

KG

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No.

Date

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Oct. 27. 1915

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Oct. 30. 1915

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" " "

21



March 21, 1915

Dear Mr. [illegible]

[illegible]

Harvard Plates of the Moon  
Measures and Reductions  
Ernestine Fuller.















94 61

Surv. 4

Tycho 22.4 16.0 1

## Star Measures

	d	n	d	n
1	1 7 1 8 1	1 8 2 7 6	1 4 8 5 7	1 6 9 9 1
16.1	1 6 6 2 1 } 23	8 8 4 8 } 49	9 3 6 3 } 65	1 2 4 8 3
9.5	2 0 7	5 0	6 7	8 3
	7 1 7 9	8 4	4 8 5 7	9 3
	<u>1 6.0 5 5 8</u>	<u>1 6.0 5 6 5</u>	<u>9.5 4 9 2</u>	<u>9.5 4 9 0</u>

2				
20.7	1 5 6 4 2	1 6 9 5 8	1 5 6 2 8	1 6 3 0 0
23.4	8 5 9 3 } 91	1 4 0 1 6 } 17	1 1 4 7 9 } 80	1 0 4 5 1
	8 9	1 8	8 1	7 5 1
	4 2	6 9 6 0	5 6 2 4	0 2
	<u>2 0.7 0 5 1</u>	<u>2 0.7 0 5 7</u>	<u>2 3.4 1 3 8</u>	<u>2 3.4 1 5 0</u>

3				
31.6	1 6 3 5 1	1 5 7 5 7	1 7 0 0 5	1 5 3 3 2
7.7	1 0 4 7 6 } 75	1 7 6 4 3 } 42	9 4 5 3 } 52	1 2 8 8 8
	7 4	4 1	5 1	8 8
	4 7	5 7 5 1	0 3	5 3 2 8
	<u>3 1.5 8 7 4</u>	<u>3 1.5 8 8 8</u>	<u>7.7 5 5 3</u>	<u>7.7 5 5 7</u>

## Moon Measures

1	1 3 7 2 8	1 5 0 3 8	1 9 0 2 7	1 6 7 0 7
22.6	8 2 5 3	1 0 5 1 2 } 14	1 3 0 9 4 } 95	1 0 6 4 0 } 44
15.4	5 3	9 6	9 6	4 8
22.	2 6	5 0 4 4	3 1	6 7 0 9
	<u>2 2.5 4 7 5</u>	<u>2 2.5 4 7 3</u>	<u>1 5.3 9 3 2</u>	<u>1 5.3 9 3 6</u>

2				
23			1 7 6 0 9	1 2 6 3 8
15.5			1 2 2 9 8 } 97	1 7 9 5 8 } 56
			9 6	5 4
			0 1	2 6 4 8
			<u>1 5.5 3 0 8</u>	<u>1 5.5 3 1 2</u>

3	1 6 1 9 0	1 7 1 2 2		
23.6	9 9 2 1 } 20	1 3 3 9 7 } 90		
16.0	1 9	9 3		
	6 1 8 8	1 8		
	<u>2 3.6 2 6 9</u>	<u>2 3.6 2 7 5</u>		







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Dec 4

Tycho 22.4 16.0 1

## Star Measures

	d	n	d	n
1	1 7 1 8 1	1 8 2 7 6	1 4 8 5 7	1 6 9 9 1
16.1	1 6 6 2 4 } 23	8 8 4 8 } 49	9 3 6 3 } 65	1 2 4 8 3
9.5	2 0 1	5 0	6 7	8 3
	7 1 7 9	8 4	4 8 8 7	9 3
	<u>1 6.0 5 5 8</u>	<u>1 6.0 5 6 5</u>	<u>9.5 4 9 2</u>	<u>9.5 4 9 0</u>

2

20.4	1 5 6 4 2	1 6 9 3 8	1 5 6 2 8	1 6 3 0 0
22.4	8 5 9 3 } 91	1 4 0 1 6 } 17	1 1 4 7 9 } 50	1 0 4 5 2 } 50
	8 9 1	1 8	2 1	7 2 5 1
	4 2	6 9 6 0	5 6 2 4	0 2
	<u>2 0.7 0 5 1</u>	<u>2 0.7 0 5 7</u>	<u>2 3.4 1 9 8</u>	<u>2 3.4 1 5 0</u>

3

31.6	1 6 3 5 1	1 5 7 5 7	1 7 6 8 5	1 5 3 3 2
7.7	1 0 4 7 6 } 75	1 5 6 4 3 } 42	8 4 5 3 } 52	1 2 8 8 2
	7 4	4 1	5 1	8 8
	4 7	5 7 5 1	0 3	5 3 2 8
	<u>3 1.5 8 7 4</u>	<u>3 1.5 8 8 8</u>	<u>7.7 5 5 3</u>	<u>7.7 5 5 7</u>

## Moon Measures

1	1 3 7 2 8	1 5 0 3 8	1 9 0 2 7	1 6 7 0 7
22.6	8 2 5 3	1 0 5 1 2 } 14	1 5 0 9 4 } 95	1 0 6 4 0 } 44
15.4	5 3	1 6	9 6	4 8
30	2 6	5 0 4 4	3 1	6 7 0 9
	<u>2 2.5 4 7 5</u>	<u>2 2.5 4 7 3</u>	<u>1 5.3 9 3 2</u>	<u>1 5.3 9 3 6</u>

2

23			1 7 6 0 9	1 3 6 3 8
15.5			1 2 2 9 8 } 77	1 7 9 5 8 } 56
			9 6	5 4
			0 1	3 6 4 8
			<u>1 5.5 3 0 8</u>	<u>1 5.5 3 1 2</u>

3

23.6	1 6 1 9 0	1 7 1 2 2		
16.0	9 9 2 1 } 20	1 3 3 7 7 } 20		
	1 7	9 3		
	6 1 8 8	1 8		
	<u>2 3.6 2 6 9</u>	<u>2 3.6 2 7 5</u>		







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Moon Measures.

2

$$\begin{array}{r}
 4 \quad 16092 \quad 16329 \\
 24+ \quad 15489 \quad 6910 \quad 14 \\
 17 \quad 91 \quad 18 \\
 \quad 88 \quad 6323 \\
 \hline
 24.0602 \quad 24.0591
 \end{array}$$

$$\begin{array}{r}
 5 \quad 18676 \quad 17919 \\
 24.1+ \quad -17923 \quad 8667 \\
 17.2 \quad 29 \quad 67 \\
 Max \quad 78 \quad 7911 \\
 \hline
 24.0750 \quad 24.0750
 \end{array}$$

$$\begin{array}{r}
 6 \quad 17508 \quad 17060 \\
 23.8 \quad 8588 \quad 15973 \quad 72 \\
 18 \quad 88 \quad 71 \\
 \quad 7502 \quad 7060 \\
 \hline
 23.8915 \quad 23.8912
 \end{array}$$

$$\begin{array}{r}
 7 \quad 18345 \quad 18709 \\
 21 \quad 9631 \quad 17411 \quad 07 \\
 18.8 \quad 29 \quad 03 \\
 \quad 8339 \quad 8703 \\
 \hline
 18.8710 \quad 18.8714
 \end{array}$$

$$\begin{array}{r}
 8 \quad 14464 \quad 17924 \\
 22.3 \quad 14040 \quad 8325 \quad 24 \\
 19.4 \quad 40 \quad 23 \\
 Max \quad 4458 \quad 7912 \\
 \hline
 19.0424 \quad 19.0412
 \end{array}$$







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Uranus measures

2

4	1 6 0 9 2	1 6 3 2 9
24+	1 5 4 8 9 } 90	6 9 1 0 } 14
17	9 1	1 8
	8 8	6 3 2 3
	<u>24.0602</u>	<u>24.0591</u>

5	1 8 6 7 6	1 7 9 1 9
24.1-	1 7 9 2 3 } 26	8 6 6 7
17.2	2 9	6 7
4 max	7 8	7 9 1 1
	<u>24.0750</u>	<u>24.0750</u>

6	1 7 5 0 8	1 7 0 6 0
23.8	8 5 8 8	1 5 9 7 3 } 72
18	8 8	7 1
	7 0 0 2	7 0 6 0
	<u>23.8915</u>	<u>23.8912</u>

7	1 8 3 4 5	1 8 7 0 9
23.	9 6 3 1 } 30	1 7 4 1 1 } 07
18.8	2 9	0 3
	8 3 3 9	8 7 0 3
	<u>18.8710</u>	<u>18.8714</u>

8	1 4 4 6 4	1 7 9 2 4
22.3	1 4 0 4 0 } 52	8 3 2 5 } 24
19.4	4 0	2 3
4 max	4 4 5 8	7 9 1 2
	<u>19.0424</u>	<u>19.0412</u>







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Times etc.

Oct. 27, 1915

Exp to Stars	0 7	1 2	0 7	2 4
" to Moon	0 7	1 7	0 7	1 7
Clock fast		0 3		1 6.8
H Sid Time	0 7	1 4	1 6.7 0	+ 59 <sup>m</sup> 30 <sup>s</sup>
H Long.	4	4 4	3 1.0 5	
G Sid Time	1 1	5 8	4 7.7 5	
Sid. Time Mean Moon	1 4	1 9	0 3.3 9	
Interval	2 1	3 9	4 4.3 6	
Reduction		0 3	3 2.9 3	
G. M. Time	2 1	3 6	1 1.4 3	2 1. 6 0 3.2

From Naut. Almanac

R.A.

Decl.

Moon 21h	0 6	1 3	2 6.4 9	+ 26	4 0	5 0 0
Motion in 1 <sup>m</sup>			2.1 9 49			2.7 0
" " 36.1905		1	1 9.4 3		- 1	3 7.7 1
Tabular Place	0 6	1 4	4 5.9 2	+ 26	3 9	1 2.3

Moon's Age 19.5

Parallax	54'	0 7.8 8
Semi-diam.	1 4	4 6.6
R		8 8 6.6
Augment		1 3.3
Dist. (H)		- 0.6
R		8 9 9.3
R		1.9 2 7 7
a R		- 9 1 8
(1+a)R		1.8 3 5 9
R <sup>2</sup>		3.3 7 0 5

$$934'' = 14.75$$

$$a = -500.5$$

$$\begin{array}{r} + 24 \\ - 476.5 \end{array}$$







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Times etc.

Oct. 27, 1915

Exp. to Stars

0 7 1 2

0 7 2 4

" to Moon

0 7 1 7 33.4

0 7 1 7 33.6

Clock fast

0 3 16.8

H Sid Time

0 7 1 4 16.80 +

59" 30"

H Long.

4 4 4 34.05

S Sid Time

1 1 5 8 47.95

Sid Time Mean Moon

1 4 1 9 03.39

Interval

2 1 3 9 44.36

Reduction

0 3 32.93

S. M. Time

2 1 3 6 11.43

From Naut Almanac

R.A.

Decl.

Moon 21<sup>h</sup>

0 6 1 3 26 49 26 40 59.0

Motion in 1<sup>h</sup>

2.1749 2.70

" " 26.1905

1 1 9.43 1 37.71

Tabular Place

0 6 1 4 45.92 26 39 12.3

Moon's App

19.5

Parallax

54' 07.98

Semi-diam

14 46.6

R

886.6

Augment

43.3

Dist (4)

-0.6

R

899.3

R

1.9277

aR

-9.18

11+AR

183.59

R<sup>2</sup>

3.3705

934" = 14.75

a = -570.5

+34

-476.5







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## Plate Constants.

4

X	16.0562	20.7054	31.5881
$\Sigma$	16.0380	21.0359	32.8322
X- $\Sigma$	+0.0182	-0.3305	-0.7441

y	9.5491	23.4144	7.7555
$\Sigma$	9.4161	23.9399	7.4026
y- $\Sigma$	+0.1330	-0.5255	+0.3529

X- $\Sigma$	+500X	+83.7y	+5X	-9.018
+0.0182	+8028	+799	+8	+9017
-0.3305	+10353	+1960	+10	+9018
-0.7441	+15794	+649	+16	+9018
22.2377	+11119	+1440	+11	22.5929

y- $\Sigma$	+500y	-83.5X	+2.9y	-4791
+0.1330	+4774	-1341	+28	+4791
-0.5255	+11707	-1729	+68	+4791
+0.3529	+3878	-2637	+22	+4792
17.2025	+8601	-1857	+50	17.4028

Table	a = -0.8	l = -0.8	a - l = 0	a + d = 0
abs	= -500.5	= -502.9	+2.4	= -0.2
0 - C	-499.7	-502.1		-0.2







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## Plate Constants.

4

X	16.0562	20.7054	31.5881
$\Sigma$	16.0380	21.0359	32.8322
$-\Sigma$	+0.0182	-0.3305	-0.7441

$\mu$	9.5491	23.4144	77.5555
$\nu$	9.4161	23.9399	7.4026
$-\nu$	+1.330	-0.5255	+3.529

$$\begin{array}{rcll}
 -\Sigma & +500\mu & +8847\mu & +.5X & -9018 \\
 +.0182 + & 8028 = +8210 & +799 = 9009 & +8 = 9017 \\
 -.3305 + & 11353 = +7148 & +1960 = 9018 & +10 = 9018 \\
 -.7441 + & 15794 = +8353 & +649 = 9012 & +16 = 9018 \\
 22.2390 + & 11119 = & +1440 & +11 & 22.5929
 \end{array}$$

$$\begin{array}{rcll}
 \mu - \nu & +500\mu & -83.5X & +2.94 & -47 \\
 +1.330 + & 4774 = +6104 & -1341 = 4763 & +28 = 4791 \\
 -.5255 + & 11707 = +6452 & -1729 = 4723 & +68 = 4791 \\
 +.3529 + & 3878 = +7417 & -2637 = 4770 & -22 = 4792 \\
 17.2010 + & 2800 = & -1857 & +50 & 17.4028
 \end{array}$$

$$\begin{array}{rcll}
 \text{Tables } a = -0.8 & l = -0.8 & a - l = 0 & +d = 0 \\
 \text{Abs} & = -5.005 & = -5.029 & +2.4 & = -0.2
 \end{array}$$



1  
2  
3  
4  
5  
6  
7  
8

1  
2  
3  
4  
5  
6  
7  
8



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Moon's Center

5

	X	X - X <sub>0</sub>	ΔX	(X - X <sub>0</sub> ) <sup>2</sup>	(Y - Y <sub>0</sub> ) <sup>2</sup>	O - C
1	22.5474	+0.3084	-0	0.0951	3.3625	-80
2	23.0000	+0.7610	-0	0.5791	3.3680	-25
3	23.6272	+1.3882	-0	1.9271	3.3695	-10
4	24.0596	+1.8206	-0	3.3145	3.3549	-156
5	24.0750	+1.8360	0	3.3709	3.3709	+4
6	23.8914	+1.6524	+0	2.7304	3.3688	-17
7	23.0000	+0.7610	+0	0.5791	3.3687	-18
8	22.2390	+0.0000	+0	0.0000	3.3886	+181
					R <sup>2</sup> 3.3705	

	Y	Y - Y <sub>0</sub>	ΔY		
1	15.3934	-1.8076	-0	3.2674	1.71°
2	15.5310	-1.6700	-0	2.7889	1.55°
3	16.0000	-1.2010	-0	1.4424	1.31
4	17.0000	-0.2010	0	0.0404	96
5	17.2011	0.0000	+0	0.0000	90
6	18.0000	+0.7990	+0	0.6384	64
7	18.8712	+1.6702	+0	2.7896	24
8	19.0418	+1.8408	+0	3.3886	0
					171

approx. Center

$$X = 23. \quad Y = 18.8712$$

$$15.5310$$

$$2 \quad 34.4022$$

$$Y_0 = 17.2011$$

$$\text{Com R} = 1.8360$$

$$X_{\text{max}} = 24.0750$$

$$X_0 = 22.2390$$

$$\text{Moon's Center} \begin{cases} Y_0 = 22.2390 \\ Y_0 = 17.2010 \end{cases}$$



1  
2  
3  
4  
5  
6  
7  
8

1  
2  
3  
4  
5  
6  
7  
8



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## Moons Center

5

	X	$X - X_0$	$\Delta X$	$(X - X_0)^2$	$(Y - Y_0)^2$	O - C
1	22.5454	+0.3084	-0	0.0951	3.3625	-80
2	23.0000	+0.7610	-0	0.5791	3.3680	-25
3	23.6272	+1.3882	-0	1.9271	3.3695	-10
4	24.0596	+1.8206	-0	3.3145	3.3549	-156
5X	24.0750	+1.8360	0	3.3769	3.3709	+4
6	23.8914	+1.6524	+0	2.7304	3.3688	-17
7	23.0000	+0.7610	+0	0.5791	3.3687	-19
8	22.2390	+0.0000	+0	0.0000	3.3886	+189
					$R^2$	3.3705

	Y	$Y - Y_0$	$\Delta Y$		
1	15.3934	-1.8076	-0	3.2674	1.71°
2	15.5310	-1.6700	-0	2.7889	1.60
3	16.0000	-1.2010	-0	1.4424	1.30
4	17.0000	-0.2010	0	0.0404	.96
5	17.2011	0.0000	+0	0.0000	.90
6	18.0000	+0.7990	+0	0.6381	.64
7	18.8712	+1.6702	+0	2.7896	.24
8	19.0418	+1.8408	+0	3.3886	0

## approx. Center

$$X = 23 \quad Y = 18.8712$$

$$15.5310$$

$$21344022$$

$$Y_0 = 17.2011$$

$$\text{Com R} = 1.8760$$

$$X_{\text{mix}} = 24.0759$$

$$Y_0 = 22.2390$$

$$\left. \begin{array}{l} X_0 = 22.2390 \\ Y_0 = 17.2010 \end{array} \right\} \text{Moons Center}$$



# Formation of Normals.

1	- 0.56	- 24.8	+ 144.8
2	- 1.27	- 119.0	+ 41.7
3	- 1.67	- 43.9	+ 12.0
4	- 0.36	- 282.0	+ 31.2
5	+ 0.00	+ 7.4	+ 0.0
6	+ 1.32	- 28.0	- 13.6
7	+ 1.27	- 13.7	- 30.0
8	+ 0.00	+ 00.0	+ 333.0
	+ 2.59	+ 7.4	+ 562.7
	- 3.86	- 381.4	- 43.6
	- 1.27	- 374.0	+ 480.9

- a	- b	- 15 + ΔC
+ 3	- 1	- 13
+ 8	- 1	- 8
+ 15	- 0	0
+ 20	- 0	+ 5
+ 20	+ 0	+ 5
+ 18	+ 0	+ 3
+ 8	+ 1	- 6
+ 0	+ 1	- 14



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## Conditional Equations

6

							0 - C Corr
1	+ 0.31	- 1.81 = - 80	- 8	- 56	- 64	- 16	- 29
2	+ 0.76	- 1.67 = - 25	- 20	- 52	- 72	+ 47	+ 39
3	+ 1.39	- 1.20 = - 10	- 36	- 37	- 73	+ 63	+ 63
4	+ 1.82	- 0.20 = - 156	- 47	- 6	- 53	- 103	- 98
5	+ 1.84	+ 0.00 = + 4	- 48	+ 00	- 48	+ 52	+ 57
6	+ 1.65	+ 0.80 = - 17	- 43	+ 25	- 18	+ 1	+ 4
7	+ 0.76	+ 1.67 = - 18	- 20	+ 52	+ 32	- 50	- 56
8	+ 0.00	+ 1.84 = + 181	- 00	+ 57	+ 57	+ 124	+ 110
	+ 9.34	- 0.57				+ 287	- 169
	12.59	- 1.27 =	- 374.0	+ 9.34	arr.	57	

$$-1.27 + 1435 = +480.9 - 0.57$$

$$+1.27 - 0.13 = -37.7 + 0.93$$

$$+14.22 = 443.2 + 0.36$$

$$12.59 = -374.0 + 39.49 = -334.51 \quad f = +31.1 + 0.03$$

$$a = -26.5 + 0.74$$

arc 171

 $\frac{S}{m}$ 

$$\frac{P}{m} = .25$$

$$+15$$

$$\frac{+15}{25} = +.60$$

$$\Delta R = +0.75$$

$$\text{Corr} +0.2$$

$$-2R = -3.67$$

$$-2R \text{ corr} = -0.73$$

$$\text{True } \Delta R = +0.55$$

$$A \delta = -0.02$$

$$\Delta \delta = -0.0$$

$$\Delta a = -0.54$$

$$\Delta a = -0.02$$







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## Conditional Equations

6

							0-C
	+ 0.31						
	+ 0.31	- 1.81 = - 80	+ 8	- 56	- 64	- 16	
2	+ 0.76	- 1.67 = - 25	- 20	- 52	- 72	+ 47	
3	+ 1.39	- 1.20 = - 10	- 26	- 37	- 73	+ 63	
4	+ 1.82	- 0.20 = - 156	- 47	- 6	- 53	- 103	
5	+ 1.84	+ 0.00 = + 4	- 48	+ 00	- 48	+ 52	
6	+ 1.65	+ 0.80 = - 17	- 43	+ 25	- 18	+ 1	
7	+ 0.76	+ 1.67 = - 18	- 20	+ 52	+ 32	- 50	
8	+ 0.00	+ 1.84 = + 181	- 00	+ 57	+ 57	- 124	
					+ 287	- 169	
					av	57	
	12.59	- 1.27 =	- 374.0				

$$- 1.27 + 14.35 = + 480.9$$

$$+ 1.27 - 0.18 = - 37.7$$

$$+ 14.22 = 443.2$$

$$12.59 = - 374.0 + 39.99 = - 334.01 \quad \text{av} = 26.5$$

arc 171

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$$\frac{P}{n} = .25$$

$$+ 15$$

$$\frac{+ 15}{25} = + 60 \quad \Delta R = + 0.75$$







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## Moon's Mean Position.

7

$$\begin{array}{r} X_0 \quad 22.2390'' \\ \quad \quad - 13 \\ \hline 22.2377'' \end{array}$$

$$\begin{array}{r} Y_0 \quad 17.2010'' \\ \quad \quad + 15 \\ \hline 17.2025'' \end{array}$$

## From Plate Constants.

$$\begin{array}{r} X \quad 22.5929'' \\ \quad \quad - 22 \\ \hline \xi_0 \quad +0.5929'' \end{array}$$

$$\begin{array}{r} Y \quad 17.4028'' \\ \quad \quad - 18 \\ \hline \eta_0 + \eta_1 \quad -0.5972'' \\ \quad \quad \quad \delta \quad 26.23'' \end{array}$$

$$\begin{array}{r} \log \xi_0 \quad 9.77298'' \\ \log \cos \delta \quad 9.95218'' \\ \hline 8.50724'' \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 9.6955'' \\ \log \xi_0^2 \quad 9.5460'' \\ \hline 7.0534'' \\ \log \eta_1 \quad 6.2949'' \end{array}$$

$$l \sin(\alpha - A) \quad 1.31356''$$

$$\begin{array}{r} \eta_1 \quad 0.0002'' \\ \eta_0 \quad -0.5974'' \end{array}$$

$$(\alpha - A) \quad +20.58''$$

$$A \quad 06 \quad 13 \quad 34.97''$$

$$\begin{array}{r} \log \eta_0 \quad 9.77627'' \\ \quad \quad 7.33115'' \end{array}$$

$$\alpha_0 \quad 06 \quad 13 \quad 55.55''$$

$$\begin{array}{r} \log \tan(\delta - \delta_0) \quad 2.44512'' \\ \quad \quad - 278.7'' \end{array}$$

$$\text{Red} \quad 4.68''$$

$$(\delta - \delta_0) \quad -4 \quad 38.7''$$

$$\alpha' \quad 06 \quad 14 \quad 0.23''$$

$$\delta \quad 26 \quad 28 \quad 29.0''$$

$$\delta_0 \quad 26 \quad 23 \quad 50.3''$$

$$\text{Red.} \quad +4.0''$$

$$\delta \quad 26 \quad 23 \quad 54.3''$$







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Uloona Mean Position

7

$$\begin{array}{r} X_0 \quad 22.2390 \\ \quad \quad -13 \\ \hline 22.2377 \end{array}$$

$$\begin{array}{r} y_0 \quad 17.2010 \\ \quad \quad +15 \\ \hline 17.2025 \end{array}$$

## From Plate Constants

$$\begin{array}{r} X \quad 22.5929 \\ \quad \quad -22 \\ \hline \epsilon \quad +0.5929 \end{array}$$

$$\begin{array}{r} y \quad 17.4028 \\ \quad \quad -18 \\ \hline \eta + \eta_0 - 0.5972 \end{array}$$

$$\begin{array}{r} \log \beta_0 \quad 9.77298 \\ \log \cos \delta \quad 9.95218 \\ \hline 8.55724 \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 9.69552 \\ \log \epsilon^2 \quad 9.54506 \\ \hline 7.0534 \end{array}$$

$$\log(\alpha - A) \quad 1.31356$$

$$\begin{array}{r} \eta \quad 1.0002 \\ \eta_0 \quad -0.5974 \\ \hline \end{array}$$

$$\alpha - A \quad +20.58$$

$$A \quad 06 \quad 13 \quad 34.97$$

$$\begin{array}{r} \log \eta_0 \quad 9.77127m \\ \quad \quad 7.33115 \end{array}$$

$$X_0 \quad 06 \quad 13 \quad 55.55$$

$$\begin{array}{r} \log \tan \delta - \delta \\ \quad \quad -278.7 \end{array}$$

$$\text{Red} \quad 4.68$$

$$\delta - \epsilon \quad -4 \quad 38.7$$

$$\alpha' \quad 06 \quad 14 \quad 0.23$$

$$\delta \quad 26 \quad 28 \quad 29$$

$$\delta_0 \quad 26 \quad 23 \quad 50.8$$

$$\text{Red.} \quad +4.0$$

$$\delta' \quad 26 \quad 23 \quad 54.3$$







9461

## Reduction to Apparent Position.

8

$H + \alpha_0$	09	49.0	$147^\circ 15'$	$\delta_0$	26	23.8
$H$	03	35.1		$\log \cos \delta_0$	9.9522	
$\alpha_0$	06	13.9		$\log i$	0.8299	
$G$	23	51.6		$\log (i)$	0.7821	
$G + \alpha_0$	29	05.5	$76^\circ 22.5'$			

$\log \cos(G + \alpha)$	9.3721	
$\log g$	1.3393	
$\log \sin(G + \alpha)$	9.9876	
$\log \tan \delta_0$	9.6958	
	8.8239	

$\log g'$	0.7114	
$\log g$	9.8466	

$A$	+3.200	
$B$	+0.702	
$C$	+0.778	
	+4.680	

$\log \sin \delta_0$	9.6480	
$\cos(H + \alpha)$	9.9248	
$\log h$	1.2860	
$\sin(H + \alpha)$	9.7332	
$\sec \delta_0$	0.0478	
	8.8239	

$\log (h')$	0.8588	
$\log h$	9.8909	

$(g')$	5.145	
$(h')$	-7.224	
$(l)$	6.055	
	+3.976	







9461

## Reduction to Apparent Position

8

$H + \alpha$  0.9 49.0 147° 15'  
 $H$  0.3 35.1  
 $\alpha_0$  0.6 33.9  
 $C$  2.2 51.6  
 $C + \lambda_0$  2.9 05.5 76° 22.5'

$\delta_0$  26 23.8503  
 $\log \cos \delta_0$  9.9522  
 $\log i$  0.8299  
 $\log (i)$  0.7821

$\log \cos(C+N)$  9.3721  
 $\log q$  1.3393  
 $\log \sin(C+N)$  9.9876  
 $\log \tan E$  9.6958  
 $8.8239$

$\log \sin \delta_0$  9.4480  
 $\cos(H+N)$  9.9248  
 $\log L$  1.2860  
 $\sin(H+N)$  9.7332  
 $\sec \delta_0$  0.0478  
 $8.8239$

$\log q'$  0.7114  
 $q$  9.8466

$\log K'$  0.8588  
 $\log K$  9.8909

$A + 3.200$   
 $B + 0.70$   
 $K + 0.778$   
 $+ 4.680$

$g$  5.145  
 $k$  -7.224  
 $l$  6.055  
 $+ 3.976$







9461

## Lunar Parallax.

9

$\alpha'$	06	14	0.23"	$\Pi$	54'	7.88"
$\theta$	07	14	16.70"			
$\theta - \alpha'$	1	00	16.47"	$\log \sin \delta'$	9.86913"	
$=$	15°	4'	07.05"	" $\sin \Pi$	8.19721"	
$\frac{1}{2}(\alpha - \alpha') =$		+5'	48.70"	" $\sin(\theta - \alpha')$	9.41493"	
$\theta - \alpha' - \frac{1}{2}(\alpha - \alpha') =$	14	58	18.35"	" $\sec \delta$	0.04782"	
$\log \tan \delta' =$	9.95727			" $\sin(\alpha - \alpha')$	7.52909"	
" $\cos \frac{1}{2}(\alpha - \alpha') =$	0.00000			$\alpha - \alpha'$	+11'	37.4"
$\sec(\theta - \alpha' - \frac{1}{2}(\alpha - \alpha')) =$	0.01500			$=$		+46.8"
$\log \tan \gamma$	9.97227					.49
$\gamma$	43°	10'	19.2"			
$\delta'$	26	23	54.3"			
$\gamma - \delta'$	16°	46	24.9"			
$\log \sin \delta'$	9.82640					
" $\sin \Pi =$	8.19721					
$\sin(\gamma - \delta')$	9.46028					
" $\csc \gamma =$	0.16483					
" $\sin(\delta - \delta') =$	7.64872					
$\delta - \delta'$	+15'	18.6"		$\alpha$	06	14 46.78"
$\delta$	26	39	12.9	$\epsilon_{\text{fla}}$	06	14 45.92"
$\epsilon_{\text{fla}} \delta$	26	39	12.3"	$0 - c$		+0.81"
$0 - c$		+0.6"		$\text{Curv.}$		-0.2
$2^{\text{nd}} \text{ ord. ref.}$		0.0		$\text{Inv. Corr.}$		-0.2
$\text{Curv.}$		+0.6				
$\text{Inv. Corr.}$		-0.0		$\alpha$	06	14 46.78"
$\delta =$	26	39	12.9			+0.79"
$0 - c$		+0.6				







9461

## Lunar Parallax.

9

$\alpha'$	06	14	00.23"	$\Pi$	54	788"
$\epsilon$	07	14	16.70"			
$\epsilon - \alpha'$	1	00	16.47"	$\log \sin \delta'$	9.86913"	
$=$	15	4	07.05"	" $\sin \Pi$	819721"	
$\frac{1}{2}(\alpha - \alpha') =$		+5	48.70"	" $\sin(\epsilon - \alpha')$	9.41493"	
$\epsilon - \alpha' - \frac{1}{2}(\alpha - \alpha') =$	14	58	18.35"	" $\sec \delta$	0.04782"	
$\log \tan \delta' =$			9.95727"	" $\sin(\alpha - \alpha')$	7.52909"	
" $(\cos \frac{1}{2}(\alpha - \alpha')) =$			1.000000"	$(\alpha - \alpha')$	+11	374"
$\sec(\epsilon - \alpha' - \frac{1}{2}(\alpha - \alpha')) =$			1.001502"	$=$		+46 <sup>3</sup> 5"
$\log \tan \gamma$			9.97227"			
$\gamma$	43°	10	19.0"			
$\delta$	26	23	54.3"			
$\gamma - \delta'$	16	46	24.9"			
$\log \sin \delta$			9.82640"			
" $\sin \Pi$			819721"			
" $\sin(\gamma - \delta)$			9.46028"			
" $\cos \gamma =$			0.16483"			
" $\sin(\delta - \delta')$			7.64872"			
$\delta - \delta'$		+15	18.8"	$\alpha$	06	14 46.73"
$\delta$	26	29	12.9"	$\delta$		
$\epsilon - \delta$	26	39	12.3"	$\epsilon - \alpha$	06	14 45.92"
$O - C$			+0.6"	$O - C$		+0.81"
2nd ord ref			+0.0			-0.02
curr.				curr.		
Err corr		0.0		Err Corr		-0.02
$\delta$	26	37	12.9"	$\alpha$	06	14 46.71"
$O - C$			+0.6			+0.79











9

1

13

15

2

29

13

9

31

31

1

12

14

30

2

23

14

2

20

16



9492	Dec 5.	Star Measures	Tycho. 21.8	15.0 11
d	n	d	n	
1	16516	15874	14659	16304
13.2	13621	8782	14316	6659
15.5	27	8782	16	63
	12	5878	49	6308
	13.2897	13.2905	15.0343	15.0353

2	15682	15972	14832	18558
19.2	14172	7492	12252	11134
13.3	72	93	52	38
	78	5968	28	62
	29.1510	29.1524	13.2579	13.2575

3	18761	14720	16577	16018
31.1	17785	5693	8211	14379
31.8	81	89	11	83
	59	4712	71	6008
	31.0978	31.0978	21.8361	21.8365

## Moon Measures

1	16771	18276	14808	16220
22.2	14729	10320	10743	10273
14.4	25	16	57	83
cc.	71	8256	4810	6228
	22.2044	22.2058	14.4063	14.4053

2			16532	16201
23			9238	13497
14.7			30	87
			26	6201
			14.7294	14.7292

3	16982	17232		
29.3	13972	10238		
15	64	38		
	74	20		
	23.3013	23.3015		



9

1

13

15

2

29

13

3

31

21

1

22

14

2

2

23

14

3

22

15



9492	Dec 5.	Star Measures	Tycho 21.8	15.11
d	n	d	n	
1	16516	15874	14659	16304
133	13628	8782	14316	6659
15+	27	8782	16	65
	12	5834	49	6308
	13.2894	13.2905	15.0343	15.1353
2	15682	15972	14832	18558
292	14172	7492	12252	11134
13.3	72	93	52	38
	78	5968	28	62
	29.1510	29.1524	13.2588	13.2575
3	18761	14720	16597	16018
31.1	17785	5693	8211	14379
21.8	81	89	11	83
	59	4712	71	6008
	31.0978	31.0978	21.8361	21.8365

### Uncon Measures

1	16771	18276	14808	16220
222	14729	10320	16743	10273
144	25	16	57	83
22	71	8256	4812	6228
	22.2044	22.2058	14.4068	14.4053
2			16532	16201
23			9238	13497
14.7			20	87
			26	6201
			14.7294	14.7292
3	16982	17232		
23.3	13982	16238		
15	64	38		
	74	20		
	23.3013	23.3015		



$\frac{4}{23.}$   
 $\frac{16}{23.}$   
 $\frac{5}{23.8}$   
 $\frac{16.2}{23.8}$   
 $\frac{7}{23.8}$   
 $\frac{6}{23.}$   
 $\frac{17.}{23.}$   
 $\frac{7}{23.}$   
 $\frac{17.8}{23.}$   
 $\frac{2}{23.}$   
 $\frac{17.8}{23.}$   
 $\frac{2}{23.}$   
 $\frac{17.9}{23.6}$



9492 d

N Moon measures

n

12

4	14944	16550	
3.8	7214	14282	80
16	14	78	
	38	6552	
	<u>23.7726</u>	<u>23.7728</u>	

5	13419	15527	
3.8	5527	13420	24
16.2	21	13420	
8	23	5527	
	<u>23.7898</u>	<u>23.7893</u>	

6	13591	15444	
3.6	7258	11778	82
17.0	50	86	
	91	5438	
	<u>23.6337</u>	<u>23.6341</u>	

7		17500	16351
3		9612	14241
7.8		10	14249
		04	6349
		<u>17.7892</u>	<u>17.7894</u>

8	17883	18626	17752	16406
2.8	9399	17120	8906	15238
17.8	97	18	02	38
2	87	8632	52	6408
	<u>22.8485</u>	<u>22.8491</u>	<u>17.8848</u>	<u>17.8830</u>

Star measure

9	17177	18809	17233	18132
7.9	8022	17979	11264	14092
5.6	16		70	94
	7169	8807	7229	8132
	<u>17.9155</u>	<u>17.9169</u>	<u>25.5963</u>	<u>25.5961</u>



7+92

Times and etc.

Oct 30, 1915

Exp to stars	07	40		07	52
to Moon	7	45	48.6	7	45 48.8
Clock fast		3	22.2		
7 Sid Time	07	43	26.50	$\delta - \alpha =$	$-1^h 5^m$
7. Young	14	44	31.05		
8 Sid Time	12	26	57.55		
8 Sid Time mean Moon	14	30	53.05		
Interval	21	56	4.50		
Reduction		3	35.61		
M T	21	52	28.87		

From East Almanac

RA

Decl.

Moon 21.6	08	45	41.42	18	25	21.8
Motion in 1 <sup>h</sup>			2.0228			10.6911
52 <sup>m</sup> 48 <sup>s</sup> 15 <sup>u</sup>		1	46.16		9	21.0
Tabular Place	08	47	27.58	18	16	0.7

Moon's age 21.6

Parallax

Semi-diam

R

Aug

Dist

R

R

a R

11+4.8

R =

$$934'' = 13.9$$

$$a = -503.1$$

$$+24$$

$$-479.1$$

$$5.5 \quad 17.3$$

$$1.5 \quad 05.5$$

$$9 \quad 05.5$$

$$13.0$$

$$-0.6$$

$$9 \quad 17.9$$

$$19 \quad 676$$

$$-9 \quad 43$$

$$1.8 \quad 73.3$$

$$3 \quad 5092$$



9492.4

Nitrogen measures

n

12

4	14944	16550
3.5	7214	14282.80
16	14	78
	38	6552
	<u>23.7726</u>	<u>23.7728</u>

5	13419	15527
23.8	5527	13420
0.2	21	13420
1	23	5527
	<u>23.7898</u>	<u>23.7893</u>

6	13591	15444
3.6	7258	11775.82
17.0	50	54
	91	5458
	<u>23.6337</u>	<u>23.6341</u>

7		17500	10351
23.		9612	14241
17.8		40	14249
		04	6349
		<u>17.7892</u>	<u>17.7894</u>

8	17883	18626	17752	16406
2.8	9399	17120	8706	15228
17.8	97	18	02	38
10	27	8632	55	6408
	<u>22.8485</u>	<u>22.8491</u>	<u>17.8848</u>	<u>17.8830</u>

Star measure.

9	17177	18809	17233	18142
17.9	8022	79779	11264	14072
13.6	16		70	94
	7169	8807	7229	8132
	<u>17.9155</u>	<u>17.9162</u>	<u>25.5763</u>	<u>25.5961</u>



## Times and etc.

492.  
Oct. 30, 1915

Exp to stars.	07	40		07	52	
" to Moon	7	45	48.6	7	45	48.8
Clock fast.		3	22.2			
H. Sid Time	07	42	26.50	$\delta - \alpha =$	-1	5 <sup>m</sup>
H. Young	04	44	31.05			
S. Sid Time	12	26	57.55			
S. Sid Time mean from	14	30	53.05			
Interval	21	56	4.50			
Reduction		3	35.61			
G. M. T.	21	52	38.89			

From Naut Almanac	RA			Decl-		
Moon 21 <sup>h</sup>	08	45	41.42	18°	25	21.80
Motion in 1 <sup>m</sup>			2.0228		-	10.691
" 52 <sup>h</sup> 48 <sup>m</sup> 15 <sup>s</sup>		1	46.16		-9	21.08
Tabular Place	08	47	27.58	18°	16	0.72

Moon's age	21.6		
Parallax	55	17.30	
Semi-diam	15	05.5	
R		905.5	
Aug		13.1	
Inv. 4		-0.6	
R		918.0	
R		1.9678	
a R		-943	
(1+a) R		1.8735	
R <sup>2</sup>		3.5100	

$$934'' = 13.9''$$

$$\begin{array}{r} a = -503.1 \\ + 24. \\ \hline -479.1 \end{array}$$



9491

Oct. 30, 1915

Times Etc.

13

Exp. to Stars	07	26	"	07	38	"
" to Moon	07	32	04.0	07	32	04.1
Clock fast		3	22.2			

H. Sid Time	07	28	41.85	"	$4-\alpha = -1^h.48^m$
H. Long.	04	44	31.05	"	
G. Sid Time	12	13	12.90	"	
Sid time mean Nom.	14	30	53.05	"	
Interval	21	42	19.85	"	21.64 + 25
Reduction		3	33.35	"	
G. M. T.	21	38	46.50	"	

From Nant Alus

RA

Dec.

Moon 21 <sup>h</sup>	08	45	41.43	"	+18	25	21.8	"
Motion in 1 <sup>m</sup>			2.023	"			-10.681	"
" " 38.7750		71	18.44	"		-6	54.2	"
Tabular Place	08	46	59.86	"	+18	18	27.6	"

Moon's ap

22.5 days

Parallax

55"

16.94

Semi-diam

15

05.4

R

905.4

Aug.

12.9

Semi. 5

-0.8

R

917.5

R

1.9668

a R

-942

(1+a) R

1.8726

R2

35066

934" = 13.7

a = 503.1

+24.

-479.1







9491

Oct. 30. 1915

Times etc.

13

Exp. to Stars	07	26		07	38	
to Moon	07	32	040	07	32	04.1
Clock Fast		3	222			

21 Sid Time	07	28	4185	$\alpha - \lambda = -1^{\circ} 18'$
H Long.	04	44	31.05	
Sid Time	12	13	1290	
Sid Time mean Mon	14	30	53.05	
Interval	21	42	19.85	
Reduction		3	33.35	
to M.T.	21	38	46.50	

From Transit Obs.			RA		Dec.	
Upper 21 <sup>h</sup>	08	45	41.42	+18	25	21.8
Lower 1 <sup>h</sup>			20.231			10.681
38.775		1	18.44		6	54.2
Tabular Place	08	46	59.86	+18	18	27.6

Throm eq	22.5 day
Parallax	5.5
Semi-diam	1.5
R	9
Aug.	12.9
Inv. 5	6.8
R	617.5
R	1.9668
a. R	9.42
11-11	187.26
R2	350.66

934" = 13.7

 $\alpha = -50.34$ 

+24

-479.1



P. M

C	19	12	18.7
Q			18.6
E			18.1
Mean	19	12	18.5
rec.	-	3	18.6
S	19	08	59.9
B	18	07	16.6
S-D + 01		01	43.3
tan (S-D)		+ 3	703.7
dy "		3.56	863
dy %		0.89	978
dy tan S		9.54	065
dy 3 "		1.25	14
dy %		7.84	54
70	+ 7.9	392	
71	0.0	07.0	
72	25.9	462	
73	25.5	962	
74	25.0	000	



9492

## Standard Coordinates

14

PM

Cape no.	1219	mg. 7.7	Cape No. 1237	mg. 6.3	Cape No. 1241	mg. 6.5			
C	08	42	27.22	08	51	31.03	8	52	38.92
L			27.28	(AG) 8	51	31.11			38.88
E			27.20						38.89
Mean	08	42	27.23	08	51	31.07	8	52	38.90
Prec			+50.945			50.67			51.02
a	08	43	18.17	08	52	21.74	8	52	89.92
A	08	48	14.00	08	48	14.00	8	48	14.00
a-A	-	04	55.83	+04		7.74	+05		15.92
sin(a-A)			-295.81			+247.73			+315.92
log "	2.47	10	1m	2.39	398		2.49	958	
" cos δ	9.97	89	2	9.97	949		9.97	661	
" sin	0.95	71	7m	0.88	071		0.98	343	
tan	-9.06	08		7.59	82		+9.62	56	
sin	-0.00	20		0.00	16		0.00	26	
cos	12.93	72		29.59	98		31.62	82	
X	13.28	98		29.15	17		31.09	78	
X-δ	+3.35	26		-448	1		-530	4	
C	+17	45	47.8	+17	31	42.8	+18	41	41.0
L			47.5	(AG)		43.3			41.0
E			47.4						41.0
Mean	17	45	47.6	17	31	43.1	+18	41	41.0
Prec	-03		16.1	-03		25.4	-03		26.1
δ	+17	42	31.5	+17	28	17.7	+18	38	14.9
δ	18	07	16.6	+18	07	16.6	18	07	16.6
δ-δ	-24		45.1	-38		58.9	+30		58.3
tan(δ-δ)	-14		85.1	-23		39.0	+18		58.3
log "	3.17	17	6m	3.36	903	m	3.26	912	
" sin	0.50	29	1m	0.70	018	m	0.60	027	
log tan δ	9.15	042		9.49	81		9.52	80	
log sin	1.91	43		1.76	14		1.96	63	
" sin	8.47	19		8.31	29		8.54	77	
tan	-3.18	35		-5.01	40		+3.98	35	
sin	0.02	96		0.02	05		0.03	53	
cos	14.84	61		13.00	65		22.01	88	
δ	15.03	48		13.25	77		21.83	63	
δ-δ	+18	87		+25	12		-18	25	







9492

## Standard Coordinates.

14

Cape No.	1219	mg 77	Cape No.	1237	mg 63	Cape No.	1241	mg 65
C	08	42	27.22	08	51	31.03	8	52
AG			27.28	(AG) 8	51	31.11		
E			27.20					
Mean	08	42	27.23	08	51	31.07	8	52
Dec	-		+50.94			50.67		
$\lambda$	08	43	18.17	08	52	21.74	8	52
A	08	48	14.00	08	48	14.00	8	48
$\lambda-A$	-	04	55.83		+04	7.74		+05
$\sin(\lambda-A)$			-2.9588			+2.4774		+3.1592
$\log "$	2.47	1.01	m	2.39	3.98		2.49	7.58
$\log \delta$	9.97	8.92		9.97	9.49		9.97	6.61
$\log \rho$	0.95	7.17	m	0.88	0.71		0.98	3.43
$\delta$	-9.06	08		7.59	8.2		9.62	5.6
$\delta_1$	-	00.20		0.01	6		0.02	6
$\delta$	12.93	7.2		29.59	9.8		31.62	8.2
$\gamma$	13.28	9.8		29.15	1.7		31.09	7.8
$\gamma-\delta$	+3.52	6		-4.48	1		-5.30	4
C	+1.7	45	47.87	+1.7	31	42.8	+1.8	41
AG			47.5	(AG)		43.3		
E			47.4					
Mean	1.7	45	47.6	1.7	31	43.1	+1.8	41
Dec	-0.3		16.1	-	-0.3	25.4	-0.3	
$\delta$	+1.7	42	31.5	+1.7	28	17.7	+1.8	38
$\delta$	1.8	0.7	16.6	+1.8	1.7	16.6	1.8	1.7
$\delta-E$	-2.4		45.1	-	3.8	59.9	+	30
$\tan(\delta-E)$	-	14	85.1		-23	38.0	+	18
$\log "$	3.17	1.76	m	3.36	9.03	m	3.26	9.12
$\log \rho$	0.50	2.91	m	0.70	0.18	m	0.60	0.27
$\log \tan \delta$	9.50	4.21		9.49	8.1		9.52	8.0
$\log \tan \delta_1$	1.97	4.31		1.76	1.4		1.96	6.2
$\log \rho$	8.47	1.9		8.31	2.9		8.54	7.7
$\gamma_0$	-3.18	3.5		-5.01	4.0		3.91	3.5
$\gamma_1$	0.02	9.6		0.12	0.5		0.03	5.30
$\gamma_2$	14.84	6.10		13.11	6.5		30.01	8.0
$\gamma_3$	15.13	4.8		13.25	7.7		21.83	6.3
$\gamma_4$	-1.8			-2.5	1.7		-1.8	



mustaken cap. X  
marker 7" diff in  
plate center



9492

Plate Center.

15

$\gamma$	$\delta$	$\alpha$	$\delta$
* 13.2893	15.5848	08 43	1.8.17
29.1517	13.2577	08 52	21.74
31.0978	21.8363	08 53	29.76
17.9161	25.5962	08 45	54.94
492.1484	475.7250	432 193	124.61
23.0371	18.9312	08 48	46.15
22.	1.8	-	32.15
- 1.0371	-0.9312	08 48	14.00
31 <sup>s</sup>	46.65		18 07
- 32.15			16.6

Plate Center {  
 A = 08 48 14.0  
 D = 18 07 16.6

$\gamma - \delta$	+500X	-19.2y	+3.2x	-9925
+3526	+6645	= 10171	-288	= 9883
-4481	+14576	= 10095	-254	= 9841
-5304	+15549	= 10245	-419	= 9826
+1410	+8958	= 10368	-491	= 9877
21.9161	+10958	-312	+70	21.9952

$\gamma - \eta$	+500y	+16.4x	+2.4y	-9655
+1887	+7517	= 9404	+21.8	= 9622
+2512	+6629	= 9141	+478	= 9619
-1825	+10929	= 9093	+518	= 9603
-3500	+12798	= 9298	+294	= 9592
16.2585	+8129	+359	+39	16.1457

Tables  
 abs.  $\alpha - -1.2$   $\epsilon = -1.5$   $\alpha - -0.3$   $\delta + \alpha - +1.2$   
 $-503.2$   $= -502.4$   $+0.8$   $+2.8$   
 O-C  $-502.0$   $-500.9$   $+1.6$







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Plate Center.

15

$\chi$	$\gamma$	$\alpha$	$\delta$
13 28 93	15 03 48	08 43	18 17
29 15 17	13 25 77	08 52	21 74
31 09 78	21 83 63	08 53	29 76
29 16 1	25 52 62	08 45	34 94
2 14 84	47 57 250	32 143	12 461
3 03 71	18 93 12	08 48	46 15
2	18	-	32 15
- 1 03 71	-0.93 12	08 48	14 00
- 3 1	46 65		
- 3 2.15			

Plate Center

$$\begin{cases} A = 08 \ 48 \ 1 \\ B = 18 \ 07 \ 1 \end{cases}$$

$$\begin{aligned} \chi - 5 & + 500\chi & - 19.2\chi & + 3.2\chi & - 992 \\ 3526 + 6645 & = 10171 & - 288 & = 9883 & + 42 & - 9925 \\ - 4481 + 14576 & = 10095 & - 254 & = 9841 & + 93 & - 9934 \\ - 5304 + 15549 & = 10245 & - 419 & = 9826 & + 99 & - 9925 \\ 14114 & 8958 & 10368 & - 491 & = 9877 & - 57 & - 9934 \\ 21.9167 + 10958 & = & - 312 & + 70 & 21.9952 \end{aligned}$$

$$\begin{aligned} \chi - 7 & + 500\chi & + 16.4\chi & + 2.4\chi & - 965. \\ 1.1887 + 7517 & = 9404 & + 21.8 & = 9622 & + 36 & = 9658 \\ - 2512 + 6629 & = 9141 & + 478 & = 9619 & + 32 & = 9651 \\ - 1825 + 10929 & = 9093 & + 518 & = 9603 & + 52 & = 9655 \\ - 3500 + 12798 & = 9298 & - 294 & = 9592 & + 61 & = 9653 \\ 162585 + 8129 & = & + 359 & + 39 & 161437 \end{aligned}$$

Tables  
Chs.

$a = -11.2$

$e = -1.5$

$a - e = 0.3$

$A + d = +1.2$

$- 50325$

$- 50246$

$+ 0.8$

$+ 5.8$



1  
2  
3  
4  
5  
6  
7  
81  
2  
3  
4  
5  
6  
7  
8

Completed by J. J. O'Connell  
Date 1/1/19



9492

Moom Center.

16

	X	X - $\bar{X}$	$\Delta X$	$(X - \bar{X})^2 + (Y - \bar{Y})^2$	
1	22.2051	+2.871	+2	0.825	3.5165 + 65
2	23.0000	+1.0820	+1	1.1709	3.5104 + 14
3	23.3014	+1.3834	+1	1.9141	3.4992 - 108
4	23.7727	+1.8547	+0	3.4399	3.5070 - 30
5	23.7896	+1.8716	-0	3.5029	3.5038 - 62
6	23.6339	+1.7159	-1	2.9440	3.4931 - 169
7	23.0000	+1.0820	-1	1.1705	3.5130 + 30
8	22.8488	+0.9308	-2	0.8660	3.5066 - 34

$$R^2 = 3.5100$$

	Y	Y - $\bar{Y}$	$\Delta Y$	$(Y - \bar{Y})^2$	
1	14.4058	-1.8532	-1	3.4340	1.710 ✓
2	14.7293	-1.5297	-1	2.3395	1.45 ✓
3	15.0000	-1.2590	-0	1.5851	1.32 ✓
4	16.0000	-0.2590	-0	0.0671	98 ✓
5	16.2593	+0.0003	+0	0.0009	90 ✓
6	17.0000	+0.7410	+0	0.5491	67 ✓
7	17.7898	+1.5303	+1	2.3425	35 ✓
8	17.8839	+1.6249	+1	2.6406	30 ✓ 141

approx. Center

$$X = 23 \quad Y = 14.7293$$

$$Y = 17.7898$$

$$3.25186$$

$$Y_D = 16.2593$$

$$R = 1.8720$$

$$Y_{\text{max}} = 18.1313$$

$$X_{\text{max}} = 23.7896$$

$$X_0 = 21.9176$$

$$\left. \begin{array}{l} X_0 = 21.9180 \\ Y_0 = 16.2590 \end{array} \right\} \text{Moom's Center}$$



2



9492

Mooms Center

16

$X$	$X - X_0$	$\Delta X$	$(X - X_0)^2$	$(X - X_0)$
2220051	+2871	+2	08245	35165
2300000	-10820	+1	11709	35104
233014	-13839	+1	19141	34992
237727	+18547	+0	34399	35070
237896	+18716	-0	35029	35038
236339	+17159	-1	29440	34931
2300000	+10820	-1	11705	35130
228488	+09308	-2	08660	35066

 $R^2 = 35100$ 

$Y$	$Y - Y_0$	$\Delta Y$	$(Y - Y_0)^2$	$(Y - Y_0)$
144058	-18532	-1	34340	1710
147293	-15297	-1	23395	145
150000	-12590	-0	15851	132
160000	-02590	-0	00671	98
162593	+00003	+0	00009	90
170000	+07410	+0	05491	62
177893	+15303	+1	23425	35
178839	+16249	+1	26906	30

approx center

$$X = 23 \quad y = 147293$$

$$y_0 = 127893$$

$$325186$$

$$y_0 = 162593$$

$$X_0 = 18720$$

$$y_{max} = 181313$$

$$X_{max} = 237896$$

$$X_0 = 219176$$

$$\left. \begin{array}{l} X_0 \\ y_0 \end{array} \right\} \begin{array}{l} 219180 \\ 162590 \end{array}$$

Mooms Center



## Formation of Normals

1	- 0.54	+	18.9	-	120.0
2	- 1.65	+	4.3	-	6.1
3	- 1.74	-	149.0	+	36.0
4	- 0.48	-	55.6	+	7.8
5	+ 0.0	-	116	-	0.0
6	+ 1.26	-	289	-	125.0
7	+ 1.65	+	32	+	46.0
8	+ 1.50	-	32	-	55.0
	<u>+ 4.41</u>		<u>- 586</u>		<u>+ 189.8</u>
	- 4.41				<u>- 306.1</u>
	- 0.00				- 116.3

-a	-b	-15 + ΔC
+ 3	+ 2	- 10 ✓
+ 11	+ 1	- 3 ✓
+ 14	+ 1	0 ✓
+ 18	+ 0	+ 3 ✓
+ 19	- 0	+ 4 ✓
+ 17	- 1	+ 1 ✓
+ 11	- 1	- 5 ✓
+ 9	- 2	- 8 ✓



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## Conditional Equations.

17

1	+ 0.29	- 1.85	= + 1.65	- 1.0	+ 1.8	+ 8	+ 65	0-C
2	+ 1.08	- 1.53	= + 4	- 36	+ 14	- 22	+ 34	
3	+ 1.38	- 1.26	= - 1.08	- 46	+ 12	- 34	- 66	
4	+ 1.85	- 0.26	= - 3.0	- 62	+ 2	- 60	+ 38	
5	+ 1.87	+ 0.0	= - 6.2	- 62	+ 0.0	- 62	- 8	
6	+ 1.71	+ 0.74	= - 1.69	- 57	- 7	- 64	- 97	
7	+ 1.08	+ 1.53	= + 3.0	- 36	- 14	- 50	+ 88	
8	+ 0.93	+ 1.62	= - 3.4	- 31	- 15	- 46	+ 20	
+ 10.19		- 1.01					+ 245	- 171
+ 15.09		+ 0.00	= - 503.8	- 586	+ 10.19	ar.	52	

$$0.00 + 12.96 = -123.2 = -116.3 - 1.01$$

$$12.96 = -123.2 = -116.3 \quad b = -9.51 = -8.9 - 0.08$$

$$15.09 - 0.0 = -503.8$$

$$a = -33.38$$

$$-38.9 + 0.67$$

				corr 0-C
- 11	+ 16	+ 5	+ 60	+ 50
- 42	+ 14	- 28	+ 32	+ 29
- 54	+ 11	- 43	- 65	- 65
- 72	+ 2	- 70	+ 40	+ 43
- 73	+ 0	- 73	+ 11	+ 15
- 66	- 7	- 73	- 96	- 95
- 42	- 14	- 56	+ 86	+ 81
- 36	- 14	- 50	+ 16	+ 8
				+ 245 - 161
				ar. 51

arc 141

 $\frac{\Sigma V}{n}$ 

$$\frac{P}{n} = .11$$

$$+ 10.5$$

$$\frac{+ 10.5}{.11} = + 96$$

$$\Delta R = + 1.2$$

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

$$2R = -3.74 + 0.1 - 2R_{\text{Corr}} = -0.74 - 15$$

$$\Delta b = + 0.06$$

$$\Delta \delta = + 0.0$$

$$\text{True } \Delta R = + 1.0$$

$$\Delta a = - 0.49$$

$$\Delta \alpha = - 0.02$$







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## Conditional Equations

17

0-2

1	+0.29	-1.85	= +	65	-	10	+	18	+	8	+	15
2	+1.08	-1.53	= +	4	-	36	+	14	-	22	+	34
3	+1.38	-1.26	= -	108	-	46	+	12	-	34	-	66
4	+1.85	-0.26	= -	30	-	62	-	2	-	60	+	38
5	+1.87	+0.0	= -	62	-	62	+	00	-	62	-	8
6	+1.71	+0.74	= -	169	-	57	-	9	-	64	-	97
7	+1.08	+1.53	= +	30	-	36	-	14	-	50	+	88
8	+0.93	+1.62	= -	34	-	31	-	15	-	46	+	20

+245 - 171  
av. 52

$$+15.09 + 0.00 = +503.8 - 586$$

$$0.00 + 12.96 = -123.2 - 1163$$

$$+12.96 = -123.2 - 1163 \quad 10 = -9.51 = 8.9$$

$$+12.96 = -123.2 - 1163$$

$$15.09 - 0.00 = -503.8 - 9$$

$$a = +33.38 - 38.9$$

-11	+16	+5	+60
-42	+14	-28	+32
-54	+11	-43	+65
-72	+2	-70	+40
-73	+0	-73	+11
-66	-7	-73	-96
-42	-14	-56	+86
-36	-14	-50	+16

arc 141

 $\frac{\Sigma v}{n}$ 

$$\frac{P}{n} = 11$$

$$+10.5$$

$$+10.5 = +96$$

$$DR = +1.2$$







9492

Moon's Mean Position

18

$$X_0 \quad 21.9180^{\circ}$$

$$-19^{\circ}$$

$$21.9161$$

$$Y_0 \quad 16.2590^{\circ}$$

$$-5^{\circ}$$

$$16.2585$$

From Plate Constants.

$$X \quad 21.9952^{\circ}$$

$$-22$$

$$S \quad -0.0048^{\circ}$$

$$\log S \quad 7.68124^{\circ}$$

$$\cos S \quad 9.97849^{\circ}$$

$$8.50724^{\circ}$$

$$\log \sin(\alpha - A) \quad 9.19551^{\circ}$$

$$\alpha - A$$

$$-16^{\circ}$$

$$A \quad 8 \quad 48 \quad 14.00^{\circ}$$

$$\alpha_0 \quad 8 \quad 48 \quad 13.84^{\circ}$$

$$\text{Red} \quad +3.59^{\circ}$$

$$\alpha' \quad 8 \quad 48 \quad 17.43^{\circ}$$

$$Y \quad 16.1457^{\circ}$$

$$-18$$

$$\eta_0 - \gamma_0 \quad -1.8543^{\circ}$$

$$\delta \quad 17 \quad 52$$

$$\log \tan \delta \quad 9.5083^{\circ}$$

$$S^2 \quad 5.3625^{\circ}$$

$$7.0534^{\circ}$$

$$\log \eta_0 \quad -8.9242^{\circ}$$

$$\eta_1 + 0.0000^{\circ}$$

$$\eta_0 - 1.8543^{\circ}$$

$$\log \gamma_0 \quad 0.26818^{\circ}$$

$$7.33115^{\circ}$$

$$2.93703^{\circ}$$

$$\delta - \delta_0 \quad -86.502^{\circ}$$

$$-14 \quad 25.0^{\circ}$$

$$\delta \quad 18 \quad 07 \quad 16.6^{\circ}$$

$$\delta_0 \quad 17 \quad 52 \quad 51.6^{\circ}$$

$$\text{Red} \quad -9.1^{\circ}$$

$$\delta' \quad 17 \quad 52 \quad 42.5^{\circ}$$







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Moss's Mean Position

18

$$\begin{array}{r} X_0 \quad 21.9180 \\ + 19 \quad \text{Sun's 1/19} \\ \hline 21.9161 \end{array}$$

$$\begin{array}{r} J_0 \quad 16.2590 \\ - 5 \\ \hline 16.2585 \end{array}$$

From Plate Constants.

$$\begin{array}{r} X \quad 21.9950 \\ - 22 \\ \hline S \quad -0.0048 \end{array}$$

$$\begin{array}{r} Y \quad 16.1457 \\ - 18 \\ \hline -Y \quad -1.8543 \end{array}$$

$$\begin{array}{r} \log S \quad 7.68124 \\ \cos S \quad 9.97849 \\ \hline 8.50724 \end{array}$$

$$\begin{array}{r} \log \tan S \quad 9.5083 \\ S^2 \quad 5.3625 \\ \hline 7.0534 \end{array}$$

$$-7.7 \quad -8.9242$$

$$\log \sin(X-A) \quad 9.19551$$

$$X-A \quad -1.6$$

$$Z_1 \quad +0.0000$$

$$Z_0 \quad -1.8543$$

$$\begin{array}{r} \log Z_0 \quad 0.26818 \\ Z_0 \quad 7.33115 \\ \hline 2.93703 \end{array}$$

$$A \quad 8 \quad 48 \quad 14.00$$

$$\alpha_0 \quad 8 \quad 48 \quad 13.84$$

$$\text{Red} \quad +3.59$$

$$\alpha_1 \quad 8 \quad 48 \quad 17.43$$

$$S-E \quad -86.502$$

$$-14 \quad 25.0$$

$$E \quad 18 \quad 07 \quad 16.6$$

$$S_0 \quad 17 \quad 52 \quad 51.6$$

$$\text{Red} \quad -9.1$$

$$S^* \quad 17 \quad 52 \quad 42.5$$



$$\begin{array}{r}
 8 \quad 42 \quad 19.90 \text{ ap} \\
 8 \quad 42 \quad \underline{16.58} \text{ mean} \\
 + 3.32
 \end{array}$$

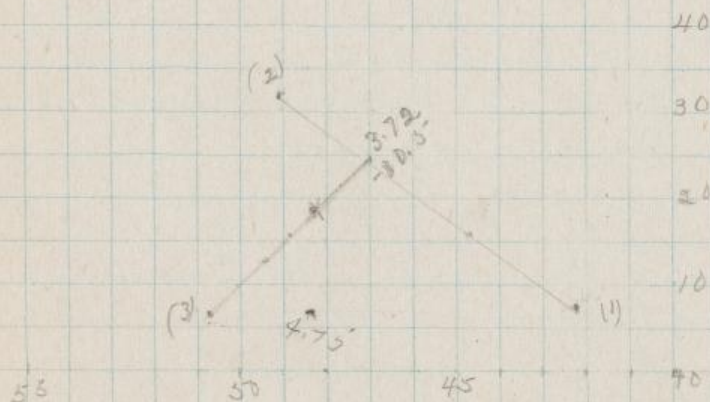
$$\begin{array}{r}
 6 \quad 43 \quad 48.6 \\
 6 \quad 43 \quad \underline{53.1} \\
 - 4.5
 \end{array}$$

$$\begin{array}{r}
 2 \quad 8 \quad 49 \quad 7.67 \\
 8 \quad 49 \quad \underline{3.75} \\
 + 3.92
 \end{array}$$

$$\begin{array}{r}
 30 \quad 53 \quad 54.0 \\
 30 \quad 54 \quad \underline{7.5} \\
 - 13.5
 \end{array}$$

$$\begin{array}{r}
 3 \quad 8 \quad 50 \quad 57.41 \\
 8 \quad 50 \quad \underline{54.15} \\
 + 3.26
 \end{array}$$

$$\begin{array}{r}
 6 \quad 16 \quad 6.0 \\
 6 \quad 16 \quad \underline{11.0} \\
 - 5.0
 \end{array}$$





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## Reduction to apparent Position

19.

$H + \alpha$	12	10.9	$182^{\circ} 43.5''$	$\delta_0$	17	52.9
H	3	22.7		$\log \cos i$	9.9785	
$\alpha_0$	8	48.2		$\log i$	0.8139	
G	22	52.0		$\log (i)$	0.7923	
$G + \alpha$	31	40.2	$115^{\circ} 3''$			

$\log \cos G + \alpha$	9.6268	
$\log q$	1.3434	
$\sin (G + \alpha)$	9.9571	
$\tan \delta$	9.5087	
	8.8239	

$\log \sin \delta$	9.4872	
$\cos (H + \alpha)$	9.9995	
$\log h$	1.2879	
$\sin (H + \alpha)$	8.6771	
$\sec \delta$	0.0215	
	8.8239	

$\log (q')$	0.9702	
$(q)$	9.6331	

$\log (h')$	0.7746	
$(h)$	8.8104	

$Q +$	3.225	
$(q) +$	0.430	
$(Q)$	-0.065	
$+ 3.590$		

$(q')$	-9.337	
$(h')$	-5.954	
$(l)$	+6.199	
	-9.089	







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## Reduction to apparent Position

19

$H + \alpha$	1 2	110.9"	18.2°	43.5"	$\delta$	17	52.9"
$H$	3	23.5"			$\log \cos i$	9 9785	
$\alpha$	8	48.3"			$\log i$	0 8137	
$G$	22	52.0"			$\log (h)$	0 7923	
$G + \alpha$	31	40.2"	115°	3'			

$\log \cos \delta$	9 6268	
$\log$	1 3434	
$\sin (G + \alpha)$	9 9571	
$\tan i$	9 5687	
	8 8239	

$\log g'$	0.9702	
$g'$	9.6831	

$g + 3.225$	
$(g) + 0.430$	
$(h) - 0.065$	
$+ 3.590$	

$\log \sin \delta$	9 4872	
$\cos (H + \alpha)$	9 9995	
$\log h$	1 2879	
$\sin (H + N)$	8 6771	
$\sec i$	0 0215	
	8 8239	

$\log h'$	0 7746	
$h'$	8 8109	

$g'$	-9 337	
$(h')$	-5 954	
$(h)$	+6 199	
	+9 089	







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Lunar Parallax.

20

$\alpha$	8	48	17.43	"	$\Pi$	55	17.30	"
$\theta$	7	42	26.50	"		9.86913	"	
$\theta - \alpha$	-1	05	50.93	"	$\log \sin \Pi$	8.20634	"	
$=$	-16°	27'	43.95	"	" $\sin(\theta - \alpha)$	9.45227	"	
					" $\sec \phi 1.3$	0.02246	"	
$\frac{1}{2}(\alpha - \alpha')$	-6	06.24	"		" $\sin(\alpha - \alpha')$	7.55020	"	

$\theta - \alpha' - \frac{1}{2}(\alpha - \alpha') - 16^\circ$	21	39.66	"		$\alpha - \alpha'$	-12'	12.19	"
					$=$	-48°	83	"

	9.95727	"						
$\log \cos \frac{1}{2}(\alpha - \alpha')$	0.00000	"						
$\sec \theta - \alpha' - \frac{1}{2}(\alpha - \alpha')$	0.01795	"						
$\log \tan \frac{1}{2}(\alpha - \alpha')$	9.97522	"						

 $\gamma = 43 \quad 21 \quad 57.7$ 
 $\delta = 17 \quad 52 \quad 42.5$ 
 $\gamma - \delta = 25 \quad 29 \quad 15.2$ 

	9.82640	"						
$\log \sin \Pi$	8.20640	"						
$\sin(\gamma - \delta)$	9.63328	"						
$\cos \gamma$	0.16327	"						
$\sin \delta - \delta'$	7.82985	"						

 $\delta - \delta' = +23 \quad 1.41$ 
 $\delta = 18 \quad 15 \quad 56.6$ 
 $\phi \delta = 18 \quad 16 \quad 0.7$ 
 $\theta - C = -7.1$ 
 $2^{\text{nd}} \text{ ord ref}$   
 $\text{Curv.} = 0.0$   
 $+0.0$ 
 $\text{Gen. Corr.} = +0.1$ 
 $\delta = 18 \quad 15 \quad 56.7$ 
 $\theta - C = -4.0$ 
 $\alpha = 8 \quad 47 \quad 28.62$ 
 $\phi \alpha = 8 \quad 47 \quad 27.58$ 
 $\theta - C = +1.04$   
 $\text{curv.} = 0.00$ 
 $\text{Gen. Corr.} = -0.04$ 
 $\alpha = 8 \quad 47 \quad 28.58$ 
 $\theta - C = +1.00$







2492

Lunar Parallax

26

$$\begin{aligned}
 \alpha & 4^h 17^m 43^s \\
 \delta & 7^{\circ} 42' 26.50'' \\
 \alpha - \delta & -1^{\circ} 05' 50.93'' \\
 = & -16^{\circ} 27' 48.95''
 \end{aligned}$$

$$\frac{1}{2}(\alpha - \delta) = -6^{\circ} 06' 24''$$

$$\alpha - \delta = \frac{1}{2}(\alpha - \delta) - 16^{\circ} 21' 39.66''$$

$$9^{\circ} 99' 57.27''$$

$$\log \sin \alpha = 0.000000$$

$$\log \sin \delta = 0.01795$$

$$\log \sin \gamma = 9.97522$$

$$\gamma = 21^{\circ} 57.7'$$

$$\delta = 17^{\circ} 52' 42.5''$$

$$\gamma - \delta = 25^{\circ} 29' 15.2''$$

$$9^{\circ} 982' 640''$$

$$\log \sin \pi = 8.20640$$

$$\log \sin \gamma - \delta = 9.63378$$

$$\log \sin \gamma = 0.16327$$

$$\log \sin \delta = 7.82985$$

$$\delta - \delta' = +23' 14.1''$$

$$\delta - \delta' = 18^{\circ} 15' 56.6''$$

$$\phi = 18^{\circ} 16' 07.7''$$

$$O-C$$

$$2nd ord ref = 0.0$$

$$corr. = +0.0$$

$$2nd Cor = +0.1$$

$$\delta = 18^{\circ} 15' 56.7''$$

$$O-C = -4.0$$

$$\pi = 55' 17.30''$$

$$9.86913$$

$$\log \sin \pi = 8.20634$$

$$\log \sin(\alpha - \delta) = 9.45227$$

$$\log \sin S = 0.02246$$

$$\log \sin(\gamma - \delta) = 7.55020$$

$$\alpha - \delta = -12' 12.17''$$

$$= -48.81$$

$$\alpha = 8^h 47^m 28.63''$$

$$\phi = 8^h 47^m 27.58''$$

$$O-C = +1.04$$

$$0.00$$

$$+1.04$$

$$2nd Cor = -0.04$$

$$\alpha = 8^h 47^m 28.58''$$

$$O-C = +1.00$$



9.

4

13.

40.

2

29.

13.

9

31.

22

4

18

25.

7

51

74

4

2

22.

15.



## 9491 Div. 5. Star Measures

Tycho 21.8 15.4 21.

	d	m	d	m
1	1 7 7 8 0	1 6 8 9 3	1 5 8 8 7	1 5 5 4 9
13.8	9 7 2 1 } 24	1 4 9 5 3 } 57	1 5 1 0 3	6 3 1 4 } 12
45.1	2 7	6 1	0 3	1 0
	8 8	6 8 9 9	8 7	5 0
	<u>13.8 0 6 2</u>	<u>13.8 0 6 2</u>	<u>15.0 7 8 4</u>	<u>15.0 7 6 2</u>
2	1 6 8 0 8	1 6 6 3 6	1 8 7 0 0	1 6 0 9 2
29.6	1 0 0 0 0 } 11	1 3 4 2 8 } 29	1 4 5 8 1	1 0 2 2 1 } 22
13.4	1 2	3 0	8 1	2 3
	0 2	6 6 3 2	1 0	6 0 9 2
	<u>29.6 7 9 3</u>	<u>29.6 7 9 3</u>	<u>13.4 1 2 3</u>	<u>13.4 1 3 0</u>
3	1 6 8 4 1	1 5 5 7 0	1 1 5 2 8 6	1 5 6 0 6
22	1 1 1 8 8 } 87	1 1 2 3 9 } 37	1 5 2 2 8	1 5 6 4 9 } 51
	8 6	3 5	2 8	5 3
	5 1	5 5 7 2	9 6	5 6 1 2
	<u>31.5 6 6 0</u>	<u>31.5 6 6 0</u>	<u>22.0 0 5 8</u>	<u>22.0 0 3 9</u>
4	1 7 9 3 8	1 5 5 5 9	1 8 9 4 2	1 5 7 4 7
18.4	1 4 3 7 1 } 70	9 1 3 1 } 32	1 2 2 1 8 } 17	1 2 4 5 1 } 52
25.7	6 9	3 3	1 6	5 3
	3 8	1 5 5 5 3	4 2	5 7 4 7
	<u>18.3 5 6 8</u>	<u>18.3 5 7 6</u>	<u>25.6 7 2 5</u>	<u>25.6 7 0 5</u>

## Moon Measures:

1	1 4 4 8 9	1 3 1 7 0	y min
21.8	6 8 5 8 } 61	1 0 7 9 3	
34.8	6 4	9 3	
y min	9 3	3 1 7 4	
	<u>14.7 6 2 6</u>	<u>14.7 6 2 2</u>	
2	1 4 6 0 6	1 6 3 5 8	y x
22.8	6 6 8 2	1 4 2 9 4	
15.	8 2	9 4	
	4 6 1 2	6 3 6 0	
	<u>22.7 9 3 9</u>	<u>22.7 9 3 5</u>	



31

22

4

18

25

1

21

74

4

2

25

5



## 491 Jan. 5. Star Measures

Tycho 218 154 21

	d	m	d	
	1 7 7 8 0	1 6 8 9 3	1 5 1 2 7	1 5 5 4 9
8	9 7 2 1 } 24	1 4 9 5 3 } 57	1 5 1 0 3	6 3 0 4 } 12
1	2 7	6 1	0 3	1 0
	2 8	6 8 9 9	3 7	5 0
	<u>13.8062</u>	<u>13.8062</u>	<u>15.0784</u>	<u>15.0762</u>

	1 6 8 0 8	1 6 6 3 6	1 8 7 0 0	1 6 0 9 2
3	1 0 0 0 0 } 11	1 3 4 2 8 } 29	1 4 5 8 1	1 0 2 2 1 } 22
	1 2	3 0	8 1	2 3
	0 2	6 6 3 2	1 0	6 0 9 2
	<u>29.7793</u>	<u>29.6793</u>	<u>13.4129</u>	<u>13.4130</u>

316	1 6 8 4 1	1 5 5 7 0	1 1 5 2 8 6	1 5 6 0 6
22.	1 1 1 8 8 } 27	1 1 2 3 9 } 37	1 5 2 2 8	1 5 6 4 9 } 51
	8 6	3 5	2 8	5 3
	0 1	5 5 7 2	9 6	5 6 1 2
	<u>31.5660</u>	<u>31.5660</u>	<u>22.0058</u>	<u>22.0039</u>

4	1 7 9 3 8	1 5 5 5 9	1 8 9 4 2	1 5 7 4 7
184	1 4 3 7 1 } 70	9 1 3 1 } 32	1 2 2 1 8 } 17	1 2 4 5 1 } 52
25.7	6 9	3 3	1 6	5 3
	3 8	1 5 5 5 3	4 2	5 7 4 7
	<u>18.3568</u>	<u>18.3576</u>	<u>25.6725</u>	<u>25.6705</u>

## Moon Measures

1	1 4 4 8 9	1 3 9 9 8
218	8 8 5 8 } 66	1 0 7 9 3
748	6 7	9 3
4 not	8 3	3 1 7 4
	<u>21.7824</u>	<u>21.7612</u>

2	1 4 6 0 6	1 6 3 5 8
28	6 6 8 2	1 4 2 9 4
5	8 2	9 4
	4 6 1 2	6 3 6 0
	<u>22.7929</u>	<u>22.7935</u>



9

3

23

15

4

23

16

5

23

16

Xm

6

23

17

7

23

18

8

23

18



9491

Moon Measures.

22

$d$   
 $z$  16838  
 $23.1$  15512 } 09  
 $15.1$  06  
 $36$   
 $15.1329$

$d$   
 $z$  16838  
 $15.5$  12 } 09  
 $06$   
 $36$   
 $15.1329$

$d$   
 $z$  16302  
 $7622$  } 21  
 $20$   
 $6312$   
 $15.1315$

$4$  16690  
 $23.7$  10218  
 $16$  18  
 $90$   
 $23.6472$

$z$  15008  
 $11496$   
 $96$   
 $08$   
 $23.6488$

$5$  14108  
 $23.8$  6461 } 65  
 $16.5$  6469 }  
 $x_{max}$  02  
 $23.7643$

$z$  14941  
 $12572$  } 73  
 $74$   
 $39$   
 $23.7633$

$6$  17149  
 $23.7$  9846 } 44  
 $17$  42  
 $41$   
 $23.7299$

$z$  15060  
 $12368$  } 69  
 $70$   
 $5060$   
 $23.7309$

$7$  17272  
 $23.2$  15439 } 40  
 $18$  41  
 $76$   
 $23.1832$

$z$  13948  
 $5778$   
 $78$   
 $48$   
 $23.1830$

$17084$   
 $15523$   
 $23$   
 $84$   
 $18.1561$

$16381$   
 $7921$  } 20  
 $19$   
 $6381$   
 $18.1539$



7  
2  
3  
10  
4  
3  
6  
2  
3  
7  
1  
2  
3  
17  
8  
2  
8



9491

Upon Measures.

22

3 16838  
 57 15512 } 09  
 101 06  
 36  
23.1329

16838  
 15512 } 09  
 06  
 36  
 151329  
 116302  
 7422 } 21  
 20  
 6312  
151305

5  
 38  
 60  
 15008  
 11496  
 96  
 08  
23.6488

3 14108  
 39 6461 } 65  
 75 6469 }  
 02  
23.7643  
 14941  
 12572 } 73  
 74  
 39  
23.7633

2 17149  
 37 9846 } 44  
 18 42  
 41  
23.7299  
 15060  
 12368 } 69  
 70  
 5060  
23.7309

8 17272  
 32 15439 } 40  
 81 41  
 76  
23.1832  
 13948  
 5808  
 78  
 48  
23.1830

17084  
 15523  
 23  
 84  
18.1561  
 16381  
 7901 } 20  
 17  
 6381  
18.1539







9491

## Plate Constants.

23

X	13.8062	29.6793	31.5660	18.3572
$\Sigma$	12.9372	29.5998	31.6282	17.7751
X- $\Sigma$	+ .8690	+ .0795	- .0622	+ .5821

y	15.0773	13.4127	22.0048	25.6715
$\eta$	14.8461	13.0065	22.0188	25.9462
y- $\eta$	+ .2312	+ .4062	- .0140	- .2747

$$\begin{array}{rclcl}
 X-\Sigma & +500x & +54.5y & +3.1x & -16.458 \\
 +.8690 + 6903 = +15593 + 822 = +16415 + 43 = +16458 \\
 +.0795 + 17840 = +15635 + 73.1 = +16366 + 92 = +16458 \\
 -.0622 + 15783 = +15161 + 1199 = +16360 + 98 = +16458 \\
 +.5821 + 9179 = +15000 + 1399 = +16399 + 57 = +16456 \\
 21.8919 + 10946 = +13135.8919 + 907 = +14042.8919 + 68 = 21.4382
 \end{array}$$

$$\begin{array}{rclcl}
 y-\eta & +500y & -57.8x & +2.2y & -9.085 \\
 +.2312 + 7539 = +9851 - 798 = +9053 + 33 = +9086 \\
 +.4062 + 6706 = +10768 - 1715 = +9053 + 30 = +9083 \\
 -.0140 + 11002 = +10862 - 1824 = +9038 + 48 = +9086 \\
 -.2747 + 1283 = +10083 - 1061 = +9022 + 56 = +9078 \\
 16.6427 + 8321 = +9985.6427 - 1263 = +8722.6427 + 37 = 16.4437
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables } a = & -1 & c = & -1.5 & a-c = +0.5 \\
 & = -503.1 & & = -5002.2 & = -0.9 \\
 & & & & b+d = +0.3 \\
 & & & & = +3.3
 \end{array}$$

$$\begin{array}{rclcl}
 0^\circ C & -502.1^\circ & -5007^\circ & & +3.0^\circ
 \end{array}$$

Times on page 13.







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## Plate Constants

23

X	13.8062	29.6793	31.5660	18.3572
$\Sigma$	12.9372	29.5998	31.6282	19.7751
-5	+8.690	+0.795	-0.622	+5.821

$\Sigma$	15.0773	33.4127	22.0048	25.1715
$\Sigma$	14.8461	13.0065	22.0188	25.9462
-2	+2.2312	+4.062	-0.0140	-2.747

$\Sigma$	+500X	+54.54	+3.1X	-16.451
690 + 6903	= -15.593 + 8.22	= -16.415 + 43	= +16.458	
795 + 19840	= -15.635 + 73.1	= -16.366 + 92	= +16.458	
222 + 15783	= -15.161 + 11.99	= -16.360 + 98	= +16.458	
221 + 9179	= -15.000 + 13.99	= -16.399 + 57	= +16.456	
21.8919 + 10946	+ 9.07	+ 68		21.4382

$\Sigma$	+500y	-57.8X	+2.28	-9.08
12 + 7539	= +9.851 + 7.98	= +9.053 + 33	= +9.086	
62 + 6706	= +10.768 - 17.15	= +9.053 + 30	= +9.083	
40 + 11002	= +10.862 - 18.24	= +9.038 + 48	= +9.080	
47 + 1283	= +10.084 - 10.61	= +9.028 + 56	= +9.084	
16.6427 + 8321	- 7.263	+ 37		16.4437

Table a - -1 - e = -1.5 a-e = +0.5 b+d = +0.3  
 = -5.083 = -5.022 = -0.9 = +3.3







9491.

Moon's Center

24

	X	X - X <sub>0</sub>	ΔX	(X - X <sub>0</sub> ) <sup>2</sup>	(Y - Y <sub>0</sub> ) <sup>2</sup>	0 - C
1	21.89 00	0 0 0 0 0	+1	0 0 0 0 0	3.54 0 0	+ 3 3 4 $\frac{1}{2}$
2	22.79 32	+0.9 0 3 2	+1	0.81 59	3.52 0 2	+ 1 3 6
3	23.00 00	+1.1 1 0 0	+1	1.23 23	3.51 75	+ 1 0 9
4	23.64 80	+1.7 5 8 0	+0	3.09 06	3.50 53	- 0 1 3
5	X 23.76 38	+1.8 7 3 8	+0	3.51 11	3.51 11	+ 0 4 5
6	23.73 04	+1.8 4 0 4	-0	3.38 71	3.51 45	+ 0 7 9
7	23.18 31	+1.2 9 3 1	-1	1.67 18	3.51 05	+ 0 3 9
8	23.00 00	+1.1 1 0 0	-1	1.23 19	3.51 40	+ 0 7 4

	$y - y_0$	$\Delta y$	$(y - y_0)^2$	$R^2 = 3.5066$
1	(y) 14.7624	-1.8816	-1	3.5400 + 180 $\frac{1}{2}$
2	15.0000	-1.6440	-1	2.7043 + 151
3	15.1322	-1.5118	-1	2.2852 + 144
4	16.0000	-0.6440	-0	0.4147 + 110
5	16.6440	0.0000	+0	0.0000 + 90
6	17.0000	+0.3560	+0	0.1274 + 79
7	18.0000	+1.3560	+1	1.8387 + 43
8	18.1550	+1.5110	+1	2.2831 + 36 ✓

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approx. Center

$$X = 23 \quad Y = 15.1322$$

$$18.1550$$

$$2/3 \quad 3.2872$$

$$Y = 16.6436$$

$$Y_{\min} = 14.7624$$

$$R = 1.8812$$

$$\text{com. } R = 1.8740$$

$$X_{\max} = 23.7638$$

$$X_0 = 21.8898$$

$$\text{Moon's Center} \left\{ \begin{array}{l} X_0 = 21.8900 \\ Y_0 = 16.6440 \end{array} \right.$$







1491.

Moon's Center

24

X	X - X <sub>0</sub>	(X - X <sub>0</sub> ) <sup>2</sup>	Y	Y - Y <sub>0</sub>	(Y - Y <sub>0</sub> ) <sup>2</sup>	(X - X <sub>0</sub> )(Y - Y <sub>0</sub> )
21.8900	0.0000	0.0000	14.7624	-1.8816	3.5400	-3.34
22.7932	+0.9032	0.8159	15.0000	-1.6440	2.7043	+1.36
23.0000	+1.1100	1.2323	15.1322	-1.5118	2.2852	+1.09
23.6480	+1.7580	3.0906	16.0000	-0.6440	0.4147	-0.15
23.7638	+1.8738	3.5111	16.6440	0.0000	0.0000	+0.40
23.7204	+1.8404	3.3871	17.0000	+0.3560	0.1274	+0.79
23.1831	+1.2931	1.6718	18.0000	+1.3580	1.8387	+0.39
23.0000	+1.1100	1.2319	18.1550	+1.5110	2.2831	+0.74

R<sup>2</sup> = 3.5066

X	X - X <sub>0</sub>	(X - X <sub>0</sub> ) <sup>2</sup>	Y	Y - Y <sub>0</sub>	(Y - Y <sub>0</sub> ) <sup>2</sup>	(X - X <sub>0</sub> )(Y - Y <sub>0</sub> )
14.7624	-1.8816	3.5400	15.1322	-1.5118	2.2852	-3.34
15.0000	-1.6440	2.7043	16.0000	-0.6440	0.4147	+1.36
15.1322	-1.5118	2.2852	16.6440	0.0000	0.0000	+1.09
16.0000	-0.6440	0.4147	17.0000	+0.3560	0.1274	-0.15
16.6440	0.0000	0.0000	18.0000	+1.3580	1.8387	+0.40
17.0000	+0.3560	0.1274	18.1550	+1.5110	2.2831	+0.79
18.0000	+1.3580	1.8387				+0.39
18.1550	+1.5110	2.2831				+0.74

Moon's Center

X = 23 Y = 15.1322

18.1550

2/3 3 2 8 7 2

Y = 16.6436

Y<sub>mean</sub> = 14.7624

R = 1.8812

corr R = 1.8740

X<sub>mean</sub> = 23.7638X<sub>0</sub> = 21.8898

Moon's Center

X<sub>0</sub> = 21.8900Y<sub>0</sub> = 16.6440



# Formation of Normals.

1	- 0.00	+	00.0	-	157.0	1/2 wt
2	- 1.48	+	122.3	-	222.7	
3	- 1.68	+	121.0	-	164.8	
4	- 1.13	-	22.9	+	8.3	
5	+ 0.00	+	84.1	+	000.0	
6	+ 0.66	+	145.1	+	28.4	
7	+ 1.75	+	50.4	+	53.0	
8	+ 1.68	+	82.2	+	111.7	
	+ 4.09	+	605.1	+	201.4	
	- 4.29	-	22.9	-	544.5	
	- 0.20	+	582.2	-	343.1	

- a	- b	- 37 + ΔC
+ 0	+ 13	- 24 ✓
+ 18	+ 11	- 8 ✓
+ 22	+ 11	- 4 ✓
+ 35	+ 5	+ 3 ✓
+ 37	- 0	+ 0 ✓
+ 37	- 3	- 3 ✓
+ 26	- 9	- 20 ✓
+ 22	- 10	- 25 ✓



## Conditional Equations

									0-C Corr
1	+0.00	-1.88	= +334	+00.0	+50	= +	50	$\frac{1}{2}$ +2.8	4.260
2	+0.90	-1.64	= +136	+35	+44	= +	79	+57	+49
3	+1.11	-1.51	= +109	+43	+40	= +	83	+26	+22
4	+1.76	-0.64	= -13	+68	+17	= +	85	-98	-95
5	+1.87	0.00	= +45	+72	+00	= +	72	-27	-27
6	+1.84	+0.36	= +79	+71	-10	= +	61	+18	+15
7	+1.29	+1.36	= +39	+50	-36	= -	14	+53	+33
8	+1.11	+1.51	= +74	+43	-40	= -	03	+77	+52
	+9.88	-2.44					+515	-125	

average 80

$$14.90 - 0.20 = +582.2 + 9.88$$

$$0.20 + 13.19 = -343.1 - 2.44$$

$$0.20 - 0.02 = +7.80 + 0.13$$

$$13.21 = -350.90 - 2.57 \quad b = -26.5 - 0.19$$

$$14.90 = 582.2 - 5.30 = 576.9 \quad a = +38.7 + 0.59$$

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 $\frac{\Sigma V}{n}$ 

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

$$+49$$

$$\frac{+31}{13} = +24 \quad \Delta R = +3.0$$

Corr. +0.5

True  $\Delta R = +2.5$ 

$$-2R = -3.74 \quad -2R_{\text{Corr}} = -1.87 - 3.7$$

$$\Delta b = +0.36$$

$$\Delta \delta = +0.2$$

$$\Delta a = -1.01$$

$$\Delta \alpha = -0.03$$

-2.0







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## Conditional Equations

0-25

1	+0.00	-1.42	= +334	+0.00	= +50	= +50	-224
2	+0.40	-1.64	= +126	+335	= +44	= +79	-87
3	+1.11	-1.51	= +109	+43	= +40	= +83	-26
4	+1.76	-1.64	= -112	+78	= +17	= +85	-98
5	+1.87	0.00	= +045	+72	= +00	= +72	-27
6	+1.84	+1.36	= +077	+71	= +10	= +81	+12
7	+1.29	+1.36	= +139	+50	= +26	= +114	+5
8	+1.11	+1.51	= +074	+43	= +40	= +83	+77
						+515	-125
						average	8.0

$$1490 - 0.20 = +582.2$$

$$0.20 + 13.19 = -343.1$$

$$0.20 - 0.00 = +7.80$$

$$13.27 = -350.90 \quad b = 26.5$$

$$1490 = 582.2 - 5.36 = 576.84 \quad a = +38.7$$

arc 144

ΣK

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

$$+49$$

$$\frac{+31}{13} = +2.4 \quad \Delta R = +3.0$$







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## Moon's Mean Position

26

$$\begin{array}{r} X_0 \quad 21.8900 \\ \quad + 19 \\ \hline 21.8919^{\circ} \end{array}$$

$$\begin{array}{r} Y_0 \quad 16.6440 \\ \quad - 13 \\ \hline 16.6427^{\circ} \end{array}$$

## Frame Plate Constants.

$$\begin{array}{r} X \quad 21.4382^{\circ} \\ \quad - 22 \\ \hline \Sigma \quad - .5618^{\circ} \end{array}$$

$$\begin{array}{r} Y \quad 16.64437^{\circ} \\ \quad - 18 \\ \hline \eta + \eta_1 \quad - 1.5563^{\circ} \end{array}$$

$$\begin{array}{r} \log S \quad 9.74958^{\circ} \\ \log \cos \delta \quad 9.97840^{\circ} \\ \hline 8.50724^{\circ} \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 9.5096^{\circ} \\ \log \tan \delta_0 \quad 9.4991^{\circ} \\ \hline 7.0534 \\ \log \eta_1 \quad 6.0621 \end{array}$$

$$\log \sin(\alpha - A) \quad 1.26394^{\circ}$$

$$\sin(\alpha - A) \quad - 18.36^{\circ}$$

$$\begin{array}{r} \eta_1 \quad + .0001^{\circ} \\ \eta_1 \quad - 1.5564^{\circ} \end{array}$$

$$A \quad 08 \quad 48 \quad 14.00^{\circ}$$

$$\begin{array}{r} \log \eta_0 \quad 0.19212^{\circ} \\ \hline 7.33115^{\circ} \end{array}$$

$$\eta_0 \quad 08 \quad 47 \quad 55.64^{\circ}$$

$$\begin{array}{r} \log \tan(\delta - \delta_0) \quad 2.86097^{\circ} \\ \hline - 7.260 \end{array}$$

$$\text{Red} \quad + 3.59^{\circ}$$

$$\begin{array}{r} \delta - \delta_0 \quad - 1.2 \quad 06.0 \\ B \quad 18 \quad 07 \quad 16.6^{\circ} \end{array}$$

$$\alpha' \quad 08 \quad 47 \quad 59.23^{\circ}$$

$$\delta_0 \quad 17 \quad 55 \quad 10.6^{\circ}$$

$$\text{Red} \quad - 9.1^{\circ}$$

$$\delta' \quad 17 \quad 55 \quad 1.5^{\circ}$$







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Moon's Mean Position

26

$$\begin{array}{r} X_0 \quad 21.8900 \\ \quad + 19 \\ \hline 21.8919 \end{array}$$

$$\begin{array}{r} Y_0 \quad 16.6440 \\ \quad - 13 \\ \hline 16.6427 \end{array}$$

From Plate Constants

$$\begin{array}{r} X \quad 21.4382 \\ \quad - 22 \\ \hline - .5618 \end{array}$$

$$\begin{array}{r} Y \quad 16.4437 \\ \quad - 18 \\ \hline - 1.5563 \end{array}$$

$$\begin{array}{r} \log S \quad 9.74958 \\ \log \cos \delta \quad 9.97840 \\ \hline 8.50724 \end{array}$$

$$\begin{array}{r} \log \tan \delta \quad 9.5196 \\ \log \sin \delta \quad 9.4991 \\ \hline 7.0534 \\ \log W \quad 6.0621 \end{array}$$

$$\log \sin(X-W) \quad 1.26394$$

$$\sin(X-W) \quad - 18.36$$

$$\begin{array}{r} \gamma_1 \quad - 0.0001 \\ \gamma_2 \quad - 1.5564 \end{array}$$

$$A \quad 08 \quad 48 \quad 14.00$$

$$\log \gamma_0 \quad 0.19212$$

$$\gamma_0 \quad 08 \quad 47 \quad 55.64$$

$$\log \tan \delta \quad 2.86097$$

$$Red \quad + 3.59$$

$$\begin{array}{r} \delta - E \quad - 12 \quad 06.1 \\ \delta \quad 18 \quad 07 \quad 16 \end{array}$$

$$X' \quad 08 \quad 47 \quad 59.23$$

$$\delta_0 \quad 17 \quad 55 \quad 10.6$$

$$Red \quad - 9.1$$

$$S' \quad 17 \quad 55 \quad 1.5$$



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## Reduction to apparent Position

27

$H + \alpha$	12	10.6	182° 39'	$\delta_0$	17	55.2"
$H$	3	22.7"				
$\alpha_0$	08	47.9"		$\log \cos \delta_0$	9.9784"	
$\beta$	22	52.0"		$\log i$	0.8137"	
$\beta + \alpha$	31	39.9"	114° 58.5"	$\log (i')$	0.7921"	
$\log \cos(G + \alpha)$	9.6255					
$\log g$	1.3434					
$\sin(G + \alpha)$	9.9574			$\log \sin \delta_0$	9.4881"	$R'$
$\tan \delta_0$	9.5097			$\cos(H + \alpha)$	9.9995"	
	8.8239			$\log h$	1.2879	
				$\sin(H + \alpha)$	8.6650	$h$
$\log(g')$	0.9689			$\sec \delta_0$	0.0216	
$g$	9.6844				8.8239	
				$\log(h')$	0.7755	
				" $h$	8.7984	
$2$	+3.225			$(g')$	-9.309	
$g$	+0.431			$(h)$	-5.963	
$h$	-0.063			$(l)$	+6.196	
	+3.593				-9.076	







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 $H + \lambda$ 

## Reduction to apparent Position

27

$H + \lambda$	12	10.6	182°	37'	$\epsilon_0$	17	52.2"
$H$	03	22.7					
$\lambda_0$	08	47.9			$\log \cos \delta_0$	9.9784	
$G$	22	52.0			$\log 1$	0.8137	
$G + \lambda$	31	39.9	114°	58.5'	$\log(l)$	0.7920	
$17 \cos(G + \lambda)$	96	25.5					
$\log g$	1.34	34.5					
$\sin(G + \lambda)$	99	57.4			$\log \sin \delta_0$	9.4881	$R'$
$\cos \epsilon_0$	95	09.9			$\cos(H + \lambda)$	9.9995	
	8.8239				$\log L$	1.2879	
					$\sin(H + \lambda)$	8.6650	$R$
$\log(g)$	0.9689				$\sec \delta_0$	0.0216	
$g$	9.6344					8.8239	
					$\log(L')$	0.7755	
					$\log(L)$	8.7984	
$z$	+3.225				$g'$	-9.309	
$g$	-0.431				$(L')$	-5.963	
$L$	+0.063				$(L)$	+6.197	
	+3.593					-9.076	







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## Lunar Parallax

28

$\alpha'$	08	47	59.23	$\pi$	55	16.94
$\theta$	07	28	41.85	$\log \sin d'$	9.869	13
$\theta - \alpha'$	-1	19	17.38	" $\sin \pi$	8.206	29
$=$	-19°	49'	20.70	" $\sin (\theta - \alpha')$	9.530	33
$\frac{1}{2}(\alpha - \alpha')$	-	7	18.23	" $\sec \delta'(\text{eph})$	0.022	56
$(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha')$	-19	42	2.47	$\sin (\alpha - \alpha')$	7.628	31
$\log \tan d'$	9.957	27		$(\alpha - \alpha')$	-14	36.47
" $\cos \frac{1}{2}(\alpha - \alpha')$	0.000	00		$=$	-58.43	
$\sec (\theta - \alpha') - \frac{1}{2}(\alpha - \alpha')$	0.026	19				
$\log \tan \gamma$	9.983	46				
$\gamma$	43°	54'	33.6			
$\delta'$	17	55	01.5			
$\gamma - \delta'$	25	59	32.1			
$\log \sin d$	9.826	40				
" $\sin \pi$	8.206	29				
$\sin (\gamma - \delta')$	9.641	72				
$\csc \gamma$	0.158	94				
$\sin (\delta - \delta')$	7.833	35				
$(\delta - \delta')$	+23	25.3				
$\delta$	+18	18	26.8	$\alpha$	08	47 00.80
$\text{eph } \delta$	+18	18	27.6	$\text{eph } \alpha$	08	46 59.86
$\theta - c$	-	0.8		$\theta - c$		+0.94
2nd ord. ref.		0		corr.		+0.00
corr.		+0				+0.04
		+0.2		Err. Cor.		-0.03
$\delta$	+18	18	27.0	$\alpha$	08	47 0.77
$\theta - c$		-0.6		Times etc on page 13.		
				$\theta - c$		+0.91







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Lunar Parallax

78

$\alpha'$	08	47	59.23	$\pi$	55	16.94
$\delta$	07	28	41.85	$\log \sin d'$	9.86913	
$(\alpha - \alpha')$	-1	19	17.38	" $\sin \pi$	8.20629	
$=$	-19	49	20.70	" $\sin (\alpha - \alpha')$	9.53033	
$1/(x - x')$	-	7	18.23	" $\sec \delta'(\alpha)$	0.02256	
$-(x') - 1/2(x - x') - 19$	42		242	$\sin (\alpha - \alpha')$	7.62831	

$\log \tan d'$	9.95727	$(\alpha - \alpha')$	-14	36.47
" $\sec 1/(x - x')$	0.00000	$=$	-58.43	
$\log (\alpha - \alpha') - (\alpha - \alpha')$	0.00119			
$\log \tan \gamma$	9.98346			

 $\gamma$  43 54 33.6 $\delta$  17 55 01.5 $\gamma - \delta$  25 59 32.1

$\log \sin d$	9.82640
" $\sin \pi$	8.20629
$\sin (\gamma - \delta)$	9.64172
$\csc \gamma$	0.15894
$\sin (\delta - \delta')$	7.83335

 $(\delta - \delta')$  +23 25.3 $\delta$  +18 18 26.8 $\text{eph } \delta$  +18 18 27.6 $\delta - C$  -0.8

2nd. order app. +0.0

curr.

+0.2

 $\delta$  +18 18 27.0 $\delta - C$  -0.6 $\alpha$  08 47 00.80 $\text{eph } \alpha$  08 46 59.86 $\alpha - C$  +0.94

curr. - curr. 0.00

2nd. order - -0.03

 $\alpha - \delta$  47 0.77

Times etc on page 13.

 $\alpha - C$  +0.91











