

KG

11366

v.931

Vol. LV

Plate No

2146

2172

1912phae.proj

Harvard Lunar Plates

Measures and Reductions

Mary Fowler

Volume LV

Plate No.	Date	Page.
2146	1912 Nov. 18	1
2172	1912 Nov. 20	10

2

1
7.
22

2
13.
9.

3
18.
27

4
27
19

2146

Stars - Measures

1914 January 8.

1

	d	v	d	v
1	16068	18201	17254	19391
7.3	1109388	1318785	961015	1700900
22.5	90	89	10	0400
	76	08	45	80
	<u>22.4982</u>	<u>.4984</u>	<u>7.2365</u>	<u>.2384</u>
2				
13.5	15950	16755	16260	18609
9.7	865963	1404541	1212520	1273030
	65	40	25	30
	40	70	50	15
	<u>9.7281</u>	<u>.7283</u>	<u>13.5867</u>	<u>.5882</u>
3				
18.7	19143	15827	15400	17230
27.5	1375761	1121010	1289791	973531
	60	08	90	29
	50	30	09	36
	<u>27.5387</u>	<u>.5381</u>	<u>18.7490</u>	<u>.7502</u>
4				
27.0	18990	15440	1261100	11052
19.4	1628381	814550	0000	10969
	82	50	12515	6969
	84	60		
	<u>19.2706</u>	<u>.2694</u>	<u>27.0088</u>	<u>.0083</u>

Grade 3.

2146		Stars - measures.		1914 January 8.	
	d	n	d	n	
1	16068	18201	17254	19391	
7.3	11093	13187	9610	17009	
22.5	90	89	10	09	
	76	05	45	80	
	<u>22.4982</u>	<u>4984</u>	<u>7.2365</u>	<u>2384</u>	
2					
13.5	15950	16755	16260	18609	
9.7	8659	14045	12125	12730	
	65	40	25	30	
	40	70	50	15	
	<u>9.7281</u>	<u>7283</u>	<u>13.5867</u>	<u>5882</u>	
3					
18.7	19193	15527	15400	17230	
27.5	13757	11210	12897	9731	
	60	08	90	29	
	50	30	09	36	
	<u>27.5387</u>	<u>5381</u>	<u>18.7490</u>	<u>7102</u>	
4					
27.0	18990	15440	12611	11052	
19.9	16283	8145	0000	10969	
	82	50	125	69	
	84	60			
	<u>19.2706</u>	<u>2694</u>	<u>27.0088</u>	<u>0083</u>	

Grade 3.

2146 Moon-measures

2

	d	y	n	d	n
1	17786		19232		
19.5	1095550		1608578		
16.7	60		80		
min	98		40		
8.	<u>16.6839</u>		<u>.6847</u>		

2	16808		19222		
19.0	980909		1619087		
16.7	20		00		
	08		20		
	<u>16.6995</u>		<u>.6971</u>		

3
18.2
17.0

16905	15995
865139	1427019
45	75
90	90
<u>18.1752</u>	<u>.1723</u>

4	11194		1060082		
18.0	993447		90		
17.2	41		9360		

<u>17.1254</u>	<u>.1231</u>
----------------	--------------

5
17.5
18.0

16102	15790
1009904	1179400
10	90
90	93
<u>17.4009</u>	<u>.3996</u>

6
17.4
18.5
min
26

16073	16851
900790	1390014
9809	01
68	70
<u>17.2931</u>	<u>.2952</u>

2146 Moon Measures

2

	d	q	n	d	q	n
1	17786		19232			
19.5	10955	50	16085	78		
16.7		60		80		
14.0		98		40		
11.3	<u>166839</u>		<u>6847</u>			

2	16808		19222			
19.0	9809	09	16190	87		
16.7		20		00		
		08		20		
	<u>166995</u>		<u>6971</u>			

3
182
170

16905	15995
865139	1927069
45	75
90	90
<u>181752</u>	<u>1723</u>

4	11194	10600	82
18.0		90	
17.2	993447	9360	
	41		

<u>17.1254</u>	<u>1231</u>
----------------	-------------

5
175
180

16102	15790
1009904	1179400
10	90
90	93
<u>17.9009</u>	<u>3996</u>

6
174
185
190

16073	16851
900790	1390014
9809	01
68	70
<u>17.2931</u>	<u>2952</u>

2
2
1
1
8
1
2
9
18
20

2146

duoond measures.

3

2

17.4

19.0

8

17.8

20.0

9

18.0

20.2

8849

759098

87

8003

9206

6739

20.1257.1261

d

y

v

d

x

v

15048

836059

50

44

17.3311

15175

1384330

32

69

17.8661

18179

1485770

6855

75

.3315

19230

1055571

6963

30

.8665

2146

brown line curves

3

d	q	v	d	q	v
2			15048		18179
174			8360	59	1485
190			50		6854
			44		75
			<u>17.3311</u>		<u>3315</u>

8			15171		19230
178			13843	30	10555
210			32		6963
			69		30
			<u>17.8061</u>		<u>8665</u>

9			8849		8003
180			7590		9206
222			87		6789
			<u>201257</u>		<u>1261</u>

2146	Times etc								
Exposition	1912 Nov. 18	23 ^h	36 ^m			- 23 ^h	48 ^m		
moon		23	41	34.5 ^v		- 23	41	34.8 ^v	
Block fast			0	01.4 ^v					
H Sid T.		23	41	33.25 ^v		6-d = + 0 ^h	79 ^m		
H. long		4	44	31.05 ^v					
G. Sid T.		28	26	04.30 ^v					
Sid T. to moon		15	48	38.55 ^v					
Interval		12	37	25.75 ^v					
Reduction			2	04.09 ^v					
G.M.T.		12	35	21.66 ^v					

From Kant Alman				R. G.		10 days.			
moon 12 ^h	23 ^h	21 ^m	38 ^s	32 ^v		- 6 ^o	19'	05.9 ^v	
moon 6 ^h	1.7927 ^v					14150 ^v			
" " 35.361 ^v		+ 1	03.39 ^v			+ 8	20.4 ^v		
Tabular place	23	22	41.71 ^v			- 6	10	45.5 ^v	

Moon's age	10 days.				
parallax	54' 48.2 ^v				
semidiameter	14' 57.6 ^v				
R	897.6 ^v				
Augmentation	+ 9.6 ^v				
Irradiation (3)	- 0.7 ^v				
R	906.5 ^v				
R	1.9432 ^v				
a - - 1.9	(1+a)R				
	R ²				
	1.9428 ^v				
	37744 ^v				

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Tanner etc

Enthalpy	1912 Nov. 18	23 ^m	36 ^m	-23 ^m	48 ^m	
Enthalpy		23	41	34.5	-23	41 34.8
Alcohol of acid			0	0.14		
H. L. d. i.		23	41	33.25	6-1	+0.79
H. L. d. i.		4	44	31.05		
G. L. d. i.		28	26	04.30		
Sed. L. d. i.		15	48	38.55		
Enthalpy		12	37	25.75		
Reduction			2	04.09		
G. L. T.		12	35	21.66		

Enthalpy of acid			R. G.		Red.	
Enthalpy 12 ^m		23 ^m	21 ^m	38.32	-6 ^m	19 ^m 0.59
Enthalpy 12 ^m	1.7927				14.150	
Enthalpy 12 ^m	35.361		+1	03.39	+8	20.4
Tabular place		23	22	41.71	-6	10 45.5

Enthalpy of acid

10 days

Enthalpy of acid			54' 48.2
Enthalpy of acid			14 57.6
Enthalpy of acid		R	897.6
Enthalpy of acid		Amputation	+ 9.6
Enthalpy of acid		Irregularity	- 0.7
Enthalpy of acid		R	906.5
Enthalpy of acid		R	1943.2
Enthalpy of acid		(17.9) R	1942.8
Enthalpy of acid		R ²	3774.4

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Plate Constants

5

x	7.2374	13.5874	18.7496	27.0086
z	7.9258	14.4397	19.3641	27.7356
$x-z$	-6884	-8523	-6145	-7270

y	22.4983	9.7282	27.5384	19.2700
y	22.5998	9.9088	27.7959	19.6334
$y-y$	-1015	-1806	-2575	-3634

$$\begin{array}{rclclclcl}
 2-3 & -1344 & & +1.9x & & -14 & & +9802 \\
 -6884 & -3015 & = & -9899 & +14 & = & -9885 & -2 = -9887 = \\
 -8523 & -1304 & = & -9827 & +26 & = & -9801 & -1 = -9802 = 0 \\
 -6145 & -3690 & = & -9835 & +36 & = & -9799 & -3 = -9802 = 0 \\
 -7270 & -2582 & = & -9852 & +51 & = & -9801 & -2 = -9803 = -1 \\
 19.2371 & -2996 & & +37 & & & -2 & = 19.9712
 \end{array}$$

$$\begin{array}{rclclclcl}
 y-y & +133x & & +4.6y & & -46 & & \\
 -1015 & +961 & = & -54 & +103 & = & +49 & = \\
 -1806 & +1807 & = & +1 & +45 & = & +46 & = 0 \\
 -2575 & +2494 & = & -81 & +127 & = & +46 & = 0 \\
 -3634 & +3592 & = & -42 & +89 & = & +47 & = +1 \\
 18.6256 & +2558 & & +86 & & & & = 18.8854
 \end{array}$$

$$\begin{array}{lclclcl}
 \text{Tabers} & a = +0.9 & e = -2.7 & a+e = +3.6 & b+a = -0.5 \\
 \text{Obs} & a = -1.9 & e = -4.6 & a-e = +2.7 & b+a = +1.1
 \end{array}$$

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Plate Constant

5

2	7.2374	13.5874	18.7496	27.0086
3	7.9258	14.4397	19.3641	27.7356
2-3	-6884	-8523	-6145	-7270
4	22.4983	9.7282	27.5384	19.2700
7	22.1998	9.9088	27.7959	19.6334
4-7	-1015	-1806	-2575	-3634

2-3	-1347	+1.92	-14	+9802		
-6884	-3015	-9899	+14	-9885-2	-9887	=
-8523	-1304	-9827	+26	-9801-1	-9802	= 0
-6145	-3690	-9835	+36	-9799-3	-9802	= 0
-7270	-2582	-9852	+51	-9801-2	-9803	= -1
19.2371	-2996	+37	-2	19.9712		
7-7	+1332	+464	-46			
-1015	+961	-54	+103	+49		
-1806	+1807	+1	+45	+46	= 0	
-2575	+2494	-81	+127	+46	= 0	
-3634	+3192	-42	+89	+47	= +1	
18.6256	+2558	+86			= 18.8854	

Tables $a = +0.9$ $a = -2.7$ $a + e = +3.6$ $b + a = -0.5$
 Obs $a = -1.9$ $a = -4.6$ $a - e = +2.7$ $b + a = +1.1$

pt.	pos. L	resid.
1	1809.0	-31
2	187.0	-11
3	213.5	+6
4	219.5	+116
5	251.2	-86
6	270.0	+5
7	281.1	-20
8	315.2	-48
9	320.2	+85

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Inoos Center

6.

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	19.2350	0.0000	0.0000	3.7691	-53
2	19.0000	-0.2350	0.0552	3.7701	-43
3	18.1738	-1.0612	1.1261	3.7687	-57
4	18.0000	-1.2350	1.5252	3.7791	+47
5	17.4002	-1.8348	3.3665	3.7574	-170
6	17.2942	-1.9408	3.7667	3.7667	-77
7	17.3313	-1.9037	3.6241	3.7648	-96
8	17.8663	-1.3687	1.8734	3.7654	-90
9	18.0000	-1.2350	1.5252	3.7794	+50

$$\text{approx } R^2 = 3.7744$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	16.6843	-1.9407	-7	3.7691
2	16.6983	-1.9267	-7	3.7149
3	17.0000	-1.6250	-6	2.6426
4	17.1242	-1.5008	-5	2.2539
5	18.0000	-0.6250	-2	0.3909
6	18.6250	0.0000	0	0.0000
7	19.0000	+0.3750	+1	0.1407
8	20.0000	+1.3750	+5	1.8920
9	20.1259	+1.5009	+5	2.2542

Aphe. Center

$$z = 18.0 \quad y = 17.1242$$

$$20.1259$$

$$37.2501$$

$$y_0 = 18.6250$$

$$y - \text{min} = 16.6843$$

$$R = 1.9407$$

$$z - \text{min} = 17.2942$$

$$x_0 = 19.2349$$

$$\text{Center} \left\{ \begin{array}{l} x_0 = 19.2350 \\ y_0 = 18.6250 \end{array} \right.$$

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Innova Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	19.2350	0.0000	0.0000	3.7691	-5.3
2	19.0000	-0.2350	0.0552	3.7701	-4.3
3	18.1738	-1.0612	1.1261	3.7687	-5.7
4	18.0000	-1.2350	1.5252	3.7791	+4.7
5	17.4002	-1.8348	3.3665	3.7574	-17.0
6	17.2942	-1.9408	3.7667	3.7667	-7.7
7	17.3313	-1.9037	3.6241	3.7648	-9.6
8	17.8663	-1.3687	1.8734	3.7654	-9.0
9	18.0000	-1.2350	1.5252	3.7794	+5.0

Group $R^2 = 3.7744$

	y	$y - y_0$	$(y - y_0)^2$
1	16.6843	-1.9407	-7
2	16.6982	-1.9267	-7
3	17.0000	-1.6250	-6
4	17.1242	-1.5008	-5
5	18.0000	-0.6250	-2
6	18.6250	0.0000	0
7	19.0000	+0.3750	+1
8	20.0000	+1.3750	+5
9	20.1259	+1.5009	+5

Alpha Center

 $x = 18.0$ $y = 17.1242$ 20.1259

372501

 $y_0 = 18.6250$ $y - y_0 = 16.6843$ $R = 1.9407$ $x - y_0 = 17.2942$ $x_0 = 19.2349$

Center { $x = 19.2350$
 $y = 18.6250$

Formation of Normals

	ab	an	bn
1	- 0.00	- 0.0	+ 103.0
2	+ 0.46	+ 10.3	+ 83.0
3	+ 1.72	+ 60.4	+ 92.4
4	+ 1.86	- 58.4	- 70.5
5	+ 1.13	+ 311.0	+ 105.1
6	- 0.00	+ 149.2	- 0.0
7	- 0.72	+ 182.3	- 36.5
8	- 1.89	+ 123.3	- 124.2
9	- 1.86	- 62.0	+ 75.0
	+ 0.70	+ 716.1	+ 227.3

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Moore's Center

Conditional Equations

7

	a	b	c		c	0-c
1	0.00	-1.94	=	-53	+ 0 - 22 = -22	-31
2	-0.24	-1.93	=	-43	-10 - 22 = -32	-11
3	-1.06	-1.62	=	-57	-44 - 19 = -63	+ 6
4	-1.24	-1.50	=	+47	-52 - 17 = -69	+116
5	-1.83	-0.62	=	-170	-77 - 7 = -84	-86
6	-1.94	+0.00	=	-77	-82 + 0 = -82	+ 5
7	-1.90	+0.38	=	-96	-80 + 4 = -76	-20
8	-1.37	+1.38	=	-90	-58 + 16 = -42	-48
9	-1.24	+1.50	=	+50	-52 + 17 = -35	+85

Average = 45

Normal Equations

$$\begin{aligned}
 &+ 16.86 + 0.70 = +716 \\
 &+ 0.70 + 17.06 = +227 \\
 &- 0.70 - 0.03 = -30 \\
 &\quad + 17.03 = +197 \\
 &+ 16.86a = +716 - 8 = +708
 \end{aligned}$$

$$b = +11.5$$

$$a = +42.0$$

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Hoovers Center

Concentrated Equations

7

	a	b	c		d	e
1	0.00	-1.94	-5.3	+	0.22	-2.2
2	-0.24	-1.93	-4.3	-	1.0	-2.2
3	-1.06	-1.62	-5.7	-	4.4	-1.9
4	-1.24	-1.50	+4.7	-	5.2	-1.7
5	-1.83	-0.62	-1.70	-	7.7	-7
6	-1.94	+0.00	-7.7	-	8.2	0
7	-1.90	+0.38	-9.6	-	8.0	4
8	-1.37	+1.38	-9.0	-	5.8	+1.6
9	-1.24	+1.50	+5.0	-	5.2	+1.7

Average: 4.5

Normal Equations

$$+16.86 + 0.70 = +7.16$$

$$+ 0.70 + 17.06 = +2.27$$

$$- 0.70 - 0.03 = - 3.0$$

$$+ 17.03 = + 1.97$$

$$+16.86 + 7.16 - 8 = +7.06$$

$$b = +11.5$$

$$a = +42.0$$

2146 Red. ad l. aph.

$$H + \alpha \quad 1 \quad 27 = 21^\circ 45' \quad S \quad - 6^\circ 52'$$

$$H \quad 2 \quad 05$$

$$\alpha = 23^\circ 22'$$

$$G \quad 22 \quad 04$$

$$G + \alpha \quad 21 \quad 26 = 321^\circ 30'$$

$$\log \cos \delta = 9.9969$$

$$\log \sin \delta = 9.9969$$

$$\log \tan \delta = 9.9969$$

$$\log \cos(G + \alpha) = 9.8935$$

$$\log \sin \delta = 9.7942$$

$$\log \tan \delta = 9.0807$$

$$\log \sec \delta = 8.8239$$

$$\log \csc \delta = 8.8239$$

$$\log (g') = 1.1566$$

$$\log (g) = 89619$$

$$\log \sin \delta = 9.0776$$

$$\log \cos(H + \alpha) = 9.9679$$

$$\log \tan \delta = 1.3003$$

$$\log \sec \delta = 9.5689$$

$$\log \csc \delta = 0.0031$$

$$\log \tan \delta = 8.8239$$

$$\log (h) = 0.3458$$

$$\log (h) = 9.6962$$

$$\begin{array}{r} f \\ (g) \\ (h) \\ \hline + 2.46 \\ + 0.09 \\ + 0.50 \\ \hline + 3.05 \end{array}$$

$$\begin{array}{r} (g') \\ (h') \\ (i) \\ \hline + 14.34 \\ - 2.22 \\ + 4.48 \\ \hline + 16.60 \end{array}$$

2146 Moon's mean Position (1912.0)

$$\begin{array}{r} X_0 = 19.2350 \\ + 21 \\ \hline 19.2371 \end{array} \quad \begin{array}{r} Y_0 = 18.6250 \\ + 6 \\ \hline 18.6256 \end{array}$$

From Plate Constants $X = 19.9712$ $Y = 18.8854$

$$S = +1.9712$$

$$\eta = -3.1146$$

$$\begin{array}{r} \log S = 0.29473 \\ \cos S = 9.99687 \\ 8.50724 \end{array}$$

$$\begin{array}{r} \log \tan S = 9.0786 \\ S = 0.5895 \\ \eta = 6.7215 \end{array}$$

$$(A - A) = 1.79062$$

$$\eta_1 = -5$$

$$X - A = +1.0675$$

$$\eta_0 = -3.1141$$

$$A = 23 \quad 21 \quad 24$$

$$\begin{array}{r} \log 0.49333 \\ 7.33115 \end{array}$$

$$X_0 = 23 \quad 22 \quad 25.75$$

$$(S - D) = 3.16218$$

$$Red = +3.05$$

$$(S - D) = -24 \quad 12.7$$

$$X' = 23 \quad 22 \quad 28.80$$

$$D = -6 \quad 28 \quad 04$$

$$S' = -6 \quad 52 \quad 16.7$$

$$Red = +16.6$$

$$S' = -6 \quad 52 \quad 00.1$$

2146 known mean Position (1912.0)

8

$$X_0 = 19.2350 \quad Y_0 = 18.6250$$

$$\begin{array}{r} 1.00 \\ + 21 \\ \hline 19.2371 \end{array} \quad \begin{array}{r} 1.00 \\ + 6 \\ \hline 18.6256 \end{array}$$

$$\text{from Plate Constants } X = 19.9712 \quad Y_p = 18.8859$$

$$S = +1.9712$$

$$z = -3.1146$$

$$\log S = 0.29473$$

$$\dots \log S = 9.99687$$

$$8.50724$$

$$\log 100 S = 9.07862$$

$$S = 0.5895$$

$$z = 6.72152$$

$$(d-A) = 1.79062$$

$$\eta = -5$$

$$X-A = +1.0875$$

$$z_0 = -3.1141$$

$$A = 23 \quad 21 \quad 24$$

$$\log 0.993332$$

$$7.33115$$

$$X_0 = 23 \quad 22 \quad 25.75$$

$$(S-D) = 3.16218$$

$$\text{Rea} = +3.05$$

$$(S-D) = -24.127$$

$$X' = 23 \quad 22 \quad 28.80$$

$$D = -6.2804$$

$$S = -6.52167$$

$$\text{Rea} = +16.6$$

$$S' = -6.52001$$

2146 Lunar Parallax

$$\begin{aligned}
 \alpha' &= 23 \quad 22 \quad 28.80'' \\
 \delta &= 23 \quad 41 \quad 33.25'' \\
 \delta - \alpha' &= +19 \quad 04.45'' \\
 &= +4^\circ \quad 46' \quad 07''
 \end{aligned}$$

$$\delta' = -6^\circ \quad 52' \quad 00.1''$$

$$IT \quad 54' \quad 48.2''$$

$$\begin{aligned}
 &986913 \\
 &820252 \\
 &891976 \\
 &000253
 \end{aligned}$$

$$\sin(\alpha - \alpha') = 6.99394$$

$$\alpha - \alpha' = +3' \quad 23.41''$$

$$= +13.56''$$

$$\begin{aligned}
 &9.95727 \\
 &0.00000 \\
 &0.00150 \\
 \tan f &= 9.95877 \\
 &+42^\circ \quad 17' \quad 05'' \\
 &-6 \quad 52 \quad 00 \\
 &49 \quad 09 \quad 05
 \end{aligned}$$

$$\begin{aligned}
 &9.82640 \\
 &8.20252 \\
 &9.87878 \\
 &0.17211 \\
 &407981
 \end{aligned}$$

$$\delta - \delta' = +41 \quad 18.8''$$

$$\delta = -6 \quad 10 \quad 41.3''$$

$$\text{Circ Eph } \delta = -6 \quad 10 \quad 45.5''$$

$$O - C \quad +4.2''$$

$$\alpha : 23 \quad 22 \quad 42.36''$$

$$\alpha = 23 \quad 22 \quad 41.71''$$

$$+0.65''$$

2146

Lunar Parallax

9

$$\begin{aligned}
 \alpha' &= 23 \quad 22 \quad 28.80 \\
 \delta &= 23 \quad 41 \quad 33.25 \\
 \delta - \alpha &= +19 \quad 04.45 \\
 &= +9^\circ \quad 46' \quad 07''
 \end{aligned}$$

$$\delta' = -6^\circ \quad 52' \quad 00''$$

$$IT \quad 54 \quad 48.2$$

$$9.86913$$

$$8.20252$$

$$8.91976$$

$$0.00253$$

$$\text{sub } \alpha' = 699394$$

$$9.45727$$

$$0.00000$$

$$0.00150$$

$$\tan f = 995877$$

$$+42^\circ \quad 17' \quad 05''$$

$$-6 \quad 52 \quad 00$$

$$49 \quad 09 \quad 05$$

$$9.82640$$

$$8.20252$$

$$9.87878$$

$$0.17211$$

$$807981$$

$$\delta - \delta' = +41 \quad 18.8$$

$$S = -6 \quad 10 \quad 41.3$$

$$\text{Circ. Eph. } S = -6 \quad 10 \quad 45.5$$

$$O - C \quad +42$$

$$\alpha = 23 \quad 22 \quad 42.38$$

$$\alpha = 23 \quad 22 \quad 41.71$$

$$+0.65$$

2172 Stars - measures

1914 January 8. 10

	d	4	v
1	19753	18500	
6.6	17780	1045754	
18.2	72	59	
	55	86	
	<u>18,1978</u>	<u>1968</u>	

d ²	v
19740	19070
1650312	1226971
1011	6172
33	51
<u>6,6771</u>	<u>6789</u>

2	17611	15660
5.9	14351	8900
10.4	6060	0207
	91	50
	<u>10,3247</u>	<u>3250</u>

18675	17662
17552	8760
6060	6058
50	51
<u>25,8885</u>	<u>8893</u>

3	16781	16225
26.8	14735	826962
27.3	3940	61
	78	20
	<u>27,2042</u>	<u>2043</u>

16457	17292
14620	9108
1514	0909
37	82
<u>28,8163</u>	<u>8181</u>

Grade 2.

2172

Stars - measures

1914 January 8.

10

α 4
 $\frac{1}{1}$ 19753 18500
 66 17780 1045759
 42 72 59
 55 86
18.1975 1968

α 2
 $\frac{1}{1}$ 19740 19070
 1650312 1226971
 1011 6172
 33 51
6.6771 6789

$\frac{2}{2}$ 17611 15660
 259 1435160 8900
 10.4 6060 0207
 91 50
10.3247 3250

$\frac{2}{2}$ 18675 17662
 17552 8760
 6060 6058
 50 51
25.8885 8893

$\frac{3}{3}$ 16781 16225
 288 14735 826962
 273 3940 61
 78 20
27.2042 2043

16457 17292
 14620 9108
 1514 0909
 37 82
288163 8181

$\frac{4}{4}$ 2042

2172

moon measures

	d	4	v	d	x	v
L	16184		17810			
18.6	12693		11312		03	
16.5	8999		10			
min	80		01			
$\frac{1}{4}$	<u>16.3489</u>		<u>.3504</u>			

$\frac{2}{2}$	15205		17780			
18.0	10727		12259		55	
16.5	30		60			
	00		71			
	<u>16.4477</u>		<u>4453</u>			

$\frac{3}{3}$	
17.2	
17.0	

15600	18800
7000	17404
0006	0006
00	89
<u>17.1402</u>	<u>1395</u>

$\frac{4}{4}$		
17.0	19791	19512
17.2	18080	11190
	1000	7890
	80	00
	<u>17.1689</u>	<u>1684</u>

$\frac{5}{5}$		19002	14907
16.7		15521	8387
18.0		1418	8083
		95	91
	direct measurements gives 6528	<u>16.6575</u>	<u>6574</u>

$\frac{6}{6}$		18982	17371
16.6		15210	11149
18.5		0000	50
min		80	87
$\frac{1}{2}$		<u>16.6222</u>	<u>6231</u>

2172

linear measures

a

4

2

a

2

a

16184

17810

186 1269399

1131203

16.5 8999

10

min 80

01

16.3489

3504

15205

17780

180 1072720

1225955

16.5 30

60

00

71

164477

4453

3

172

170

15600

18800

7000

1740406

0006

00

00

89

17.1402

1395

4

170 19791

19512

172 1808010

1119090

1000

7890

80

00

17.1689

1684

5

167

180

19002

14907

15521

838783

1918

8083

95

91

act remeasure given 628

16.6518

6574

6

146

18.5

18982

17371

1521000

1114950

00

10

80

87

16.6222

6231

2172 moon-measures.

12

$$\begin{array}{r} 2 \\ 167 \\ 19.0 \end{array}$$

$$\begin{array}{r} 17921 \\ 15260 \\ \hline 11 \\ 167340 \end{array}$$

$$\begin{array}{r} 17444 \\ 10082 \\ \hline 8072 \\ 30 \\ 7356 \end{array}$$

$$\begin{array}{r} 8 \\ 17.0 \\ 19.5 \\ 17522 \\ 1258980 \\ 80 \\ 32 \\ \hline 19.4944 \end{array}$$

$$\begin{array}{r} 15355 \\ 1027968 \\ 75 \\ 38 \\ \hline .4928 \end{array}$$

$$\begin{array}{r} 9 \\ 17.5 \\ 20.0 \end{array}$$

$$\begin{array}{r} 18178 \\ 1335560 \\ 4142 \\ 66 \\ \hline 17.5177 \end{array}$$

$$\begin{array}{r} 18080 \\ 1255060 \\ 55 \\ 76 \\ \hline 5223 \end{array}$$

2172

moon-measures

12

a

y

w

d x

N

2

167

190

17921

15260₅₅⁶⁰

11

16.7340

17444

10082₈₀⁷²

30

73568

170

195

17122

12589₈₀⁸⁰

80

32

19.4944

15355

10279₇₅⁶⁸

75

38

49289

175

200

18178

13355₆₀⁶⁰

4142

66

17.5177

18080

12450₅₅⁶⁰

55

76

1223

2172 Times etc.
 Eph + stars 1912 Nov. 20 23^m 14^m - 23^m 26^m
 ... Moon 23 19 53.4 - 23 19 53.7^v
 clock fast 00 02.6^v

H. Sid T. 23 19 509.5^v 0-2-1^m 29^m
 H. hour 4 44 31.05^v
 G. Sid T. 24 04 22.00^v
 Sid T. h. Moon 15 56 31.67^v
 Interval 12 07 50.33^v
 Reduction 1 59.24^v
 G. M. T. 12 05 51.09^v

From Kant Allen R.A. Decl.
 Moon 12^m 0^m 48^m 46^s 11^v + 5° 24' 19" 1^v
 Motion in 1.8690^v 14.863^v
 .. 5.8515^v + 10 94^v + 1 27.0^v
 Tabular place 0 48 57.05^v + 5 25 46.1^v

Moon Age 12 days.
 " parallax 55' 55.7^v
 " semidiameter 15 15.9^v
 R 9 15.9^v
 Augmentation + 11.3^v
 Irradiation (2) - 0.5^v
 R 9 26.7^v
 R 1.9865^v
 (1+a) R 1.9871^v
 R² 3.9486^v

9.34 = 11.7^v
 9.16 = 11.3^v

a = + 2.8

2172 Tunes etc
 Eph. station 1912 Nov. 20 23^m 14^m - 23^m 26^m
 Moon 2.3 19 53.4 - 23 19 53.7
 clock fast 00 02.6

H. Sid. T. 23 19 50.95 G-X. - 1^m 29^m
 H. long 4 44 31.05
 G. Sid. T. 24 04 22.00
 Sid. T. in Moon 15 56 31.67
 Interval 12 07 50.33
 Reduction 1 59.24
 G. in T. 12 05 51.09

From bank Allen R. A. h. Dec.
 Moon 12^m 0^m 48^m 46.11 + 5^m 24^m 19.1
 Moon is 1.8690 - 14.863
 5.8515 + 10.94 + 1 27.0
 Tabular place 0 48 57.05 + 5 25 46.1

Moon age 12 days.
 " parallel 5-5' 55.7
 " semidiam 15 15.9
 R 9 15.9
 Augmentation + 11.3
 Trachach 12 - 0.5
 R 9 26.7
 R 19 86.5
 (1st) R 19 87.1
 R² 39 48.6

934:117
 916:113

a: + 2.8

Standard Coordinates											
Cape W. 128 m 18.4				Cape W. 128 m 18.4				Cape W. 128 m 18.4			
C	0	43	08.39	0	53	09.00	0	54	38.60		
L			30			09					
E			22			01					
Mean	0	43	08.30	0	53	09.03					
Proc			+37.70			+37.11				+37.28	
S	0	43	46.00	0	53	46.14	0	55	15.88		
A	0	49	40	0	49	40	0	49	40		
Diff	-5		54.00	+4		06.14	+5		35.88		
Diff (A)	-3		53.96	+2		46.13	+3		35.85		
log	2		54895	2		39116	3		52614		
cos	9		99845	9		99904	9		99760		
30	1		05464	0		89744	7		03098		
3	-1		1.3408	+7		8966	+1		0.7395		
3	-		40	+		38	+		37		
3			6.6552	-2		5.9004			28.7432		
2			6.6780	2		5.8889			28.8172		
2-3			+228	-1		15			+740		
L	+4°	45'	55.5	+3°	45'	22.8	+5°	56'	37.0		
L			576			229					
C			59.8			23.0					
Mean	+4	45	57.6	+3	45	22.9					
Proc		+3	42.7		+3	54.0		+3	54.1		
S	+4	49	40.3	+3	49	16.9	+6	00	31.1		
D	+5	19	45	+5	19	45	+5	49	45		
S-B	-	30	04.7	-1	30	28.1	+	40	46.1		
Diff (D)	-1		804.7	-5		429.4			+2446.2		
log	3		25641	3		73475	3		38851		
40	0		58756	1		06590	0		71966		
tan S	8		9267	8		8247	9		0222		
82	2		1093	1		7949	2		0620		
71	8		0894	7		6730	8		1376		
70	-3		8686	-1		1.6387	+5		2440		
71	+		123	+		47	+		137		
7	1		81437	1		0.3660	2		72577		
9	1		81973	1		03248	2		72042		
9-m			+536	-4		12			-535		

2172

Standard Coordinates

C	0	43	08.39	0	53	09.00	0	54	38.60
L			30			09			
L			22			01			
mean	0	43	08.30	0	53	09.03			
Proc			+37.70			+37.11			+37.28
x	0	43	46.00	0	53	46.14	0	55	15.88
A	0	49	40	0	49	40	0	49	40
x-H	-5		54.00	+4		06.14	+5		35.88
ln(L-A)			-353.96			+246.13			+335.85
log			2.54895~			2.39116			2.52614
ws			999845~			999909			999760
Σ			1.05464~			0.89744			1.03098
Σ_1	-11.3408			+7.8966			+10.7395		
Σ_2	-		40	+38			+37		
Σ_3			6.6552	-25.9004			28.7432		
Σ_4			6.6780	25.8889			28.8172		
Σ_5			+228	-115			+740		

C	+4°	45'	55.5	+3°	45'	22.8	+5°	56'	37.0
L			576			229			
L			598			230			
mean	+4	45	57.6	+3	45	22.9			
Proc			+3	42.7	+3	54.0	+3	54.1	
S	+4	49	40.3	+3	49	16.9	+6	00	31.1
D	+5	19	45	+5	19	45	+5	49	45
S-D	-	30	04.7	-1	30	28.1	+40	46.1	
ln(S-D)			-180.47			-54.294			+2446.2
log			3.25641~			3.73475~			3.38851
Σ			0.58756~			1.06590~			0.71966
tanS			8.9267			8.8247			9.0222
Σ^2			21093			17949			20620
Σ_1			8.0894			76730			8.1376
Σ_2	-38686			-11.6387			+52490		
Σ_3	+1		123	+47			+137		
Σ_4			181437			10.3660			272577
Σ_5			181973			10.3248			272042
Σ_6			+536			-412			-535

2172

Plate Constants

15

x	y	R.A.	Decl.
6.6780	181973	0 43 46	+4 49 40
25.8889	103248	53 46	+3 49 17
28.8172	272042	55 16	+6 00 31
36138	5573	151 108	113 98 88
2046	1858	0 50 86	+4 53 09
-18	-22	-1 16	+26 36
246	342	0 49 40	+5 19 45
31	465		
76	1596		

$$A = 0^h 49^m 40^s$$

$$D = +5^\circ 19' 45''$$

$$\begin{array}{rcl}
 x-3 & -50.24 & -2.8x \\
 +228 & -914 & -19 \\
 -115 & 518 & -73 \\
 +740 & -1366 & -81 \\
 18.6098 & 921 & -52
 \end{array}
 \begin{array}{rcl}
 & & +706 \\
 & & = +1 \\
 & & = 0 \\
 & & = -1 \\
 & & = 18.5831
 \end{array}$$

$$\begin{array}{rcl}
 y-4 & +48.8x & -1.2y \\
 +536 & +326 & -22 \\
 -412 & +1263 & -12 \\
 -535 & +1406 & -33 \\
 18.3369 & 908 & -22
 \end{array}
 \begin{array}{rcl}
 & & -839 \\
 & & = +1 \\
 & & = 0 \\
 & & = -1 \\
 & & = 18.3416
 \end{array}$$

Tables. $a = 0.0$ $e = -3.4$ $a - e = +3.4$ $b + a = +3.2$
 Obs $a = +2.8$ $e = +1.2$ $a - e = +1.6$ $b + a = +1.4$

2172

Plate Constant

15

x	y	R.A.	Decl.
6.6780	18.1973	0 43 46	+4 49 40
25.8889	10.3248	5 3 46	+3 49 17
28.8172	27.2042	5 5 16	+6 00 31
36.138	55.73	15 1 10.8	13 98 88
20.46	18.58	0 50 56	+4 53 09
-18	-22	-1 16	+26 36
246	342	0 49 40	+5 19 45
31	465		
76	1596		

$A = 0^s 49^m 40^s$
 $D = +5^{\circ} 19' 45''$

-3	-50.24	-2.82	+706
+228	-1914	-686	-19
-115	518	-633	-73
+740	-1366	-626	-81
18.6098	921	-52	

$= +1$
 $= 0$
 $= -1$
 $= 18.5831$

4	+48.82	-1.24	-839
+536	+326	+862	-22
-912	+1263	+851	-12
-535	+1406	+871	-33
18.3369	908	-22	

$= +840$
 $= +839$
 $= +838$
 $= 18.3416$

Tables $a = 0.0$ $b = -3.4$ $a = 6.2 + 3.4$ $b + a = +3.2$
 clrs $a = +2.8$ $b = +1.2$ $a - b = +1.6$ $b + a = +1.4$

2172 Moon's Center

16

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$
1	18.6050	0.0000	+4	0.0000	3.9311
2	18.0000	-0.6050	+3	0.3656	3.9162
3	17.1398	-1.4652	+2	2.1462	3.9209
4	17.0000	-1.6050	+2	2.5754	3.9294
5	16.6546	-1.9504	+1	3.8037	3.9139
6	16.6226	-1.9824	-0	3.9299	3.9299
7	16.7348	-1.8702	-1	3.4980	3.9443
8	17.0000	-1.6050	-2	2.5766	3.9263
9	17.5200	-1.0850	-3	1.1779	3.9608

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
1	16.3496	-1.9824	-3	3.9311
2	16.4480	-1.8840	-3	3.5506
3	17.0000	-1.3320	-2	1.7744
4	17.1686	-1.1634	-2	1.3540
5	18.0000	-0.3320	-0	0.1102
6	18.3320	0.0000	0	0.0000
7	19.0000	+0.6680	+1	0.4463
8	19.4936	+1.1616	+2	1.3497
9	20.0000	+1.6680	+2	2.7829

Aprior. Center

$$x = 17.0 \quad y = 17.1686$$

$$19.4936$$

$$36.6622$$

$$\text{mean } y = 18.3311$$

$$y - \text{min} = 16.3496$$

$$R = 1.9815$$

$$x - \text{min} = 16.6226$$

$$x_0 = 18.6041$$

$$\text{Center } \begin{cases} x_1 = 18.6050 \\ y_0 = 18.3320 \end{cases}$$

217 v *hucan* Center

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$
1	18.6050	0.0000	+4	0.0000	3.9311
2	18.0000	-0.6050	+3	0.3656	3.9162
3	17.1398	-1.4652	+2	2.1462	3.9209
4	17.0000	-1.6050	+2	2.5754	3.9294
5	16.6546	-1.9504	+1	3.8037	3.9139
6	16.6226	-1.9824	0	3.9299	3.9299
7	16.7348	-1.8702	-1	3.4980	3.9443
8	17.0000	-1.6050	-2	2.5766	3.9263
9	17.5200	-1.0850	-3	1.1779	3.9608

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
1	16.3496	-1.9824	-3	3.9311
2	16.4480	-1.8840	-3	3.5506
3	17.0000	-1.3320	-2	1.7747
4	17.1686	-1.1634	-2	1.3540
5	18.0000	-0.3320	0	0.1102
6	18.3320	0.0000	0	0.0000
7	19.0000	+0.6680	+1	0.4463
8	19.4936	+1.1616	+2	1.3497
9	20.0000	+1.6680	+2	2.7829

Aphe Center

$$x = 17.0 \quad y = 17.1686$$

$$19.4936$$

$$36.6622$$

$$\text{mean } y = 18.3311$$

$$y - \text{mean} = 16.3496$$

$$x = 19.815$$

$$x - \text{mean} = 16.6226$$

$$x = 18.6041$$

$$\text{Center } \begin{cases} x = 18.6050 \\ y = 18.3320 \end{cases}$$

2172 Moon - Remeasures.

	d	N	d	N
✓	17700	14350		
18.6	14200	7850		
16.5	94	5051		
	94	50		
✓	<u>16.3500</u>	<u>3500</u>		

✓	16719	15315		
18.0	12230	980905		
16.6	29	20		
	06	20		
	<u>16.4483</u>	<u>4493</u>		

3
17.2
17.0

17449
884040
2736
35
17.1399

15870
1450090
8060
60
1381

4				
17.0	16489	15535		
17.2	14800	719290		
	1209	8090		
	75	28		
	<u>17.1675</u>	<u>1658</u>		

5
16.7
16.0

16420
1290911
10
60
16.6497

17300
1078070
6970
95
6524

6
16.6
18.5
min
26

16420
1261512
19
10
16.6199

17320
1108900
9500
26
6229

2012 Moon - Remains

	d	4	N	d	21	N
✓	17700		14350			
186	14200	99	7850			
105	94		5051			
-	94		50			
-	163500		3500			

2	16719		15315			
180	12230	31	980905			
166	29		20			
	06		20			
	164483		4493			

3			17449		15870
172			8840		1450090
170			2736		8080
			35		60
			171399		1381

4			15535	
170	16489		719290	
172	14800	09	80	
	12		28	
	75		1658	
	171675			

5			16420		17300
167			1290911		1078070
160			10		6970
			60		95
			166497		6524

6			16420		17320
166			1261112		1108900
185			19		9500
180			10		26
			166199		6229

2

2

16.

9.

8

17.

19.

9

17.

20

2172

Moon - Releases.

a

y

n

a

SL

n

2

16.7

19.0

15426

12760

5952

10

16.7336

18362

11009

10

60

7351

8

17.0

19.5

19521

17340

14566

1225960

6570

8067

14

40

19.49514926

9

17.5

20.0

19484

14600

9295

21

17.5168

18220

1298701

9100

16

5223

2172

Huron - Remembrance

a

4

m

a

m

a

2

107

190

15426

12760

5952

10

16.7336

18362

11009

10

60

7351

3

170

195

19521

1456670

65

14

19.4951

17340

1225960

8067

40

4926

3

175

200

19489

14600

9295

21

17.5168

18220

1298701

9100

16

15223

pt	pos. L	residual
1	1800	+1.2
2	197.8	-9.6
3	227.8	+8
4	234.0	+100
5	260.3	-5.6
6	270.0	+29
7	289.6	+79
8	305.8	-179
9	326.8	+6.4

2172

Inwon's Center - Residuals

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$
1	18.6050	0.0000	+4	0.0000	3.9295
2	18.0000	-0.6050	+3	0.3656	3.9132
3	17.1390	-1.4660	+2	2.1486	3.9233
4	17.0000	-1.6050	+2	2.5759	3.9340
5	16.6510	-1.9540	+1	3.8177	3.9279
6	16.6214	-1.9836	0	3.9347	3.9347
7	16.7344	-1.8706	-1	3.4995	3.9458
8	17.0000	-1.6050	-2	2.5766	3.9268
9	17.5196	-1.0854	-3	1.1779	3.9608

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.3500	-1.9820	-3	3.9295
2	16.4488	-1.8832	-3	3.5476
3	17.0000	-1.3320	-2	1.7747
4	17.1666	-1.1654	-2	1.3586
5	18.0000	-0.3320	0	0.1102
6	18.3320	0.0000	0	0.0000
7	19.0000	+0.6680	+1	0.4463
8	19.4938	+1.1618	+2	1.3502
9	20.0000	+1.6680	+2	2.7829

Mean Residuals + Residuals

	$\bar{O} - \bar{C}$
1	3.9303
2	3.9147
3	3.9221
4	3.9317
5	3.9209
6	3.9323
7	3.9450
8	3.9266
9	3.9608

Comp R^2 3.9486

2172

Various Centers - Residuals

	x	$x - x_c$	Δx	$(x - x_c)^2$	$(x - x_c)^2 + (y - y_c)^2$
1	18.6050	0.0000	+4	0.0000	3.9295
2	18.0000	-0.6050	+3	0.3656	3.9132
3	17.1390	-1.4660	+2	2.1486	3.9233
4	17.0000	-1.6050	+2	2.5759	3.9340
5	16.6510	-1.9540	+1	3.8177	3.9279
6	16.6214	-1.9836	0	3.9347	3.9347
7	16.7344	-1.8706	-1	3.4995	3.9458
8	17.0000	-1.6050	-2	2.5766	3.9268
9	17.5196	-1.0854	-3	1.1779	3.9608

	y	$y - y_c$	Δy	$(y - y_c)^2$
1	16.3500	-1.9820	-3	3.9295
2	16.4488	-1.8832	-3	3.5476
3	17.0000	-1.3320	-2	1.7747
4	17.1666	-1.1654	-2	1.3586
5	18.0000	0.3320	0	0.1102
6	18.3320	0.0000	0	0.0000
7	19.0000	+0.6680	+1	0.4463
8	19.4438	+1.1618	+2	1.3502
9	20.0000	+1.6680	+2	2.7829

Mean Residuals + Residuals

	$\Delta - C$
1	3.9303
2	3.9147
3	3.9241
4	3.9317
5	3.9209
6	3.9323
7	3.9450
8	3.9266
9	3.9608

Average 3.9486

Termination of Normals

	ab	dis	bu
1	- 0.00	- 0.0	+ 362.5
2	+ 1.13	+ 203.5	+ 637.5
3	+ 1.95	+ 389.3	+ 352.5
4	+ 1.86	+ 270.2	+ 196.0
5	+ 0.64	+ 540.5	+ 91.5
6	- 0.00	+ 322.5	- 0.0
7	- 1.25	+ 67.4	- 24.1
8	- 1.86	+ 352.0	- 255.2
9	- 1.82	- 133.0	+ 203.9
	+ 0.65	+ 2012.4	+ 1564.6

2172

Moon's Center.

Conditional Equations.

	a	b	0		c	0-c
1	0.00	-1.98	= -1.83		0 - 1.95 = -1.95	+12
2	-0.60	-1.88	= -3.39	-	58 - 1.85 = -2.43	-96
3	-1.47	-1.33	= -2.65	-	142 - 1.31 = -2.73	+8
4	-1.60	-1.16	= -1.69	-	155 - 1.14 = -2.69	+100
5	-1.95	-0.33	= -2.77	-	189 - 32 = -2.21	-56
6	-1.98	+0.00	= -1.63	-	192 + 0 = -1.92	+29
7	-1.87	+0.67	= -3.6	-	181 + 66 = -1.15	+79
8	-1.60	+1.16	= -2.20	-	155 + 1.14 = -4.1	-179
9	-1.09	+1.67	= +1.22	-	106 + 1.64 = +5.8	+64

Average = 69

Normal Equations.

$$+20.08a + 0.65b = +2012$$

$$+0.65a + 15.30b = +1565$$

$$-0.65a - 0.02b = -65$$

$$+15.28b = +1500$$

$$b = +98.4$$

$$+20.08a = +2012 - 64 = +1948$$

$$a = +97.0$$

2172

Moon's Center

Conditional Equations.

	a	b	c						
1	0 00	- 198	: - 183		0 - 195	: - 195		+ 12	
2	- 0 60	- 1 88	: - 339		- 58 - 185	: - 243		- 96	
3	- 1.47	- 1 33	: - 265		- 142 - 131	: - 273		+ 8	
4	- 1.60	- 1.16	: - 169		- 155 - 114	: - 269		+ 100	
5	- 1.95	- 0.33	: - 277		- 189 - 32	: - 221		- 56	
6	- 1.98	+ 0.00	: - 163		- 192 + 0	: - 192		+ 29	
7	- 1.87	+ 0.67	: - 36		- 181 + 66	: - 115		+ 79	
8	- 1.50	+ 1.16	: - 220		- 155 + 114	: - 41		- 179	
9	- 1.09	+ 1.67	: + 122		- 106 + 164	: + 58		+ 64	
							Average	69	

Normal Equations.

$$+ 20.08a + 0.65b = + 2012$$

$$+ 0.65a + 15.30b = 2.1565$$

$$- 0.65a - 0.02b = 65$$

$$+ 15.28b = + 1500$$

$$b = + 98.4$$

$$+ 20.08a + 2012 = 64 + 1948$$

$$a = + 97.0$$

2172 Moon's Mean Position (1912.0)

$$X_0 = 18.6050 \quad Y_0 = 18.3320$$

$$a = +48 \quad b = +44$$

$$18.6098 \quad 18.3369$$

From Plate Constants: $X = 18.5831 \quad Y = 18.3416$

$$z = +0.5831$$

$$\log z = 9.76574$$

$$\log z^2 = 9.99844$$

$$8.50724$$

$$(X-A) = 1.26006$$

$$X-A = +18.20$$

$$A = 0.4940$$

$$\alpha_0 = 0.495820$$

$$\text{Red} = +3.34$$

$$\alpha' = 0.500154$$

$$m = -3.6584$$

$$\log \tan \delta = 8.9346$$

$$z^2 = 9.5315$$

$$m_1 = 5.5195$$

$$\log m_0 = 0.56329$$

$$7.33115$$

$$(H-D) = 3.23214$$

$$S-D = -28.266$$

$$D = +5.1945$$

$$S_0 = +4^{\circ} 51' 18.4''$$

$$\text{Red} = +23.1$$

$$\delta' = +4.51415$$

2172 Brown's Mean Position (1912.0)

$$X = 18.6050$$

$$Y = 18.3320$$

$$+ 48$$

$$+ 49$$

$$18.6098$$

$$18.3369$$

From Plate Constants $X = 18.5831$ $Y = 18.3416$

$$z = +0.5831$$

$$\eta = -3.6584$$

$$\log z = 9.76574$$

$$\log \tan \delta = 8.9346$$

$$\log z = 9.99899$$

$$z = 9.5315$$

$$8.50724$$

$$\eta = 5.5195$$

$$(X - A) = 1.26006$$

$$\log \eta = 0.56329$$

$$7.33115$$

$$X - A = +1.820$$

$$(H - D) = 3.23214$$

$$A = 0.4940$$

$$S - D = -28.266$$

$$X_0 = 0.495820$$

$$D = +5.1945$$

$$\text{Red.} = +3.34$$

$$S = +9.51184$$

$$X = 0.500154$$

$$\text{Red.} = -23.1$$

$$S = +4.51415$$

2172 Red. ad. l. app.

$$\delta_0 = +4^\circ 51'$$

$$\begin{array}{rcl} H + \alpha & 2 & 48 = 42^\circ \\ H & 1 & 58 \\ \alpha & 0 & 50 \\ G & 22 & 05 \\ G + \alpha & 22 & 55 = 343^\circ 45' \end{array}$$

$$\begin{array}{rcl} \cos(H + \alpha) & 9 & 9823 \\ g & 1.2638 \\ \sin & 9 & 4469 \\ \tan S & 8.9287 \\ & 8.8239 \end{array}$$

$$\begin{array}{rcl} \log(g') & 1 & 2461 \\ \therefore g' & 8.4633 \end{array}$$

$$\begin{array}{rcl} Q & = & + 2.48 \\ q & = & - 0.03 \\ h & = & + 0.89 \\ \hline & & + 3.34 \end{array}$$

$$\begin{array}{rcl} \log \cos S & 9.9984 \\ \therefore 2 & 0.6310 \\ \therefore (c) & 0.6294 \end{array}$$

$$\begin{array}{rcl} \sin S & 8.9271 \\ \cos(H + \alpha) & 9.8711 \\ h & 1.3014 \\ \sin & 9.8255 \\ \sec S & 0.0016 \\ & 8.8239 \end{array}$$

$$\begin{array}{rcl} \log(h') & = & 0.0996 \\ \therefore (h) & = & 9.9524 \end{array}$$

$$\begin{array}{rcl} g' & = & + 17.62 \\ h' & = & + 1.26 \\ l & = & + 4.26 \\ \hline & & + 23.14 \end{array}$$

2172 Rad. and G. Effects.

$$S_0 = +4^{\circ} 51'$$

$$\begin{array}{rcl} H + A & 2 & 48 = 42^{\circ} \\ H & 1 & 58 \\ A & 0 & 50 \\ G & 22 & 03 \\ G + A & 22 & 55 = 343^{\circ} 45' \end{array}$$

$$\begin{array}{rcl} \cos(G+A) & 9 & 9823 \\ \sin & 1 & 2638 \\ \cos & 9 & 4469 \\ \sin S & 8 & 9287 \\ & 8 & 8237 \end{array}$$

$$\begin{array}{rcl} \log(S) & 1 & 2461 \\ \log & 8 & 4633 \end{array}$$

$$\begin{array}{rcl} Q & + & 248 \\ q & - & 003 \\ h & + & 090 \\ \hline & = & 335 \end{array}$$

$$\begin{array}{rcl} \log \cos S & 9 & 9984 \\ L & 0 & 6310 \\ \hline & 0 & 6294 \end{array}$$

$$\begin{array}{rcl} \sin S & 8 & 9271 \\ \cos(H+A) & 9 & 5711 \\ h & 1 & 3014 \\ \sin & 9 & 8255 \\ \sec S & 0 & 0016 \\ & 8 & 8237 \end{array}$$

$$\begin{array}{rcl} \log h' & 0 & 0996 \\ h' & 9 & 9524 \end{array}$$

$$\begin{array}{rcl} q & + & 1762 \\ h' & + & 126 \\ l & + & 426 \\ \hline & = & 23.14 \end{array}$$

2172 Lunar parallel.

$$\begin{aligned} \alpha' &= 0^{\circ} 50' 01.54'' \\ \theta &= 23 \quad 19 \quad 50.95'' \\ \delta - \alpha &= -1 \quad 30 \quad 10.60'' \\ &= -22^{\circ} 32' 39'' \end{aligned}$$

$$\begin{aligned} & - 7 \quad 58'' \\ 22 \quad 24 \quad 41'' \end{aligned}$$

$$\begin{aligned} & 9.95727 \\ & 0.00000 \\ & 003410 \\ \hline \tan f &= 9.99137 \end{aligned}$$

$$\begin{aligned} \gamma &= 44 \quad 25 \quad 50'' \\ & 4 \quad 51 \quad 42'' \end{aligned}$$

$$\gamma - \delta = 39 \quad 34 \quad 08''$$

$$\begin{aligned} & 9.82640 \\ & 8.21134 \\ & 9.80414 \\ & 0.15487 \\ \hline & 7.99675 \end{aligned}$$

$$\delta - \delta' = +34 \quad 07.3''$$

$$\delta = +5 \quad 25 \quad 48.8''$$

$$\text{Ann Eph } \delta = +5 \quad 25 \quad 46.1''$$

$$\delta - \alpha = +2.7''$$

$$\delta' = +4^{\circ} 51' 41.5''$$

$$\pi = 55' 55.7''$$

$$\begin{aligned} & 9.86913 \\ & 8.21134 \\ & 9.58365 \\ & 0.00195 \\ \hline & 7.66607 \end{aligned}$$

$$\alpha - \alpha' = -15' 56.09''$$

$$= -1'' 03.74''$$

$$\alpha = 0 \quad 48 \quad 57.80''$$

$$\alpha = 0 \quad 48 \quad 57.05''$$

$$+ 0.75''$$

2172

Lunar parallel

$$\begin{array}{rcl}
 \alpha & : & 0^{\circ} 50' 01.54 \\
 \delta & : & 23^{\circ} 19' 50.95 \\
 \alpha - \delta & : & -1^{\circ} 30' 10.60 \\
 & & -22^{\circ} 32' 39''
 \end{array}$$

$$-7^{\circ} 58'$$

$$22^{\circ} 24' 41''$$

$$995727$$

$$000000$$

$$003410$$

$$\text{rang} \quad 999137$$

$$y \quad 44^{\circ} 25' 50''$$

$$4^{\circ} 51' 42''$$

$$y - \delta \quad 39^{\circ} 34' 08''$$

$$982640$$

$$821134$$

$$980414$$

$$015487$$

$$799675$$

$$\delta - \delta' \quad +34^{\circ} 07.3'$$

$$\delta \quad +5^{\circ} 25' 48.8''$$

$$\text{Sun Eff} \quad \delta \quad +5^{\circ} 25' 46.1''$$

$$\delta - \delta' \quad +27'$$

$$\delta' = +4^{\circ} 51' 41.5''$$

$$\pi \quad 55' 55.7''$$

$$9.86913$$

$$821134$$

$$9.58365$$

$$000195$$

$$7.66607$$

$$\alpha - \alpha' = -15' 56.09''$$

$$= -1^{\circ} 03.74'$$

$$\alpha \quad 0^{\circ} 48' 57.80''$$

$$\alpha \quad 0^{\circ} 48' 57.05''$$

$$= 0.75'$$

