</u>	<u>14.7430</u>
3	18395	19798
21	15930	12250
15.2	28	38
	90	802
	<u>15.2465</u>	<u>15.2493</u>

9998

Star Measures

21

d	2	d	2
- 17902	20912	18850	17968
2 15523	12792	15591	17238
4 27	90	601	32
88	08	98	70
<u>11 2374</u>	<u>11.2382</u>	<u>19.3253</u>	<u>19.3265</u>
20668	20398	19988	19276
2 18318	12692	16556	12709
7 10	86	50	96
62	42	80	76
<u>192352</u>	<u>19.2396</u>	<u>73991</u>	<u>7.3929</u>
19972	10396	20228	19508
3.2 17782	12590	16758	12972
9.9 78	00	52	68
66	82	16	02
<u>33.2191</u>	<u>33.2213</u>	<u>19.3969</u>	<u>19.3967</u>

Moon Measures

-	19380	18872
2.5	12182	16086
9.8	82	76
7	72	76
	<u>19.7212</u>	<u>19.7208</u>
2	19902	18852
1.2	11962	16283
9.8	68	82
	12	59
	<u>19.7999</u>	<u>19.7930</u>
2	18395	19798
11	15930	12250
5.2	28	38
	90	802
	<u>15.2965</u>	<u>15.2993</u>

9998

Moon Measures.

8	18682	18456
20.6	13362	13790
16	70	86
	82	67
	<u>20.5316</u>	<u>20.5328</u>

5	18732	18407
20.5	14360	12762
16.5	70	68
1X	32	07
	<u>20.4367</u>	<u>20.9358</u>

6	17766	18370
20.6	12912	13222
17	02	29
	68	72
	<u>20.9860</u>	<u>20.4852</u>

7	20436	20192
21.	11259	19352
17.9	58	48
	70	96
	<u>17.9188</u>	<u>17.9160</u>

8	19641	19902	20482	20040
21.7	14160	15369	17639	12878
18.3	56	61	33	76
00	32	899	96	78
	<u>28.5478</u>	<u>28.5464</u>	<u>18.2899</u>	<u>18.2831</u>

7998

Moon Measures

9	18682	18926
20.6	13362	13790
16	70	86
	82	67
	<u>20.5316</u>	<u>20.5328</u>

5	18732	18907
20.5	19360	12762
16.5	70	68
11	32	07
	<u>20.9367</u>	<u>20.9358</u>

6	17766	18370
20.6	12912	13222
17	02	29
	68	72
	<u>20.9860</u>	<u>20.9852</u>

7		20936	20190
21		11259	19852
17.9		58	98
		90	96
		<u>17.9187</u>	<u>17.9160</u>

8	19641	19902	20982	20040
21.7	19160	15369	17639	12878
13.3	56	61	33	70
26	32	899	96	78
	<u>78.5475</u>	<u>21.9464</u>	<u>18.2899</u>	<u>18.2831</u>

9998

Times Etc

23

Dec 15 '13

Exp. to Stars	7	16		7	28
Moon	7	21	34.7	7	21 3 1.9
Clock fast		5	10.5		

H. Sid Time	7	16	21.3	7-2 = +2 ^h 5 ^m 5 ^s
H. Long	7	27	31.05	
G. Sid T.	9	00	52.33	
Sid T. M.H.	17	32	18.69	
Interval	15	28	37.66	
Reduction		2	32.13	
G. M. T.	15	26	05.53	

From Naut alim.		R A		Dec.
Moon 15 ^h	1	20	24.10	+ 13 79 03.9
Motion in 1 ^h			1.9319	+ 12.159
" 26.0922			50.39	5 17.2
Tabular Place	1	21	19.99	+ 13 59 21.7

Moon's Age 9 days

Parallax	55" 07.17
Semid	15' 02.8
R	902.8
Aug	10.0
Dist 7	-0.6
R	972.2
R	1.9539
alt	-937
(1+alt/R)	1.8617
R	39659

$$937 = 10.8 +$$

$$\begin{array}{r}
 a = 503.7 \\
 + 27 \\
 - 779.4
 \end{array}$$

9998

Lenses Etc

23

Dec 12 '13

Exp to Stars

9 16

9 28

111000

9 21

31.7

9 21

31.9

Clock fast

5

10.5

H. Sid time

9 16

21.3

9.8 = 2' 55"

H. Long

9 99

31.03

Q. Sid J.

9 00

52.33

Sid J M. N.

17 32

19.69

Interval

15 28

37.66

Reduction

2

32.13

Q. M. J.

15 26

05.53

From Marshall

R A

Dec.

Moon 12h

1 20

29 10

+ 13

99

03.9

Moon 12h

1.9319

1 12.139

26.0922

50.39

5

17.26

Tabular Place

1 21

19.99

+ 13

59

21.7

Moon Age

9 days

Parallax

55' 08.17"

Semi d

15' 02.8"

K

902.8"

Aug

10.0"

K

- 0.6"

K

912.2"

K

1.9339"

K

- 937"

11 + 4K

1.8617"

K

37659"

937 = 10.5

a = 503.4

+ 29

= 779.9

9998

Polar Constants

29

X	11.2378	19.2379	33.2202
Y	17.3632	19.6516	37.7545
X-Y	-1.278	-4.167	-1.2383

Y	19.3259	7.3733	19.3768
Y	19.9157	7.2577	19.7297
Y-Y	-5898	+859	-3826

X-Y	+500Y	+97.5Y	+3.7X	-6209
-1277	+5619	= 9393	+1826	= 6171
-9167	+9617	= 9450	+697	= 6147
12393	+16610	= 9267	+1828	= 6195
22.2986	+11179	+1567	+76	= 22.9569

Y-Y	+500Y	-97.7X	+6Y	-2713
-5898	+9663	= -3765	-1067	= +2701
+859	+3671	= -9530	-1822	= +.08
-3826	+9673	= +3847	-3196	= +01
16.5815	+8291	-2112	+18	= 16.9291

Tables
Obs. a = -.8 e = -1.2 a-e = +.4 b+d = -3.5
 -503.7 -500.6 -2.8 +.2

O-C -502.6 -499.4 +3.7

9998

Plate constants

29

$$\begin{array}{rcl}
 x & 11.2378 & 19.2399 & 33.2202 \\
 y & 11.3632 & 19.6516 & 39.9593 \\
 x-y & -1.279 & -9.167 & -1.2383
 \end{array}$$

$$\begin{array}{rcl}
 y & 19.3259 & 7.3933 & 19.3968 \\
 y & 19.9157 & 7.2579 & 19.7297 \\
 y-y & -5898 & +859 & -3826
 \end{array}$$

$$\begin{array}{rcl}
 x-y & +500.8 & +99.57 & +3.71 & -6.209 \\
 -1.279 & 15619 & : 9392 & + 1826 & - 6171 & + 38 & = - 6209 & 0 \\
 -9167 & + 9617 & : 9950 & + 699 & - 6199 & + 65 & = + 09 & 0 \\
 1.2393 & + 16610 & : 9267 & + 1828 & = 6195 & + 113 & = + 08 & -1 \\
 22.2986 & + 11179 & & + 1567 & & + 76 & & 22.9569
 \end{array}$$

$$\begin{array}{rcl}
 y-y & +500.9 & -99.71 & +.67 & -2.713 \\
 -5898 & + 9663 & : + 3765 & - 1064 & = +2701 & + 12 & = + 2713 & = 0 \\
 + 5899 & + 2671 & : + 9530 & - 1822 & = + 08 & + 7 & = 12 & -1 \\
 -3826 & + 9673 & : + 3897 & - 3196 & = + 01 & + 12 & = 13 & = 0 \\
 16.5815 & + 8291 & & - 2112 & & + 16 & = 16.9291
 \end{array}$$

$$\begin{array}{rcl}
 \text{Tables} & a = -.8 & e = -1.2 & a-e = +.4 & b+d = -3.5 \\
 \text{Obs.} & -503.9 & -500.6 & -2.8 & +.2
 \end{array}$$

$$A = +3.5$$

$$B = +1.2$$



	99 98	Moon's Center					25-
	X	X-X ₀	ΔX	(X-X ₀) ²	(X-X ₀) + (Y-Y ₀) ²	0 - c	
1	22.2980	0.0000	-6	0.0000	3.4596	-63	
2	22.0000	-0.2980	-6	0.0892	3.4649	-10	
3	21.0000	-1.2980	-5	1.6861	3.4699	+40	
4	20.5322	-1.7658	-2	3.1188	3.4564	-95	
5	20.4362	-1.8618	0	3.4663	3.4663	+7	
6	20.4856	-1.8124	+1	3.2851	3.4607	-52	
7	21.0000	-1.2980	+5	1.6861	3.4713	+56	
8	21.5771	-0.7509	+6	0.5629	3.4631	-28	

	Y	Y-Y ₀	ΔY	(Y-Y ₀) ²	R ² 3.4659	
1	-1.97210	-1.8600	-0	3.4596	+1.800 ⁰	
2	1.97937	-1.8373	-4	3.3757	1.89 ⁰	
3	15.2459	-1.3356	-	1.7838	2.24 ⁰	
4	16.0000	-0.5810	-	0.3376	2.52 ⁰	
5	16.5810	0.0000	-	0.0000	2.70 ⁰	
6	17.0000	+0.4190	+	0.1756	2.83 ⁰	
7	17.9172	+1.3362	+	1.7857	3.16 ⁰	
8	18.2820	+1.7030	+	2.9002	3.36 ⁰	15 ⁰

Approx. Center

$$\begin{aligned}
 Y &= 21 & Y &= 15.2459 \\
 & & & 17.9172 \\
 & & & 33.1626 \\
 & & Y_0 & 16.5813 \\
 & & Y_{\text{min}} & 17.7210 \\
 & & R & 1.8603 \\
 & & Y_{\text{min}} & 20.4362 \\
 & & & 22.2975
 \end{aligned}$$

$$\text{Moon's Center} \begin{cases} X_0 & 22.2980 \\ Y_0 & 16.5810 \end{cases}$$

9978	X	$X - X_0$	$(X - X_0)^2$	$(X - X_0) + (Y - Y_0)$	$(X - X_0) + (Y - Y_0)^2$	$Y - C$	20-
1	222980	0.0000	-6	0.0000	34596	-63	
2	220000	-0.2980	-6	0.0892	34697	-10	
3	210000	-1.2980	-5	1.6861	34697	+70	
4	205322	-1.7658	-2	3.1188	34569	-95	
5	204362	-1.8618	0	3.7663	34663	+7	
6	209856	-1.8124	+1	3.2851	34607	-52	
7	210000	-1.2980	+5	1.6861	34713	+56	
8	215971	-0.7309	+6	0.5627	34631	-28	

Y	$Y - Y_0$	$(Y - Y_0)^2$	$(X - X_0) + (Y - Y_0)$	$(X - X_0) + (Y - Y_0)^2$	$Y - C$	15-60
1	-19.7210	-1.8600	-0	3.4596	+1.800	
2	19.7937	-1.8373	-4	3.3757	1.89	
3	13.2459	-1.3356	-	1.7838	2.29	
4	~~10.0000~~	0.0000	-	0.3376	2.52	
5	18.5810	0.0000	01	0.0000	2.70	
6	18.6000	+0.4178	+	0.1756	2.83	
7	18.7172	+1.3268	+8	-1.2823	3.16	
8	18.8484	+1.6103	+1	2.9002	3.36	

$\Sigma Y = 147.9172$
 $\Sigma Y^2 = 16.5813$
 $\Sigma (Y - Y_0) = 19.7210$
 $\Sigma (Y - Y_0)^2 = 1.8603$
 $\Sigma (Y - Y_0) + (Y - Y_0)^2 = 20.7362$

$\Sigma X = 165813$
 $\Sigma X^2 = 19.7210$
 $\Sigma (X - X_0) = 1.8603$
 $\Sigma (X - X_0) + (X - X_0)^2 = 20.7362$
 $\Sigma X \cdot Y = 12.01 + 28.0 -$
 $\Sigma Y = 50.0 - [] +$

Moon's Center } $X_0 = 222980$
 $Y_0 = 16.5813$

$\Delta 11.9 - = \Delta 20. - 30.8 - = 98.01$

Formation of Normals.

$$\begin{array}{r}
 1 \quad 0.0 \\
 2 \quad + 0.55 \\
 3 \quad + 1.74 \\
 4 \quad + 1.03 \\
 5 \quad 0.0 \\
 6 \quad - 0.76 \\
 7 \quad - 1.74 \\
 8 \quad - 1.28 \\
 \hline
 + 3.32 \\
 - 3.78 \\
 \hline
 - 0.46
 \end{array}$$

$$\begin{array}{r}
 - \quad 0.0 \\
 + \quad 3.0 \\
 - \quad 5.20 \\
 + \quad 16.80 \\
 - \quad 7.5 \\
 + \quad 9.4 \\
 - \quad 72.8 \\
 + \quad 21.0 \\
 \hline
 + 286.0 \\
 - 132.3 \\
 \hline
 + 153.7
 \end{array}$$

$$\begin{array}{r}
 + \quad 117.0 \\
 + \quad 18.7 \\
 - \quad 53.6 \\
 + \quad 55.0 \\
 - \quad 0.0 \\
 - \quad 22.0 \\
 + \quad 75.0 \\
 - \quad 47.5 \\
 \hline
 + 255.4 \\
 - 123.1 \\
 \hline
 + 132.3
 \end{array}$$

	Δa	Δt	$\Delta \mu$
$-20.42 = -10$	1 - 0	+ 6	- 9
	2 + 3	+ 3	- 7
$-20.44 = -3$	3 + 13	+ 4	+ 2
	4 + 18	+ 2	+ 5
$+20.0 = -15$	5 + 19	0	+ 4
	6 + 18	- 1	+ 2
	7 + 13	- 4	- 6
	8 + 7	- 5	- 13

$$\begin{array}{r}
 - 0.46 + 13.81 = - 2.16 \\
 + [] - 0.02 = - 0.27
 \end{array}$$

$$+ 13.79 = - 2.73$$

$$+ 13.89 = - 9.09 - 0.8 \Delta = - 9.17 \Delta$$

9998

Conditional Equations

26

							b-c	new o-c
1	0.0	-1.86	2-63	0	-20	=	-20	-43
2	0.30	-1.87	2-10	-3	-20	=	-23	+13
3	1.30	-1.37	2+40	-15	-14	=	-29	+69
4	1.77	-0.58	2-93	-20	-6	=	-26	-69
5	1.86	0.00	2+9	-22	0	=	-22	+26
6	1.81	+0.82	2-52	-21	+4	=	-17	-35
7	1.30	+1.37	2+56	-15	+14	=	-1	+57
8	0.75	+1.70	2-28	-9	+18	=	+9	-37

+ 145 - 184

Average 43

$$13.89 - 0.46 = +155.7 - 9.09$$

$$-0.46 + 13.81 = +142.3 - 2.16$$

$$+ [] - 0.01 + 5.2 - .18 \Delta$$

$$+ 13.80 = +147.5 \quad b = +10.7$$

$$13.89 = +155.7 + 9.9 + 160.60$$

$$a = +11.6$$

$$- .66$$

arc Measured 156°

$$\frac{p}{n} = .17$$

$$\frac{\Sigma V}{h} = -2.4$$

$$\text{Im } \gamma \quad R \quad 1.86$$

$$-2RC = -0.74$$

$$\frac{-2.4}{.17} = -14$$

$$\Delta R = -0.2$$

$$\text{Err} = +0.2$$

$$\Delta b = +0.13 \Delta \delta = +0.11$$

$$\Delta R = -0.7$$

$$\Delta a = +0.89 \Delta \alpha = +0.02$$

9998

Conditional Equations

26

1	0.0	-1.86	= -63	0	-20	= -20	-73
2	0.30	-1.89	= -10	-3	-20	= -23	+13
3	-1.30	-1.39	= -190	-15	-19	= -29	+69
4	-1.77	-0.38	= -95	-20	-6	= -24	-69
5	-1.86	0.00	= +9	-22	0	= -22	+26
6	-1.81	+0.92	= -52	-21	+4	= -17	-35
7	-1.30	+1.39	= +56	-15	+19	= +4	+57
8	-0.75	+1.70	= -28	-9	+18	= +9	-37

$$+145 = -189$$

Average 73

$$13.89 - 0.96 = +155.7$$

$$-0.96 + 13.81 = +192.3$$

$$+ [I - 0.01] + 5.2$$

$$+ 13.80 = +197.5 \quad L = +10.7$$

$$13.89 = +155.7 + 9.9 + 160.60$$

$$a = +11.6$$

are measured 156°

$$\frac{p}{h} = .17$$

$$\frac{z}{h} = 2.9$$

$$\frac{-2.9}{.17} = -17$$

$$\Delta R = -0.2$$

9998 Moon's Mean Position

27

$$\begin{array}{r} \alpha_0 \ 22.2980^{\circ} \\ +6^{\circ} \\ \hline 22.2986^{\circ} \end{array}$$

$$\begin{array}{r} \gamma_0 \ 16.5810^{\circ} \\ +5^{\circ} \\ \hline 16.5815^{\circ} \end{array}$$

From Plate Constants

$$\chi \ 22.9569^{\circ}$$

$$\gamma \ 16.9291^{\circ}$$

$$\xi \ +0.9569^{\circ}$$

$$\eta \ -1.0709^{\circ}$$

$$\begin{array}{r} \log z \ 9.98087^{\circ} \\ \log s \ 9.98799^{\circ} \\ \hline 8.50727^{\circ} \\ 1.48564^{\circ} \end{array}$$

$$\begin{array}{r} \log \tan \delta \ 9.3776^{\circ} \\ \gamma \ 9.9617^{\circ} \\ \hline 7.0537^{\circ} \\ 6.3927^{\circ} \end{array}$$

$$\alpha - A \ +30.59^{\circ}$$

$$\eta \ +0.002^{\circ}$$

$$A \ 1 \ 18 \ 43^{\circ}$$

$$\log h_0 \ 0.02983^{\circ}$$

$$7.33115$$

$$\alpha_0 \ 1 \ 19 \ 13.59^{\circ}$$

$$2.69868^{\circ}$$

$$499.7^{\circ}$$

$$Red \ +4.36^{\circ}$$

$$\delta - D \ -8 \ 19.7^{\circ}$$

$$\alpha' \ 1 \ 19 \ 17.95^{\circ}$$

$$D \ +13 \ 33 \ 08^{\circ}$$

$$\delta_0 \ +13 \ 24 \ 44.3^{\circ}$$

$$Red \ +29.7^{\circ}$$

$$\delta' \ 13 \ 25 \ 14.0^{\circ}$$

9998 *Moon's Mean Position*

$$\lambda_0 \quad 22.2940^{\circ}$$

$$+6^{\circ}$$

$$22.2986^{\circ}$$

$$\gamma_0 \quad 16.5810^{\circ}$$

$$+3^{\circ}$$

$$16.5813^{\circ}$$

From Plate Constants

$$\lambda \quad 22.9569^{\circ}$$

$$\gamma \quad 16.9291^{\circ}$$

$$\delta \quad +0.9569^{\circ}$$

$$\eta \quad -1.0709^{\circ}$$

$$\log 2 \quad 9.98087^{\circ}$$

$$\log 5 \quad 9.98719^{\circ}$$

$$8.50729^{\circ}$$

$$1.48569^{\circ}$$

$$\log \tan \delta \quad 9.3776^{\circ}$$

$$\gamma \quad 9.9617^{\circ}$$

$$7.6539^{\circ}$$

$$6.3927^{\circ}$$

$$x-A \quad +30.59^{\circ}$$

$$h_1 \quad +.0002^{\circ}$$

$$A \quad 1 \quad 18 \quad 93^{\circ}$$

$$\log h_0 \quad 0.02983^{\circ}$$

$$7.33115^{\circ}$$

$$\lambda_0 \quad 1 \quad 19 \quad 13.59^{\circ}$$

$$2.69868^{\circ}$$

$$499.7^{\circ}$$

$$Red \quad +4.36^{\circ}$$

$$S.D. \quad -8 \quad 19.7^{\circ}$$

$$\gamma' \quad 1 \quad 17 \quad 17.15^{\circ}$$

$$D \quad +13 \quad 33 \quad 09^{\circ}$$

$$S_0 \quad +13 \quad 29 \quad 49.3^{\circ}$$

$$Red \quad +27.7^{\circ}$$

$$S' \quad 13 \quad 25 \quad 14.0^{\circ}$$

9998

Lunar Parallax

$$\begin{array}{rcl}
 \delta & 4 & 16 \quad 21.3 \quad \checkmark \\
 \alpha & 1 & 19 \quad 17.95 \quad \checkmark \\
 \delta - \alpha & +2 & 57 \quad 03.35 \quad \checkmark \\
 = & +49 & 15 \quad 50.25 \quad \checkmark \\
 \delta(\alpha\alpha): & +17 & 39.62 \quad \checkmark \\
 & 49 & 01 \quad 10.63 \quad \checkmark
 \end{array}$$

$$\pi \quad 55' \quad 0'' \quad 7.17 \quad \checkmark$$

$$\begin{array}{r}
 9.86913 \quad \checkmark \\
 8.20502 \quad \checkmark \\
 9.84383 \quad \checkmark \\
 0.01292 \quad \checkmark \\
 \hline
 7.93090 \quad \checkmark
 \end{array}$$

$$9.95727 \quad \checkmark$$

$$0.00000 \quad \checkmark$$

$$0.17321 \quad \checkmark$$

$$0.10098 \quad \checkmark$$

$$\delta - \alpha \quad 29 \quad 19.25 \quad \checkmark$$

$$= \quad +1 \quad 57.28 \quad \checkmark$$

$$\delta \quad 51 \quad 39 \quad 11.5 \quad \checkmark$$

$$\delta + 13 \quad 25 \quad 14.0 \quad \checkmark$$

$$\delta - \alpha \quad 38 \quad 08 \quad 57.5 \quad \checkmark$$

$$9.82670 \quad \checkmark$$

$$8.20502 \quad \checkmark$$

$$9.79078 \quad \checkmark$$

$$0.10603 \quad \checkmark$$

$$7.92823 \quad \checkmark$$

$$\delta - \alpha \quad 29 \quad 08.5 \quad \checkmark$$

$$\delta \quad 13 \quad 57 \quad 22.5 \quad \checkmark$$

$$\alpha \quad 1 \quad 21 \quad 15.23 \quad \checkmark$$

$$\text{Eph} \delta + 13 \quad 57 \quad 21.1 \quad \checkmark$$

$$\text{Eph} \alpha \quad 01 \quad 21 \quad 19.79 \quad \checkmark$$

$$\delta - \alpha \quad +1.7 \quad \checkmark$$

$$\delta - \alpha \quad +0.79 \quad \checkmark$$

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

$$-0.02$$

$$2^{\text{nd}} \text{ Order Ref} \quad 0.0$$

$$\text{Irr. Corr} \quad +0.1$$

$$+0.02$$

$$\delta \quad +13 \quad 57 \quad 22.6$$

$$\alpha \quad 1 \quad 21 \quad 15.23$$

$$\delta - \alpha \quad +1.6$$

$$+0.76$$

9998 Lunar Parallax

δ 9 16 21.3 -
 α 1 19 17.95 -
 $\delta - \alpha$ + 2 37 03.35 -
 $=$ + 99 15 30.25 -
 $\mu(\delta)$ + 19 39.62 -
 $\mu(\alpha)$ 99 01 10.63 -

 π 55' 07.17 -

9.86913 -
 8.20502 -
 9.89383 -
 0.01272 -
 1.93090 -

9.95727 -
 0.00000 -
 0.19321 -
 0.10098 -

 $\delta - \alpha$ 29 19.25 -

 $=$ 1 57.28 -

 $\tan \delta$ 51 39 11.5 -

 $\delta + 13$ 25 19.0 -

 $\delta - \alpha$ 38 08 57.5 -

9.82690 -
 8.20502 -
 9.79078 -
 0.10603 -
 7.92823 -

 $\delta - \alpha$ 29 08.5 -

 δ 13 59 22.5 -

 α 1 21 15.23 -

 $\tan \delta$ + 13 59 21.1 -

 $\tan \alpha$ 19.99 -

 $\delta - \alpha$ + 1.9 -

 $\delta - \alpha$ + 0.79 -

Curv. of Plate + 0.1
 2nd Order 1/4 0.0

 -0.02

