

KG
11366
v.873



Harvard Lunar Plates
Measures and Reductions
Martha C. Bortin.

12
E
1
C
17
14
9
5

7
11
11
J

9

8110

Times & Etc.

D. = 9

1

Date Mar 7, 1915

Eph. to stars	17	47	17	56
" " Moon	17	49	59.0	17 49 59.7
Clock slow		00	15.9	
H. Sid Time	17	50	15.1	$\delta - \alpha = +1^h$ 0m
H. Long.	7	47	31.05	
G. Sid Time	19	37	46.15	
Sid. T. M. noon	22	47	39.72	
Interval	20	50	06.43	
Reduction		3	29.80	
G. M. T.	20	46	41.63	

From Naut Almanac	R. A.		Dec.	
Moon 20 ^h	13	49	09.90	-16 19 57.7
Motion in 1 ^m			2.3117	17.106
" " 46.6938	1		48.03	-10 58.7
Jatular place	13	50	57.93	-16 30 53.1

Moon's Age 18 days

Parallax	59' 47.53"
Semidiam.	16' 19.1"
R.	979.1"
Augm.	8.5"
Sr. 4	-0.6"
R	987.0"
R	2.1158"
at R	-1013"
(H+R	2.0145"
R"	4.0582"

939 = 7.75

a = -502.7

29
- 478.7

8110

Times & Etc.

Date Mar 7, 1915

Eph. W. Star	19	99	19	56
" Moon	19	99	59.0	19 99 59.9
Clock slow		00	15.9	
H. Sid Time	19	50	15.1	-7 : +1 ^m
H. Long.	9	99	31.05	
G. Sid Time	19	39	46.15	
Sid. T. M. hour	22	99	39.72	
Interval	20	50	06.93	
Reduction		3	29.80	
G. M. T.	20	96	41.63	

From Naut Almanac R. A.

Dec.

Moon 20"	13	99	09.90	-16	19	59.7
Motion in 1 ^m			2.0117			19.106
" 46.6938		1	48.03	-10		58.7
Jupiter place 13	50		57.93	-16	30	53.1

9

Moon's Age 18 days

Parallax	59' 47.53"
Semidiam.	16' 19.1"
R.	979.1
Augm.	853
Shr.	-0.6
R	9876
R	2.1158
at R	-1013
(H+R	2.0145
R	4.0582

929 = 7.79

9 = -502.7

29

- 978.1

1
1
2
2
3
3
9
1
2
1
2
28
18
-
3
2
1

8110

Star Measures

2

$$\begin{array}{r}
 16.1 \\
 13.7 \\
 \hline
 16986 \\
 15689 \\
 8688 \\
 69 \\
 \hline
 16.1296
 \end{array}$$

$$\begin{array}{r}
 20134 \\
 11420 \\
 2020 \\
 30 \\
 \hline
 11290
 \end{array}$$

$$\begin{array}{r}
 17240 \\
 7310400 \\
 01 \\
 40 \\
 \hline
 13.4138
 \end{array}$$

$$\begin{array}{r}
 16489 \\
 10619 \\
 2019 \\
 00 \\
 \hline
 .4123
 \end{array}$$

$$\begin{array}{r}
 2 \\
 21.9 \\
 29.1 \\
 \hline
 10491 \\
 8999 \\
 10198 \\
 \hline
 21.9705
 \end{array}$$

$$\begin{array}{r}
 15525 \\
 15230 \\
 3030 \\
 \hline
 .9705
 \end{array}$$

$$\begin{array}{r}
 17750 \\
 1676162 \\
 6562 \\
 54 \\
 \hline
 29.0987
 \end{array}$$

$$\begin{array}{r}
 19469 \\
 1045750 \\
 5550 \\
 69 \\
 \hline
 .0986
 \end{array}$$

$$\begin{array}{r}
 3 \\
 32.1 \\
 9.8 \\
 \hline
 19760 \\
 18568 \\
 7567 \\
 32 \\
 \hline
 32.1186
 \end{array}$$

$$\begin{array}{r}
 17355 \\
 853930 \\
 32 \\
 59 \\
 \hline
 .1175
 \end{array}$$

$$\begin{array}{r}
 19850 \\
 1219689 \\
 9089 \\
 40 \\
 \hline
 9.7650
 \end{array}$$

$$\begin{array}{r}
 17913 \\
 1555042 \\
 5042 \\
 30 \\
 \hline
 .7630
 \end{array}$$

Moon Measures

1
29
19.2
may to on
phase limit of moon.

$$\begin{array}{r}
 20029 \\
 1893428 \\
 20 \\
 79 \\
 \hline
 14.1152
 \end{array}$$

$$\begin{array}{r}
 15830 \\
 7010 \\
 9804 \\
 40 \\
 \hline
 .1165
 \end{array}$$

2
29.7
14.
-2

$$\begin{array}{r}
 13470 \\
 7061 \\
 13385 \\
 \hline
 13.9918
 \end{array}$$

$$\begin{array}{r}
 13059 \\
 1299080 \\
 8280 \\
 \hline
 .9925
 \end{array}$$

3
25
14.1

$$\begin{array}{r}
 13361 \\
 1324856 \\
 4156 \\
 \hline
 14.0113
 \end{array}$$

$$\begin{array}{r}
 13214 \\
 9103 \\
 13080 \\
 \hline
 .0123
 \end{array}$$

8110

Star Measures

2

λ		γ	
1	16986	20134	17240
16.1	15689	11420	1310400
13.9	8688	2020	01
	69	30	40
	<u>16.1296</u>	<u>.1290</u>	<u>13.4138</u>
2	10491	15525	17750
21.9	8999	15230	1676162
29.1	10158	3030	65
			54
	<u>21.9705</u>	<u>.9705</u>	<u>29.0987</u>
3	19760	17355	19850
32.1	18568	853930	12296
9.8	7569	32	9089
	32	59	40
	<u>32.1186</u>	<u>1.175</u>	<u>9.7650</u>
			<u>7630</u>

Moon Measures

1		20079	15830
29	may to on	1893428	7010
19.2	phase limit of moon.	20	9804
		79	40
		<u>14.1152</u>	<u>1165</u>
2		13470	13059
29.7		7061	12990
14.		13385	8280
-4		<u>13.9918</u>	<u>9.925</u>
3		13361	13214
25		13248	9103
19.1		4176	13080
		<u>14.0113</u>	<u>0123</u>

Moon Measures

3

2
26
18.5

17485
12800
9511
78
14,4680

15864
10531
3232
58
.4671

5
26.9
15
16530
12085
6970
19
26.4450

17328
11771
8089
31
.4450

6
26.6
16
+X
17396
1025867
60
90
26.7130

17298
14417
1915
99
.7119

7
26.9
17
16459
1194842
50
39
26.4502

17259
11755
4448
69
4484

8
26
17.5

16298
10903
9108
88
17.5392

18570
13951
6261
85
15380

9 scratched

25.619991
17.81380900
91
91
25.6191

17568
13761
5860
74
.6190

15349
7416
0110
58
17.7947

19384
17302
10
90
.7922

Moon Measures

X

Y

2
26
18.5

17485
12800
911
78
174680

15864
10531
3232
58
7671

5
269
15
16530
1208570
69
19
26.4450

17328
1177189
8089
31
4450

6
266
16
+X
17396
1025867
60
90
26.7130

17298
1441715
19
99
7119

7
269
17
16459
1194842
50
39
26.4502

17259
1175548
44
69
4484

8
26
17.5

16298
1090308
71
88
17.5392

18570
1395161
62
85
5380

9 scratch

25.619991
17.81380900
91
91
25.6191

17568
1376160
58
74
6190

15349
741610
01
58
17.7947

19384
1730210
10
90
7922

8110

x

Plate Center

y

7

$$\begin{array}{r}
 16.1293 \\
 21.9705 \\
 \hline
 32.1181 \\
 370.2179 \\
 23.4059 \\
 -22 \\
 \hline
 -1.91 \\
 31.2 \\
 \hline
 -44.
 \end{array}$$

$$\begin{array}{r}
 13.7131 \quad 13.95 \quad 15.0 \quad -17.42.40.5 \\
 29.0986 \quad 13.48 \quad 36.9 \quad 15.34.42.1 \\
 \hline
 09.7640 \quad 13.59 \quad 23.7 \quad 18.12.35.7 \\
 352.2757 \quad 339.147 \quad 75.6 \quad 50.88.118.3 \\
 17.4252 \quad 13.49 \quad 25.2 \quad -17.09.59.9 \\
 18 \quad -44. \quad +9.28.1 \\
 \hline
 +0.5748 \quad 13.48 \quad 41.2 \quad -17.05.31.3 \\
 766.5
 \end{array}$$

Plate Center { A = 13 48 41.
D = -17 05 31.

$$\begin{array}{r}
 x-3 + 500x \quad + 32.44 \quad + 2.7x \quad - 12977 \\
 + 4903 + 8065 = +12968 + 435 = +12903 + 49 = +12977 = 0 \\
 + 959 + 10985 = +11944 + 943 = +12887 + 59 = +76 = -1 \\
 -3515 + 16039 = +12544 + 316 = +12860 + 87 = +47 = 0 \\
 24.6983 + 12399 + 518 + 67 = 24.6970
 \end{array}$$

$$\begin{array}{r}
 y-n + 500y \quad - 29.5x \quad + 13.94 \quad - 8566 \\
 + 2068 + 6707 = 8775 - 395 = +8380 - 186 = 8566 = 0 \\
 -5899 + 17599 = 18700 - 538 = +8162 + 404 = 8566 = 0 \\
 + 9339 + 9882 + 9216 - 787 = +8729 + 136 = 8565 = -1 \\
 16,0037 + 8002 - 605 + 222 = 15,9090
 \end{array}$$

Tables a = -0.7 e = -9.6 a-e = +8.9 b+d = -9.9
lbs. = -502.7 = -513.9 = +11.2 = -7.9

O-C -502 -504.3 -3.5

8110 Plate Center

7

16.1293	13.9131	13 95	15.0	-17 92	90.5
21.9705	29.0986	13 98	36.9	15 39	92.1
32.1181	89.7690	13 59	23.8	18 12	33.7
370.2179	352.2757	359 197	75.6	50 88	118.3
23.9059	17.9252	13 99	25.2	-18 07	59.9
-22	18		-49		28.1
-1.91	+0.5748	13 98	91.2	-17 05	31.3
-31.2	766.5				
-99.					

Note { A = 13 98 91.
Center { B = -17 05 31

X-3,	+500X	+32.44	+2.71	-12997	
+4903	+8065	=+12968	+935	=+12903+99	=+12997 = 0
+959	+10985	=+11944	+993	=+12887+59	=+96 = -1
-3575	+16059	=+12594	+316	=+12860+87	=+47 = 0
27.6983	+12397	+518	+67		27.6970

4-4	+5004	-29.57	+1394	-8566
+2068	+6707	=+8775-395	=8380	+186 = +8566 = 0
-5899	+14599	=+8700-538	=+8162	+904 = +8566 = 0
+9337	+4882	=+9216-787	=+8429	+136 = +65 = -1
16,0037	+8002	-605	+222	15.9090

Tables a = -07 e = -86 a-e = +79 h+d = -9.2
lbs = -502.7 = -513.9 = +11.2 = -7.9

	ξ	η	$\Delta \xi$	-3.1ξ	$+1.7 \eta$	-8
1	-6.31	-7.78	-9	+20 ~	+11	-3 = +8
2	-0.12	+11.68	0	0 ~	0	+8 = +8
3	+10.76	-8.63	+76	-32 =	+18	-6 ~ +8
4	+2.70	-2.09	0	-8	-1	<u>-17</u>
			$\Delta \eta$	-3.9η	$+1.1 \xi$	<u>-2</u>
			-7	+16 ~	+9	-7 ~ +2
			+42	-70 ~	+2	0 ~ +2
			-38	+29 ~	-9	+11 ~ +2
			0	+7	+3	<u>+8</u>

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Standard Coordinates

5-

	Cape No. 1879-mg 5.1	Cape No. 1882-mg 7.8	Cape No. 1898-mg. 7.0.
C	13 44 26.18	13 47 48.32	13 53 34.39
L	26.20	48.39	34.97
E	26.18	48.32	34.97
Mean	13 44 26.19	13 47 48.33	13 53 34.93
Pres.	+48.79"	+48.62"	49.23"
α	13 45 14.98	13 48 36.95	13 54 23.66
A	13 48 41	13 48 41	13 48 41
$\alpha-A$	-03 26.02	-04.05	+05 42.66
$\sin(\alpha-A)$	-206.01	-04.05	+342.62
Log "	9.97891	9.98374	9.97767
$\log \delta$	2.31389 n	0.60746 n	2.53481
" γ_0	0.80004 n	9.09844 n	1.01974
δ	-63 101	-0.1254	+10 46 50
δ_0	-9	00	+46
δ_1	15 68 90	21.8746	32.4696
δ_2	16 12 93	21.9705	32.1181
δ_3	+7 40 3	+09 59	-35 15
C	-17 38 09.8	-15 30 14.3	-18 08 11.2
L	10.0	14.7	8 11.5
E	10.4	14.3	11.6
Mean	-17 38 10.1	-15 30 14.3	-18 08 11.4
Pres.	-4 30.9	-4 27.8	-4 24.27
δ	-17 42 40.5	-15 34 42.1	-18 12 35.7
D	-17 05 31	-17 05 31	-17 05 31
S-D	-37 09.5	+1 30 48.9	-1 07 04.7
$\tan(\delta-D)$	-2 22 9.6	+57 50.2	-70 25.2
Log "	3.34822 n	3.73672	3.60479 n
" γ_0	0.67937 n	1.06757	0.93594 n
log $\tan \delta$	9.5042 n	9.4453 n	9.5172 n
" γ_0	1.6001	8.1969	2.0395
" γ_1	8.1577 n	9.6956 n	8.6101 n
γ_0	-4.7793	+11.6835	-8.6286
γ_1	-0.0144	-0.0000	-0.0408
γ_2	13.2063	29.6835	9.3306
γ_3	13.4131	29.0986	09.7670
$(\gamma-n)$	+20 68	-58 49	+43 34

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Standard Coordinates

5

Cape No. 1879-mg 5.1

Cape No. 1882-mg 7.8

Cape No. 1898-mg 7.0

C	13 49 26.18	13 47 48.32	13 53 39.39
L	26.20	98.39	34.99
B	26.18	98.32	34.97
Mean	13 49 26.19	13 47 48.33	13 53 39.93
Pres.	+98.79"	+98.62"	49.23"
α	13 45 14.98	13 48 36.93	13 59 23.66
A	13 48 41	13 48 41	13 48 41
$\alpha-A$	-03 26.02	-04.05	+05 32.66
Sum ($\alpha-A$)	-2 06.01	-04 05	+39 2.62
log "	9.97 811	9.98 319	9.97 769
$\log \delta$	2.31 349 h	0.60 746 h	2.53 981
" γ_0	0.80 009 h	9.07 844 h	1.01 914
γ_0	-63 101	-01 259	+10 4650
L'	-9	00	+46
δ	15 68 90	21 87 46	32 46 90
λ	16 12 93	21 97 03	32 11 81
$\gamma-\gamma_0$	+7 903	+07 59	-33 15
C	-17 38 09.8	-15 30 14.3	-18 08 11.2
L	10.0	19.7	8 11.5
B	10.4	19.3	11.6
Mean	-17 38 10.1	-15 30 14.3	-18 08 11.4
Pres	-4 38.8"	-4 27.8"	-4 29.27"
δ	-17 42 40.5	-15 34 42.1	-18 12 33.7
D	-17 05 31	-17 05 31	-17 05 31
$\delta-D$	-37 07.5	+1 30 48.9	-1 07 04.7
Tan ($\delta-D$)	-2 22 9.8	+59 50.2	-40 25.2
log "	3.34 822 h	3.73 692	3.60 979 h
$\log \gamma_0$	0.81 237 h	1.06 737	0.93 599 h
log Tan δ	9.50 42 h	9.94 53 h	9.51 72 h
" γ_0	1.60 01 h	8.19 69	2.03 95
" γ_1	8.15 77 h	9.69 56 h	8.61 01 h
γ_0	-9.77 93	+11.68 35	-1.62 86
γ_1	-0.01 74	-0.00 00	-0.09 08
γ_2	13 20 63	29 68 25	9 33 06
γ_3	13.71 31	29.69 86	29 76 40
γ_4	+20 68	-58 79	+4 23 7

$A = +0.6$
 $B = +8$

8110

Moon's Center

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)/(1 - \mu)$	$O - C$
1	24.00000	-0.69900	-7	0.4896	4.0569	-1.8
2	24.6990	0.00000	-7	0.0000	4.0497	-8.5
3	25.00000	+0.3010	-7	0.0902	4.0614	+2.2
4	26.00000	+1.3010	-6	1.6910	4.0522	-6.0
5	26.79950	+1.7960	-4	3.0471	4.0577	-3.5
6 +	26.7125	+2.0135	0	4.0542	4.0542	-4.0
7	26.9993	+1.7503	+4	3.0649	4.0605	+2.3
8	26.00000	+1.3010	+6	1.6942	4.0560	-2.2
9	25.6190	+0.9200	+6	0.8475	4.0584	+0.2

	y	$y - y_0$	Δy	$(y - y_0)^2$	Σ
1	19.1159	-1.8871	-15	3.5668	200
2 -	13.9922	-2.0108	-16	4.0497	180
3	19.0118	-1.9912	-16	3.9712	171
4	19.9676	-1.5354	-12	2.3612	139
5	15.0000	-1.0030	-8	1.0076	120
6	16.0030	0.0000	0	0.0000	90
7	17.0000	+0.9970	+8	0.9956	60
8	17.5386	+1.5356	+12	2.3618	40
9	17.7935	+1.7905	+14	3.2109	27

Approximate Center

 $x = 26$ $y = 19.9676$ 17.5386 32.0062 $y_0 = 16.0031$ $y_{max} = 13.9922$ $R = 2.0109 = 2.0127$ $x_{may} = 26.7125$ $x_0 = 24.6998$

Moon's Center

$$\begin{cases} x_0 = 24.6990 \\ y_0 = 16.0030 \end{cases}$$

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Moon's Center.

.6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$x - y_0$	$y - y_0$	$(y - y_0)^2$
1	29.00000	-0.699900	-7	0.4896	4.0569	1.5	
2	29.69990	0.000000	-1	0.0000	4.0497	85	
3	25.00000	+0.3010	-1	0.0902	4.0614	+22	
4	26.00000	+1.3010	-6	1.6910	4.0522	-60	
5	26.99950	+1.7960	-4	3.0471	4.0597	-35	
6	+26.7125	+2.0135	0	4.0592	4.0592	-90	
7	26.99993	+1.7303	+9	3.0698	4.0605	+23	
8	26.00000	+1.3010	+6	1.6912	4.0560	-22	
9	25.6190	+0.9200	+6	0.8470	4.0584	+102	

	x	$x - x_0$	Δx	$(x - x_0)^2$	y	$y - y_0$	$(y - y_0)^2$
1	19.1159	-1.9878	-13	3.5668	200		
2	-13.9922	-2.0108	-16	9.0998	180		
3	19.0118	-1.9712	-16	3.9798	171		
4	19.9676	-1.5337	-12	2.3612	139		
5	15.0000	-1.0030	-8	1.0076	120		
6	16.0030	0.0000	0	0.0000	90		
7	17.0000	+0.9970	8	0.9936	60		
8	17.5386	+1.5356	+12	2.3618	41		
9	17.7935	+1.7905	+14	3.2109	27	173	

Approximate Center

$$x = 26 \quad y = 19.9676$$

$$17.5386$$

$$32.0062$$

$$y_0 = 16.0031$$

$$y_{\text{max}} = 13.9922$$

$$R = 2.0109 = 2.0 + 27$$

$$x_{\text{max}} = 26.7125$$

$$x_0 = 24.6998$$

Moon's Center

$$\begin{cases} x_0 = 24.6998 \\ y_0 = 16.0031 \end{cases}$$

Formation of Normals.

1	+ 1.32	+ 12.5	+ 39.0
2	+ 0.00	+ 0.00	+ 171.0
3	- 1.80	+ 16.5	- 44.0
4	- 2.00	- 78.0	+ 92.5
5	- 1.75	- 61.0	+ 35.0
6	+ 0.00	- 80.5	- 0.00
7	+ 1.75	+ 80.0	+ 23.0
8	+ 2.00	- 28.5	- 34.0
9	+ 1.65	+ 1.8	+ 3.5
	+ 6.72	+ 60.8	+ 359.0
	- 4.35	- 278.0	- 78.0
	+ 2.37	- 187.2	+ 281.0

	a	b	c	New 0-c
	- 9	+ 8	- 17 ✓	- 17
a	+ 13	0	+ 8 ✓	- 64
b	- 4	+ 4	+ 8 ✓	+ 57
c	- 16	+ 17	+ 6 ✓	+ 12
	+ 23	+ 4	+ 11 ✓	+ 15
	+ 26	0	+ 10 ✓	- 1
	+ 23	- 4	+ 3 ✓	+ 37
	+ 17	- 6	- 15 ✓	- 30
	+ 12	- 7	- 11 ✓	- 22 ✓

.158

$$+ 2.37 + 21.52 = - 7.10$$

$$+ \square \square + .37 = + 1.37$$

$$+ 21.15 = - 5.97$$

$$19.98 = + 8.63 + 0.62 = + 9.25$$

8110 Moon's Center, Conditional Equations. 7

1	- 0.70	- 1.89	- 18	+ 10	- 28	- 18	0	
2	0.00	- 2.01	- 85	+ 00	- 29	- 29	- 56	
3	+ 0.30	- 1.99	+ 22	- 40	- 29	- 33	+ 55	
4	+ 1.30	+ 1.54	- 160	- 19	- 22	- 41	- 19	
5	+ 1.75	+ 1.00	- 35	- 25	- 19	- 39	+ 4	
6	+ 2.01	0.00	- 40	+ 29	00	- 29	- 11	
7	+ 1.75	+ 1.00	+ 23	- 25	+ 19	- 11	+ 39	
8	+ 1.30	+ 1.54	- 22	- 19	+ 22	+ 3	- 25	
9	+ 0.92	+ 1.79	+ 02	- 13	+ 26	+ 13	- 11	
							+ 93	- 122

$$19.98 + 2.37 = -187.2 + 8.63$$

$$+2.37 \quad 21.52 = +281.0 - 7.10$$

$$+2.37 + .37 = -129.6$$

$$- .26 \Delta$$

$$+21.15 = +310.6 \quad b = +14.7$$

$$19.98 = -34.9 - 187.2 = -222.1 \quad a = -14.9$$

$$= +0.62$$

Arc Measured 173°

$$\frac{p}{h} = .27$$

$$\frac{zV}{h} = -3.2$$

$$\text{In } 4 \quad R = 2.01 \times \frac{-3.2}{.27} = -11.9 \quad \Delta R = -0.1$$

$$-2RC = -0.80$$

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

$$\Delta R = -0.3$$

$$\Delta t = +0.21$$

$$\Delta \delta = +0.1$$

$$\Delta a = -0.66$$

$$\Delta \gamma = -0.02$$

8110 Wilsons Center, Conditional Equations. 7

						c	$0-c$
1	- 0.70	- 1.89	- 18	+ 10	- 28	- 18	0
2	0.00	- 2.01	- 85	00	- 29	- 29	- 56
3	+ 0.30	- 1.9191	- 22	- 4	- 29	- 33	+ 55
4	+ 1.30	- 1.59	- 160	- 19	- 22	- 41	+ 19
5	+ 1.72	- 1.00	- 135	- 25	- 19	- 139	+ 9
6	+ 2.04	0.00	- 140	+ 29	00	- 29	- 11
7	+ 1.75	+ 1.00	+ 123	- 25	+ 19	+ 11	+ 39
8	+ 1.30	+ 1.59	- 22	- 19	+ 22	+ 37	+ 25
9	+ 0.92	+ 1.79	+ 102	- 19	+ 26	+ 113	- 11
							+ 93 - 122

$$19.98 + 237 = -187.2$$

$$+ 2.37 - 21.52 = +1281.0$$

$$+ 2.37 + .37 = - 29.6$$

$$+ 21.15 = + 310.6 \quad a = + 19.7$$

$$19.98 = -39.9 - 187.2 = -222.1 \quad a = + 19.9$$

Are Measured 173°

$$\frac{p}{h} = .27$$

$$\frac{\Sigma V}{h} = -3.2$$

$$\frac{-3.2}{.27} = -11.9 \quad \Delta H = -0.1$$

8110

Moon's Mean Position.

8

$$\begin{array}{r} \gamma_0 = 24.6990'' \\ + - 7'' \\ \hline 24.6983'' \end{array}$$

$$\begin{array}{r} \gamma_0 = 16.0030'' \\ + 7'' \\ \hline 16.0037'' \end{array}$$

From plate constants.

$$x = 24.6970''$$

$$y = 15.9090''$$

$$z = +2.6970''$$

$$n = -2.0910''$$

$$\log z = 0.43088''$$

$$\log \tan \delta = 9.4947''$$

$$\cos \delta = 9.97975''$$

$$z^2 = 0.8617''$$

$$8.50727''$$

$$7.0537''$$

$$\log(x-A) = 7.94389''$$

$$7.4898''$$

$$\begin{array}{r} x-A \\ +1 \\ \hline \end{array} \begin{array}{r} +87.88'' \\ 27.88'' \end{array}$$

$$n_1 = -0.0026''$$

$$n_0 = -2.0884''$$

$$A = 13 \quad 48 \quad 41''$$

$$\log n_0 = 0.31981''$$

$$7.33115''$$

$$\delta_0 = 13 \quad 50 \quad 08.88''$$

$$2.98866'' - 977.2''$$

$$Red \quad +2.02''$$

$$S-D = 16 \quad 19.2''$$

$$\alpha_1 = 13 \quad 50 \quad 10.90''$$

$$D = 17 \quad 05 \quad 31''$$

$$\delta_0 = 17 \quad 21 \quad 45.2''$$

$$Red = -13.8''$$

$$S' = 17 \quad 21 \quad 59.0''$$

8110

Moon's Mean Position

8

$$\begin{aligned} \gamma_0 &= 29.6990'' \\ &+ 2.72'' \\ &= 29.6983'' \end{aligned}$$

$$\begin{aligned} \gamma_0 &= 16.0030'' \\ &+ 7'' \\ &= 16.0037'' \end{aligned}$$

From plate constants.

$$\lambda = 29.6970''$$

$$\eta = 15.9090''$$

$$\zeta + 2.6970''$$

$$\eta - 2.0710''$$

$$\log \zeta, 0.92088''$$

$$\log \tan \delta, 9.9947''$$

$$\log \delta, 9.91975''$$

$$\log \gamma, 0.8617''$$

$$8.50729''$$

$$7.0539''$$

$$\log \gamma + 9.94389''$$

$$7.4898''$$

$$15.487.88''$$

$$\lambda - A = 41.27.88''$$

$$\eta_1 = 15.90.26''$$

$$\eta_0 = 2.08.88''$$

$$A = 13.48.91''$$

$$\log \eta_0 = 0.31156''$$

$$7.33115''$$

$$\gamma_0 = 13.50.08.88''$$

$$2.14.46.5'' = 11.12''$$

$$\mu_d = 2.02''$$

$$\delta - D = 16.17.2''$$

$$\gamma_1 = 13.50.10.90''$$

$$D = 17.05.31''$$

$$\delta_0 = 17.21.45.2''$$

$$\mu_d = 13.8''$$

$$\delta' = 17.21.52.0''$$

4 Hydrae

$$\begin{array}{r}
 13 \quad 14 \quad 19.88 \\
 \underline{17.83} \\
 + 2.05 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -22 \quad 93 \quad 36.2 \\
 \underline{29.10} \\
 - 12.1 \\
 \hline
 \end{array}$$

m Virgo

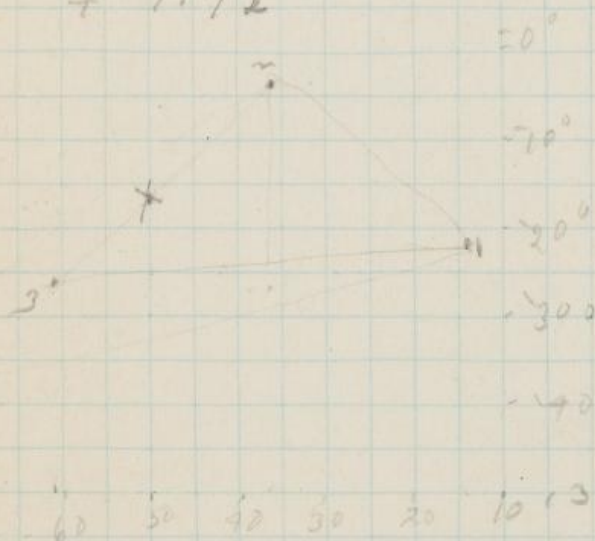
$$\begin{array}{r}
 13 \quad 37 \quad 10.97 \\
 \underline{8.91} \\
 + 2.00 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -08 \quad 16 \quad 43.8 \\
 \underline{28.09} \\
 - 15.7 \\
 \hline
 \end{array}$$

π Hydrae

$$\begin{array}{r}
 14 \quad 01 \quad 35.57 \\
 \underline{31.62} \\
 + 1.92 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -26 \quad 16 \quad 35.1 \\
 \underline{27.30} \\
 - 10.8 \\
 \hline
 \end{array}$$



4 Centauri

$$\begin{array}{r}
 14 \quad 30 \quad 18.15 \\
 \underline{6.23} \\
 + 1.92 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 -41 \quad 47 \quad 11.8 \\
 \underline{6.06} \\
 - 5.7 \\
 \hline
 \end{array}$$

8110

Red. to Apparent Place.

9

$$= 135^{\circ} 10.5' \checkmark$$

$$H + \alpha \quad 32 \quad 60.7' \checkmark$$

$$H \quad 19 \quad 10.8' \checkmark$$

$$\alpha \quad 13 \quad 50.1' \checkmark$$

$$G \quad 20 \quad 51.1' \checkmark$$

$$G + \alpha \quad 34 \quad 41.2' \checkmark$$

$$= 160^{\circ} 18.0' \checkmark$$

$$S \quad -17 \quad 21.75' \checkmark$$

$$\log \cos S \quad 9.9797' \checkmark$$

$$i \quad 0.8932' \checkmark$$

$$(W) \quad 0.8729' \checkmark$$

$$\log \cos G + \alpha \quad 9.9738' \checkmark$$

$$g \quad 1.0417' \checkmark$$

$$\sin \quad 9.5277' \checkmark$$

$$\tan S \quad 9.4951' \checkmark$$

$$8.8239$$

$$\log \sin S \quad 9.9798' \checkmark$$

$$\cos H + \alpha \quad 9.8508' \checkmark$$

$$h \quad 1.2769' \checkmark$$

$$\sin H + \alpha \quad 9.8482' \checkmark$$

$$\sec S \quad 0.0203' \checkmark$$

$$8.8239$$

$$\log g' \quad 1.0155' \checkmark$$

$$g \quad 8.8884' \checkmark$$

$$\log h' \quad 0.5025' \checkmark$$

$$h \quad 9.9693' \checkmark$$

$$f + 1.161' \checkmark$$

$$g - 0.078' \checkmark$$

$$h + 0.932' \checkmark$$

$$+ 2.016' \checkmark$$

$$g' - 10.365' \checkmark$$

$$h' + 8.007' \checkmark$$

$$i - 7.763' \checkmark$$

$$- 13.827' \checkmark$$

8110

Red. to Apparent Place.

9

$$= 1132^{\circ} 10.5'$$

$$H+x \quad 32 \quad 60.7'$$

$$H \quad 19 \quad 10.8'$$

$$x \quad 13 \quad 50.1'$$

$$G \quad 20 \quad 51.1'$$

$$G+x \quad 39 \quad 91.2'$$

$$= 160^{\circ} 18.0'$$

$$d \quad -17 \quad 21.75'$$

$$\log \cos d \quad 9.9797'$$

$$l \quad 0.89324'$$

$$l \quad 0.81294'$$

$$\log \cos G+x \quad 9.9738'$$

$$g \quad 1.0411'$$

$$\sin \quad 9.5277'$$

$$\sin d \quad 9.79584'$$

$$8.8239$$

$$\log \sin d \quad 9.7798'$$

$$\cos H+x \quad 9.95084'$$

$$h \quad 1.2761'$$

$$\sin H+x \quad 9.8482'$$

$$\sin d \quad 0.02034'$$

$$8.8239$$

$$\log g' \quad 1.01554'$$

$$g \quad 8.88884'$$

$$\log h' \quad 0.60254'$$

$$h \quad 9.76934'$$

$$f + 1.161'$$

$$g - 0.077'$$

$$h + 0.932'$$

$$+ 2.016'$$

$$g'' + 0.365'$$

$$h' + 8.007'$$

$$i - 7.763'$$

$$13.828'$$

8110

Lunar Parallax.

10

$$\begin{array}{rcl}
 \delta' & 13 & 50 & 10.90 \checkmark \\
 \delta & 14 & 50 & 15.1 \checkmark \\
 \delta - \delta' & 1 & 00 & 0.4.20 \checkmark \\
 & & & = +15^{\circ} 01' & 03.0
 \end{array}$$

$$\begin{array}{rcl}
 \delta' & -17^{\circ} & 21' & 56.8 \\
 \pi & & 59' & 47.53 \checkmark
 \end{array}$$

$$\begin{array}{r}
 9.86913 \checkmark \\
 8.29035 \checkmark \\
 9.41349 \\
 \hline
 0.01830 \\
 \hline
 7.54127
 \end{array}$$

$$\frac{1}{2}(\delta - \delta') + \delta = 58.67$$

$$(0 - \frac{1}{2}(\delta - \delta')) 17^{\circ} 55' 09.3 \checkmark$$

$$\begin{array}{r}
 9.95727 \checkmark \\
 0.00000 \checkmark \\
 0.01489 \checkmark \\
 \hline
 9.97216 \checkmark
 \end{array}$$

$$\delta - \delta' = 11' 57.29$$

$$= + 0^m 47.82$$

$$\delta = 43^{\circ} 9' 53.2$$

$$\delta - 17 \quad 21 \quad 59.0 \checkmark$$

$$\delta - \delta = 60 \quad 31 \quad 52.2 \checkmark$$

$$\begin{array}{r}
 9.82640 \checkmark \\
 8.29035 \checkmark \\
 9.93985 \checkmark \\
 0.16486 \checkmark \\
 \hline
 8.17196
 \end{array}$$

$$\begin{array}{r}
 + 51 \\
 21 \\
 \hline
 01.3 \\
 36.6
 \end{array}$$

$$\delta_1 - 16 \quad 30 \quad 57.7$$

$$\delta \quad 13 \quad 50 \quad 58.72$$

$$\text{Am. Eph. } \delta - 16 \quad 30 \quad 53.1 \checkmark$$

$$\delta \quad 13 \quad 50 \quad 57.93 \checkmark$$

$$0 - e \quad - 7.6$$

$$0 - e \quad + 0.79$$

$$2^{\text{nd}} \text{ Order Ref.} \quad + 0.1$$

$$\text{Curv. of Plate} \quad + 0.7$$

$$- 0.06$$

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

$$- 0.02$$

$$\delta - 16 \quad 30 \quad 57.5 \checkmark$$

$$\delta \quad 13 \quad 50 \quad 58.70$$

$$0 - e \quad - 7.7$$

$$+ 0.77$$

8110

Lunar Parallax.

10

$\alpha' \quad 13 \quad 50 \quad 10.90''$
 $\delta' \quad 14 \quad 50 \quad 15.1''$
 $\mu \quad 1 \quad 00 \quad 09.20''$
 $= +15^\circ 01' \quad 03.0$

$\alpha' \quad -11' \quad 21' \quad 56.8''$
 $\pi \quad 59' \quad 47.53''$

$\mu \quad -6' \quad +5' \quad 58.69$

$\mu \quad -2(14)17.55' \quad 50.93.6$

$9.95727''$
 $0.00000''$
 $0.01789''$
 $9.97216''$

$\delta = 43^\circ \quad 9' \quad 53.2''$

$\delta \quad -17' \quad 21' \quad 59.0''$

$\delta - \delta' \quad 60' \quad 31' \quad 52.2''$

$9.82690''$
 $8.29035''$
 $9.93185''$
 $0.16986''$
 $8.15196''$

$+51 \quad 01.3$

$\delta_1 \quad -16 \quad 30 \quad 57.7 \quad \alpha \quad 13 \quad 50 \quad 58.72$

$\text{Am. Gph. } \delta \quad -16 \quad 30 \quad 53.1'' \quad \alpha \quad 13 \quad 50 \quad 57.93''$

$\text{D.C.} \quad -9.6 \quad \text{D.C.} \quad +0.79$

$\text{Curv of Plate} \quad +0.9 \quad -0.06$

8288

Star Measures

11

19.5	14790	17468	17456	17842
16.16	10050	1224043	81620	13670
	6055	46	72	68699
	78	90	56	54
	<u>14.4740</u>	<u>17.4764</u>	<u>16.5840</u>	<u>16.5822</u>
3	17966	18298	17402	18529
31.9	8640	17638	916465	1677275
13.8	4849	9843	66	78
	58	08	12	29
	<u>31.9319</u>	<u>31.9349</u>	<u>13.8246</u>	<u>13.8250</u>
2	18052	15782	17378	18600
19.7	1068079	1319496	15997	995098
22.2	78	98	94	96
	60	92	72	588
	<u>19.7378</u>	<u>19.7412</u>	<u>22.1387</u>	<u>22.1358</u>

Moon Measures

25			16378	17860
15.5			11252	1295097
			7850	49
			88	98
			<u>15.5139</u>	<u>15.5094</u>
2	16499	16700		
24.1	15700	7564		
16	0603	5861		
	96	20		
	<u>24.0792</u>	<u>24.0842</u>		

3			15692	17086
24			19870	79.7850
16.1			3035	52
			99	82
			<u>16.0858</u>	<u>16.0868</u>
3Star	17320	15376	19956	17202
31.9	787875	1980808	12552	9586
13.3	72	0808	9850	8686
	16	52	60	98
	<u>31.9445</u>	<u>31.9462</u>	<u>13.2906</u>	<u>13.2388</u>

Star No 2.

	17890	15292	15808	16790
B7	10860	12304	9988	13096
9.6	62	298	8986	13100
	00	9.8	12	8.00
	<u>13.7036</u>	<u>13.7062</u>	<u>29.6329</u>	<u>29.6309</u>

8288

Star Measures

11

	19790	177408	17956	17898
10.5	10450	1224043	1622	10670
18	604	46	42	68
	78	90	56	54
	<u>19.7794</u>	<u>19.7764</u>	<u>18.5840</u>	<u>16.5222</u>
3	17966	18298	17402	18529
11.9	✓ 8640	17638	9164	1677275
13.8	9879	9873	46	78
	58	68	12	29
	<u>31.7319</u>	<u>31.9349</u>	<u>13.8246</u>	<u>13.8250</u>
2	18052	15782	17378	18600
19.7	1068079	13199	12999	995048
22.2	78	9896	99	96
	60	92	72	588
	<u>19.7382</u>	<u>19.7412</u>	<u>22.1389</u>	<u>22.1358</u>

Moon Measures

25			16378	17860
15.5			11252	1295077
			98	49
			88	98
			<u>15.5139</u>	<u>15.5094</u>
4	16479	16700		
19.1	15700	7564		
16	06	5861		
	96	20		
	<u>29.0792</u>	<u>29.0842</u>		
3			15692	17086
29			19870	797850
16.1			50	52
			79	82
			<u>16.0858</u>	<u>16.0868</u>
Star	17320	15396	19956	17202
31.9	787875	19808	12552	958686
13.3	72	08	98	86
	16	52	60	78
	<u>31.9942</u>	<u>31.9962</u>	<u>13.2906</u>	<u>13.2388</u>

Star No. 2.

2	17890	15292	15808	16790
137	10860	12304	9488	13096
29.6	6261	27806	8486	13100
	00	98	12	800
	<u>13.7036</u>	<u>13.7062</u>	<u>29.6329</u>	<u>29.6309</u>

8288.

±	14166	14706
23.7	10682	9924
17	5046	2826
	61	06
	<u>23.5318</u>	<u>23.5520</u>

5	15690	14372
23.6	10390	9662
17?	88	5056
7-	88	92
	<u>23.5300</u>	<u>23.5279</u>

6	16730	13338
23.7	10226	983836
18	26	34
	18	38
	<u>23.6496</u>	<u>23.6498</u>

7	16292	15282
24	10520	1097782
18.6	18	90
	72	78
	<u>18.5762</u>	<u>18.5702</u>

8	15300	16508
24.6	969943	12196
19	42	724
	16	00
	<u>24.5666</u>	<u>24.5690</u>

7	17068	19397
25	15532	1086870
19.2	38	72
	72	80
	<u>19.1534</u>	<u>19.1988</u>

8288.

1.

1	164 6 6	144 0 6
3.7	10 6 42	9 9 24
17	50 46	28 26
	69	06
	<u>23.5518</u>	<u>23.5520</u>

3	12 6 90	143 72
23.6	10 3 90	9 6 62
17	88	50 56
1-	88	9 2
	<u>23.5300</u>	<u>23.5279</u>

4	16 7 30	133 38
23.7	10 2 26	98 38 36
18	26	34
	18	38
	<u>23.6496</u>	<u>23.6498</u>

1	162 92	152 92
24	100 20	1097 722
14.6	18	90
	72	78
	<u>18.5708</u>	<u>18.5702</u>

3	153 00	165 08
24.6	96 99 43	121 96
17	42	72
	16	00
	<u>24.5666</u>	<u>24.5690</u>

1	48 948	193 97
23	150 88 90	108 68 70
19.2	10 38 90	72
	72	80
	<u>19.1539</u>	<u>19.1788</u>

8288 Times & Etc.

13

Date Mar 23 '15

Exp. to stars	07	59	08	11
" " Moon	08	05	01.6	08 05 01.8 ✓
Clock slow		00	02.1	

H. Sid. Time	08	05	03.8 ✓	$\delta - \alpha = + 1^h 50^m \checkmark$
H. Long.	7	47	31.05 ✓	
G. Sid. Time	12	49	34.55 ✓	
Sid. T. M. Noon	23	59	37.27 ✓	
Interval	12	50	00.61 ✓	
Reduction		2	06.15 ✓	
G. M. Time	12	47	54.76 ✓	

From Naut. Alm.	R. A.	Dec.
Moon 12 ^h 6 12	45.60 + 27	37 22.2
Motion in 1 ^m	2.2668	- 2.371
" " 97. ^m 9077 1	98.61 - 1	53.59
Tabular Place 6 14	34.21 + 27	32 28.6 ✓

Moon's Age 8 days.

Parallax	59' 50".85 ✓
Semid.	17' 58".3 ✓
R.	898.3 ✓
Augm.	13.0 ✓
Cor. $\delta = 9$	- 0.6 ✓
R.	910.7 ✓
R.	1.9522 ✓
aR	- 929 ✓
$\delta + aR$	1.8593 ✓
R ²	3.9570 ✓

937 = 19.0

a = -499.7

29
-475.7

8288 *Turner & Etc.*

13

Date Mar 23 '15

Exp. to stars	07	59	08	11
" " Moon	08	05	01.6	08 05 01.8
Clock slow		00	02.1	

H. Sid Time	08	05	03.8	-x: + 1" 50m
H. Long	9	44	31.05	
T. Sid. Time	12	49	34.85	
Sid. T. M. Noon	23	59	39.29	
Interval	12	50	00.61	
Reduction		2	06.15	
G. M. Time	12	47	59.96	

From Mean Alm.	R. A.	Dec.
Moon 12" 6 12	75.60	+ 27 34 22.2
Motion in 1 ^m	2.2668	- 2.371
" " 97.9077 1	78.61	- 1 53.57
Libular Place 6 19	39.21	+ 27 32 28.6

Moon's Age 8 days.

Parallax	59' 50" 85
Semid.	14' 58" 3
R.	898.3
Augm.	12.9
Lv.	-0.6
R.	910.7
R.	1.9522
ak	- 929
V + ak R	1.8593
R	39570

939 = 19.8

a = -999.7

29

-475.7

Plate Center & Plate Constants.

19.

X	Y				
1) 14.4752	16.5831	06 06 27.5	27 09 08.5		
2) 19.7395	22.1371	06 10 33.5	27 53 22.8		
3) 31.9452	13.2397	06 17 07.9	26 42 35.2		
3) 66.1599	51.9599	3) 18 33 68.9	80 104 66.5		
22.0533	17.3199	06 11 22.9	27 15 02.2		
22	18	+ 1.6	- 5 17		
- .053	+ .6801	06 11 24.5	27 09 45.2		
313	466.5				

$- 1.64$
 $+ 3 16.9$
 $= 5' 16.9$

Plate Center { $A = 06 11 24$
 $D = +27 09 45$

$X - \xi + 500X - 61.54 - 3X - 15.810$
 $+ 10785 + 6802 = +17637 - 1822 = +15815 - 9 = +15811 = +1$
 $+ 9596 + 7238 = +16834 - 1020 = +15814 - 9 = +10 = 0$
 $+ 661 + 15973 = +16634 - 819 = +15820 - 10 = +10 = 0$
 $25,3847 + 12.692 = - 1066 - 8 = 29,9653$

$\alpha - \eta + 500\eta + 62.8A + 2.6\eta + 4561$
 $- 20315 + 19816 = - 5499 + 861 = - 4638 + 77 = - 4561 = 0$
 $- 13809 + 8292 = - 5512 + 919 = - 4603 + 93 = - 4560 = +1$
 $- 13221 + 6620 = - 6601 + 2006 = - 4595 + 39 = - 4561 = 0$
 $17.3318 + 8666 = + 1599 + 45 = 18.8189$

Tables $a = +1.0$ $e = +1$ $a - e = 0$ $b + d = -.5$
 $(b - c) = -478.7 - 502.6 = +2.9 = -1.3$
 $O - C = -500.7 - 503.6 = -0.8$

log 10.011 1.04 1.16

6 09 53.89

53.99

53.85

6 09 53.89

57.16

6 05 51.05

6 11 29

- 05 32.95

- 3 32.92

2 522394

997213

0971714

- 93699

- 42

126269

137099

+ 10785

128 55 38.31

37.83

38.38

128 55 38.17

- 07.6

128 55 31.1

27 09 45

+ 1 45 96.1

+ 6398.1

380265

113380

97124

19734

87392

+136081

+ 00578

316629

296319

- 20315

Plate center & Plate constants.

19.

X	Y		
1 19.9702	16.5834	06 06 27.5	27 09 08.5
2 19.7393	22.1371	06 10 33.5	27 53 22.8
3 31.9952	13.2897	06 17 07.9	26 42 35.2
3) 66.1599	51.9599	18 33 68.9	80.109 66.5
22.0533	19.3199	06 11 22.9	27 15 02.2
22	18	+ 1.6	- 5 17
- .053	+ .6881	06 11 24.5	27 09 95.2
31 ³	966.2		

$$- 1.69$$

$$+ 3116.9 = \text{Plate center} \begin{cases} A = 06 11 24 \\ D = +27 09 75 \end{cases}$$

$$\begin{aligned} X - \bar{X} &+ 500A & - 61.24 & - 3A & - 15.81 \\ + 10785 & + 6832 & = +17637 & - 1822 & - 115810 & - 9 & = +115811 = +1 \\ + 9596 & + 7238 & = +16834 & - 1020 & - 112819 & - 9 & = +112810 = 0 \\ + 661 & + 10977 & = +16638 & - 819 & - 115820 & - 10 & = +115810 = 0 \\ 25.2897 & + 12.692 & & - 1066 & & - 8 & = 29.965 \end{aligned}$$

$$\begin{aligned} y - \bar{y} &+ 500A & + 62.81 & + 2.64 & + 9561 \\ - 20310 & + 19816 & = - 5994 & + 862 & - 9638 & + 77 & = - 9561 = 0 \\ - 13809 & + 8292 & = - 5517 & + 919 & - 9603 & + 93 & = - 9560 = +1 \\ - 13221 & + 6220 & = - 6601 & + 2006 & - 9595 & + 39 & = - 9562 = 0 \\ 17.3318 & + 8666 & & + 1599 & & + 95 & = 18.411 \end{aligned}$$

$$\text{Saturn } a = +1.0 \quad e = +1$$

$$\text{Ulns } = -489.7 \quad -502.6$$

$$a - e = 0$$

$$= +2.9$$

$$b + d = -2$$

$$= -1.3$$

Cape No. 879-mg 7.6

6 04 53.89
 53.94
 53.85

6 04 53.89

57.16

6 05 51.05

6 11 27

- 05 32.95

- 3 32.92

2.52234 n

9.94213

0.97171 n

5

7

 $\Delta 5 - 3.5$

+54 +1

- 9.3694

- 42

12.6269

13.7099

+ 1.0755

+28 55 38.31

37.83

38.38

+28 55 38.17

- 07.4

+28 55 31.1

27 09 75

+ 1 45 46.1

+ 6348.1

- 3.80265

1.13380

1 -9.37 +13.61 -72 +28 ~ -19 +7 ~ -7

2 -8.98 -0.08 -16 +25 ~ +9 0 ~ +9

3 -11.73 +5.61 -1 +4 ~ +3 +3 ~ +6

4 +9.88 -3.79 +27 -30 ~ -3 -2 ~ -5

M +3.76 +0.64

- 11

+ 0

-10

 $\Delta 7 - 2.24$

+2.75

- 6

+ 90 - 30 ~ +60 - 25 ~ +35

- 5 + 0 ~ 0 - 23 ~ -23

+ 5 ~ 12 ~ -7 + 4 ~ -11

- 10 + 8 ~ -2 + 27 ~ +25

0 - 1

+ 10

+ 3

9.7424

1.9434

8.7392

+13.6081

4.00578

3.46629

2.96317

- 2.0315

8288.

Standard Coordinates.

15-

Cape No 883-mg 8.2			Cape No 897-mg 8.0			Cape No 913-mg 8.3		
c	06 05	31.12	06 09	36.80		06 16	11.68	
L		31.29		36.82			11.82	a.g.
E		31.07		36.81			11.71	
Mean	06 05	31.19	06 09	36.81		06 16	11.74	
Prec.		+56.36		56.69			56.15	
α	06 06	27.50	06 10	33.50		06 17	07.59	
A	06 11	24	06 11	24		06 11	24	
$\delta-A$		-09 56.50		-0 50.50			+05 43.89	
$\sin(\delta-A)$		-296.99		-50.50			+343.85	
log "	2.47	201 n	1.70	32.9 n		2.53	437	
" cos	9.94	929	9.94	638		9.95	099	
" ζ_0	0.92	859 n	0.15	691 n		0.99	460	
ζ_0	-8.48	28	-1.43	52		+9.87	64	
ζ_1		-16		-1			+27	
ζ	13.51	56	20.56	47		31.87	91	
λ	19.97	52	19.73	95		31.94	52	
$\lambda-\zeta$	+ .95	96	-	8252		+ .06	61	

C	+27 09	16.6	+27 53	36.4		+26 42	57.3	
L		16.1		35.9			56.5	a.g.
E		16.34		35.7			57.1	
Mean	+27 09	16.3	+27 53	36.0		+26 42	57.0	
Prec.		-07.8		-13.2			-21.8	
δ	+27 09	08.5	+27 53	22.8		+26 42	35.2	
D	27 09	45	27 09	45		27 09	45	
$\delta-D$		-36.5		+43 37.8		-0 27	09.8	
$\tan(\delta-D)$		-36.5		+26 17.9			-16 29.8	
log "	1.56	229 n	3.41	795		3.21	214 n	
" η_0	8.89	349 n	0.79	910		0.54	329 n	
Stan δ	9.71	00	9.72	37		9.70	17	
" ζ_0	1.85	71	0.31	38		1.98	92	
" η_1	8.62	05	7.09	09		8.74	43	
η_0	-0.07	82	+5.61	18		-3.99	37	
η_1	+0.04	17	+0.00	12		+0.05	55	
η	17.96	35	23.61	38		19.56	18	
η	16.58	31	22.13	71		13.23	97	
$(\eta-\eta_0)$	-1.38	04	-1.47	59		-1.32	21	

8288.

Standard Coordinates

15

Cap. No 883-mg 8.2 Cap. No 891-mg 8.0 - Cap. No. 913-mg 8.3

C	06 05 31.12	06 09 36.80	06 16 11.68
L	31.29	36.82	11.82 ag.
E	31.07	36.81	11.71
Mean	06 05 31.19	06 09 36.81	06 16 11.79
Proc	+56.56	56.69	56.15
L	06 06 27.50	06 10 33.50	06 17 07.59
A	06 11 29	06 11 29	06 11 29
S-A	-09 58.50	-0 50.50	+05 43.89
Sum (S-A)	-296.99	-50.50	+393.85
log ..	2.97201 n	1.70329 n	2.53637
" log d	9.99929	9.99638	9.95099
" log	0.92859 n	0.15691 n	0.79960
T	-898.28	-143.52	+949.89
T'	-16	-1	+27
T	13.5158	20.5697	31.8771
T	19.9732	19.7395	31.9452
X-S	+9596	-8252	+0661
C	+27 09 18.6	+27 53 36.9	+26 42 57.3
L	16.1	35.9	56.5 ag.
E	16.39	35.7	57.1
Mean	+27 09 16.3	+27 53 36.0	+26 42 57.0
Proc.	-07.8	-13.2	-21.8
S	+27 09 08.5	+27 53 22.8	+26 42 35.2
D	27 09 75	27 09 95	27 09 95
S-D	-36.5	+93.378	-0 27 09.8
tan S-D	-36.5	+2617.9	-1629.8
log ..	1.56229 n	3.91795	3.21214 n
" log	8.89399 n	0.79910	0.54329 n
Sum d	9.7100	9.7237	9.7017
" log	1.9371	0.2138	1.9892
" log	8.7205	7.0969	8.7943
h	-0.0182	+5.6118	-3.9937
h	+0.0526	+0.0012	+0.0555
h	17.7194	23.6136	17.5616
h	16.5811	22.1371	13.2377
h-A	-1.8913	-1.4759	-1.3221

$a = f \cdot A$
 $b = - \cdot l$

8288

Moon's center.

16

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	25.0000	-0.3880	-1	0.1506	3.4398	-1.72
2	24.0866	-1.3014	0	1.6936	3.4625	+ 55
3	24.0000	-1.3880	0	1.9265	3.4732	+ 162
4	23.5519	-1.8361	0	3.3713	3.4802	+ 232
5	23.5287	-1.8593	0	3.4570	3.4570	0
6	23.6497	-1.7383	+0	3.0216	3.4705	+ 135
7	24.0000	-1.3880	+0	1.9265	3.4720	+ 150
8	24.5653	-0.8227	+1	0.6767	3.4656	+ 086
9	25.0000	-0.3880	+1	0.1506	3.4670	+ 100

	y	$y - y_0$	Δy	$(y - y_0)^2$	$R = 3.4570$	L
1	15.5164	-1.8136	+0	3.2892		192 ^v
2	16.0000	-1.3300	+0	1.7689		225 ^v
3	16.0863	-1.2437	+0	1.5467		228 ^v
4	17.0000	-0.3300	+0	0.1089		260 ^v
5	17.3300	0.0000		0.0000		270 ^v
6	18.0000	+0.6700	-0	0.4489		291 ^v
7	18.5732	+1.2432	-0	1.5455		312 ^v
8	19.0000	+1.6700	-0	2.7889		337 ^v
9	19.1511	+1.8211	-0	3.3169		378 ^v 15-6

Approximate center

$$\begin{aligned}
 x &= 24 & y &= 16.0863 \\
 & & & 18.5732 \\
 & & & \hline
 & & & 34.6595 \\
 & & y_0 &= 17.3297
 \end{aligned}$$

$$R = 1.8593$$

$$x_{\text{mean}} = 23.5287$$

$$x_0 = 25.3880$$

$$\begin{aligned}
 \text{Moon's center } x_0 &= 25.3880 \\
 y_0 &= 17.3300
 \end{aligned}$$

8248

Moon's center.

16

	λ	$\lambda - \lambda_0$	$\Delta \lambda$	$\lambda - \lambda_0$	$\gamma - \gamma_0$	$\gamma - \gamma_0$	$\lambda - \lambda_0$
1	2540000	-0.3880	-1	0.1306	39398	-172	
2	240866	-1.3019	0	1.6936	39625	+53	
3	240040	-1.3880	0	1.9265	39732	+162	
4	235219	-1.8361	0	3.3713	39802	+232	
5	235287	-1.8393	0	3.9570	39570	0	
6	236997	-1.7383	0	3.0216	39705	+130	
7	240000	-1.3880	+0	1.9265	39720	+150	
8	245653	-0.8227	+1	0.2767	34656	+086	
9	2540000	-0.3880	+1	0.1306	39670	+100	

	γ	$\gamma - \gamma_0$	$\Delta \gamma$	$\gamma - \gamma_0$	$R = 3.9570$	L
1	155169	-1.8136	+	3.2892		192
2	160000	-1.3300	+	1.7689		225
3	160803	-1.2937	+	1.5467		228
4	170000	-0.3300	+	0.1089		260
5	173287	0.0000		0.0000		270
6	180000	+0.6700	-	0.9489		291
7	182732	+1.2932	-0	1.5455		312
8	190000	+1.6700	-0	2.7889		337
9	191511	+1.8211	-0	3.2169		348

Approximate center

$$\begin{aligned}
 \lambda &= 24 \quad \gamma = 16.0863 \\
 &\quad \quad \quad 19.2722 \\
 &\quad \quad \quad \hline
 &\quad \quad \quad 39.6395 \\
 \gamma_0 &= 17.3297
 \end{aligned}$$

$$R = 1.8593$$

$$\lambda_{\text{mean}} = 23.5287$$

$$\lambda_0 = 25.3880$$

Moon's center $\lambda_0 = 25.3880$

$$\gamma_0 = 17.3307$$

Formation of Normals

1	+ 0.71	+ 67.0	+ 311.5
2	+ 1.73	- 71.5	- 73.0
3	+ 1.72	- 225.0	- 201.0
4	+ 0.45	- 318.0	- 76.5
5	0.0	0.0	0.0
6	- 1.17	- 235.0	+ 90.5
7	- 1.72	- 208.5	+ 186.0
8	- 1.37	- 70.5	+ 143.5
9	- 0.71	- 39.0	+ 182.0
	+ 4.61	+ 67.0	+ 913.5
	- 4.97	- 1167.5	- 350.5
	- 0.36	- 1100.5	+ 363.0

	a	b	c	new u-c
a	-10	+7	0	-11.0
b	+0	+13	-2	+16
c	-15	+14	-1	+117
		+14	-1	+152
		+19	+4	-119
		+17	+2	-3
		+14	-1	+11
		+8	-7	-36
		+7	-11	-4

.022

$$-0.36 + 14.81 = +0.69$$

$$+ [] - 01 = -0.23$$

$$+14.8 = +0.86$$

$$16.37 = -10.65 + .01$$

8288

Conditional Equations - Moon's Center 17

						6-C
1	- 0.39	- 1.81	= - 172	+ 26	- 66	= - 90 - 13.2
2	- 1.30	- 1.33	= + 55	+ 86	- 49	= + 37 + 18
3	- 1.39	- 1.29	= + 162	+ 93	- 45	= + 48 + 118
4	- 1.37	- 0.33	= + 232	+ 91	- 12	= + 79 + 153
5	- 1.86	0.00	= 0	+ 123	00	= + 123 - 123
6	- 1.79	+ 0.67	= + 135	+ 116	+ 29	= + 140 - 5
7	- 1.39	+ 1.29	= + 150	+ 93	+ 45	= + 138 + 12
8	- 0.82	+ 1.67	= + 86	+ 59	+ 61	= + 115 - 29
9	- 0.39	+ 1.82	= + 100	+ 26	+ 67	= + 93 + 7
						+ 308 - 289

a

b

$$+ 16.37 - 0.36 = - 1100.5 - 10.65$$

$$- 0.36 + 14.81 = + 563.0 + 0.69$$

$$+ 0.36 - .01 = - 24.2$$

$$+ .031$$

$$+ 14.8 = + 538.8$$

$$b = + 36.5$$

$$16.37 = + 13.3 - 1100.5 = - 1087.2$$

$$a = - 66.4$$

$$- 0.65$$

Arc Measured $15^{\circ} 6'$

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

$$\frac{\Sigma v}{n} = + 2.1$$

$$\text{In } 7 \quad R \quad 1.86 \quad + \frac{2.1}{.17} = + 12.4$$

$$\Delta R = + 0.2$$

$$- 2RC = - 0.74$$

$$\text{Corr} + 0.2$$

$$\Delta R \quad 0$$

$$\Delta b = - 0.02 \quad \Delta \delta = - 0.0$$

$$\Delta a = + 0.48 \quad \Delta \alpha = + 0.02$$

8288

Conditional Equations - Moon's Center 17

10 - C

Are Measured 10^{-6} u

$$\frac{10}{5} = 17$$

$$\frac{\Sigma V}{4} = +2.1$$

$$\begin{array}{r} + 2.1 \\ \hline .17 \end{array} = +12.9$$

$$\Delta R = +0.2$$

8288

Moon's Mean Position.

18

$$\begin{array}{r} \chi_0 = 25.3880 \\ - 33 \\ \hline 25.3847 \end{array}$$

$$\begin{array}{r} \eta_0 = 17.3300 \\ + 18 \\ \hline 17.3318 \end{array}$$

From Plate constants.

$$\chi = 24.9655$$

$$\eta = 18.8189$$

$$z = + 2.9655$$

$$\mu = + 0.8189$$

$$\log z = 0.47209$$

$$\log \tan \delta = 9.7118$$

$$\cos \delta = 9.97885$$

$$z^2 = 0.9442$$

$$8.50727$$

$$7.0534$$

$$\log(\chi - A) = 2.01600$$

$$7.7094$$

$$\chi - A = 103.75$$

$$\mu_1 = 0.0050$$

$$= 143.75$$

$$\mu_0 = + 0.8133$$

$$A = 06 \quad 11 \quad 27$$

11

$$\chi_0 = 06 \quad 13 \quad 07.75$$

$$\log \mu = 9.91025$$

$$7.33115$$

$$\log(\delta - D) = 2.57910$$

$$+ 379.70$$

$$\mu_{id} = + 1.61$$

$$\delta - D = + 6 \quad 19.9$$

$$\chi_0 = 06 \quad 13 \quad 09.36$$

$$D = + 27 \quad 09 \quad 75$$

$$\delta_0 = + 27 \quad 16 \quad 04.4$$

$$\mu_{id} = + 8.8$$

$$+ 27 \quad 16 \quad 13.2$$

 δ'

9248 Moon's Mean Position

18

$$\begin{array}{r} \gamma_0 = 25.3880 - \\ - 3.3 - \\ \hline 25.3847 - \end{array}$$

$$\begin{array}{r} \gamma_0 = 17.3300 - \\ + 18 - \\ \hline 17.3318 - \end{array}$$

From Plate constants.

$$\gamma = 29.9655 -$$

$$\gamma = 18.8189 -$$

$$\beta = + 2.9655 -$$

$$\eta = + 0.8189 -$$

$$\log \beta \quad 0.97209 -$$

$$\log \tan \delta \quad 8.7118 -$$

$$\cos \delta \quad 9.97885 -$$

$$\beta^2 \quad 0.9492 -$$

$$8.50127 -$$

$$7.0539 -$$

$$\log(\gamma - A) \quad 2.01600 -$$

$$7.7099 -$$

$$\gamma - A \quad 103.75 -$$

$$\eta_1 = 0.0056 -$$

$$1 \quad 93.75 -$$

$$\eta_{10} + 0.18133 -$$

$$A \quad 06 \quad 11 \quad 29 -$$

$$\eta_0$$

$$\gamma_0 \quad 06 \quad 13 \quad 07.75 -$$

$$\log \mu \quad 8.91035 -$$

$$7.33115 -$$

$$\log(\delta - D) \quad 2.57910 -$$

$$\mu \quad + 1.64 -$$

$$+ 319.70 -$$

$$06 \quad 13 \quad 09.36 -$$

$$\delta - D \quad + 6 \quad 19.9 -$$

$$\delta'$$

$$D \quad + 27 \quad 09 \quad 75 -$$

$$\delta_0 \quad + 27 \quad 16 \quad 04.4 -$$

$$\mu \quad + 8.8 -$$

$$+ 27 \quad 16 \quad 13.2 -$$

$$\delta'$$

I.

$$\begin{array}{r}
 5-53 \quad 57.13 \\
 \underline{55.50} \\
 +1.63
 \end{array}$$

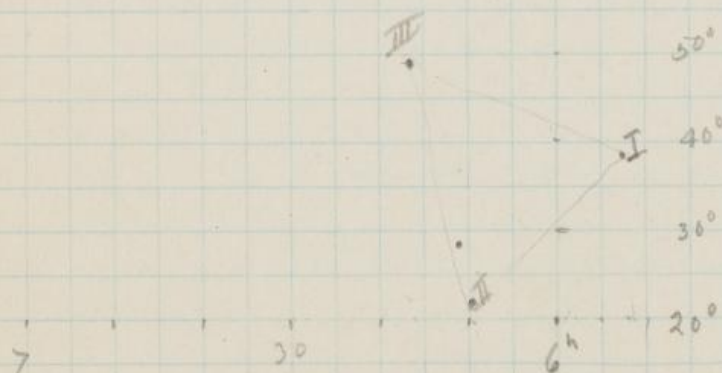
$$\begin{array}{r}
 37 \quad 12 \quad 40.8 \\
 \underline{27.7} \\
 +13.1
 \end{array}$$

$$\begin{array}{r}
 II, 6 \quad 09 \quad 46.92 \\
 \underline{44.85} \\
 +1.57
 \end{array}$$

$$\begin{array}{r}
 22 \quad 31 \quad 69.0 \\
 \underline{56.7} \\
 +7.3
 \end{array}$$

$$\begin{array}{r}
 III \quad 6 \quad 18 \quad 23.39 \\
 \underline{21.29} \\
 +2.10
 \end{array}$$

$$\begin{array}{r}
 99 \quad 19 \quad 73.5 \\
 \underline{57.2} \\
 +16.3
 \end{array}$$



8288 Reduction to Apparent Place

19

 $= 0^{\circ} 43' 5''$

$$K + \alpha \quad 24 \quad 02.9$$

$$H \quad 17 \quad 99.8$$

$$\alpha \quad 6 \quad 12.1$$

$$G \quad 21 \quad 6.1$$

$$G + \alpha \quad 27 \quad 19.2$$

$$= 490 \quad 48'.0$$

$$\log \cos (G + \alpha) \quad 9.8099$$

$$9 \quad 1.0629$$

$$\sin \quad " \quad 9.8830$$

$$\tan \quad \epsilon \quad 9.7122$$

$$8.8239$$

$$\log \quad q' \quad 0.8723$$

$$" \quad 9 \quad 9.4815$$

$$f + 1.286$$

$$q + 0.303$$

$$h + 0.018$$

$$+ 1.607$$

$$S + 27 \quad 16 \quad 09.4$$

$$\log \cos S \quad 9.99488$$

$$l \quad 0.9105n$$

$$bl \quad 0.8593n$$

$$\log \sin \quad \epsilon \quad 9.6610$$

$$\cos (H + d) \quad 0.0000$$

$$h \quad 1.2737$$

$$\sin (H + \alpha) \quad 8.1022$$

$$\sec \quad \delta \quad 0.0512$$

$$8.8239$$

$$h' \quad 0.9347$$

$$h \quad 8.2510$$

$$q' + 7.753$$

$$h' + 8.607$$

$$i - 7.233$$

$$+ 8.829$$

8288

Reduction to Apparent Place

19

= 0° 48' 3"

H + 1 29 02.9

H 17 99.8

L 6 13.1

G 21 6.1

G + L 27 19.2

= 99° 33' 0"

log cos (G + L) 9.8099

9 1.0629

Sum " 1.8830

tan 8 9.7122

8.8239

S + 27 16 09.7

log cos S 9.9788

L 0.9105 n

(L) 0.8593 n

log sin S 9.6610

cos (H + L) 0.0000

h 1.2737

sin (H + L) 8.7622

Sec 6 0.0512

8.8239

log 9' 0.8725

" 9 9.4875

h" 0.9347

h 8.2579

f + 1.286

9 + 0.203

h + 0.018

+ 1.607

g' + 1.953

h' + 3.609

i - 1.223

+ 8.829

8288

Lunar Parallax.

20

 α' 06 12 09.36 $\checkmark$
 δ 8 05 03.8 $\checkmark$
 δ' 27 16 13.2
 π 54 50.85 $\checkmark$
 $\delta - \alpha'$ +1 51 54.49 $\checkmark$
 27° 58 36.60 $\checkmark$
 $\frac{1}{2}(\alpha - \delta)$ 10 49.01
 27° 47' 52.59 $\checkmark$
9.86913 $\checkmark$ 8.20286 $\checkmark$ 9.67128 $\checkmark$ 0.05223 $\checkmark$ 7.79550 $\checkmark$ 9.95727 $\checkmark$ 0.00000 $\checkmark$ 0.05328 $\checkmark$ tan γ = 0.01047 $\checkmark$ $\alpha - \delta' =$ 21' 28.03 $\checkmark$ tan $\gamma =$ 45° 41' 26.4= + 1" 25.87 $\checkmark$ δ 27 16 13.2 $\checkmark$ $\delta - \delta$ 18 25 13.29.82640 $\checkmark$ 8.20286 $\checkmark$ 9.79958 $\checkmark$ 0.14538 $\checkmark$ 7.67428 $\checkmark$
 $\delta - \delta'$ 16 14.3 $\checkmark$
 16 13.1

 δ 27 32 27.5 $\checkmark$ 6 14 35.23 $\checkmark$

 Am Eph. 27 32 28.6 $\checkmark$ 6 14 34.21 $\checkmark$
 $\delta - \epsilon$ -1.1 $\checkmark$ +1.02 $\checkmark$

Curv. of Plate +0.1 -.03

2nd Cr. Ref 0.0

Irr Corr -0.0 +0.02

 δ +27 32 27.5 $\checkmark$ α 6 14 35.23 $\checkmark$
 $\delta - \epsilon$ -1.1 +1.07

1288 Lunar Parallax.

20

$$x' \quad 0.6 \quad 1.2 \quad 0.9.26''$$

$$5' \quad 2.7 \quad 1.6 \quad 13.2$$

$$x \quad 1 \quad 0.5 \quad 0.3.8''$$

$$11 \quad 5.7 \quad 50.43''$$

$$x-x' \quad 1.1 \quad 5.2 \quad 51.99''$$

$$27'' \quad 5.8 \quad 6.60''$$

$$x-x' \quad 1.0 \quad 49.01$$

$$9.86 \quad 91.3''$$

$$27'' \quad 7.1 \quad 52.59''$$

$$1.20 \quad 28.6''$$

$$9.47 \quad 71.28''$$

$$9.95 \quad 12.7''$$

$$0.05 \quad 2.23''$$

$$0.00 \quad 0.00''$$

$$1.19 \quad 55.0''$$

$$0.05 \quad 3.27''$$

$$\tan \gamma = 0.01097''$$

$$\tan \gamma = 25'' \quad 41' \quad 26.4$$

$$x-x' \quad 2.1 \quad 28.03''$$

$$x \quad 2.7 \quad 1.6 \quad 13.2''$$

$$11'' \quad 25.87''$$

$$x-x' \quad 1.8 \quad 25 \quad 13.2$$

$$9.826 \quad 90''$$

$$1.20 \quad 28.6''$$

$$9.99 \quad 71.68''$$

$$0.17 \quad 3.9''$$

$$1.47 \quad 92.8''$$

$$x-x' \quad 1.6 \quad 19.3''$$

$$x \quad 2.7 \quad 3.2 \quad 27.5''$$

$$1.4 \quad 35.23''$$

$$\text{Ann Eph. } 2.7 \quad 3.2 \quad 28.6''$$

$$6 \quad 1.7 \quad 34.21''$$

$$0-C$$

$$-1.2''$$

$$+1.02''$$

Curv. of Plate

$$+0.1$$

$$-0.3$$

1
12.
29

2
13.1
16.7

3
30.5
13.1

1
29
15.3

2
23.
16

3
23
16.2

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Star Measures

21

	d	x	n	d	n	d	n
1	14370		16728	13930		17132	
12.2	14284		8810	10229	15	1081207	
29.5	8886		12	06		02	
	70		18	28		30	
	<u>12.2084</u>		<u>12.2090</u>	<u>29.3714</u>		<u>29.3676</u>	
2	17418		15722	17228		17218	
13.1	16820	19	6358	13999		1096262	
16.4	18		6260	8087		62	
	26		20	30		30	
	<u>13.0600</u>		<u>13.0640</u>	<u>16.3272</u>		<u>16.3236</u>	
3	17206		15380	16958		15878	
30.5	11668	65	10932	16009	03	684993	
13.1	62		32	02		42	
	08		90	78		99	
	<u>30.5542</u>		<u>30.5548</u>	<u>13.0956</u>		<u>13.0950</u>	

Moon Measures.

1	15668	16062
29	13060	8666
15.3	66	6063
	68	62
	<u>15.2604</u>	<u>15.2600</u>

2	17026	18496
23.2	15682	9888
16	8880	88
	30	92
	<u>23.1376</u>	<u>23.1392</u>

3	16939	17898
23	17277	1060206
16.2	42	10
	30	89
	<u>16.2690</u>	<u>162720</u>

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Star Measures

	2	1		2	1		2	1
102	10380		10728	173930		17132		
145	14224		1410	14204		1081207		
	12		18	28		30		
	122089		122090	292713		293676		

11	17418		15722	17228		11418		
14	16820	19	6338	13799		15466		
	18		20	8087		30		
	26		30	30		30		
	130660		130640	2182292		163236		

15	17206		15340	16956		13878		
11	17268	65	10732	16004	3	134770		
	62		30	02		4		
	84		90	18		99		
	303592		303598	130936		130930		

Moon Measures

1			15098	18062				
9			130603	8066				
10			66	6063				
			62	62				
			152609	152600				

32	17026		18496					
6	12682		7888					
	78		81					
	30		90					
	231296		231392					

32			16939	17798				
42			1729733	10602				
			22	19				
			30	19				
			162690	162720				

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Moon Measures.

22

2	17142	15472
22.9	8520 ²⁵	1408278
177	30	74
X	30	78
	<u>22,8608</u>	<u>22,4609</u>

5	16530	15078
23	9650	11958 ⁶¹
17.7	50	69
	48	82
	<u>17,6890</u>	<u>17,6882</u>

6	17456	15481
23.3	15776 ⁷⁴	7162 ⁶⁵
18	72	68
	54	88
	<u>23,1682</u>	<u>23,1678</u>

7	17526	16552
24.	10616	13960 ⁶⁷
18.7	16	74
	92	58
	<u>18,6918</u>	<u>18,6912</u>

8	16962	17510	17544	15600
24.3	12720 ²⁵	11758	9938 ³⁶	13712
18.8	30	5054	34	04 ⁰⁸
Sc.	70	08	54	10
	<u>24,4270</u>	<u>24,7276</u>	<u>18,8116</u>	<u>18,8106</u>

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Moon Measures

32

2	17172	15472
22.9	2020	1408278
172	30	77
2	30	78
	<u>228608</u>	<u>228609</u>

5		14520	12078
3		1450	1195861
17.7		50	87
		47	82
		<u>174890</u>	<u>116882</u>

6	17456	15468
23	1776	116265
18	70	68
	59	48
	<u>221652</u>	<u>231678</u>

		11226	16552
2		10616	1276061
21		70	19
187		42	153
		<u>180718</u>	<u>186912</u>

3	16862	17510	17594	15600
27.3	12720	11758	993836	13712
18.8	30	54	39	0408
50	70	08	59	10
	<u>2992704</u>	<u>299296</u>	<u>188116</u>	<u>188106</u>

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Times & Etc.

23

Date Mar 23

Exp. to Stars	8	16		8	28
" " Moon	8	22	21.2 [✓]	8	22, 21.7 [✓]
Clock slow		00	2.1 [✓]		
H. Sid Time	8	22	23.7 [✓]	$\theta - \alpha = +2^h 7^m$	
H. Long.	7	77	31.03 [✓]		
G. Sid Time	13	06	54.45 [✓]		
Sid T. M. Noon	23	59	34.27 [✓]		
Interval	13	07	20.21 [✓]		
Reduction		2	8.99 [✓]		
G. M. T.	13	05	11.22 [✓]		

From Naut. Alm.

R. A.

Dec.

Moon 13 ^h	6	15	01.61	+27	31	59.1
Motion in 1 ^m			2.2668			-2.761
" " 5.1870			11.76			-12.8
Jabular Place	6	15	13.37 [✓]	+27	31	46.3 [✓]

Moon's Age 8 days

$$939 = 13.66$$

Parallax	59'	51".22 [✓]
Semidiam.	17'	58".7 [✓]
R.		898.4 [✓]
Aug.		12.6 [✓]
Dist. 10 = 9		-0.6 [✓]
R.		910.4 [✓]
R.		1.9516 [✓]
aR.		-927 [✓]
(1+a)R		1.8389 [✓]
R ²		3.4555 [✓]

$$\begin{array}{r}
 a = -499, \\
 +27 \\
 \hline
 -475
 \end{array}$$

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Times & Etc.

23

Date Mar 23

Exp. to Stars	8	16		8	28
" " Moon	8	22	21.2	8	22 21.9
Clock slow		00	2.1		

H. Sid Time	8	22	23.4	$\theta - \alpha = 2^h 7^m$
H. Long.	9	99	31.05	
P. Sid Time	13	06	59.45	
Sid. T. M. Moon	23	59	39.29	
Interval	13	07	20.21	
Reduction		2	8.99	
G. M. T.	13	05	11.22	

From Naut. Alman.

R. A.

Dec.

Moon 13 ^h	6	15	01.61	+27	31	59.1
Moon in 1 ^m			2.2668			-2.961
" " 5.1870			11.76			-12.8
Jabular Place	6	15	13.37	+27	31	46.3

Moon's Age 8 days

939 = 13.6

Parallax	59'	51".22
Semidiam.	17'	58".4
R.		898.4
Aug.		12.6
Lat.		-0.6
R.		910.9
R.		1.9516
AR		-92.7
(1+u)R		1.8389
R ²		3.9555

a = -99.9

+2.9

-97.5

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Standard Coordinates.

24

λ	12.20 87	13.06 20	30.55 45
β	12.62 69	13.51 56	31.87 91
$\lambda - \beta$	- .41 77	- .45 36	- 1.32 46

μ	29.36 95	16.32 39	13.09 53
η	31.66 29	17.96 35	14.56 18
$\mu - \eta$	- 2.29 94	- 1.63 96	1.46 65

$\lambda - \beta$	+ 500 λ	+ 512 η	- 1. λ	- 2067
-	9177 + 6107 = + 1927	+ 152 = + 2079	- 12 = + 2067	= 0
-	9536 + 6531 = + 1995	+ 85 = + 2080	- 13 = + 2067	= 0
-	13296 + 15277 = + 2031	+ 68 = + 2099	- 31 = + 2068	= +1
	29.71 87 + 12.35 94 + 88"		- 2" =	25.75 65

$\mu - \eta$	+ 500 μ	- 6.9 λ	+ 18 η	+ 8304
-	22937 + 17685 = - 8299	- 78 = - 8327	+ 23 = - 8304	= 0
-	16396 + 8162 = - 8237	- 83 = - 8317	+ 13 = - 8304	= 0
-	17665 + 6548 = - 8117	- 196 = - 8313	+ 10 = - 8303	= 4
	16.97 60 + 8488"	- 158"	+ 19" =	18.64 08

Tables	$a = +.5$	$e = +.5$	$a - e = 0$	$b + d = -0.5$
Obs	$z = -499$	$z = -500.8$	$= + 1.8$	$= + 1.2$
O-C	-499.5	-501.3		+ 1.7

8289

Standard Coordinates

24

1	12.2087	13.0620	30.5595
2	12.6264	13.5156	31.8791
1-2	-4.4177	-4.4536	-1.3296

η	29.3695	16.3239	13.0953
η	31.6629	17.9635	14.5618
$\eta-\eta$	-2.2934	-1.6396	1.4665

$$\begin{array}{rcll}
 X-3 & +500A & +5.24 & -1.1 & -2.067 \\
 - & 9177 + 6108 = +1927 + 152 = +2079 & -12 = +2067 & = 0 \\
 - & 9536 + 6531 = +1993 + 85 = +2080 & -13 = +2067 & = 0 \\
 - & 13296 + 15277 = +2031 + 68 = +2099 & -31 = +2068 & = +1 \\
 & 29.7187 + 12.359 + 88 & -2 = 25.7565
 \end{array}$$

$$\begin{array}{rcll}
 \eta-\eta & +500A & -4.91 & +.84 & +8309 \\
 - & 22934 + 19685 = -8299 - 78 = -8327 + 23 = -8304 \\
 - & 16396 + 8162 = -8234 - 83 = -8317 + 13 = -8304 \\
 - & 19665 + 6598 = -8117 - 196 = -8313 + 10 = -8303 \\
 & 16.9760 + 8988 & -158 & +19 = 18.6908
 \end{array}$$

$$\begin{array}{rcll}
 \text{Tables} & a = +.5 & e = +.5 & a-e = 0 & b+d = -0.5 \\
 \text{Obs} & = -999 & = -500.8 & = +1.8 & = +1.2
 \end{array}$$

$$a = +1.2$$

$$b = -1.2$$

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Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$(y - y_0)^2$	$(y - y_0)$
1	24.0000	-0.7190	-2	0.5173	3.4613	2.5	+58
2	23.1369	-1.5821	-1	2.5033	3.4559	1	+04
3	23.0000	-1.7190	-1	2.9553	3.4530	1	-25
4	22.8606	-1.8584	0	3.4537	3.4537	0	-18
5	23.0000	-1.7190	+1	2.9546	3.4624	1	+69
6	23.1680	-1.5510	+1	2.4053	3.4539	1	-16
7	24.0000	-0.7190	+2	0.5167	3.4596	4	+41
8	24.4243	-0.2947	+2	0.0867	3.4543	4	-12

$$R^2 = 3.4555$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	L
1	15.2602	-1.7158	+0	2.9440	203
2	16.0000	-0.9760	+0	0.9526	238
3	16.2705	-0.7055	+0	0.4977	248
4	16.9760	-0.0000	+0	0.0000	270
5	17.6886	+0.7126	0	0.5078	293
6	18.0000	+1.0240	0	1.0486	304
7	18.6915	+1.7155	0	2.9429	337
8	18.8111	+1.8351	0	3.3676	351

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Approximate Center

$$\begin{aligned}
 x &= 24 & y &= 15.2602 \\
 & & & 18.6915 \\
 & & & \hline
 & & & 33.9517 \\
 & & y_0 &= 16.9758
 \end{aligned}$$

$$\begin{aligned}
 x_{\min} &= 22.8606 \\
 R &= 1.8589 \\
 x_0 &= 24.7195
 \end{aligned}$$

Approx. Center

$$\begin{cases}
 x_0 = 24.7190 \\
 y_0 = 16.9760
 \end{cases}$$

2289

Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	24.0000	-0.7190	-2	0.5173	3.9613	+0.5
2	23.1369	-1.5821	-1	2.5033	3.4559	+0.4
3	23.0000	-1.7190	-1	2.9553	3.4530	-2.3
4	22.8606	-1.8589	0	3.4537	3.4537	-4.2
5	23.0000	-1.7190	+1	2.9546	3.4629	+6.9
6	23.1680	-1.5510	+1	2.4053	3.4539	-1.6
7	24.0000	-0.7190	+2	0.5147	3.4596	+4.7
8	24.4293	-0.2947	+2	0.0867	3.4593	-1.2

$$R^2 = 3.7555$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	L
1	15.2602	-1.7158	+0	2.9440	203
2	16.0000	-0.9760	+0	0.9526	238
3	16.2705	-0.7055	+0	0.4977	248
4	16.9760	-0.0000	+0	0.0000	270
5	17.6886	+0.7126	-0	0.5078	293
6	18.0000	+1.0240	-0	1.0486	304
7	18.6915	+1.7155	-0	2.9429	337
8	18.8111	+1.8351	-0	3.3676	351

Approximate Center

$$\begin{array}{rcl}
 x = 24 & y = & 15.2602 \\
 & & 18.6915 \\
 & & \hline
 & & 33.9517 \\
 & y_0 = & 16.9758
 \end{array}$$

$$\begin{array}{rcl}
 x_{\text{mean}} = & 22.8606 \\
 R = & 1.8589 \\
 x_0 = & 24.7193
 \end{array}$$

Approx. Center

$$\begin{cases}
 x_0 = 24.7190 \\
 y_0 = 16.9760
 \end{cases}$$

Formation of Normals.

1 + 1.24	- 41.5	- 100.
2 + 1.55	- 6.3	- 4.0
3 + 1.22	+ 43.0	+ 17.5
4 + 0.00	+ 33.5	+ 00.0
5 - 1.22	- 119.8	+ 49.0
6 - 1.58	+ 24.8	- 16.5
7 - 1.24	- 29.5	+ 70.5
8 - 0.53	+ 3.5	- 22.0
9 + 4.01	+ 104.8	+ 137.0
- 4.57	- 196.3	- 142.5
- 0.56	- 91.5	- 5.5

	a	b	c	new o-e
a	- 9	+ 6	- 3	- 12 ^v
b	+ 2	+ 14	- 2	- 3 ^v
c	- 13	+ 15	- 1	- 1 ^v
		+ 17	+ 0	+ 2 ^v
		+ 13	+ 1	+ 1 ^v
		+ 14	+ 2	+ 1 ^v
		+ 6	+ 3	- 6 ^v
		+ 3	+ 4	- 8 ^v

+ 27.0

.0367

$$-0.56 + 12.26 = +11.88$$

$$+12.24 = +1.51$$

$$+15.39 = -10.16 + 1.07 = -10.09$$

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Conditional Equations.

26.

1	- 0.72 - 1.72 = +58	+ 4 + 1 = 5	b-c	+ 5.3
2	- 1.58 - 0.98 = +04	+ 9 + 1 = 10		- 6
3	- 1.72 - 0.71 = -25	+ 10 + 1 = 11		- 36
7	- 1.86 - 0.00 = -18	+ 11 + 0 = 11		- 29
5	- 1.72 + 0.71 = +69	+ 10 - 1 = 9		+ 60
6	- 1.55 + 1.02 = -16	+ 9 - 1 = 8		- 32
7	- 0.72 + 1.72 = +41	+ 4 - 1 = 3		+ 38
8	- 0.29 + 1.84 = -12	+ 2 - 1 = 1		- 13
				+ 151 - 116

$$+ 15.39 - 0.56 = - 91.5 - 10.16$$

$$- 0.56 + 12.26 = - 5.5 + 1.88$$

$$+ 0.56 - 1.02 = - 3.3$$

$$+ 12.24 = - 8.8$$

$$b = - 0.72 + 0.120$$

$$+ 15.39 = - 91.5 - .40 = - 91.9$$

$$a = - 6.0 - 0.65 \Delta$$

Arc Measured 1980

$$\frac{p}{h} \quad 1.195$$

$$\frac{\Sigma v}{h} = + 8.7$$

In 7

$$R \quad 1.86$$

$$\frac{+ 8.7}{1.95} + 30.7 \quad \Delta R = + 0.7$$

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

$$- 2RC = - .74$$

$$\Delta R = + 0.2$$

$$\Delta b = - 0.09 \quad \Delta s = - 0.0$$

$$\Delta a = + 0.95 \quad \Delta x = + 0.02$$

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Conditional Equations.

26

B-C

1	- 0.72 - 1.72 = +58	+ 9 + 1 = 10	+ 5.2
2	- 1.58 - 0.98 = +09	+ 9 + 1 = 10	- 6
3	- 1.72 - 0.71 = -25	+ 10 + 1 = 11	- 36
4	- 1.86 - 0.00 = -18	+ 11 + 0 = 11	+ 29
5	- 1.72 + 0.71 = +69	+ 10 - 1 = 9	+ 60
6	- 1.53 + 1.02 = -16	+ 9 - 1 = 8	- 32
7	- 0.72 + 1.72 = +91	+ 9 - 1 = 8	+ 38
8	- 0.29 + 1.84 = -16	+ 2 - 1 = 1	- 13
			+ 151 - 116

$$+ 15.39 + 0.56 = -91.5$$

$$- 0.56 + 12.26 = - 3.5$$

$$+ 0.56 - 1.02 = - 3.3$$

$$+ 12.24 = - 8.8$$

$$b = - 0.72$$

$$+ 12.39 = - 91.5 - 90 = - 91.9$$

$$a = - 6.0 -$$

are measured 1980

$$\frac{P}{h} \quad 195$$

$$\frac{\Sigma V}{h} = + 9.9$$

$$\frac{+ 9.9}{195} + 30.9 \quad \Delta R = + 0.9$$

8289

Moon's Mean Position.

27

$$\begin{array}{r} \lambda_0 = 29.7190'' \\ \quad \quad \quad - 3'' \\ \hline 29.7187'' \end{array}$$

$$\begin{array}{r} \gamma_0 = 16.9760'' \\ \quad \quad \quad 0'' \\ \hline 16.9760'' \end{array}$$

From Plate Constants.

$$\lambda = 25.7565''$$

$$\gamma = 18.6708''$$

$$\xi = +3.7565''$$

$$\eta = +0.6708''$$

$$\log \xi \quad 0.57478''$$

$$\log \tan \delta \quad 9.9118''$$

$$\cos \delta \quad 9.94893''$$

$$\xi'' \quad 1.1496''$$

$$\quad \quad \quad 8.00724''$$

$$\quad \quad \quad 7.0534''$$

$$\alpha - A \quad 2.11861''$$

$$\quad \quad \quad 7.9148''$$

$$\begin{array}{r} \alpha - A \quad \quad \quad 131.90 \\ \quad \quad \quad 2 \quad 11.90'' \end{array}$$

$$\eta_1 + 0.0082''$$

$$A \quad 06 \quad 11 \quad 29''$$

$$\eta_0 + 0.6326''$$

$$\alpha_0 \quad 06 \quad 13 \quad 35.70''$$

$$\log h_0 \quad 9.80113''$$

$$\quad \quad \quad 7.33115''$$

$$\text{Red} \quad \quad \quad + 1.61''$$

$$\quad \quad \quad 2.46998''$$

$$\alpha' \quad 06 \quad 13 \quad 37.01''$$

$$S-D \quad \quad \quad 295.1''$$

$$D \quad 27 \quad 09 \quad 95''$$

$$S_0 \quad 27 \quad 14 \quad 40.1''$$

$$\text{Red} \quad \quad \quad + 8.8''$$

$$S' \quad 27 \quad 14 \quad 48.9''$$

1289

Mercury Mean Position

27

$$\begin{array}{r} \lambda_0 = 29.7190'' \\ - 3'' \\ \hline 29.7187'' \end{array}$$

$$\begin{array}{r} \gamma_0 = 16.9760'' \\ - 0'' \\ \hline 16.9760'' \end{array}$$

From Plate Constants.

$$\lambda = 25.7565''$$

$$\gamma = 18.6908''$$

$$\eta = +3.7565''$$

$$\pi = +0.6708''$$

$$\log r_1 = 0.57978''$$

$$\log \tan \delta = 9.7118''$$

$$\cos \delta = 9.74873''$$

$$z = 1.1496''$$

$$85.0724''$$

$$7.0539''$$

$$q-A = 21.1861''$$

$$7.9148''$$

$$131.90$$

$$q-A = 21.1861''$$

$$\eta = 1.0082''$$

$$A = 06 \ 11 \ 29''$$

$$\gamma_0 + 0.6326''$$

$$\lambda_0 = 06 \ 13 \ 35.40''$$

$$\log h_0 = 9.80113''$$

$$7.33115''$$

$$Red = +1.61''$$

$$2.96778''$$

$$2.951''$$

$$\lambda' = 06 \ 13 \ 37.01''$$

$$\delta-D = 4 \ 55.1''$$

$$D = 27 \ 09 \ 95''$$

$$S_0 = 27 \ 14 \ 40.1''$$

$$Red = +8.8''$$

$$S' = 27 \ 17 \ 48.9''$$

9289 Reduction to Apparent Place

28

$$= 46^{\circ} 0$$

$$H + \alpha \quad 24 \quad 03.4$$

$$H \quad 17 \quad 49.8$$

$$\alpha \quad 06 \quad 13.6$$

$$G \quad 21 \quad 06.1$$

$$G + \alpha \quad 27 \quad 19.7$$

$$49^{\circ} \quad 55' 5''$$

$$\log \cos(G + \alpha) \quad 9.8088$$

$$q \quad 1.0625$$

$$\sin \quad 9.8838$$

$$\tan \delta \quad 9.7117$$

$$8.8239$$

$$\log q' \quad 0.8713$$

$$" \quad q \quad 9.4819$$

$$f + 1.287$$

$$g + 0.303$$

$$h + 0.019$$

$$+ 1.609$$

$$\delta \quad 27 \quad 19 \quad 90$$

$$\log \cos \delta \quad 9.9489$$

$$i \quad 0.9106 \quad n$$

$$n' \quad 0.8593 \quad n$$

$$\log \sin \delta \quad 9.6607$$

$$\cos(H + \alpha) \quad 0.0000$$

$$h \quad 1.2737$$

$$\sin(H + \alpha) \quad 8.1265$$

$$\sec \delta \quad 0.8511$$

$$8.8239$$

$$h' \quad 0.9344$$

$$h \quad 8.2752$$

$$g' \quad + 7.736$$

$$h' \quad + 8.598$$

$$i \quad - 7.236$$

$$+ 8.798$$

1289 Reduction To Apparent Place

= 46.0

H + α 24 03.4

H 17 49.8

 α 06 13.6

G 21 06.1

G + α 27 19.7

49° 55' 5"

log cos(G + α) 9.8088

q 1.0623

sin .. 9.8835

tan δ 9.7117

8.8239

log q' 0.8713

.. q 9.4219

k + 1.287

g + 0.303

h + 0.019

+ 1.609

 δ 27 19 70log cos δ 9.7489

i 0.9106 h

x' 0.8595 h

log sin δ 9.6607cos(H + α) 0.0000

h 1.2737

sin(H + α) 8.1265sec δ 0.0511

8.8239

k' 0.7344

h 8.2752

g' + 7.736

k' + 8.598

i - 7.236

+ 8.798

8289

Lunar Parallax

29

$$\begin{aligned} \alpha' & 06 \quad 13 \quad 37.01'' \\ \delta & \quad 8 \quad 22 \quad 23.7'' \\ \alpha - \alpha' & 2 \quad 08 \quad 46.39'' \\ & = 32^\circ 11' 35.85'' \end{aligned}$$

$$\begin{aligned} \frac{1}{2} \alpha - \alpha' & \quad 12 \quad 11.41'' \\ & 31 \quad 59 \quad 24.47'' \end{aligned}$$

$$\begin{aligned} 9.95727'' \\ 0.00000'' \\ 0.07153'' \\ \hline 0.02880'' \end{aligned}$$

$$\gamma \quad 46^\circ 53' 55.2''$$

$$\delta \quad 27 \quad 17 \quad 48.9''$$

$$\gamma - \delta \quad 19 \quad 39 \quad 06.3''$$

$$\begin{aligned} 9.82640'' \\ 8.20291'' \\ 9.52673'' \\ 0.13659'' \\ \hline 7.69263'' \end{aligned}$$

$$\begin{aligned} & 17 \quad 48.9'' \\ + & 16 \quad 56.4'' \end{aligned}$$

$$\delta \quad 27 \quad 31 \quad 45.3'' \quad \alpha' \quad 06 \quad 15 \quad 14.53''$$

$$\text{Ann. Eph. } \delta \quad 27 \quad 31 \quad 46.3'' \quad \alpha \quad 06 \quad 15 \quad 13.37''$$

$$\alpha - \alpha' \quad -1.0'' \quad +1.16''$$

$$\text{Corr. of Plato} \quad +0.1 \quad -0.03$$

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

$$\text{In Corr} \quad -0.0 \quad +0.02$$

$$\begin{aligned} \delta & +27 \quad 31 \quad 45.3'' & \alpha & 06 \quad 15'' & 14.55'' \\ & -1.0'' & & +1.18'' \end{aligned}$$

2289

Lunar Parallax

29

$\lambda' \ 06 \ 13 \ 37.01''$ $\lambda' \ 27 \ 19 \ 48.9''$
 $\delta \ 8 \ 22 \ 23.9''$ $\delta \ 59 \ 51.22''$
 $\alpha - \lambda' \ 2 \ 08 \ 46.39''$

$= 32^\circ \ 11' \ 35.85''$

$9.86913''$

$8.20298''$

$9.72655''$

$0.05298''$

$7.95079''$

$\frac{1}{2} \lambda - \lambda' \ 12 \ 11.71''$
 $31 \ 59 \ 21.99''$

$9.95727''$

$0.00000''$

$0.01153''$

$0.02886''$

$\lambda - \lambda' = 19' \ 12.88''$

$= 1 \ 37.88''$

$\delta \ 46^\circ \ 53' \ 55.2''$

$\lambda \ 27 \ 19 \ 48.9''$

$\lambda - \lambda' \ 19 \ 39 \ 06.3''$

$9.82670''$

$8.20291''$

$9.52673''$

$0.13659''$

$7.69263''$

$16 \ 56.9''$

$\delta \ 27 \ 31 \ 45.3''$ $\lambda' \ 06 \ 15 \ 13.89''$

Am. Eph. $\delta \ 27 \ 31 \ 46.3''$ $\lambda \ 06 \ 15 \ 13.37''$

$10 - \epsilon \quad - 1.0'' \quad + 1.16''$

Curv of Plate $+0.1 \quad -0.03$

