

KG

11366
1023

CLXXI

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Plate	Date	Page
12017	Jan. 2, 1917	1
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12027	" 6 "	21

12017

Star Measures

1

1 18750 18041
 150 18655 814548
 45 55 52
 50 41
 150095 150107

18174 18341
 13358 1315049
 58 48
 74 41
 44816 44808

2 18968 17377
 23.6 12620 1371419
 27.3 2422 24
 68 77
 23.6346 23.6342

18522 16750
 1579792 948025
 89 90
 22 50
 272729 272735

3 18297 17836
 30.0 17948 8203
 131 5049 03
 97 46
 30.0348 30.0357

18941 17177
 18045 8082
 45 8483
 41 87
 130896 130896

Moon Measures

1 1
 23.6
 12.9

16640 17272
 827072 15640
 74 40
 40 72
 12.8368 12.8368

2
 23
 130+

3 16942 16770
 22.0 16454 726867
 140 4449 66
 42 6770
 22.0493 22.0497

17915 17062
 1776564 7222
 68 22
 15 7062
 13.0151 13.0160

12017

Star Measures

$\begin{array}{r} 18750 \\ 150 \\ 45 \end{array}$
 $\begin{array}{r} 18655 \\ 55 \\ 50 \end{array}$
 $\begin{array}{r} 18041 \\ 814548 \\ 52 \\ 41 \end{array}$
 $\begin{array}{r} 150095 \\ 150107 \end{array}$

$\begin{array}{r} 18174 \\ 13358 \\ 58 \\ 74 \end{array}$
 $\begin{array}{r} 18341 \\ 1315049 \\ 4849 \\ 41 \end{array}$
 $\begin{array}{r} 44816 \\ 44808 \end{array}$

$\begin{array}{r} 18968 \\ 23.6 \\ 27.3 \end{array}$
 $\begin{array}{r} 12620 \\ 2422 \\ 68 \end{array}$
 $\begin{array}{r} 17377 \\ 1371419 \\ 24 \\ 77 \end{array}$
 $\begin{array}{r} 236346 \\ 236342 \end{array}$

$\begin{array}{r} 18522 \\ 1579793 \\ 89 \\ 22 \end{array}$
 $\begin{array}{r} 16750 \\ 948085 \\ 90 \\ 50 \end{array}$
 $\begin{array}{r} 272789 \\ 272735 \end{array}$

$\begin{array}{r} 18297 \\ 300 \\ 131 \end{array}$
 $\begin{array}{r} 1794849 \\ 5049 \\ 97 \end{array}$
 $\begin{array}{r} 17836 \\ 8203 \\ 03 \\ 46 \end{array}$
 $\begin{array}{r} 150348 \\ 150357 \end{array}$

$\begin{array}{r} 18941 \\ 18045 \\ 45 \\ 41 \end{array}$
 $\begin{array}{r} 17177 \\ 8082 \\ 8483 \\ 87 \end{array}$
 $\begin{array}{r} 130896 \\ 130896 \end{array}$

Moon Measures

$\begin{array}{r} 16640 \\ 236 \\ 129 \end{array}$
 $\begin{array}{r} 827072 \\ 74 \\ 40 \end{array}$
 $\begin{array}{r} 17272 \\ 15640 \\ 40 \\ 72 \end{array}$
 $\begin{array}{r} 128368 \\ 128368 \end{array}$

$\begin{array}{r} 16640 \\ 827072 \\ 74 \\ 40 \end{array}$
 $\begin{array}{r} 17272 \\ 15640 \\ 40 \\ 72 \end{array}$
 $\begin{array}{r} 128368 \\ 128368 \end{array}$

$\begin{array}{r} 16942 \\ 220 \\ 140 \end{array}$
 $\begin{array}{r} 16454 \\ 4449 \\ 42 \end{array}$
 $\begin{array}{r} 16770 \\ 726867 \\ 66 \\ 6770 \end{array}$
 $\begin{array}{r} 220493 \\ 220497 \end{array}$

$\begin{array}{r} 17915 \\ 1776564 \\ 63 \\ 15 \end{array}$
 $\begin{array}{r} 17062 \\ 7222 \\ 22 \\ 7062 \end{array}$
 $\begin{array}{r} 130151 \\ 130160 \end{array}$

12017

Moon measures

2

4	17.675	16267
21.9	866365	1527879
14.6	67	80
	75	67
	<u>21.9010</u>	<u>21.9012</u>

5	17702	16251
21.9	850105	15458
15.0	09	58
	02	51
	<u>21.9191</u>	<u>21.9193</u>

6
22.0
15.3

18132	16198
14630	971208
30	04
32	98
<u>15.8502</u>	<u>15.9510</u>

7	16352	17071
22.4	12547	10873
16.0	47	73
	52	70
	<u>22.3805</u>	<u>22.3803</u>

8
23.0
16.4

18568	18842
13896	1350510
96	15
68	42
<u>16.4672</u>	<u>16.4668</u>

12017

Moon Measures

2

4	17.67.5"	16267
21.9	8663.65"	1527879
14.6	67	80
	75"	07
<u>21.90.10</u>		<u>21.90.12</u>

5"	17702	16251
19.	8501.05"	15458
5.0	09	58
	02	51
<u>21.91.91</u>		<u>21.91.93</u>

6
22.0
15.3

18132	16198
14630	9712.08
30	04
32	98
<u>15.25.02</u>	<u>15.35.10</u>

7.	16352	17071
12.4	12547	10873
6.0	47	73
	52	70
<u>22.38.05</u>		<u>22.38.03</u>

8
23.0
6.4

18568	18842
13896	13505.10
96	15"
68.	42
<u>164672</u>	<u>16.46.68</u>

12017

Times Etc.

3

Date Jan. 2, 1917

Epp & Stern	02	34		02	46
" " Moon	02	30	37.2	02	39 37.4

Clock fast		12	41.4
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H. Sid Time	02	26	55.9	-0 ^h 7 ^m
-------------	----	----	------	--------------------------------

" " Young	04	44	31.05
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S. Sid Time	07	11	26.95
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Is Sid Time M. Norm	18	46	12.20
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Interval	12	25	14.75
----------	----	----	-------

Red		02	02.09
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S. M. T.	12	23	12.66	12,38685
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From Naut. Alman.

RA

DEC.

Moon 12 ^h	02	33	10.65	+20	11	51.4
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Motion 1 ^m			2.1719			+8.890
-----------------------	--	--	--------	--	--	--------

Motion 23, 2110			50.41		+03	26.3
-----------------	--	--	-------	--	-----	------

Tabular Place	02	34	01.06	+20	15	17.7
---------------	----	----	-------	-----	----	------

Moon's Age 9^d

934" = 14.5

Parallax	56	10.23
----------	----	-------

Semi-diam	15	19.9
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R	91.9
---	------

Aug.	14.0
------	------

Dist. 4	-0.4
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R	933.5
---	-------

R	2.0011
---	--------

(1+a)P	-95.9
--------	-------

R	1.9052
---	--------

R2	3.6298
----	--------

a = -503.5

+24

-479.5

12017

Lunar Etc.

3

Date Jan 2, 1917

Exp to Stars 02 34

02 46

Moon

02 39 37.8

02 39 37.4

Clock fast

12 41.4

H Sid Time

02 26 55.9

-0^h 7^m

" Yung

04 44 31.15"

S Sid Time

07 11 26.95

S Sid Time M. Moon

18 46 12.20

Interval

12 25 14.75

Red

02 02.09

S M. T.

12 23 12.66

12.38685"

from Haut Alman

RA

Dec.

Moon 12^h

02 33 10.65 +20 11 51.4

Mars 1^m

2.1719 8.890

Mars 23.2100

50.41 03 26.3

Johann Place

02 34 01.06 +20 15 17.7

Moon's Age 9^d

34 = 14.5

Parallax

56 10.23

Semi-diam

15 19.9

R

91.99

Ang.

14.0

D₁

- 0.4

R

933.5

R

2.0011

H + aR

95.9

R

1.9052

R₂

3.6298

a = -513.5

+24

-479.5

12017

Plate Center + Constants

4

15.0101	4.4812	02	28	57.86	18	30	52.5
23.6344	27.2732	02	34	05.96	21	36	11.4
30.0353	13.0896	02	37	40.94	19	39	30.4
23.6344	27.2732	02	34	05.96	+21	36	11.4
22.	18			-50.67	-1	12	05.9
-1.6344	-9.2732						
31	466.5						

Plate Center $\left\{ \begin{array}{l} A = 02 \quad 33 \quad 15.29 \\ D = +20 \quad 24 \quad 5.5 \end{array} \right.$

$$\begin{aligned}
 X-S + 500X & \quad +136.14 \quad +3.5X - 16804 \\
 +8638 + 7505 & = 16143 + 609 = 16752 + 52 = 16804 \\
 +1193 + 1181X & = 13010 + 3712 = 16722 + 83 = 16805 \\
 -0100 + 15018 & = 14918 + 1781 = 16699 + 105 = 16804 \\
 23.8057 + 11903 & \quad +2002 \quad +83 = 23.52412
 \end{aligned}$$

$$\begin{aligned}
 y-z & \quad -137X \quad +2.5X - 10443 \\
 +9.0246 + 2241 & = 12487 - 2056 = 10431 + 11 = 10442 \\
 -.0023 + 13636 & = 13613 - 3238 = 10375 + 68 = 10443 \\
 +.7981 + 6545 & = 14526 - 4115 = 10411 + 32 = 10443 \\
 14.7417 + 7371 & \quad -3261 \quad +37 = 14.1721
 \end{aligned}$$

$$\begin{aligned}
 \text{Table 9} & +0.9 \quad a = +0.5 \quad a-e = +0.4 \quad b+d = 0.0 \\
 -503.5 & \quad -502.5 \quad -1.0 \quad +0.9 \\
 0-C & -504.4 \quad -503.0 \quad -1.4 \quad +0.9
 \end{aligned}$$

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Plate Center + Constants

4

150001	4.4812	02	28	57.86	18	30	52.5
23.6344	27.2732	02	34	05.96	21	36	11.4
30.0353	13.0896	02	37	40.94	19	39	30.4
23.6344	27.2732	02	34	05.96	+21	36	11.4
22.	18			-50.67	-1	12	05.9
-1.6344	-9.2732						
31	466.5						

Plate Center { A = 02 33 15.29
D = +20 24 5.5

$$\begin{aligned}
 Y-S + 500X & +136.14 & +3.5X & -16804 \\
 +8638 + 7505 & -16143 + 609 = 16752 + 52 = 16804 \\
 +1193 + 1181X & -13010 + 3712 = 16722 + 83 = 16805 \\
 -0100 + 15018 & = 14918 + 1781 = 16699 + 105 = 16804 \\
 .8057 + 11903 & + 2002 & + 83 & = 23.5241
 \end{aligned}$$

$$\begin{aligned}
 Y-Z & -137X & +2.5X & -11443 \\
 1.0246 + 2241 & = 12487 - 2056 = 10431 + 11 = 10442 \\
 .0023 + 13636 & = 13613 - 3238 = 10375 + 68 = 10443 \\
 7981 + 6545 & = 14526 - 4115 = 10411 + 32 = 10443 \\
 7417 + 7374 & -3261 & + 37 & = 14.1721
 \end{aligned}$$

$$\begin{aligned}
 \text{chles } a & +0.9 & e & +0.5 & a-e & +0.4 & b+d & 0.0 \\
 -503.5 & & -502.5 & & -1.0 & & +0.9 & \\
 -c & -504.9 & -503.0 & & -1.4 & & +0.9 &
 \end{aligned}$$

Curvature

S_0	η_0	ΔS_0	-4.15	-1.87	$+1.0$
-7.84	-14.57	$-53 + 32 = -21 + 11 = -10$			
$+1.51$	$+9.27$	$+4 - 6 = -2 - 7 = -9$			
$+8.04$	-5.73	$+19 - 33 = -14 + 4 = -10$			
$M +1.52$	-3.89	-6	$+3$	$= + \underline{7}$	$+0.02$

$\Delta \eta$	$+3.5\eta$	-3.15	$+1.8$
-95	$+53 = -42 + 24 = -18$		
$+21$	$-34 = -13 - 5 = -18$		
-14	$+21 = +7 - 25 = -18$		
-16	-5	$- \underline{3} = - \underline{0.1}$	

12017			Standard Coordinates			5-			
Cape No	372	mag 6.8	Cape No	383	mag 5.3	Cape No	393	mag 5.7	
C	02	28	0.98	02	33	08.16	02	36	43.56
q			1.02			08.15			43.60
E			0.95			08.15			43.56
m	02	28	0.98	02	33	08.15	02	36	43.57
Prec			+ 56.88			+ 57.81			+ 57.37
α	02	28	57.86	02	34	05.96	02	37	40.94
A	02	33	15.29	02	33	15.29	02	33	15.29
X-A	-	4	17.43	+		50.67	+	4	25.65
Sin "		-	257.41	+		50.67	+		265.63
log "	2.41	0.63	m	1.70	4.75		2.42	4.28	
log cos	9.97	6.92		9.96	8.37		9.97	3.92	
" S ₀	0.89	4.79	m	0.18	0.36		0.90	5.44	
S ₀	-	7.8486		+	1.5148		+	8.0434	
S ₁	-	51		+	3			19	
S	14.14	63		23.51	51		30.04	53	
X	15.01	01		23.63	44		30.03	53	
X-S	+	8638		+	1193		-	0100	
C	18	26	20.4	+21	31	44.5	19	35	07.1
q			20.6			44.9			07.3
E			20.4			44.4			07.2
m	18	26	20.5	+21	31	44.6	19	35	07.2
Prec	+	04	32.0	+	04	26.8	+	04	23.2
S	+18	30	52.5	+21	36	11.4	+19	39	30.4
D	+20	24	05.5	+20	24	05.5	+20	24	05.5
S-D	-1	53	13.0	+1	12	05.9	-	44	35.1
tan "		-	6795.4		+	4326.5		-	2675.2
log "	3.83	2.21	m	3.63	6.14		3.42	7.35	m
log uo	1.16	3.36	m	0.96	7.29		0.75	8.50	m
log tan	9.52	4.9		9.59	7.7		9.55	2.9	
S ₀ ²	1.78	9.6		0.36	0.7		1.81	0.9	
" n ₁	8.36	7.9		7.01	1.8		8.41	7.2	
n ₀	-14.56	6.7		+	9.27	4.5	-5.73	4.6	
n ₁	+0.02	3.3		+	0.00	1.0	+	0.02	6.1
n	3.43	6.6		27.27	5.5		12.29	1.5	
y	4.48	1.2		27.27	3.2		18.08	9.6	
y-n	+10.24	6		-	0.02	3	+	7.98	1

Standard Coordinates									
12017									
Cape No 372	mag 6.8	Cape No 383	mag 5.3	Cape No 393	mag 5.7				
C	02 28	098	02 33	08.16	02 36	43.56			
Q		1.02		08.15		43.61			
E		0.95		08.15		43.56			
M	02 28	098	02 33	08.15	02 36	43.5			
Prec		+ 56.88		+ 57.81		+ 57.37			
X	02 28	57.86	02 34	05.96	02 37	40.94			

A
X-A
Sum "
log "
log cos δ
" S₁

S_0						
S_1	-	51	+	3		19
S		14.1468		23.5151		30.0453
X		15.0101		23.6344		30.0353
$1-S$	+	8.638	+	1.193		- 0.100

C	18 26	20.44	+21 31	44.5	19 35	07.1			
Q		20.6		44.9		07.			
E		20.4		44.4		07.			
M	18 26	20.5	+21 31	44.6	19 35	07.2			
Prec	+ 04	32.0	+ 04	26.8	+ 04	23.2			
S	+ 18 30	52.5	+21 36	11.4	+19 39	30.4			

Q
S-F
tan "
log "
log cos δ

log tan δ
S₀²
" n₁

n ₁									
n ₁									
n ₁	3.4566		27.2755		12.291				
y	4.4812		27.2732		13.0896				
4-n	+10.246		- 0.023		+ 7.981				

12017

Moon's Center

6

 $\Delta x (x-x_0)^2$ $+ (y-y_0)^2$

O-C

1	23.8060	-0.0000	0.0000	3.6260	-	38
2	23.0000	-0.8060	0.6496	3.6269	-	29
3	22.0495	-1.7565	3.0852	3.6348	+	45
4	X 21.9011	-1.9049	3.6286	3.6286	-	12
5	21.9195	-1.8865	3.5589	3.6260	-	38
6	22.0000	-1.8060	3.2616	3.6382	+	34
7	22.3804	-1.4256	2.0323	3.6374	+	76
8	23.0000	-0.8060	0.6496	3.6287	-	11
				3.6298		

 Δy

arc

1	12.8368	-1.9042	0.36260	180
2	13.0155	-1.7255	2.9773	205
3	14.0000	-0.7410	0.5491	247
4	14.7410	-0.0000	0.0000	270
5	15.0000	+0.2590	0.0671	278
6	15.3506	+0.6096	0.3716	289
7	16.0000	+1.2590	1.5851	311
8	16.4670	+1.7260	2.9791	335
				arc 755

Approx. Center

$$X = 23 \quad y = 13.0155$$

$$16.4670$$

$$29.4825$$

$$y_0 \quad 14.7412$$

$$y \text{ min} \quad 12.8368$$

$$R \quad 1.9044$$

$$1.9052$$

$$X \text{ min} \quad 21.9011$$

$$X_0$$

$$\text{Moon's Center} \quad \left\{ \begin{array}{l} X_0 \quad 23.8060 \\ y_0 \quad 14.7410 \end{array} \right.$$

2017

Moons Center

6

 $\Delta x (1 - \lambda_0)^2$ $+y - y_0)^2$

O-C

1	23.8060	+0.0000	0	0.0000	3.6260	-	38
2	23.0000	-0.8060		0.6496	3.6269	-	29
3	22.0495	-1.7565		3.0852	3.6343	+	45
4	21.9011	-1.9049		3.6286	3.6286	-	12
5	21.9195	-1.8865		3.5589	3.6260	-	38
6	22.0000	-1.8060		3.2616	3.6382	+	34
7	22.3804	-1.4256		2.0323	3.6374	+	76
8	23.0000	-0.8060		0.6496	3.6287	-	11
					3.6298		

 Δy

1	12.8368	-1.9042	0	3.6260	180
2	13.0155	-1.7255		2.9773	205
3	14.0000	-0.7410		0.5491	247
4	14.7410	-0.0000		0.0000	270
5	15.0000	+0.2590		0.0671	278
6	15.3506	+0.6096		0.3716	289
7	16.0000	+1.2590		1.5851	311
8	16.4670	+1.7260		2.9791	335

arc 755

Approx. Center

$$x = 23 \quad y = 13.0155$$

$$16.4670$$

$$29.4825$$

 y_0

$$14.7412$$

 y_{min}

$$12.8368$$

 R

$$1.9044$$

$$1.9052$$

 x_{min}

$$21.9011$$

 x_0

$$\text{Moons Center} \left\{ \begin{array}{l} x_0 \quad 23.8060 \\ y_0 \quad 14.7410 \end{array} \right.$$

Formation of Normals

1	+ 0.00	+ 0.00	+ 72.3
2	+ 1.39	+ 23.5	+ 49.8
3	+ 1.30	- 79.3	- 33.3
4	+ 0.00	+ 22.8	+ 0.0
5	- 0.49	+ 72.0	- 9.9
6	- 1.10	- 61.4	+ 20.7
7	- 1.79	- 108.0	+ 95.7
8	- 1.40	+ 9.3	- 19.0
	<hr/>	<hr/>	<hr/>
	+ 2.69	+ 127.6	+ 238.5
	- 4.78	- 248.7	- 62.2
	- 2.09	- 121.1	+ 176.3

	a	L	c	corr
	+ 0	+ 10	- 28	- 40
a	- 24	+ 9	- 9	- 18
b	- 5	+ 4	+ 8	+ 53
c	+ 38	+ 0	+ 8	- 14
	+ 45	- 1	+ 6	- 46
	+ 43	- 3	+ 2	+ 18
	+ 34	- 6	- 10	+ 41
	+ 20	- 9	- 27	- 66

12817

Conditional Equations

0 - e

1	-0.0.0	-1.9.0	= -38	+ 0	-26	= -26	-1.2	-0.0
2	-0.8.1	-1.7.2	= -29	+ 4	-24	= -20	- 9	-0.0
3	-1.7.6	-0.7.4	= +45	+10	-10	= 0	+45	+0.0
4	-1.9.0	-0.0.0	= -12	+10	- 0	= +10	-22	-0.0
5	-1.8.9	+0.2.6	= -38	+10	+ 4	= +14	-52	-0.0
6	-1.8.1	+0.6.1	= +34	+10	+ 8	= +18	+16	+0.0
7	-1.4.2	+1.2.6	= +76	+ 8	+17	= +25	+51	+0.0
8	-0.8.1	+1.7.3	= -11	+ 4	+24	= +28	-39	-0.0
								+112 - 134
								av. 31

$$+16.86 - 2.09 = -121.1 \quad -10.40$$

$$-2.09 + 12.14 = +176.3 \quad -0.50$$

$$+() - 0.26 = -15.0 \quad -1.04$$

$$+11.88 = +161.3$$

$$b = +13.6 - 0.13$$

$$+16.86 = -121 + 28.4 = -92.6$$

$$a = -5.5 - 0.63$$

$$\text{arc} = 1.55 \quad \phi = 0.19$$

$$\frac{\Sigma v}{n} = -2.75$$

$$\frac{-2.75}{0.19} = -14.5$$

$$\Delta R = -0.2^{\circ}$$

$$\text{corr} + 0.5^{\circ}$$

$$\text{err 4} \quad R = 1.9.1$$

$$\text{true } \Delta R = -0.7^{\circ}$$

$$-2 R.C. = -1.9.1$$

$$\Delta t = +0.25$$

$$\Delta \delta = +0.1$$

$$\Delta \alpha = +1.20$$

$$\Delta \alpha = +0.04$$

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Conditional Equations

			0 - c				0 - c	
1	-0.0.0	-1.90	= -38	+	0	-26	= -26	-1.2
2	-0.81	-1.72	= -29	+	4	-24	= -20	-9
3	-1.7.6	-0.74	= +45	+	10	-10	= 0	+45
4	-1.90	-0.00	= -12	+	10	-0	= +10	-22
5	-1.89	+0.26	= -38	+	10	+4	= +14	-52
6	-1.81	+0.61	= +34	+	10	+8	= +18	+16
7	-1.42	+1.26	= +76	+	8	+17	= +25	+51
8	-0.81	+1.73	= -11	+	4	+24	= +28	-39

$$-16.86 - 2.09 = -121.1 \quad -10.40$$

$$-2.09 + 12.14 = +176.3 \quad -0.50$$

$$-(0.) - 0.26 = -15.0 \quad -1.04$$

$$+11.88 = +161.3$$

$$b = +13.6 - 0.13$$

$$16.86 = -121 + 284 = -92.6$$

$$a = +5.5 - 0.63$$

$$\text{arc} = 155^\circ \quad \frac{\Delta}{\Sigma} = 0.19$$

$$\frac{\Sigma \Delta}{n} = -2.15^\circ$$

$$\frac{-2.75^\circ}{0.19} = -14.5^\circ$$

$$\Delta R = -0.2$$

$$\text{corr} + 0.5^\circ$$

$$\text{err } 4 \quad R = 1.91$$

$$\text{true } \Delta R = 0.7^\circ$$

$$-2RC = -1.91$$

$$\Delta b = +0.25^\circ$$

$$\Delta \delta = +0.1$$

$$\Delta a = +1.20$$

$$\Delta \alpha = +0.09$$

12817

Mean Moon Position

8

$$\begin{array}{r} Y_0 \quad 23.8060 \checkmark \\ \quad \quad -3 \\ \hline 23.8057 \checkmark \end{array}$$

$$\begin{array}{r} Y_0 \quad 14.7410 \checkmark \\ \quad \quad +7 \\ \hline 14.7417 \checkmark \end{array}$$

From Plate Comparison

$$\begin{array}{r} 23.5241 \\ 22 \\ \hline + \quad 1.5241 \checkmark \end{array}$$

$$\begin{array}{r} 14.1121 \checkmark \\ 18 \\ \hline -3.8879 \checkmark \end{array}$$

$$\begin{array}{r} \log S_0 \quad 0.18301 \checkmark \\ \log \cos \delta_0 \quad 9.97328 \checkmark \\ \quad \quad 8.50724 \\ \log \sin(\alpha - A) \quad 1.70249 \checkmark \end{array}$$

$$\begin{array}{r} \log \tan \delta_0 \quad 9.5583 \checkmark \\ \log S_0^2 \quad 0.3660 \checkmark \\ \quad \quad 7.0534 \\ \log \eta_1 \quad 6.9777 \checkmark \end{array}$$

$$\sin(\alpha - A) + 50.41$$

$$\begin{array}{r} \eta_1 \quad 0.0009 \checkmark \\ \eta_0 \quad -3.8888 \checkmark \end{array}$$

$$\alpha - A \quad +50.41 \checkmark$$

$$A \quad 02 \quad 33 \quad 15.29$$

$$\log \eta_1 \quad 0.58982 \checkmark$$

$$\alpha_0 02 \quad 34 \quad 05.70 \checkmark$$

$$\log \tan(\delta - \delta_0) \quad 3.25867 \checkmark$$

$$\tan(\delta - \delta_0) \quad -1814.1$$

$$\text{Red} \quad + 1.74$$

$$-30.14.1 \checkmark$$

$$\alpha' 02 \quad 34 \quad 07.44 \checkmark$$

$$\delta + 20 \quad 24 \quad 05.5$$

$$\delta_0 + 19 \quad 53 \quad 51.4 \checkmark$$

$$\text{Red} \quad + 11.5$$

$$\delta' + 19 \quad 54 \quad 02.9 \checkmark$$

12017

Mean Mean Position

8

$$\begin{array}{r} \gamma_0 \quad 23.8060 \\ \quad \quad -3 \\ \hline 23.8057 \end{array}$$

$$\begin{array}{r} \gamma_0 \quad 14.7410 \\ \quad \quad +7 \\ \hline 14.7417 \end{array}$$

From Plate Coordinates

$$\begin{array}{r} 23.5241 \\ 22. \\ \hline + 1.5241 \end{array}$$

$$\begin{array}{r} 14.1121 \\ 118 \\ \hline -3.8879 \end{array}$$

$$\begin{array}{l} \log S_0 \quad 0.18301 \\ \log \cos \delta_0 \quad 9.97328 \\ \quad \quad 8.50724 \\ \log \sin(x-A) \quad 1.70249 \end{array}$$

$$\begin{array}{l} \log \tan \delta_0 \quad 9.5583 \\ \log S_0^2 \quad 0.3660 \\ \quad \quad 7.1534 \\ \log \eta_1 \quad 6.9777 \end{array}$$

$$\sin(x-A) + 50.41$$

$$\begin{array}{l} \eta_1 \quad 0.0009 \\ \eta_0 \quad -3.8888 \end{array}$$

$$x-A \quad +50.41$$

$$A \quad 02 \quad 33 \quad 15.29$$

$$\alpha_0 \quad 02 \quad 34 \quad 05.70$$

$$\text{Red} \quad + 1.74$$

$$\alpha' \quad 02 \quad 34 \quad 07.44$$

$$\begin{array}{l} \log \eta_1 \quad 0.58982 \\ \quad \quad 7.33115 \\ \log \tan(\delta - \delta') \quad 3.25867 \end{array}$$

$$\tan(\delta - \delta') \quad -18.14.1$$

$$-30 \quad 14.1$$

$$\delta + 20 \quad 24 \quad 05.5$$

$$\delta_0 + 19 \quad 53 \quad 51.4$$

$$\text{Red} \quad + 11.5$$

$$\delta' + 19 \quad 54 \quad 02.9$$

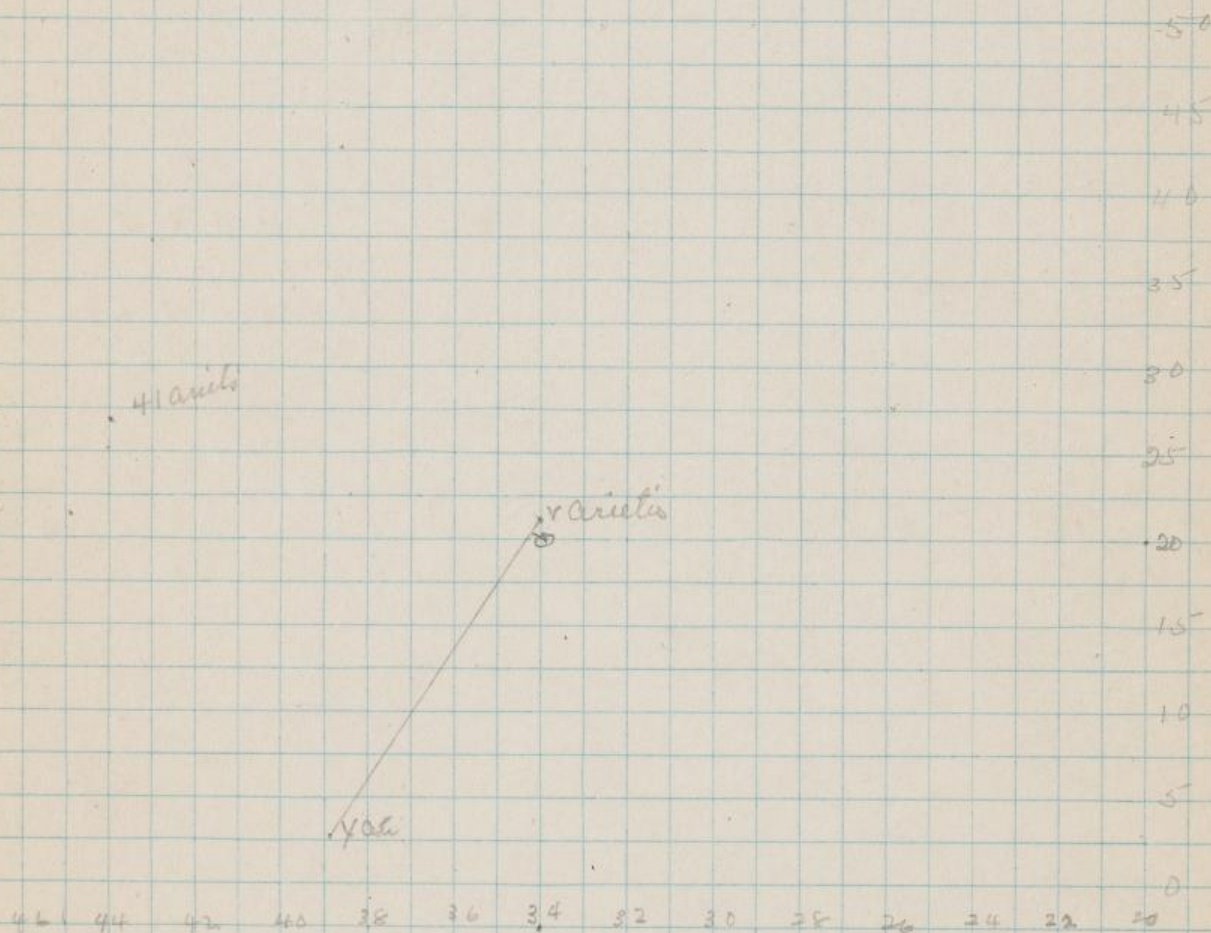
$$\begin{array}{r}
 02 \quad 34 \quad 07.766 \\
 02 \quad 34 \quad 06.008 \\
 + 1.752 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 02 \quad 39 \quad 01.562 \\
 02 \quad 38 \quad 59.876 \\
 \hline
 1.686
 \end{array}$$

.072

$$\begin{array}{r}
 21 \quad 36 \quad 23.32 \\
 + 21 \quad 36 \quad 11.29 \\
 \hline
 + 12.03
 \end{array}$$

$$\begin{array}{r}
 2 \quad 53 \quad 18.06 \\
 2 \quad 53 \quad 11.96 \\
 \hline
 6.10
 \end{array}$$



12017

Reduction to Apparent Place

9

$$H + \alpha^0 \quad 01 \quad 49.5 \quad 27 \quad 22.5$$

$$H \quad 23 \quad 15.4$$

$$\alpha_0 \quad 02 \quad 34.1$$

$$G \quad 22 \quad 30.5$$

$$G + \alpha_1 \quad 01 \quad 04.6 \quad 16 \quad 09.0$$

$$\delta_0 \quad 19^0 \quad 53.6$$

$$\log \cos \delta_0 \quad 9.9733$$

$$\log (1) \quad 0.2334^m$$

$$(1) \quad 0.2067^m$$

$$\log \cos G + \alpha_1 \quad 9.9825$$

$$\log g \quad 0.8566$$

$$\log \sin G + \alpha_1 \quad 9.4443$$

$$\log \tan \delta_1 \quad 9.5585$$

$$8.8239$$

$$\log g' \quad 0.8391$$

$$\log g \quad 8.6833$$

$$\log \sin \delta_0 \quad 9.5318$$

$$\cos (H + \alpha_1) \quad 9.9485$$

$$\log h \quad 1.3095$$

$$\log \sin (H + \alpha_1) \quad 9.6626$$

$$\sec \delta_0 \quad 0.0267$$

$$8.8239$$

$$\log (1') \quad 0.7898$$

$$\log (2') \quad 9.8227$$

$$\delta \quad +1.030$$

$$(\delta) \quad +0.048$$

$$(\delta) \quad +0.665$$

$$\text{Red.} \quad +1.743$$

$$(g') \quad +6.904$$

$$(g') \quad +6.163$$

$$i \quad -1.609$$

$$\text{Red.} \quad +1.458$$

12017

Reduction to Apparent Place

9

$H + \alpha$	01	47.5	27	22.5		
H	23	15.4			S_0	$19^\circ 53.6$
α_0	02	34.1			$\log \cos S_0$	9 9 7 3 3
G	22	30.5			$\log 11$	0 2 3 3 4 ~
$G + \alpha_1$	07	04.6	16	09.0	(11)	0 2 0 6 7 ~

$\log \cos G + \alpha_1$	9 9 8 2 5
$\log g$	0 8 5 6 6
$\sin G + \alpha_1$	9 4 4 4 3
$\tan S_1$	9 5 5 8 5
	8 8 2 3 9

$\log g'$	0 8 3 9 1
$\log g$	8 6 8 3 3

g	+ 1.030
(g')	+ 0.048
(g)	+ 0.665
Red.	+ 1.743

$\log \sin S_1$	9 5 3 1 8
$\cos(H + \alpha_1)$	9 9 4 8 5
$\log h$	1 3 0 9 5
$\sin(H + \alpha_1)$	9 6 6 2 6
$\sec S_0$	0 0 2 6 7
	8 8 2 3 9

$\log(h')$	0 7 8 9 8
$\log(h)$	9 9 2 2 7

(g')	+ 6 9 0 4
(h')	+ 6 1 6 3
i	- 1 6 0 9
Red.	+ 1 1 4 5 8

12017

Lunar Parallax

10

α' 02 34 07.44 ✓
 θ 02 26 55.90 ✓
 $\theta - \alpha'$ - 07 11.54 ✓
 $\frac{1}{2}(\alpha - \alpha')$ - 01 47 53.10 ✓
 $\theta - \frac{1}{2}(\alpha - \alpha')$ - 01 47 11.40 ✓

π 56 " 10.23 ✓
 $\log \sin \pi$ 9.86 91 3
 $\log \sin (\theta - \alpha')$ 8.21 32 2 ✓
 $\sec \delta'$ 8.49 66 2 ✓
 $\sin (\alpha - \alpha')$ 0.02 77 2 ✓
 $\sin (\alpha - \alpha')$ 6.60 66 9 ✓

$(\alpha - \alpha')$ - 1' 23" 39 ✓
 $=$ - 5.56 ✓

$\log \cos \frac{1}{2}(\alpha - \alpha')$ 9.95 72 7
 $\sec \theta - \frac{1}{2}(\alpha - \alpha')$ 0.00 00 0
 $\log \tan \gamma$ 9.95 74 8 ✓

γ 42 12 00.0 ✓

δ' 19 54 02.9 ✓

$\gamma - \delta'$ 22 17 57.1 ✓

$\log \sin \pi$ 9.82 64 0
 $\sin \gamma - \delta'$ 8.21 32 2 ✓
 $\cos \sec \gamma$ 9.57 91 4 ✓
 $\sin (\delta - \delta')$ 0.17 28 1 ✓
 $\sin (\delta - \delta')$ 7.79 15 7 ✓

$\delta - \delta'$ + 21 16.4 ✓

δ 20 15 19.3 ✓

$\gamma - \delta$ + 20 15 17.7 ✓

$\theta - \delta$ + 1.6 ✓

Curv. - 0.1 ✓

2nd Order Ref. - 0.0

$\delta =$ + 20 15 19.2

$\theta - \delta =$ + 1.5

α 02 34 01.88 ✓

$\gamma - \alpha$ 02 34 01.06 ✓

$\theta - \alpha$ + 0.82 ✓

Curv. + 0.02 ✓

$\alpha =$ 02 34 01.90

$\theta - \alpha =$ + 0.84

12017

Lunar Parallel

10

α' 02 34 07.44
 θ 02 26 55.90
 $\theta - \alpha'$ - 07 11.54
 $\frac{1}{2}(\alpha - \alpha')$ - 01 47 53.10
 $\frac{1}{2}(\alpha - \alpha')$ - 01 47 11.40

$\log \cos \frac{1}{2}(\alpha - \alpha')$ 9.95727
 $\sec \theta - \alpha'$ 0.00000
 $\log \tan \gamma$ 9.95748

γ 42 12 00.0

δ' 19 54 02.9

$\gamma - \delta'$ 22 17 57.1

$\log \sin \pi$ 9.82640
 $\sin \gamma - \delta'$ 8.21322
 $\csc \gamma$ 9.57924
 $\sin(\delta - \delta')$ 0.17281
 $\sin(\delta - \delta')$ 7.79168

$\delta - \delta'$ + 21 16.4

δ 20 15 19.3

$\gamma - \delta$ + 20 15 17.7

$\theta - \epsilon$ + 1.6

$\csc \gamma$ - 0.1

2nd Order Ref. - 0.0

δ + 20 15 19.2

$\theta - \epsilon$ + 1.5

π 56 " 10.23
 $\log \sin \pi$ 9.86913
 $\log \sin(\theta - \alpha')$ 8.21322
 $\sec \delta'$ 8.49662
 $\sin(\alpha - \alpha')$ 0.02772
 $\sin(\alpha - \alpha')$ 6.60669

$(\alpha - \alpha')$ - 1' 23" 39
 $=$ - 5.56

α 02 34 01.88

$\gamma - \alpha$ 02 34 01.06

$\theta - \epsilon$ + 0.82

$\csc \gamma$ + 0.02

$\alpha =$ 02 34 01.90

$\theta - \epsilon$ + 0.84

1
156
4.9

2
24.0
27.0

3
20.0
8.0

1
25.0
13.0

2
24.0
13.0

3
23.0
14.0

12018

Star Measures.

11

1	16150	18482	16493	17168
156	18759 ⁶⁰	15882	6811 ¹³	16849
4.9	61	84 ⁸³	15	49
	50	80	93	60
	<u>157390</u>	<u>157402</u>	<u>49680</u>	<u>49682</u>
2	17447	16586	18006	16870
24.6	11150	12872 ⁷⁴	11448 ⁵⁰	13430 ²⁶
27.6	50	76	52	22
	47	86	06	60
	<u>24.6297</u>	<u>24.6288</u>	<u>27.6556</u>	<u>27.6560</u>
3	17442	16017	17479	17746
29.9	8798	14658 ⁵³	13505 ⁰⁶	11716
33	98	48	07	16
	32	6011	79	40
	<u>308544</u>	<u>308642</u>	<u>13.3973</u>	<u>13.3972</u>

Moon Measures.

1		17410	17703
25.2		12730 ³⁵	12365
18.5		40	65
		10	03
		<u>13.4675</u>	<u>13.4662</u>
2		17872	16261
24.0		8832	15116
13.9		32	16
		92	6261
		<u>13.8840</u>	<u>13.8855</u>
3	17660	17830	
23.9	8841	16640 ⁴⁵	
14.0	41	50	
	60	30	
	<u>23.8819</u>	<u>23.8815</u>	

1
137
4.9

2
24
27

3
30
13

5
5

12018

Star Measures.

11

1	16150	18482	16478	17168
137	18759 ⁶⁰	15888	6817 ¹³⁰	16849
4.9	61	89 ⁵³	15	49
	50	80	93	60
	<u>157390</u>	<u>157402</u>	<u>49680</u>	<u>49682</u>

2	17447	16586	18005	16870
246	11150	12872 ⁷⁴	11448 ⁵⁰	13430
27.6	510	76	52	22 ²⁶
	47	86	05	60
	<u>246297</u>	<u>246288</u>	<u>276558</u>	<u>276560</u>

3	17442	16017	17479	17746
308	18798 ⁴	14658 ⁵³	13505 ⁶	11716
133	98	48	92	16
	32	6011	79	40
	<u>308644</u>	<u>308642</u>	<u>133973</u>	<u>133972</u>

Moon Measures.

5.2	17410	17703
15	12730 ³⁵	12385
	40	65
	10	03
	<u>134675</u>	<u>134662</u>

1.0	17872	16261
9	8832	15116
	32	16
	92	6261
	<u>138840</u>	<u>138855</u>

9	17660	17830
10	8841	16690 ⁴⁵
	41	50
	60	30
	<u>238819</u>	<u>238815</u>

12018

Mass Measures

12

4	18108	17818
23.4	14742	1117476
15.0	36	78
	08	18
<u>23.3369</u>		<u>23.3358</u>

5	18101	17654
23.3	15122	10636
15.2	18	36
	01	54
<u>23.2981</u>		<u>23.2982</u>

6	18416	18650
23.5	14368	1268084
16.0	68	88
	16	50
<u>23.4048</u>		<u>23.4034</u>

7	17752	18682	16288
24.0	15618	1018691	14776
16.8	18	96	76
	52	82	88
<u>24.2134</u>		<u>16.8491</u>	<u>16.8488</u>

8	17752	18850
24.3	15618	10985
17.0	18	85
	52	8850
<u>24.2134</u>		<u>24.2135</u>

12018

Mass Measures

12

4	18108	17818
23.4	14742 ₃₉	11174 ₇₆
15.0	36	78
	08	18
	<u>23.3369</u>	<u>23.3352</u>

5	18101	17654
23.3	15122 ₂₀	10636
15.2	18	36
	01	54
	<u>23.2921</u>	<u>23.2982</u>

6	18416	18650
23.5	14368	12680 ₈₄
16.0	68	88
	16	50
	<u>23.4042</u>	<u>23.4034</u>

7	17752
24.1	15617
16.8	18
	2
	<u>2184</u>

18682	16288
10186 ₉₁	14776
96	76
82	88
<u>168491</u>	<u>168482</u>

8	17752	18850
24.3	15618	10985
17.0	18	85
	52	8850
	<u>24.2134</u>	<u>24.2135</u>

12018

18

Times Etc.

Date Jan. 2, 1917

Exp. to Stars	02	47		02	59	
Exp. to Moon	02	53	06.2	02	53	06.4
Clock Fast		12	41.4			
H. Sid. Time	02	40	24.9 ^v			$\delta = +0^h 6^m$
H. Long	04	44	31.05 ^v			
G. Sid. Time	07	24	55.95 ^v			
G. Sid. Time Moon	18	46	12.20 ^v			
Interval	12	38	43.75 ^v			
Red		- 02	04.30			
G. M. T	12	36	39.45 ^v		12 ^h 6.11 ^v	

From Naut. Alman.

R. A.

Dec.

Moon 12 ^h	02	33	10.65 ^v +20	11	51.4
Motion 1 ^m			2.1722 ^v		+8.878 ^v
" 36 ^m 6575 ^v		01	19.63 ^v	05	25.4 ^v
Tabular Place	02	34	30.28 ^v +20	17	16.8 ^v

Moon's Age 9^d

934" 14.5

$a = -504.5$
 $+24.0$
 -480.5

Parallax	56	09.89 ^v
Semi-Diam	15	19.9 ^v
R	9	19.9 ^v
Aug		14.1
Sr 5.		-0.3
R		933.7 ^v
R		2001.5 ^v
1+a/R		-962 ^v
R		1905.3 ^v
R2		3.6301 ^v

12018

13

Times Etc.

Date Jan 2, 1917

xp to Stars	02	47		02	59
xp to Moon	02	53	06.2	02	53 06.4
Lock Fast:		12	41.4		

4. Sid. Time	02	40	24.9	$\theta = +0^{\circ} 6^m$
4. Long	04	44	31.05	
G. Sid. Time	07	24	55.95	
G. Sid. Time Midnoon	18	46	12.20	
Interval	12	38	43.75	
Red T.		-02	04.30	
G.M.T	12	36	39.45	12 ^h 6 ^m 11 ^s

u. Haut. Alt.		R.A.		Dec.
apri 12 ^h	02	33	10.65 +20	11 51.4
tuu 1 ^h			2.1722	8878
36.6575		01	19.63	05 25.4
ular Place	02	34	30.28 +20	17 16.8

Moon's Age 9^d

934" 14.5"

$$\begin{array}{r}
 A = -5^{\circ} 04.5' \\
 + 24.0 \\
 \hline
 = -48^{\circ} 0.5'
 \end{array}$$

Parallax	56'	09.89
Semi-Diame	15'	19.9
R		9 19.9
Aug		14.1
2hr 5.		-0.3
R		9337
R		2001.5
1+AR		-962
R		1905.3
R2		3.6301

13018

Plate Constants

14

$$\begin{array}{rcl} X & 15.7396 & 24.6293 & 30.8643 \\ \Sigma & 14.1463 & 23.5151 & 30.0453 \end{array}$$

$$\begin{array}{rcl} y & 4.9681 & 27.6558 & 13.3972 \\ d_y & 3.4566 & 27.2755 & 12.2915 \end{array}$$

$$\begin{array}{rcl} X-S+500X & +13.5y & +4.5X-23941 \\ +1.5933+7870 = 23803 & +67 = 23870 & +71 = 23941 \\ +1.1142+12315 = 23457 & +373 = 23830 & +111 = 23941 \\ +.8190+15432 = 23622 & +181 = 23803 & +139 = 23942 \\ 25.2839+12602 & +207 & +113 = 241020 \end{array}$$

$$\begin{array}{rcl} y-z+500y & -12.3X & +3.4y-17422 \\ +1.5115+2484 = 17599 & -194 = 17405 & +17 = 17422 \\ +3803+13828 = 17631 & -303 = 17328 & +97 = 17422 \\ +1.1057+6699 = 17756 & -380 = 17376 & +47 = 17422 \\ 15.3735+7687 & -310 & +52 = 143742 \end{array}$$

$$\begin{array}{rcl} a = +0.9 & e = +0.5 & a-e = +0.4 & b+d = 0.0 \\ -564.5 & -503.4 & -1.1 & = -1.2 \\ -505.4 & -503.9 & -1.5 & -1.2 \end{array}$$

12018

Plate Constants

14

X	15.7396	24.6293	30.8643
Y	14.1463	23.5151	30.0453

4	4.9681	27.6558	13.3972
5	3.4566	27.2755	12.2915

$-S + 500X$	$+ 13.5Y$	$+ 45X - 23941$
$15933 + 7870 = 23803$	$+ 67 = 23870$	$+ 71 = 23941$
$11142 + 12315 = 23457$	$+ 373 = 23830$	$+ 111 = 23941$
$8190 + 15432 = 23622$	$+ 181 = 23803$	$+ 139 = 23942$
$252039 + 12402$	$+ 207$	$+ 113 = 241026$

$-3 + 500Y$	$-12.3X$	$+ 34Y - 1742$
$15115 + 2484 = 17599$	$= 194 = -17405$	$+ 175 = 17422$
$3803 + 13828 = 17631$	$= 383 = -17328$	$+ 97 = 17422$
$11057 + 6699 = 17756$	$= 380 = -17376$	$+ 47 = 17422$
$153735 + 7687$	$- 310$	$+ 52 = 143742$

$+0.9$	$a = +0.5$	$a - c = +0.4$	$a + d = 0.0$
504.5	-503.4	-1.1	-1.2

12018

Mean's Center

D-e 15

1	25.20.40	0.00000	0.00000	3.6339	+	38
2	24.0000	-1.2040	1.4496	3.6299	-	2
3	23.8848	-1.3192	1.7403	3.6257	-	44
4	23.3364	-1.8676	3.4879	3.6270	-	31
5	23.2982	-1.9058	3.6320	3.6320	+	19
6	23.4041	-1.7999	3.2396	3.6327	+	26
7	24.0000	-1.2040	1.4496	3.6282	-	19
8	24.2134	-0.9906	0.9819	3.6293	+	92
				3.6301		

AY

L

1	13.4668	-1.9062	-1	3.6339	180°
2	13.8965	-1.4765	-1	2.1803	219
3	14.0000	-1.3730	-1	1.8854	224
4	15.0000	-0.3730	-0	0.1391	259
5	15.3730	-0.0000	-0	0.0000	270
6	16.0000	+0.6270	+0	0.3931	289
7	16.8489	+1.4759	+1	2.1786	321
8	17.0000	+1.6270	+1	2.6474	329

Approx. Center

Range 149

X = 24	Y =	13.8965
		16.8489
		30.7454
	Y ₀	15.3727
	Y _{min}	13.4668
	R	1.9059
	Com R.	1.9053
X _{min}		23.2982
		25.2035

$$\text{Mean's Center} \left\{ \begin{array}{l} X_0 = 25.2040 \\ Y_0 = 15.3730 \end{array} \right.$$

12018

Moon's Center

0-2 15

1	25.20.40	0.00000	0.00000	3.6339	+	38
2	24.0000	-1.2040	1.4496	3.6299	-	2
3	23.88.48	-1.3192	1.7403	3.6257	-	44
4	23.33.64	-1.8676	3.4879	3.6270	-	31
5	23.29.82	-1.9058	3.6320	3.6320	+	19
6	23.40.41	-1.7999	3.2396	3.6327	+	26
7	24.0000	-1.2140	1.4496	3.6282	-	19
8	24.21.34	-0.9906	0.9819	3.6293	+	92
				3.6301		

A1

L

1	13.46.68	-1.9062	-1.36339	18.0
2	13.89.65	-1.4765	-1.21803	21.9
3	14.0000	-1.3730	-1.8854	22.4
4	15.0000	-0.3738	-0.1391	25.9
5	15.37.30	-0.0000	-0.0000	27.0
6	16.0000	+0.6270	+0.3931	28.9
7	16.84.89	+1.4759	+1.21786	32.1
8	17.00.00	+1.6270	+1.26474	32.9

approx. Center

X - 24	Y -	13.89.65
		16.84.89
		30.74.54
	Y ₀	15.37.27
	Y _{min}	13.46.68
	R	1.9059
	Corr R.	1.9053
X _{min}		23.29.82
		25.20.35

Moon's Center

X₀ 25.20.40Y₀ 15.37.30

Formation of Normals

1 +0.00	- 000.0	- 72.6
2 +1.78	+ 2.4	+ 3.0
3 +1.81	+ 58.0	+ 60.3
4 +0.69	+ 58.0	+ 11.5
5 +0.00	- 36.1	- 0.0
6 -1.14	- 46.9	+ 16.3
7 -1.76	+ 22.8	- 27.9
8 -1.61	- 91.0	+ 150.0
+ 4.28	+ 141.2	+ 241.1
- 4.51	- 174.0	- 100.5
- 0.23	- 32.8	+ 140.6

	a	b	c	O-C corr
a - 5	+ 0	+ 2	- 5	+ 53
b - 1	+ 6	+ 1	- 6	+ 6
c - 7	+ 7	+ 1	- 6	- 36
	+ 9	+ 0	- 7	- 38
	+ 10	0	- 7	+ 8
	+ 8	- 1	- 8	+ 7
	+ 6	- 1	- 8	- 45
	+ 5	- 2	- 9	+ 64

12018

Conditional Equations

16

			0 - C				0 - e corr
1	-0.00	-1.91 = +	38	+	0	-20 = -20	+58 +53
2	-1.20	-1.48 = -	2	+	2	-16 = -14	+12 +
3	-1.32	-1.37 = -	44	+	3	-15 = -12	-30 -
4	-1.87	-0.37 = -	31	+	4	-4 = 0	-31 -
5	-1.90	0.00 = +	19	+	4	-0 = +4	+15 +
6	-1.80	+0.63 = +	26	+	4	+7 = +11	+15 +
7	-1.20	+1.47 = -	19	+	2	+16 = +18	-37 -
8	-0.99	+1.63 = +	92	+	2	+17 = +19	+73 +
							+173 -98

ar 34

$$15.98 - 0.23 = -32.8 - 10.28$$

$$-0.23 + 13.06 = +140.6 - 1.40$$

$$+C - 0 = -0.5$$

$$+13.06 = +140.1$$

$$15.98 = -32.8 + 2.5 = -30.3$$

$$-0.12 \Delta$$

$$b = +10.7^{\circ}$$

$$a = -1.9^{\circ}$$

$$-0.64 \Delta$$

$$\text{arc } 149$$

$$\frac{+94}{.15} = +625^{\circ}$$

$$\frac{P}{n} = .15$$

$$\frac{\Sigma v}{n} = +9.4^{\circ}$$

$$\Delta R = +0.8^{\circ}$$

$$\text{arc } 5$$

$$\text{corr } +0.1$$

$$R = 1.91$$

$$\text{True } \Delta R = +0.7$$

$$-2RC = -0.38$$

$$\Delta t = +0.04 - \Delta \delta = 0.0$$

$$\Delta a = +0.24 \quad \Delta \alpha = +0.01$$

12018

Conditional Equations.

16

			0-C				0-C
1	-0.00	-1.91	+	38	+	0	-20. = -20
2	-1.20	-1.48	-	2	+	2	-16 = -1.4
3	-1.32	-1.37	-	44	+	3	-15 = -12
4	-1.87	-0.37	-	31	+	4	-4 = 0
5	-1.90	-0.01	+	19	+	4	-0 = +4
6	-1.80	+0.63	+	26	+	4	+8 = +1.1
7	-1.20	+1.47	-	19	+	2	+16 = +18
8	-0.99	+1.63	+	92	+	2	+17 = +19

-1.13 -98

or 34

$$15.98 - 0.23 = -32.8 - 10.28$$

$$-0.23 + 13.06 = +140.6 - 1.40$$

$$+ () - 0 = -0.5$$

$$+ 13.06 = +140.1$$

$$15.98 = -32.8 + 2.5 = -30.3$$

$$-0.120$$

$$b = +10.7$$

$$a = -1.9$$

$$-0.640$$

$$\text{arc } 149$$

$$\frac{+24}{15} = +0.25$$

$$\frac{P}{n} = 15$$

$$\frac{ev}{n} = +9.9$$

$$\Delta R = +0.8$$

$$\text{err } 5$$

$$\text{corr } +0.1$$

$$R = 1.91$$

$$\text{True } \Delta R = +0.7$$

$$-2RC = -0.38$$

$$\Delta h = +0.04 \quad \Delta S = 0.0$$

$$\Delta a = +0.24 \quad \Delta \alpha = +0.08$$

12018

Mean Mean Position

17

$$X_0 \quad 25.2040 \quad \checkmark$$

$$\begin{array}{r} -1 \\ \hline 25.2039 \quad \checkmark \end{array}$$

$$4_0 \quad 15.3730 \quad \checkmark$$

$$\begin{array}{r} +5 \\ \hline 15.3735 \quad \checkmark \end{array}$$

From Plate Constants

$$24.1020$$

$$22$$

$$+2.1020 \quad \checkmark$$

$$74.3742 \quad \checkmark$$

$$18$$

$$-3.6258 \quad \checkmark$$

$$\log S_0 \quad 0.32263 \quad \checkmark$$

$$\log \cos \delta_0 \quad 9.97318 \quad \checkmark$$

$$8.50724$$

$$\log \sin(\alpha - A) \quad 1.84221 \quad \checkmark$$

$$\sin(\alpha - A) \quad 69.54$$

$$(\alpha - A) \quad 01 \quad 09.54 \quad \checkmark$$

$$A \quad 02 \quad 33 \quad 15.29$$

$$Q_1 \quad 02 \quad 34 \quad 24.83 \quad \checkmark$$

$$\text{Red} \quad + \quad 01.74 \quad \checkmark$$

$$Q' \quad 02 \quad 34 \quad 26.57 \quad \checkmark$$

$$\log \tan \delta \quad 9.5591 \quad \checkmark$$

$$S_0 \quad 0.6453 \quad \checkmark$$

$$7.1534$$

$$\log \eta \quad 7.2578 \quad \checkmark$$

$$\eta \quad 0.0018 \quad \checkmark$$

$$\eta_0 \quad -3.6276 \quad \checkmark$$

$$\log \eta_0 \quad 0.55962 \quad \checkmark$$

$$7.33115 \quad \checkmark$$

$$\log \tan(\delta - \delta') \quad 3.22847 \quad \checkmark$$

$$\tan(\delta - \delta') \quad -1.6923 \quad \checkmark$$

$$\delta - \delta'$$

$$-28 \quad 12.3 \quad \checkmark$$

$$\delta + 20 \quad 24 \quad 05.5 \quad \checkmark$$

$$\delta_0 + 19 \quad 55 \quad 53.2 \quad \checkmark$$

$$\text{Red} \quad + \quad 11.5$$

$$\delta' + 19 \quad 56 \quad 04.7$$

12018

Mean Mean Position

17

$$\begin{array}{r} X_0 \quad 25.2040 \\ \quad - \quad 1 \\ \hline 25.2039 \end{array}$$

$$\begin{array}{r} 4_0 \quad 15.3730 \\ \quad + \quad 5 \\ \hline 15.3735 \end{array}$$

From Plate Constants

$$\begin{array}{r} 24.1020 \\ 22 \\ \hline +2.1020 \end{array}$$

$$\begin{array}{r} 74.3742 \\ 18 \\ \hline -3.6258 \end{array}$$

$$\begin{array}{r} \log S_0 \quad 0.92263 \\ \log \cos \delta \quad 9.97318 \\ \quad 8.50724 \\ \log \sin(\alpha - N) \quad 1.84221 \end{array}$$

$$\sin(\alpha - N) \quad 69.54$$

$$(\alpha - N) \quad 01 \quad 09.54$$

$$A \quad 02 \quad 33 \quad 15.29$$

$$Q_1 \quad 02 \quad 34 \quad 24.83$$

$$\text{Red} \quad + \quad 01.74$$

$$Q' \quad 02 \quad 34 \quad 26.57$$

$$\begin{array}{r} \log \tan \delta \quad 9.5591 \\ S_0 \quad 0.6453 \end{array}$$

$$\begin{array}{r} 7.0534 \\ \log h \quad 7.2578 \end{array}$$

$$h \quad 0.0018$$

$$h_0 \quad -3.6276$$

$$\log h_0 \quad 0.55962 m$$

$$\log \tan(\delta - \delta') \quad 7.33115$$

$$\tan(\delta - \delta') \quad -1.6923$$

$$S_0$$

$$-28 \quad 12.3$$

$$R + 20 \quad 24 \quad 05.5$$

$$S_0 + 19 \quad 55 \quad 53.2$$

$$\text{Red} \quad + \quad 11.5$$

$$S' + 19 \quad 56 \quad 04.7$$

12018

Lunar Parallax

18

α 02 34 26.57[~]
 δ 02 40 24.90[~]
 $\theta - \alpha$ +05 58.33[~]
 $=$ 01 29 34.95[~]
 $1/2(\alpha - \alpha')$ 34.63[~]
 $\theta - \alpha' - "$ 01 29 0.32[~]

Π 53 09.9[~]
 9.86913
 $\log \sin \Pi$ 8.21318[~]
 $1/2 \sin \theta - \alpha'$ 8.41590[~]
 $1/2 \sec \delta''''$ 0.02781[~]
 $\sin(\alpha - \alpha')$ 6.52602[~]

$\log \cos 1/2(\alpha - \alpha')$ 9.95727
 $\sec \theta - \alpha' - "$ 0.00013[~]
 $\log \tan \gamma$ 9.95742[~]

$\alpha - \alpha'$ +1' 09.26[~]
 $=$ + 04.62[~]

γ 42 11 45.6[~]
 δ' 19 56 04.7[~]
 $\gamma - \delta'$ 22 15 40.9

9.82648
 $\log \sin \Pi$ 8.21318[~]
 $\sin \gamma - \delta'$ 9.57846[~]
 $\operatorname{cosec} \gamma$ 0.17284[~]
 $\sin \delta - \delta'$ 7.79088[~]

$\delta - \delta'$ + 21 14.4[~]

$\delta + 20$ 17 19.1
 $\epsilon \phi \delta + 20$ 17 16.8[~]

$O - C$ + 2.3

curr. - 0.1[~]

$2^{\text{nd}} \text{ Amd. Ref.}$ 0.0

$\delta = +20$ 17 19.0
 $O - C =$ + 2.2

α 02 34 31.19[~]
 $\epsilon \phi \alpha$ 02 34 30.28[~]

$O - C$ + 0.91[~]

curr. + 0.02[~]

$\alpha - \delta' 2$ 34 31.21

$O - C =$ + 0.93

12018

Lunar Parallax

18

α 02 34 26.57
 θ 02 40 24.90
 $\theta - \alpha$ +0.5 58.33
 $=$ 06 29 34.95
 $1/2(\alpha - \alpha')$ 34.63
 $2\alpha' - "$ 01 29 03.2

Π 56' 09.9

9.86913
 $\log \sin \Pi$ 8.21318
 $\sin \theta - \alpha'$ 8.41590
 $\sin \delta'$ 0.02781
 $\sin(\alpha - \alpha')$ 6.52602

9.95727
 $\log \cos 1/2(\alpha - \alpha')$ 0.00000
 $\log \theta - \alpha'$ 0.00015
 $\log \tan \gamma$ 9.95742

$\alpha - \alpha'$ +1' 09.26
 $=$ + 04.62

γ 42 11 45.6
 δ' 19 56 04.7
 $\gamma - \delta'$ 22 15 40.9

9.82641
 $\log \sin \Pi$ 8.21318
 $\sin \gamma - \delta'$ 9.57846
 $\cos \sec \gamma$ 0.17284
 $\sin \delta - \delta'$ 7.79088

$\delta - \delta'$ 21 14.4

$\delta + 20$ 17 59.1

$\epsilon \delta + 20$ 17 16.8

$O - C$ + 2.3

$C - M$ - 0.1

2nd Aid Ref 0.0

$\delta + 20$ 17 19.0

$O - C$ + 2.2

α 02 34 31.19

$\epsilon \alpha$ 02 34 30.28

$O - C$ + 0.91

$C - M$ + 0.02

$\alpha - \alpha'$ 34 31.21

$O - C$ + 0.93

1
14
13

2
29
12

2
23
83

2
23
13

1
23
13

3
22
18

12027

21

Star Measures.

1	180.68	174.40
147	106.28 ²⁵	149.00 ⁹⁷
134	22	8.94
	80.68	74.40
	<u>14.7443</u>	<u>14.7457</u>

188.79	192.25
152.80 ⁷⁶	135.25 ²⁷
72	29
88.79	92.25
<u>13.8603</u>	<u>13.3602</u>

2	178.38	170.08
29.7	100.58 ⁶⁰	147.82 ⁸⁶
19.2	62	90
	78.38	70.08
	<u>29.7778</u>	<u>29.7778</u>

183.62	185.70
159.82 ⁸⁰	109.36 ⁴¹
72	46
83.62	85.70
<u>19.2382</u>	<u>19.2371</u>

3	184.40	168.50
239	91.17 ¹⁶	161.81 ⁷⁷
85	15	73
	84.40	68.50
	<u>23.9324</u>	<u>23.9327</u>

180.30	164.62
133.10 ⁰⁵	111.80
00	80
80.30	62
<u>8.4725</u>	<u>8.4718</u>

Moon Measures.

2	162.90	173.27
23	80.11	156.20
139	11	20
	94	29
	<u>13.8282</u>	<u>13.8291</u>

1.00	172.20	163.88
235	115.25	120.88
13	25	88
	20	63.88
	<u>13.5695</u>	<u>13.5700</u>

185.52	171.73
143.50	113.90
50	90
52	73
<u>23.4202</u>	<u>23.4217</u>

3	166.18	169.28
22.4	130.72	104.75
15	72	75
	20	28
	<u>22.3547</u>	<u>22.3547</u>

12027

20

Star Measures.

1 180.68 174.40
 147 106.28²⁵ 149.00⁹⁷
 134 22 89.4
 80.68 74.40
1474.43 1474.57

188.79 192.25
 152.80⁷⁶ 135.25
 72 29
 88.79 92.25
1226.03 1336.02

2 178.38 170.08
 29.7 100.58⁶⁰ 147.82⁸⁶
 9.2 62 90
 78.38 70.08
2988.78 2977.78

183.62 185.70
 159.82⁸⁰ 109.36⁴
 78 46
 83.62 85.70
1923.82 1923.71

3 184.40 168.50
 139 91.17¹⁶ 161.81⁷⁷
 85 15 73
 84.40 68.50
2393.24 2393.27

180.30 164.62
 133.10⁰⁵ 111.80
 00 80
 88.30 62
847.25 847.18

Moon Measures.

2 162.90 173.27
 3 80.11 156.20
 39 11 20
 94 29
1382.82 1382.91
 178.20 163.88
 38 114.25¹¹ 121.88²⁵
 11 25 88
 20 60.88
2357.95 2358.00

185.52 171.73
 142.50 114.90
 50 90
 52 73
1343.02 1343.17

166.18 169.28
 4 130.72 104.75
 72 75
 20 28
2235.97 2235.47

12027

Moon.

4	1 6 6 5 0	1 6 8 3 6
22.3	1 3 2 6 2 66	1 0 2 1 2
15.2	70	1 2
	4.6	6 8 3 6
	2 2.3 3 8 3	2 2.3 3 7 6

4	1 6 7 5 0	1 6 7 3 2
22.6	1 1 7 5 2 55	1 1 7 1 0 15
16.0	58	20
	52	32
	2 2.4 9 9 6	2 2.4 9 8 3

6

22.0

16.6

I

24.0

17.24

2

24.1

17.1

6

1 2 3 9 0

1 6 6 4 1

1 2 4 2 1

81

90

50 0 3

41

1 8 5 0 8

1 8 6 9 8

1 1 8 7 4

1 5 3 2.2

80 77

12 17

70

8 6 9 8

1 6 6 6 3 2

1 6 6 6 1 9

1 6 0 9 0

1 7 3 7 0

1 5 2 6 0

8 1 9 7 92

60

87

88

70

1 7.0 8 3 0

1 7.0 8 2 2

1 6 5 2 4

1 8 9 4 1

1 5 5 8 6 91

9 9 8 5 9 64

96

69

26

8 9 4 1

1 7.0 9 3 3

1 7.0 9 2 3

12027

Moon

4	16650	16836
22.3	1326266	10812
15.2	70	12
	46	6836
	22.3383	22.3476

5	16750	16732
22.6	1175255	1171015
16.0	58	20
	52	32
	22.4996	22.4983

5	18588	18698
23.0	11874	15322
16.6	8077	1217
	70	8698
	16.6632	16.6619

5	16080	17376
14.0	15260	8197
7.1	60	87
	88	76
	17.0830	17.0822

5	16524	18941
7.1	1558691	998596
7.1	96	69
	26	8941
	17.0933	17.0923

5	18390	18641
7.1	13427	
7.1	76	
	90	41
	5909	

Times Etc

23

12027

Date Jan. 6, 1917

Exp. to Stars	03	39		03	51	
Exp. to Moon	03	45	11.0	03	45	11.2
Clock fast		12	48.6			
H. Sid. Time	03	32	22.5	$\alpha = -2^h 38^m$		
H. Long	04	44	31.05			
L. Sid. Time	08	16	53.55			
Sid. Time M. Moon	19	01	58.43			
Interval	13	14	55.12			
Red		02	10.23			
G. M. T	13	12	44.89	$13^h 21^m 24.7$		

From Yant. Alman.

Moon 13 ^h	06	09	45.45	+25	02	26.6
motion			2.2043			- 3.171
12 ^h 7482			28.10			- 40.4
Tabular place	06	10	13.55	+25	01	46.2

Moon's Age 13

934 = 12.6

$$\begin{aligned} \alpha &= -500.8 \\ &+ 24 \\ &= -476.8 \end{aligned}$$

Parallax	54	26.3
Semi-diam	14	51.6
R		891.6
Aug.		11.5
Dist. 3		-0.5
R		902.6
R		1934.8
1 + gR		-922
R		1.8426
R2		3.3952

Lunar Etc.

23

12020

date Jan. 6 1917

up to Stars	03	39		03	51	
up to Moon	03	45	11.0	03	45	11.2
back fast		12	48.6			
1 Sid Time	03	32	22.5			
1 Long	04	44	31.05			
1 Sid Time	08	16	53.55			
Sid Time Min	19	01	58.45			
Interval	13	14	55.12			
Red		02	10.228			
G. M. T	13	12	44.89			
						13.21247

From Yant. Alman.

Moon 13 ^h	05	09	45.45	+25	02	56.6
motion 1 ^m			22.043			3.171
" 1277482			28.10			40.4
Tabular Place	05	10	13.55	+25	01	46.8

Moon Age 13

$$\begin{array}{r}
 a = -50.08 \\
 +24 \\
 \hline
 -476.8
 \end{array}$$

Parallax	54	263
Semi-diam	19	516
R		8916
Ang.		11.5
Dist.		-0.5
R		902.6
R		19348
1+R		-922
R ²		18426
R ²		33952

12827

Plate Constants + Center.

24

14.7450	13.3602	06	06	26.89	+24	26	22.9
20.7778	19.2376	06	11	54.88	+23	46	11.9
23.9326	8.4722			-	59.91	+01	14 47
22.	18.						
-1.0326	9.5278						
31 ^s	466 ^s						

+

Plate Center

$$\begin{cases} A & 06 & 10 & 54.97 \\ D & 25 & 00 & 16.6 \end{cases}$$

$$\begin{aligned} X - S + 500X & + 738 & + .8X - 14296 \\ +5937 + 7372 & = 13309 + 976 = 14285 + 11 = 14296 \\ +1692 + 11966 & = 13658 + 619 = 14277 + 19 = 14296 \\ -2023 + 14889 & = 12866 + 1405 = 14271 + 24 = 14295 \\ 24.1802 + 12090 & + 1113 & + 19 = 24.0728 \end{aligned}$$

$$\begin{aligned} Y - n + 500Y & - 71X & + 3.88 - 2568 \\ -3117 + 6680 & = 3563 - 1046 = 2517 + 57 = 2568 \\ -0001 + 4236 & = 4235 - 1699 = 2536 + 32 = 2568 \\ -5011 + 9619 & = 4608 - 2114 = 2494 + 73 = 2567 \\ 15.2483 + 7624 & - 1717 & + 58 = 15.5880 \end{aligned}$$

Table	$a = -0.8$	$e = -0.4$	$a - e = -0.4$	$h + j = +1.5$
Obs	-500.8	-503.8	+3.0	= -2.0
O-C	-500.0	-503.4	+3.4	= -3.5

12027

Plate Constants + Center

24

14.7450	13.3602	06	06	2689	+24	26	22.9
29.7778	19.2376	06	11	54.88	+23	46	11.9
23.9326	8.4722			-	59	91	+01 14 47
22	18						
-1.9326	9.5278						
31	4665						

Plate Center

$$\begin{cases} A & 06 & 10 & 54 & 97 \\ D & 25 & 00 & 16 & 6 \end{cases}$$

$$\begin{aligned} X - S + 500X & \quad + 738 \quad \quad + .8X - 1421 \\ +5937 + 7372 & = 13309 + 976 = 14285 + 11 = 1429 \\ +1692 + 11966 & = 13658 + 619 = 14277 + 19 = 1429 \\ +2023 + 14889 & = 12866 + 1405 = 14271 + 24 = 1429 \\ 24.1802 + 12090 & \quad + 1113 \quad \quad + 19 = 2707 \end{aligned}$$

$$\begin{aligned} y - n + 500y & \quad - 71X \quad \quad + 3.58 - 256 \\ -3117 + 6680 & = 3563 - 1046 = 2517 + 57 = 2568 \\ -0001 + 4236 & = 4235 - 1699 = 2536 + 32 = 2568 \\ -5011 + 9619 & = 4608 - 2114 = 2494 + 73 = 2567 \\ 15.2483 + 7624 & \quad - 1717 \quad \quad + 58 = 15588 \end{aligned}$$

Sahler	$a = -0.8$	$e = -0.4$	$a - e = -0.4$	$h + d = +1.5$
Obs	-500.8	-503.8	+3.0	-20
O-C	-500.0	-503.4	+3.4	-3.5

Clwr.

S_0	T_0	D_3	$-2S$	$+3\eta$	$+2$
-7.85	-4.36	-16	+16 = 0	-1 = -1	
+1.76	-9.52	+4	-3 = +1	-3 = -2	
+7.98	+1.70	+14	-16 = -2	+0 = -2	
$m + 2.07$	-2.41		-4	-1	$-3^{\vee} = -0.01^{\vee}$

$A\eta$	-2.3η	$+2S$
-9	+10 = +1	-1 = 0
-22	+22 = +0	+0 = +0
+3	-4 = -1	+1 = 0

$$+5^{\circ} \quad 0 = +5^{\circ} = +0.2^{\vee}$$

12027.

Standard Coordinates.

25

Cafe No. 881 mg. 59 Cafe No. 901 mg. 62. Cafe No. 907 mg. 72

C	06	05	24.33	06	10	52.67	06	14	26.36
q			24.37			52.68			26.39
E			24.35			52.69			26.37
m	06	05	24.35	06	10	52.68	06	14	26.37
Prec	+	01	02.54		01	02.20		01	02.91
A	06	06	26.89	06	11	54.88	06	15	29.28
A	06	10	54.97	06	10	54.97	06	10	54.97
A-A	-	04	28.08	+		59.91	+	04	34.31
Sm		-	268.06		+	59.91		+	274.29
log			2.42823			1.77750			2.43821
log cos			9.95928			9.96150			9.95648
" S			0.89470			0.24624			0.90193
S	-		7.8470		+	1.7630		+	7.9787
S	-		17		+	4		+	14
S			1.4.1513			23.7634			29.9801
Y			14.7450			23.9326			29.7778
X-S	+		5937		+	1692		-	2023
C	+24	26	31.9	23	46	28.6	+25	13	53.97
q			31.8			29.2			54.4
E			31.7			28.7			54.0
m	+24	26	31.8	23	46	28.8	+25	13	54.1
Prec		-	8.9			-16.9		-	22.2
S	+24	26	22.9	+23	46	11.9	+25	13	31.9
S	+25	00	16.6	+25	00	16.6	+25	00	16.6
S-S	-	33	53.7	-1	14	04.7	+	13	15.3
tan		-	2033.8		-	4445.4		+	795.3
log			3.30831			3.64791			2.90053
log no			0.63946			0.97906			0.23168
log tan			9.6575			9.6439			9.6731
" S			1.7894			0.4925			1.8039
" n			8.5003			7.1898			8.5304
n	-4.3597			-7.5292			+1.7048		
n	+0316			+0.0015			+0.0339		
n	13.6719			8.4723			19.7387		
q	13.3602			8.4722			19.2376		
n	-2.117			-5.601			-5.601		

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Standard Coordinates.

25"

Cafe No. 881 mg 59			Cafe No. 901 mg 62			Cafe No. 907 mg 72			
C	06	05	24.33	06	10	52.67	06	14	26.36
q			24.37			52.68			26.39
E			24.35			52.69			26.37
m	06	+05	24.35	06	10	52.68	06	14	26.37
Proc		+01	02.54		01	02.20		01	02.91
A	06	06	26.89	06	11	54.88	06	15	29.28
A	06	10	54.97	06	10	54.97	06	10	54.97
A-A	-	04	28.08	+		59.91	+	04	34.31
m "		-	268.06		+	59.91		+	274.29
log "			242823n			1.77750			243821
log cos			995923			996150			995648
" S ₀			089470n			0.24624			0.90193
S ₀	-	78470		+	1.7630		+	7.9787	
S ₁	-	17		+	4		+	14	
S	1.4	15133		23.7634		29.9801			
Y	14	7450		23.9326		29.7778			
X-S	+	5937		+	1692		-	2023	
C	+24	26	31.9	23	46	28.6	+25	13	53.97
q			31.8			29.2			54.4
E			31.7			28.7			54.0
m	+24	26	31.8	23	46	28.8	+25	13	54.1
Proc		-	8.9		-	16.9		-	22.2
S	+24	26	22.9	+23	46	11.9	+25	13	31.9
Q	+25	00	16.6	+25	00	16.6	+25	00	16.6
S-Q	-	33	53.7	-	14	04.7	+	13	15.3
tan "		-	2033.8		-	4445.4		+	795.3
log "			3.30831n			3.64791n			2.90053
log no			0.63946n			0.97906n			0.23168
log tan S			9.6575			9.6439			9.6731
" S ₂			1.7894			0.4925			1.8039
" n ₁			8.5003			7.1898			8.5304
n ₀	-4.3	597		-9.5	292		+	1.7	048
n ₁	+	0316		+	0.0015		+	0339	
n	13.6	719		8.4	723		19.7	387	
g	13.3	602		8.4	722		19.2	376	
g-n	-	3117		-	0.0004		-	5.5	111

Δx Dg

-1.6

-0.3

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Moon's Center.

26

	241810	$y - y_0$	Δx	$(x - x_0)^2$		$y - y_0$	Δy	
1	23.4209	-0.7601	+3	0.5777	3.3860	-	9.2	
2	23.0000	-1.1810	+2	1.3943	3.4030	+	7.8	
3	22.3547	-1.8263	+0	3.3354	3.3958	+	6	
4	22.3380	-1.8430	-0	3.3966	3.3966	+	14	
5	22.4989	-1.6821	-1	2.8298	3.3978	+	2.6	
6	23.0000	-1.1810	-2	1.3953	3.4018	+	6.6	
7	24.0000	-0.1810	-3	0.0329	3.4060	+	10.8	
8	24.1810	0.0001	-3	0.0000	3.4107	+	15.5	
					33952			

		$y - y_0$	Δy		Δ
1	13.5702	-1.6758	0	2.8083	2.04
2	13.8287	-1.4173		2.0087	2.20
3	15.0000	-0.2460		0.0605	2.62
4	15.2460	+0.0000		0.0000	2.70
5	16.0000	+0.7540		0.5680	2.94
6	16.6625	+1.4165		2.0065	3.21
7	17.0826	+1.8366		3.3731	3.54
8	17.0928	+1.8468		3.4107	3.60

Range 1.56

$$x = 23 \quad y = 13.8287$$

$$16.6625$$

$$3.04012$$

$$y_0 \quad 15.2456$$

$$y_{\max} \quad 17.0928$$

$$R \quad 1.8472$$

$$\text{Cen } R \quad 1.8426$$

$$x_{\min} \quad 22.3380$$

$$x_0 \quad 24.1810$$

Moon's Center x_0 24.1810 y_0 15.2460

13.5702

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Moon's Center

26

		$y - y_0$	Δx	$x - x_0$		$O - C$	
1	23.42.09	-0.76.01	+3	0.57.77	3.38.60	-	9.2
2	23.00.00	-1.18.10	+2	1.39.43	3.40.30	+	7.8
3	22.35.47	-1.82.63	+0	3.33.54	3.39.58	+	6
4	22.33.80	-1.84.30	-0	3.39.66	3.39.66	+	1.4
5	22.49.89	-1.68.21	-1	2.82.98	3.39.78	+	2.6
6	23.00.00	-1.18.10	-2	1.39.53	3.40.18	+	6.6
7	24.00.00	-0.18.10	-3	0.03.29	3.40.60	+	1.08
8	24.18.10	0.00.00	-3	0.00.00	3.41.07	+	1.5
					3.38.52		

		$y - y_0$	Δx		
1	13.47.02	-1.67.58	0	2.80.83	2.04
2	13.82.87	-1.41.73		2.00.87	2.20
3	15.00.00	-0.24.60		0.06.05	2.62
4	15.24.60	+0.00.00		0.00.00	2.70
5	16.00.00	+0.75.40		0.56.80	2.94
6	16.66.25	+1.41.65		2.00.65	3.20
7	17.08.26	+1.83.66		3.37.31	3.54
8	17.09.28	+1.84.68		3.41.07	3.60

$\lambda = 23$ y - 13.82.87
 16.66.25
 30.40.12
 y_0 15.24.56
 y_{max} 17.09.28
 R 1.84.72
 Corr R 1.84.26
 λ_{min} 22.33.80
 x_0 24.18.10

Moon's Center $\left\{ \begin{array}{l} x_0 \text{ 24.18.10} \\ y_0 \text{ 15.24.60} \end{array} \right.$

Formation of Normals:

1	+ 1.27	+ 70	+ 155
2	+ 1.67	- 92	- 110
3	+ 0.46	- 11	- 1.5
4	- 0.00	- 26	+ 0
5	- 1.25	- 43.5	+ 19.5
6	- 1.67	- 78	+ 93.7
7	- 0.33	- 19.3	+ 198.5
8	- 0.00	- 00.0	+ 287.0
	+ 3.40	+ 70.0	+ 753.7
	- 3.25	- 269.8	- 111.5
	+ 0.15	- 199.8	+ 642.2

	a	b	c	?
a	- 44	+ 33	- 21	- 54
b	+ 12	+ 52	- 17	- 31
c	- 66	+ 80	- 3	+ 11
		+ 81	0	+ 15
		+ 74	+ 9	+ 17
		+ 52	+ 17	+ 3
		+ 8	+ 22	- 36
		+ 0	+ 22	- 44

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Conditional Equations:

27
6-c

1	-0.76	-1.68	= -	92	+12	-76	= -	64	-28	-52
2	-1.18	-1.42	= +	78	+19	-64	= -	45	+123	-104
3	-1.83	-0.25	= +	6	+29	-11	= +	18	-12	-1
4	-1.84	+0.00	= +	14	+29	+0	= +	29	-15	-0
5	-1.68	+0.75	= +	26	+27	+34	= +	61	-35	-12
6	-1.18	+1.42	= +	66	+19	+64	= +	83	-17	-12
7	-0.18	+1.84	= +	108	+3	+83	= +	86	+22	-1
8	-0.00	+1.85	= +	155	+0	+84	= +	84	+71	+0

$$+216 - 707$$

or 40

$$12.96 + 0.15 = -199.8 - 8.65$$

$$+0.15 + 14.23 = +642.2 + 2.51$$

$$-() - 0.02 + 2.3$$

$$+14.21 = +644.5$$

$$+0.18$$

$$b = +45.3$$

$$+12.96 = -199.8 - 6.8 = -206.6$$

$$a = -16.0$$

$$-0.67$$

$$\text{arc} = 13.6$$

$$\frac{P}{n} = 0.2$$

$$\frac{\Sigma r}{n} = +13.5$$

$$\Delta R = +0.8$$

2nd 3.

$$\frac{13.5}{2} = +6.75$$

$$\text{corr} +0.9$$

$$\text{True } \Delta R = -0.1$$

$$R = 1.84$$

$$-2RC = -3.31$$

$$\Delta b = -0.60$$

$$\Delta \delta = -0.3$$

$$\Delta a = +2.21$$

$$\Delta \alpha = +0.07$$

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Conditional Equations:

1 - 0.76	- 1.68	= - 9.2	+ 12 - 76	= - 64	
2 - 1.18	- 1.42	= + 7.8	+ 19 - 64	= - 45	+ 123 + 12
3 - 1.83	- 0.25	= + 6	+ 29 - 11	= + 18	- 12 - 1
4 - 1.84	+ 0.00	= + 1.4	+ 29 + 0	= + 29	- 15 - 0
5 - 1.68	+ 0.75	= + 2.6	+ 27 + 34	= + 61	- 35 - 18
6 - 1.18	+ 1.42	= + 6.6	+ 19 + 64	= + 83	- 17 - 18
7 - 0.18	+ 1.84	= + 1.68	+ 3 + 83	= + 86	+ 22 - 18
8 - 0.00	+ 1.85	= + 15.5	+ 0 + 84	= + 84	+ 71 + 27

+ 216 - 707
40

$$12.96 + 0.15 = -199.8 - 8.65$$

$$+10.75 + 14.23 = +642.2 + 251$$

$$- () - 0.02 + 2.3$$

$$+14.21 = +644.5$$

$$+12.96 = +199.8 - 6.8 = -206.6$$

$$b = +453$$

$$a = -10.0$$

$$- 0.61$$

$$\text{arc} = 15.6$$

$$\frac{P}{n} = 0.2$$

$$\frac{E_r}{n} = +13.5$$

$$\frac{13.5}{2} = +6.75$$

$$\Delta R = +0.8$$

$$\text{corr} = +0.9$$

$$\text{true } \Delta R = -0.1$$

$$R = 1.84$$

$$-2RC = -3.31$$

$$\Delta b = -0.60$$

$$\Delta \delta = -0.3$$

$$\Delta a = +2.21$$

$$\Delta \alpha = +0.07$$

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Moon's Mean Position

28

$$\begin{array}{r} X_0 \quad 24.1810 \\ \quad \quad - 8 \\ \hline 24.1802 \end{array}$$

$$\begin{array}{r} Y_0 \quad 15.2460 \\ \quad \quad + 23 \\ \hline 15.2483 \end{array}$$

From Plate Constants.

$$\begin{array}{r} X \quad 24.0728 \checkmark \\ \quad \quad 22 \\ \hline S \quad +2.0728 \end{array}$$

$$\begin{array}{r} Y \quad 15.5880 \checkmark \\ \quad \quad 18 \\ \hline -2.4120 \end{array}$$

$$\begin{array}{r} \log S \quad 0.31656 \checkmark \\ \log \cos S_0 \quad 9.95836 - \\ \quad \quad 8.50724 \\ \log \sin \alpha - A \quad 1.85096 \checkmark \end{array}$$

$$\begin{array}{r} \log \tan S \quad 9.6624 \checkmark \\ \log S_0^2 \quad 0.6331 \checkmark \\ \quad \quad 7.0534 \\ \log \eta_1 \quad 7.3489 \checkmark \end{array}$$

$$\begin{array}{r} \alpha - A \quad + 70.95 \\ \quad \quad + 01 \quad 10.95 \checkmark \end{array}$$

$$\begin{array}{r} \eta_1 \quad +0.0022 \checkmark \\ \quad \quad -2.4142 \checkmark \end{array}$$

$$A \quad 06 \quad 10 \quad 54.97$$

$$\alpha_0 \quad 06 \quad 12 \quad 05.92 \checkmark$$

$$\begin{array}{r} \log \eta_0 \quad 0.38278 \checkmark \\ \quad \quad 7.33115 \\ \log \tan S - D \quad 3.05163 \checkmark \end{array}$$

$$\text{Red} \quad + 2.76$$

$$S - D \quad -11.26.2 \checkmark$$

$$\alpha' \quad 06 \quad 12 \quad 08.68 \checkmark$$

$$\begin{array}{r} -18 \quad 46.2 \\ D + 25 \quad 00 \quad 16.6 \end{array}$$

$$S_0 + 24 \quad 41 \quad 30.4 \checkmark$$

$$\text{Red} \quad + 2.0 \checkmark$$

$$S' + 24 \quad 41 \quad 32.4 \checkmark$$

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Moon's Mean Position

28

$$\begin{array}{r} X_0 \quad 24.1810 \\ \quad \quad - 8 \\ \hline 24.1802 \end{array}$$

$$\begin{array}{r} Y_0 \quad 15.2460 \\ \quad \quad + 23 \\ \hline 15.2483 \end{array}$$

from Plate Constants.

$$\begin{array}{r} X \quad 24.0728 \\ \quad \quad 22 \\ \hline S \quad +2.0728 \end{array}$$

$$\begin{array}{r} Y \quad 15.5880 \\ \quad \quad 18 \\ \hline -2.4120 \end{array}$$

$$\begin{array}{r} \log S \quad 0.31656 \\ \log \cos S_0 \quad 9.95836 \\ \quad \quad 8.50724 \\ \log \sin \alpha - A \quad 1.85096 \end{array}$$

$$\begin{array}{r} \log \tan S \quad 9.6624 \\ \log S_2 \quad 0.6331 \\ \quad \quad 7.0534 \\ \log 4.141 \quad 7.3489 \end{array}$$

$$\begin{array}{r} \alpha - A \quad + 70.95 \\ \quad \quad + 01 \quad 10.95 \end{array}$$

$$\begin{array}{r} \mu \quad +0.0022 \\ \eta_0 \quad -2.4142 \end{array}$$

$$A \quad 06 \quad 10 \quad 54.97$$

$$X_0 \quad 06 \quad 12 \quad 05.92$$

$$\begin{array}{r} \log \eta_0 \quad 0.38278 \\ \quad \quad 7.33115 \\ \log \tan S - B \quad 3.05163 \end{array}$$

$$\text{Red} \quad + 2.76$$

$$S - E \quad -11.26.2$$

$$X' \quad 06 \quad 12 \quad 08.68$$

$$\begin{array}{r} -12 \quad 46.2 \\ B + 25 \quad 00 \quad 16.6 \end{array}$$

$$S_0 + 24 \quad 41 \quad 30.4$$

$$\text{Red} \quad + 2.0$$

$$S' + 24 \quad 41 \quad 32.4$$

$$\begin{array}{r}
 1.06 \quad 09 \quad 54.799 \\
 \underline{52.098} \\
 + 2.701 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 2.06 \quad 17 \quad 59.102 \\
 \underline{56.386} \\
 + 2.716 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 3.06 \quad 18 \quad 34.214 \\
 \underline{30.583} \\
 + 3.631 \\
 \hline
 \end{array}$$

4 am

$$\begin{array}{r}
 22 \quad 31 \quad 56.95 \\
 \underline{54.92} \\
 + 2.03 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 22 \quad 33 \quad 27.82 \\
 \underline{26.30} \\
 + 1.52 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 49 \quad 19 \quad 57.49 \\
 \underline{54.02} \\
 + 3.47 \\
 \hline
 \end{array}$$

49

44

39

34

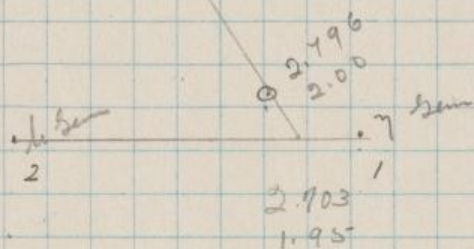
29

24

19

14

9



24 22 20 18 16 14 12 10 8 6 4 2 0 58 56
6h

2027

Reduction to Apparent Place

29

$$H + \alpha_0 \quad 5 \quad 12.4 \quad 78^\circ \quad 6' \quad \delta_0 + 24'' \quad 41.5$$

$$H \quad 23 \quad 00.3$$

$$\alpha_0 \quad 06 \quad 12.1$$

$$G \quad 22 \quad 37.3$$

$$G + \alpha_0 \quad 4 \quad 49.4 \quad 72 \quad 21$$

$$\log \cos \delta_0 \quad 9.9584$$

$$\log 1 \quad 0.3567m$$

$$\log (1) \quad 0.3151n$$

$$\log \cos G + \alpha_0 \quad 9.4817$$

$$\log g \quad 0.8772$$

$$\log \sin G + \alpha_0 \quad 9.9791$$

$$\log \tan \delta_0 \quad 9.6625$$

$$8.8239$$

$$\log g' \quad 0.3589$$

$$\log g \quad 9.3427$$

$$g \quad +1.076$$

$$g \quad +0.220$$

$$g \quad +1.460$$

$$\text{Red.} \quad +2.756$$

$$\log \sin \delta_0 \quad 9.6209$$

$$\cos H + \alpha_0 \quad 9.3143$$

$$\log h \quad 1.3084$$

$$\sin H + \alpha_0 \quad 9.9906$$

$$\sec \delta_0 \quad 0.0416$$

$$8.8239$$

$$\log f' \quad 0.2436$$

$$f' \quad 0.1645$$

$$g' \quad 2.285$$

$$h' \quad 1.752$$

$$-2.066$$

$$\text{Red.} \quad +1.971$$

2027

Reduction to Apparent Place

29

$$H + \alpha_0 \quad 5 \quad 12.4 \quad 78^\circ 6' \quad \delta_0 + 24'' \quad 41.5''$$

$$H \quad 23 \quad 00.3$$

$$\alpha_0 \quad 06 \quad 12.1$$

$$G \quad 22 \quad 37.3$$

$$G + \alpha_0 \quad 4 \quad 49.4 \quad 72 \quad 21$$

$$\log \cos \delta_0 \quad 9.9584$$

$$\log 1 \quad 0.3567 \sim$$

$$\log (1) \quad 0.3151 \sim$$

$$\log \cos G + \alpha_0 \quad 9.4817$$

$$\log g \quad 0.8772$$

$$\text{Sum } G + \alpha_0 \quad 9.9791$$

$$\text{tan } \delta_0 \quad 9.6625$$

$$8.8239$$

$$\log g' \quad 0.3589$$

$$\log g \quad 9.3427$$

$$2 \quad +1.076$$

$$G \quad +0.220$$

$$G \quad +1.460$$

$$\text{Red.} \quad +2.756$$

$$\log \sin \delta_0 \quad 9.6209$$

$$\cos H + \alpha_0 \quad 9.3143$$

$$\log h \quad 1.3084$$

$$\sin H + \alpha_0 \quad 9.9906$$

$$\sec \delta_0 \quad 0.0416$$

$$8.8239$$

$$\log l' \quad 0.2436$$

$$0.1645$$

$$g' \quad 2.285$$

$$h' \quad 1.752$$

$$l' \quad -2.066$$

$$\text{Red} \quad +1.971$$

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Lunar Parallax

30

α 0.6 12 08.68[✓]
 θ 03 32 22.50[✓]
 $\theta - \alpha$ -02 39 46.18[✓]
 $=$ -39 56 32.70[✓]
 $\alpha - \alpha'$ - 14 16.10[✓]
 $\alpha - \alpha' - \frac{1}{2}''$ -39 42 16.60[✓]

Π 54" 263[✓]
 $\log \sin \Pi$ 9.86913[✓]
 $\log \sin(\theta - \alpha)$ 8.19261[✓]
 $\log \sec \delta$ 9.80755[✓]
 $\sin \alpha - \alpha'$ 7.91912[✓]

$\log \cos \frac{1}{2}(\alpha - \alpha')$ 0.00000[✓]
 $\log \sec(\theta - \alpha)$ 0.11388[✓]
 $\log \tan \gamma$ 0.07115[✓]

$\alpha - \alpha'$ -28 32.2[✓]
 $=$ -01^m 54.14[✓]

γ +49 40 20.8[✓]
 δ +24 41 32.4[✓]
 $\gamma - \delta$ +24 58 48.4[✓]

$\log \sin \Pi$ 9.82640[✓]
 $\log \sin \gamma - \delta$ 8.19261[✓]
 $\log \sec \gamma$ 9.62563[✓]
 $\log \sec \delta$ 0.11784[✓]
 $\sin(\delta - \delta')$ 7.76948[✓]

$\delta - \delta'$ + 20 13.1[✓]

δ +25 01 45.5[✓]

$\delta - \delta' + 25$ 01 46.2[✓]

$O - C$ -0.7[✓]

curr. = +0.2[✓]

2nd Ord. Ref. - 0.0[✓]

$\delta - \delta' + 25$ 01 45.7[✓]

$O - C$ -0.5[✓]

α 06 10 14.54[✓]

$\delta - \alpha$ 06 10 13.55[✓]

$O - C$ +0.9.9[✓]

curr. - 0.01[✓]

$\alpha =$ 06 10 14.53[✓]

$O - C =$ + 0.98[✓]

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Lunar Parallax

51

α' 06 12 08.68
 θ 03 32 22.50
 $\theta - \alpha'$ -02 39 46.18
 $=$ -39 56 32.70
 $\frac{1}{2} \alpha - \alpha'$ - 14 16.10
 $\theta - \alpha' - \frac{1}{2} \alpha - \alpha'$ -39 42 16.60

 π 54" 263

9.86913

 $\log \sin \pi$ 8.19261 $\sin(\theta - \alpha')$ 9.80755 $\sec \delta'$ 0.04283 $\sin \alpha - \alpha'$ 7.91912

9.95727

 $\log \cos \frac{1}{2} \alpha'$ 0.00000 $\sec(\theta - \alpha')$ 0.11388 $\log \tan \gamma$ 0.07115 $\alpha - \alpha'$ -28 32.2 $=$ -0^h 54^m 14^s γ +49 40 20.8 δ' +24 41 32.4 $\gamma - \delta'$ +24 58 48.4

9.82640

 $\log \sin \pi$ 8.19261 $\sin \gamma - \delta'$ 9.62563 $\csc \gamma$ 0.11784 $\sin(\delta - \delta')$ 7.76948 $\delta - \delta'$ + 20 13.1 δ +25' 01 45.5 $\epsilon \text{ph } \delta$ +25' 01 46.2 $O - C$ +3.7 corr. +0.2 2nd Cor. Ref. -0.0 δ +25' 01 45.9 $O - C$ -0.5 α 06 10 14.54 $\epsilon \text{ph } \alpha$ 06 10 13.55 $O - C$ +0.99 corr. -0.01 α 06 10 14.53 $O - C$ +0.98

