

KG
11366
v. 918



Harvard Lunar Plates.

Measures and Reductions.

Mary Fowler.

Volume XI. II

Plate No.	Date	Page
1791	1912 Apr. 25	1
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1

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Stars - measures.

	α	δ	α	δ	α	δ
1	14270	14720	18988	15330		
9.5	740912	1160999	1430903	1001018		
23.7	10	00	60	20		
	83	30	00	30		
	<u>23.6869</u>	<u>.6880</u>	<u>9.5310</u>	<u>.5314</u>		
2			18010	19588		
19.2	18201	19540	1022018	1739090		
137	1065040	1711912	20	90		
	40	0912	15	90		
	16	48				
	<u>13.7870</u>	<u>.7571</u>	<u>19.2205</u>	<u>.2199</u>		
3	16598	18994	11119	1408080		
25.9	1152522	1407570	1059090	78		
26.5	21	76	85	13558		
	04	02				
	<u>26.5078</u>	<u>.5076</u>	<u>25.9469</u>	<u>.9479</u>		

Grade 4.

Remainder (1)

18411	17818	18220	16955
1152838	1470600	1352223	1165050
35	12	20	63
22	30	28	51
<u>23.6885</u>	<u>.6884</u>	<u>9.5298</u>	<u>.5299</u>

1913 Oct. 30

1

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Stage - Measures

	d	x	n
1	14270	14720	
9.5	740912	1160999	
237	10	00	
	83	30	
	<u>23.6869</u>	<u>.6880</u>	

18988	15330
1430903	1001018
60	20
00	30
<u>95310</u>	<u>.5314</u>

2	18201	19540
192	1065040	1711912
137	40	09
	16	48
	<u>13.7570</u>	<u>.7571</u>

18010	19588
1022018	1739090
20	90
15	90
<u>19.2205</u>	<u>.2199</u>

3	16598	18999
259	1152522	1407570
265	21	76
	04	02
	<u>26.5078</u>	<u>.5076</u>

11119	14080
1059090	7880
85-90	13558
<u>25.9469</u>	<u>.9479</u>

Grade 4

Remainder (1)

18411	17818
1152838	1470600
3538	12
22	30
<u>3.6885</u>	<u>.6884</u>

18220	16955
1352223	1165050
20	63
28	51
<u>9.5298</u>	<u>.5299</u>

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hydro-measures

2

a

v

a

v

w

17.5
18.0

14594

18148

910905

136557

08

61

02

50

17.4509.4493

2

17.0

19795

16905

18.5

1525755

1143620

60

09

10

17

18.4545.4511

3

16.7

19.0

19186

16962

1634048

1980820

49

10

75

68

16.7163.7153

4

16.6

19.5

min

in

x

19119

16980

1509090

10988

86

92

20

82

16.5970.5920

5

16.6

20.0

may be in a
valley.

18085

15992

1433112

974850

11

50

90

05

16.6231.6251

6

17.0

20.9

1193530

10180

30

9420

11170

3530

20.92389248

1791 moon - measures

	α	μ	α	μ
<u>7</u>	16390	14360		
18.0	974031	1102220		
24.6	26	25		
	06	70		
	<u>20.6669</u>	<u>.6680</u>		

<u>8</u>				
18.7	16960	14399		
21.7	906063	1230792		
max	60	90		
in	60	10		
8	<u>28.7899</u>	<u>.7895</u>		

<u>9</u>	15930	13425		
19.0	827285	1108982		
24.7	81	89		
	45	40		
	<u>20.7662</u>	<u>.7658</u>		

1791

moon - measures

	α	μ	δ	μ	δ	μ
<u>17</u>	16390		14360			
18.0	974031		110220			
20.6	26		25			
	06		70			
	<u>20.6669</u>		<u>6680</u>			

<u>8</u>						
18.7	16960		14399			
20.7	906063		1230792			
max	60		90			
"	60		10			
8	<u>18.7899</u>		<u>7895</u>			

<u>9</u>	15930		13425			
19.0	8272		1108982			
20.7	8185		89			
	45		40			
	<u>20.7662</u>		<u>9658</u>			

1791	Times etc.						
Exp. telars	1912 Apr. 25	11 ^h	19 ^m		- 11 ^h	31 ^m	
" moon		11	24	48.6 ^v	- 11	24	48.7 ^v
clock slow			1	40.5 ^v			
H. Sid. T.		11	26	29.15 ^v			
H. long		4	44	31.05 ^v			
G. Sid. T.		16	11	0.020 ^v			
Sid. T. moon		2	12	31.42 ^v			
Interval		13	58	28.78 ^v			
Reduction			2	17.36 ^v			
G. M. T.		13	56	11.42 ^v	$\theta - \kappa = +1^h 19^m$		
							33.32

from bank. Alm.	R. A.	Decl.	
moon 14 ⁿ	10 ^h 07 ^m	04 ^s 32 ^v	+ 16° 07' 10.9 ^v
mot. h ^m = 2.2274 ^v			14.100 ^v
" " - 3.8097 ^v		- 8.49 ^v	+ 53.7 ^v
Tabular place	10 06	55 83	+ 16 08 04.6 ^v

moon's age	8.5 days ^v
" parallax	58, 56.3 ^v
" semidiam	16 05.2 ^v
934 = 13.4	R = 965.2 ^v
965 = 14.3	Augmentation + 14.3
	Irradiation (4) - 0.8
	R = 978.7 ^v
	R = 2.0980 ^v
a = 0.	R ² = 4.4016 ^v

1791	Times etc							
Exp. 1112	1912 Apr 25	11 ^m	19 ^m		- 11 ^m	31 ^m		
known		11	24	48.6	- 11	24	48.7	
clock slow			1	40.5				
H Sid T		11	26	29.15				
H long		4	44	31.05				
G Sid T		16	11	00.20				
Sid T known		2	12	31.42				
Interval		13	58	28.78				
Rechnen			2	17.36				
G Sid T		13	56	11.42	$\Theta - X = + 1^h 19^m 33.3^s$			

from bank. Alum.			R. G.		Wheel			
known 14 ^m		10 ^m	07 ^m	04 ^m 32 ^m	+ 16 ^m	07 ^m	10 ^m	9
known 1 ^m : 2.2274					14.100			
- 38097				- 849				+ 537
Tabular place		10	06	55.83	+ 16	08	04.6	

known age		8.5 days		
parallel		58	56.3	
curvature		16	05.2	
934.134	R =		96.52	
965.143	Augmentation		+ 19.5	
	Irregularity (4)		- 0.8	
	R =		978.7	
	R =		20980	
G = 0.				
	R ²		4.4016	

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Plate Constants

5

x	9.5305	19.2202	25.9474
y	9.6934	19.6994	26.2773
$x-y$	-3629	-4792	-3299

u	23.6879	13.7570	26.5077
v	22.6334	12.8155	25.6418
$u-v$	+1.0545	+9415	+8659

$$\begin{array}{rclcl}
 x-y & -117.54 & & +.54 & +6401 \\
 -3629 & -2783 & = -6412 & +12 & = -6400 & = +4 \\
 -4792 & -1616 & = -6408 & +7 & = -6401 & = -0 \\
 -3299 & -3115 & = -6414 & +13 & = -6401 & = 0 \\
 18.6966 & -2314 & & +10 & & = 19.1063 \checkmark
 \end{array}$$

$$\begin{array}{rclcl}
 u-v & +115.12 & & -1.54 & -1.1606 \\
 +1.0545 & +1097 & = +1.1642 & -36 & = +1.1606 & = 0 \\
 +9415 & +2212 & = +1.1627 & -21 & = +1.1606 & = 0 \\
 +8659 & +2987 & = +1.1646 & -40 & = +1.1606 & = 0 \\
 19.6894 & +2152 & & -30 & & = 18.7410 \checkmark
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables } a = +0.4 & x = -0.1 & a-x = +0.5 & b+a = -0.9 \\
 \text{Obs } a = 0.0 & x = +1.5 & a-x = -1.5 & b+a = -1.9 \\
 c = 0 & & & +2.0 & -2.8
 \end{array}$$

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Plate Constants

5

2	9.5312	19.2202	25.9474
3	9.8934	19.6994	26.2773
2-3	-3622	-4792	-3299

4	23.6879	13.7570	26.5077
4	22.6334	12.8115	25.6418
4-4	+1.0540	+9.415	+8.659

2-5	-117.54	7.54	+64.01
-3629	-2783	= -6412 + 12 = -6400	= +1
-4792	-1616	= -6408 + 7 = -6401	= -0
-3299	-3115	= -6414 + 13 = -6401	= 0
18.6966	-2314	+10	= 19.1063

4-4	+115.12	-154	-1.1606
+1.0545	+1097	= +11642 - 36 = +11606	= 0
+9415	+2212	= +11627 - 21 = +11606	= 0
+8659	+2987	= +11646 - 40 = +11606	= 0
19.6894	+2152	-30	= 18.7410

Tables	$a = +0.4$	$a = 0.1$	$a = 2 = +0.5$	$a + \alpha = 0.9$
Obs	$a = 0.0$	$a = +1.5$	$a = 2 = -1.5$	$a + \alpha = -1.9$
$C = 0$			+20	-28

ht.	mag. L	resid.
1	216.5	+71
2	234.0	+68
3	250.9	-25
4	270.0	+27
5	278.5	-98
6	306.0	+17
7	340.6	-38
8	0.0	+99
9	4.2	+31

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Moon's Center

6.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.4501	-1.2490	-1	1.5603	4.4120	+109
2	17.0000	-1.6991	-1	2.8873	4.4147	+131
3	16.7158	-1.9833	0	3.9335	4.4076	+60
-4	16.5980	-2.1011	0	4.4146	4.4146	+130
5	16.6241	-2.0750	0	4.3056	4.4025	+9
6	17.0000	-1.6991	+1	2.8866	4.4138	+122
7	18.0000	-0.6991	+2	0.4855	4.4045	+29
8	18.6991	0.0000	+2	0.0000	4.4150	+134
9	19.0000	+0.3009	+2	0.0907	4.4067	+51

Comb. $R^2 = 4.4016$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	18.0000	-1.6886	-1	2.8517
2	18.4528	-1.2358	-1	1.5274
3	19.0000	-0.6886	0	0.4741
4	19.6886	0.0000	0	0.0000
5	20.0000	+0.3114	0	0.0969
6	20.9243	+1.2357	+1	1.5272
7	21.6674	+1.9788	+1	3.9160
8	22.7897	+2.1011	+1	4.4150
9	24.7660	+2.0774	+1	4.3160

Approximate Center

$$x = 17.0 \quad y = 18.4528$$

$$20.9243$$

$$3937.71$$

$$\text{mean } x = 19.6886$$

$$y = \text{max} = 22.7897$$

$$R = 2.1011$$

$$x = \text{min} = 16.5980$$

$$\text{mean } x = 18.6991$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 18.6991 \\ y_0 = 19.6886 \end{array} \right.$$

1791 known center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	174501	-12490	-1	15603	44120	+104
2	170000	-16991	-1	28873	44147	+131
3	167155	-19833	0	39335	44076	+60
-4	165980	-21011	0	44146	44146	+130
5	166241	-20750	0	43056	44025	+9
6	170000	-16991	+1	28866	44138	+122
7	180000	-06991	+2	04885	44045	+29
8	186991	00000	+2	00000	44150	+134
9	190000	+03009	+2	00907	44067	+51

Comb. $R^2 = 44016$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	180000	-16886	-1	28517
2	184528	-12358	-1	15274
3	190000	-06886	0	04741
4	196886	00000	0	00000
5	200000	+03114	0	00969
6	209243	+12357	+1	15272
7	216674	+19788	+1	39160
8	217497	+21011	+1	44150
9	217660	+20774	+1	43160

Approximate center

$$x = 170 \quad y = 184528$$

$$209243$$

$$393771$$

$$\text{mean } y = 196886$$

$$y_{\text{max}} = 217497$$

$$R^2 = 21011$$

$$x_{\text{max}} = 165980$$

$$\text{mean } x = 186491$$

Center $\begin{cases} x_0 = 186991 \\ y_0 = 196886 \end{cases}$

Formulation of Normals

	ab	ac	bc
1	+ 2.11	- 130.0	- 175.8
2	+ 2.11	- 222.7	- 162.4
3	+ 1.37	- 118.8	- 41.4
4	- 0.00	- 273.0	+ 0.0
5	- 0.64	- 18.7	+ 2.8
6	- 2.11	- 207.4	+ 151.3
7	- 1.39	- 20.3	+ 57.4
8	+ 0.00	+ 0.0	+ 281.9
9	+ 0.62	+ 15.3	+ 106.1
	+ 2.07	- 975.6	+ 219.4

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Moon's Center Conditional Equations

7

	a	b	c	c	c-c	
1	-1.25	-1.69	+104	+61-28	+33	+71
2	-1.70	-1.24	+131	+84-21	+63	+68
3	-1.98	-0.69	+60	+97-12	+85	-25
4	-2.10	+0.00	+130	+103+0	+103	+27
5	-2.08	+0.31	+9	+102+5	+107	-98
6	-1.70	+1.24	+122	+84+21	+105	+17
7	-0.70	+1.98	+29	+34+33	+67	-38
8	+0.00	+2.10	+134	-0+35	+35	+99
9	+0.30	+2.08	+51	-15+35	+20	+31
Average = 53						

Normal Equations

$$\begin{aligned}
 &+ 20.57 + 20.7 = -976 \\
 &+ 20.7 + 19.12 = +219 \\
 &- 20.7 - 0.21 = +98 \\
 &\quad + 18.91 = +317 \\
 &- 0.22 - 2.07 = -24 \\
 &+ 20.35 \quad = -1000
 \end{aligned}$$

$$b = +16.75$$

$$a = -49.2$$

1791

Moon's Center Conditional Equations

7

	a	b	0	c	0-c
1	-1.25	-1.69	+1.04	+61-28 = +33	+71
2	-1.70	-1.24	+1.31	+84-21 = +63	+68
3	-1.98	-0.69	+1.60	+97-12 = +85	+25
4	-2.10	+0.00	+1.30	+103+0 = +103	+27
5	-2.08	+0.31	+9	+102+5 = +107	-98
6	-1.70	+1.24	+1.22	+84+21 = +105	+17
7	-0.70	+1.98	+2.9	+34+33 = +67	-38
8	+0.00	+2.10	+1.34	+0+35 = +35	+99
9	+0.30	+2.08	+5.1	+15+35 = +20	+31

Average = 53

Normal Equations

$$\begin{aligned}
 + 20.57 + 20.7 &= -976 \\
 + 20.7 + 19.12 &= +219 \\
 - 20.7 - 0.21 &= +98 \\
 + 18.91 &= +317 \\
 - 0.22 - 2.07 &= -24 \\
 + 20.35 &= -1000
 \end{aligned}$$

$$b = +16.75$$

$$a = -49.2$$

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Moon's Mean Position (1912.0)

8

$$\begin{array}{r} X_0 = 18.6991 \\ \frac{1}{2}a = 25 \\ \hline 18.6966 \end{array}$$

$$\begin{array}{r} Y_0 = 19.6886 \\ \frac{1}{2}b = 8 \\ \hline 19.6894 \end{array}$$

From Plate Constants $X = 19.1063$ $Y = 18.7410$

$$\begin{array}{r} \bar{x} = +1.1063 \\ \log f = 0.04388 \\ \text{.. } \log S = 9.98352 \\ \text{.. } \log t = 8.50724 \end{array}$$

$$\text{.. } (2-A) = 1.55312$$

$$X-A = +35.74$$

$$A = 10 \quad 05 \quad 17$$

$$X_0 = 10^h \quad 05^m \quad 52.74^s$$

$$\text{Red. ind.} = +1.25$$

$$\text{Aph. } X' = 10^h \quad 05^m \quad 53.99^s$$

$$m = -3.2590$$

$$\begin{array}{r} \log T = 9.4479 \\ \text{.. } 52 = 0.0878 \\ \text{.. } \gamma_1 = 6.5891 \\ \gamma_1 = +4 \end{array}$$

$$\mu_0 = -3.2594$$

$$\log \mu_0 = 0.51314$$

$$\text{.. } \log t = 7.33115$$

$$\text{.. } (A-D) = 3.18199$$

$$\delta-D = -25 \quad 20.5$$

$$D = +16 \quad 06 \quad 23$$

$$\delta_0 = +15^\circ \quad 41' \quad 02.5''$$

$$\text{Red. } \delta = -00.5$$

$$\text{Aph. } \delta' = +15^\circ \quad 41' \quad 02.0''$$

1791

Moon's Mean Position (1912.0)

8

$$\begin{array}{r} X_0 = 18.6991 \\ \frac{1}{2}a = 25 \\ \hline 18.6966 \end{array}$$

$$\begin{array}{r} Y_0 = 19.6886 \\ \frac{1}{2}b = 18 \\ \hline 19.6894 \end{array}$$

From Plate Constants. $X = 19.1063$ $Y = 18.7410$

$$\begin{array}{r} z = +1.1063 \\ \log t \quad 0.04388 \\ \log S \quad 998352 \\ \log t \cdot S = 850724 \\ \log (t - A) \quad 1.55312 \end{array}$$

$$X - A = 3574$$

$$A \quad 10 \quad 05 \quad 17$$

$$X_0 \quad 10^h \quad 05^m \quad 52.94^s$$

$$\text{Red. } d = 125$$

$$\text{App. } d' = 10^h \quad 05^m \quad 53.99^s$$

$$m = -3.2590$$

$$\begin{array}{r} \log \tan S \quad 94479 \\ S^2 \quad 0.0878 \\ \log \gamma_1 \quad 6.5891 \\ \gamma_1 = 4 \end{array}$$

$$\gamma_0 = -3.2594$$

$$\begin{array}{r} \log \gamma_0 = 0.51314 \\ \log \gamma_1 = 7.33115 \end{array}$$

$$(t - A) = 3.18199$$

$$S + D = 25 \quad 20.5$$

$$D = 116 \quad 06 \quad 23$$

$$S_0 = +15^\circ \quad 41' \quad 02.5''$$

$$\text{Red. } S = -00.5$$

$$\text{App. } S' = +15^\circ \quad 41' \quad 02.0''$$

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Lunar Parallax

9

$$\begin{aligned} \alpha' &= 10^{\text{h}} 05^{\text{m}} 53^{\text{s}} 99^{\text{v}} \\ \theta &= 11 \quad 26 \quad 29.15^{\text{v}} \\ \theta - \alpha &= +1 \quad 20 \quad 35.16^{\text{v}} \\ &= +20^{\circ} 08' 47'' \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = +07 \quad 49$$

$$(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = +20^{\circ} 00' 58''$$

$$\log \tan \phi' = 9.95727^{\text{v}}$$

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.000000$$

$$\therefore \cos(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.97294^{\text{v}}$$

$$\tan \gamma = 9.98433^{\text{v}}$$

$$\gamma = +43 \quad 58 \quad 00.0^{\text{v}}$$

$$\delta' = +15 \quad 41 \quad 02.0$$

$$\gamma - \delta' = +28 \quad 16 \quad 58.0^{\text{v}}$$

$$\log \sin \phi = 9.82640^{\text{v}}$$

$$\sin \pi = 8.23411^{\text{v}}$$

$$\sin(\gamma - \delta') = 9.67567^{\text{v}}$$

$$\therefore \sin \gamma = 9.84151^{\text{v}}$$

$$\therefore \sin(\gamma - \delta') = 7.89461^{\text{v}}$$

$$\delta - \delta' = +26 \quad 58.2^{\text{v}}$$

$$\delta = +16 \quad 08 \quad 00.2^{\text{v}} \quad \alpha = 10 \quad 06 \quad 56.52^{\text{v}}$$

$$\text{Ann Eph } \delta = +16 \quad 08 \quad 04.6^{\text{v}} \quad \alpha = 10^{\text{h}} 06 \quad 55.83^{\text{v}}$$

$$\theta - \alpha = -4.4^{\text{v}} \quad +0.69^{\text{v}}$$

$$\delta' = +15^{\circ} 41' 02.0''^{\text{v}}$$

$$\pi = 58' 56.3''^{\text{v}}$$

$$\log \sec \phi' = 9.86913^{\text{v}}$$

$$\sin \pi = 8.23411^{\text{v}}$$

$$\therefore \sin(\theta - \alpha') = 9.53709^{\text{v}}$$

$$\therefore \cos \delta = 9.98255^{\text{v}}$$

$$\therefore \sin(\alpha - \alpha') = 7.65778^{\text{v}}$$

$$\alpha - \alpha' = +15' 38.40''^{\text{v}}$$

$$= +1^{\text{h}} 02.53^{\text{v}}$$

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Lunar Parallax

9

$$\begin{aligned} \alpha' &= 10^{\text{h}} 05^{\text{m}} 53^{\text{s}} 99 \\ \delta &= 11 \quad 26 \quad 29.15 \\ \delta - \alpha &= +1 \quad 20 \quad 35.76 \\ &= +20^{\circ} 08' 47'' \end{aligned}$$

$$\delta' = +15^{\circ} 41' 02.0''$$

$$\pi = 58' 56.3''$$

$$\frac{1}{2}(\alpha - \alpha') = +07 \quad 49$$

$$\log \sec \phi = 9.86913$$

$$\sin \pi = 8.23411$$

$$\sin(\delta - \alpha') = 9.53709$$

$$\cos \delta = 9.98255$$

$$\sin(\alpha - \alpha') = 7.65776$$

$$\delta - \delta' - \frac{1}{2}(\alpha - \alpha') = +20^{\circ} 00' 56''$$

$$\log \tan \phi = 9.95727$$

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.00000$$

$$\cos(\delta - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.97294$$

$$\tan \gamma = 9.98433$$

$$\alpha - \alpha' = +15^{\circ} 38.00$$

$$= +1^{\text{h}} 02.53$$

$$\gamma = +43 \quad 58 \quad 00.0$$

$$\delta' = +15 \quad 41 \quad 02.0$$

$$\gamma - \delta' = +28 \quad 16 \quad 58.0$$

$$\log \sec \sin \phi = 9.82640$$

$$\sin \pi = 8.23411$$

$$\sin(\gamma - \delta') = 9.67561$$

$$\sin \gamma = 9.84151$$

$$(\delta - \delta') = 7.89461$$

$$\delta - \delta' = +26 \quad 58.2$$

$$\delta = +16 \quad 08 \quad 09.2 \quad \alpha = 10^{\text{h}} 06 \quad 56.52$$

$$\text{Ann Eph } \delta = +16 \quad 08 \quad 09.6 \quad \alpha = 10^{\text{h}} 06 \quad 55.83$$

$$O - C = -44 \quad +0.69$$

MC1795

Stars - measures

1913 Oct 31

11

	α	δ	α	δ	α	δ	α	δ
1	1 6 1 1 0	1 8 3 1 0	1 7 2 0 4	1 9 1 3 0				
5.6	8 2 6 0 50	1 6 1 2 8 39	1 3 7 1 9 14	1 2 6 0 8 95-				
24.8	60	39	20	20				
mag	03	08	95	20				
8.4	2 6 7 8 4 7	7 8 2 6	5.6 5 1 7	6 5 1 9				
2	1 4 3 5 2	1 7 1 8 2	1 2 3 4 3	1 2 1 0 0 00				
13.0	8 3 8 5 76	1 3 1 5 2 68	1 2 2 2 4 18	10				
13.6	80	65	25	1 2 0 1 5 -				
mag	67	90						
3.8	1 3.5 9 8 1	5 9 7 7	1 2.9 8 7 9	9 9 1 2				
3	1 8 5 0 7	1 5 6 7 3	1 9 7 2 0	1 6 7 2 6				
21.7	1 2 2 9 0 88	1 2 8 6 5 70	1 6 8 4 0 40	9 6 1 0 05-				
24.7	86	65	33	07				
mag	09	83	20	30				
8.2	2 4.7 2 2 0	7 1 9 1	2 1 7 1 1 8	7 1 2 2				
4	1 4 6 0 8 14	9 5 6 0	1 4 8 0 0	7 9 0 0 98				
29.9	14	9 1 3 0	1 4 0 0 6 00	00				
13.9	1 3 6 9 8	30 30	00	7 1 2 8				
	1 3.9 5 8 6	9 5 7 0	2 9.9 2 0 2	9.2 2 9				

Grade (1)

(5) to be used instead of (2)

11.4	1 7 8 9 4	1 6 9 5 8	1 9 8 4 3	1 7 0 5 0
17.2	1 6 2 8 0 79	8 5 8 4 77	1 3 6 1 0 10	1 3 2 9 0 89
	83	80	10	99
	00	60	60	56
	1 7.1 6 1 5	1 6 2 0	1 1.3 7 5 7	3 7 6 0
6	1 5 0 2 8	1 4 1 6 0	1 6 6 2 7	1 6 0 5 6
20.3	1 0 1 0 5	9 0 9 0	1 9 1 7 5 70	1 3 5 0 0 00
18.5	01 04	9 6 8 5	70	00
	20	60	32	60
	1 8.4 9 2 1	4 9 3 0	2 5 2 5 4 1	2 5 5 7

MC1795

Stars - measures

1913 Oct 31

11

α	δ	α	δ	α	δ	α	δ
✓	1 6 1 1 0	1 8 3 1 0	1 7 2 0 4	1 9 1 3 0			
5.6	8 2 6 0 8 2	1 6 1 2 8 3 9	1 3 7 1 9 1 4	1 2 6 0 8 9 5			
268	60	39	20	90			
my	03	08	95	20			
84							
	<u>26.78.47</u>	<u>78.26</u>	<u>5.65.17</u>	<u>65.19</u>			
2	1 4 3 5 2	1 7 1 8 2	1 2 3 4 3	1 2 1 0 0 0 0			
130	8 3 8 5 7 6	1 3 1 5 2 6 8	1 2 2 2 4 1 8	10			
136	80	65	25	120 11			
my	67	90					
38	<u>13.59.81</u>	<u>59.77</u>	<u>12.98.79</u>	<u>99.12</u>			
3	1 9 5 0 7	1 5 6 7 3	1 9 7 2 0	1 6 7 2 6			
217	1 2 2 9 0 8 8	1 2 8 6 5 7 0	1 6 8 4 0 4 0	9 6 1 0 0 5			
247	80	65	33	07			
my	09	83	20	30			
82							
	<u>24.72.20</u>	<u>71.91</u>	<u>21.71.18</u>	<u>71.22</u>			
4	1 4 1 0 8 1 4	9 5 6 0	1 4 8 0 0	7 9 0 0 9 8			
299	14	9130	14006 00	00			
139	1 3 6 9 8	30 30	00	71.28			
	<u>13.95.86</u>	<u>95.70</u>	<u>29.92.02</u>	<u>9.22.9</u>			

Grade 1)

the used material of (2)

1 7 8 9 4	1 6 9 5 8	1 9 8 4 3	1 7 0 5 0
1 6 2 8 0 7 9	8 5 8 4 7 7	1 3 6 1 0 1 0	1 3 2 9 0 8 9
83	80	10	99
00	60	60	56
<u>17.16.15</u>	<u>16.20</u>	<u>11.37.57</u>	<u>37.60</u>
6	1 4 1 6 0	1 6 6 2 7	1 6 0 5 6
1 0 1 0 5	9 0 9 0	1 9 1 7 5 7 0	1 3 5 0 0 0 0
01 04	96 85	70	00
20	60	32	60
<u>14.92.1</u>	<u>49.30</u>	<u>25.25.41</u>	<u>25.57</u>

1795- moon - measures

	a	n	a	n
1	18006	19690		
18.0	1432043	1333560		
17.4	40	45-45		
	15	95		
	<u>17.3675</u>	<u>.3653</u>		

2	17.4	18.0	17239	19160
			11010	15390
			02	92
			15	70
			<u>17.3777</u>	<u>.3774</u>

3	17.1	19.0	17739	18224
			773741	1759200
			41	96
			31	33
			<u>17.0609</u>	<u>.0629</u>

4	17.4	20.0	16060	18284
			872822	1561810
			28	10
			50	84
			<u>17.2673</u>	<u>.2671</u>

5	18.0	20.8	14900	16170
			650040	1458080
			90	70
			05	92
			<u>20.8411</u>	<u>.8404</u>

6	18.3	21.0	15840	15840
			875240	875240
			40	40
			34	34
			<u>18.2907</u>	<u>16792</u>
				1380524
				50
				92
				<u>.2966</u>

1795 moon - measured

12

	α	γ
✓	18006	19690
180	1432043	1333560
174	40	4545
	15	95
	<u>17.3675</u>	<u>3653</u>

3	17237	19160
174	11010	1539088
180	02	92
	15	70
	<u>17.3777</u>	<u>3774</u>

3	17239	18224
171	773741	1759200
190	41	96
mm	31	33
✓		
2	<u>17.0609</u>	<u>0629</u>

4	16060	18284
174	872822	1561810
200	28	10
	50	84
	<u>17.2673</u>	<u>2671</u>

5	14900	16170
180	650090	1458080
208	90	70
	05	92
	<u>20.8411</u>	<u>8409</u>

6	15840	15840
185	875240	875240
210	40	40
	34	34
	<u>16.2907</u>	<u>16.2907</u>

16792
1380524
50
92
<u>2966</u>

1795-

hydro. measures.

13

Z

19.0+

19521

19100

21.2

1773538

1084968

man

25

5668

in

30

08

8

21.1790

1751

8

scratch.

19.8

18630

19120

19180

18575

21.4

17390

1032535

1521710

1254550

0892.

40

18

56

36

32

94

90

21.1234

1202

19.6030

.6034

1795-

hydro. measures

13

Z

190+	19521	19100
21.2	17735 ³⁸	10849 ⁶⁸
man	25	58
in	30	08
8	<u>21.1790</u>	<u>1751</u>

8

scratch.

198	18630	19120	19180	18575
21.9	17390 ⁹²	10325 ³⁵	15217 ¹⁰	12545 ⁵⁷
	08	40	18	56
	36	32	94	90
	<u>21.1234</u>	<u>1202</u>	<u>19.6030</u>	<u>6034</u>

1795	Times etc						
Exhibition 1912 Apr 27	12 ^h	0.4 ^m		-12 ^h	16 ^m		
moon	12	10	32.3 ^v	-12	10	32.4 ^v	
Block slow		1	40.3 ^v				
H sid T.	12	12	126.5 ^v				
H long	4	44	310.5 ^v				
G sid T.	16	56	437.0 ^v				
Sid T m. moon	2	20	24.53 ^v				
Interval	14	36	19.17 ^v				
Reduction		2	23.56 ^v				
G.M.T.	14	33	55.61 ^v	-X	+0 ^h	23 ^m	

From Kant-Alu.			R.G.		Reed		
moon 14 ^h	-11 ^h	48 ^m	26.50 ^v	+3 ^h	44 ^m	38.5 ^v	
motion in ^m					16.257 ^v		
" 33.9268 ^v					+68.74 ^v	-9	11.5 ^v
Tabular place	11	49	35.24 ^v	+3	35	27.0 ^v	

moon's age	10.5 days						
parallax	57' 52"			58'	17.4 ^v		
semidiameter	15' 54.5 ^v						
R =	954.5 ^v						
Augmentation	+12.6 ^v						
Immersion (I)	-0.3 ^v						
R =	966.8 ^v						
	207.25 ^v						
(1+a) R =	207.23 ^v						
R ² =	4.2945 ^v						
a = -1.0							

1795	Times etc							
Exhibition 1912 Apr 27	12 ^h 09 ^m				- 12 ^h 16 ^m			
moon	12	10	32.3	- 12	10	32.9		
Block slow		1	40.3					
H dist	12	12	1265					
H long	4	44	3105					
G dist	16	16	4370					
Sid Th moon	2	20	2453					
Interval	14	36	1917					
Reduction		2	2356					
Gm T	14	33	55610	- 1	+ 0	23		

From hand - Alu.		R. G.		Red				
moon 19 ^m	- 11 ^h	48 ^m	2650	+ 3°	44'	38.5"		
motion in ^m : 2.0261					16.257			
33.9268			+ 6874	- 9	11.5			
Tabular place	11	49	3524	+ 3	35	27.0		

moon age	10.5 days.							
parallel	~~57' 52"~~			58'	17.4			
semidiam.	15' 54.5"							
R =	954.5							
Augmentation	+ 12.6							
Immersion (1)	- 0.3							
R =	966.8							
	207.25							
(1+a) R =	2.0723							
R =	4.2945							
a = -1.0								

1795

Plate Center

x	y	$R.A.$	$Decl.$
5.6518	26.7836	11 42 16	+3 57 49
12.9896	13.5979	46 07	+2 15 38
21.7120	24.7206	50 37	+3 42 30
29.9216	13.9578	54 54	+2 19 04
17028	17906	192 114	10 133 121
17.57	1977	11 48 28	+3 03 45
-18	-22	+13	+17 20
43	223	11 48 41	+3 21 05
31	4662		
13	1040		

$$A = 11^h 48^m 41^s$$

$$D = +3^\circ 21' 05''$$

$x-5$	-45.54	+42	+1147
+67	-1219	= -1152	= -3
-366	781	= -1147	= +5
-523	619	= -1142	= +10
-35	1125	= -1160	= -4
-130	635	= -1165	= -6
19.1328	869	+8	= 191614

$y-4$	+502	+54	-865
+468	+283	= +751	= +20
+203	569	= +769	= -10
+164	649	= +813	= +12
-356	1086	= +730	= -11
-717	1496	= +785	= -10
19.1040	957	+96	= 19.1228

Tables	$a = +0.8$	$c = -1.5$	$a - c = +2.3$	$b + a = -0.5$
Obs	$a = -1.0$	-4.7	$+3.7$	$b + a = -6.4$
$C - 0$			-1.4	$+5.9$

1795

Plate Center

x	y	$R.A.$	$Decl.$
5.6518	26.7836	11 42 16	+3 57 49
12.9896	13.5979	46 07	+2 15 38
21.7120	24.7206	50 37	+3 42 30
29.9216	13.9578	54 54	+2 19 04
70.28	79.06	192 114	10 133 121
17.57	19.77	11 48 28	+3 03 45
15	22	+ 13	+ 17 20
43	223	11 48 41	+3 21 05
31	466		
13	1090		
		$A = 11^h 48^m 41^s$	
		$D = +3^{\circ} 21' 05''$	

$x - 3$	-45.54	$+42$	$+1147$
$+67$	-1219	$= -1152 + 2$	$= -1150$
-366	-781	$= -1147 + 5$	$= -1142$
-563	-619	$= -1142 + 5$	$= -1137$
-35	-1125	$= -1160 + 9$	$= -1151$
-130	-635	$= -1165 + 12$	$= -1153$
191328	-809	$+ 8$	$= 191614$

$y - 4$	$+502$	$+54$	-865
$+468$	$+283$	$= +751 - 134$	$= +885$
$+203$	-569	$= +769 - 86$	$= +855$
$+164$	$+1649$	$= +813 + 164$	$= +877$
-356	$+1086$	$= +730 + 124$	$= +854$
-711	$+1496$	$= +785 + 70$	$= +855$
191040	$+957$	$+ 96$	$= 191228$

Tabular a	$+0.8$	$c = -1.5$	$a - c = +2.3$	$b + a = -0.5$
Obs a	-1.0	-4.7	$+3.7$	$b + a = -6.4$
$C - O$			-1.4	$+5.9$

G. S. Albany 4381 m 98.2
 11 50 34.41

Price + 1 53.78[✓]
 A - 11 52 28.19[✓]
 A 11 48 41[✓]
 X-A + 3 47.19[✓]
 + 2 27.18[✓]
 log 2 35637[✓]
 cos 999944[✓]
 - 30 086305[✓]
 3. + 7.2954[✓]
 3. + 12[✓]
 3 25.2966[✓]
 2 25.2549[✓]
 X-3 - 417[✓]

G. S. + 3 06 32.1[✓]

Price - 12 21.4[✓]
 S + 2 54 10.7[✓]
 D + 3 21 05[✓]
 S-D - 26 54.3[✓]
 tan - 16 14.3[✓]
 log 3.20798[✓]
 0.53913[✓]
 tan 8.7051[✓]
 32 1726.1[✓]
 31 7.4846[✓]
 40 - 3.4604[✓]
 31 - 3.1[✓]
 31 18.5427[✓]
 4 18.4926[✓]
 4-31 - 501[✓]

1795

Standard Coordinates

Cape No. 1609 mg 8.4

Cape No. 1611 mg 3.8

C	11° 41'	38.96
L		39.03
B		38.98
Mean	11 41	38.99
Prec		+ 36.96
d	11 42	15.95
A	11 48 41	
d-A	- 6	25.05
sin(A)		- - 385.00
log	2.58546	
cos	9.99896	
30	1.09166	
30	- 12.3497	
31	-	52
3	56451	
2	5.6518	
2-3	+ 67	

C	+ 4° 01'	49.0
L		49.2
B		48.1
Mean	+ 4 01	48.8
Prec	- 3	59.8
d	+ 3 57	49.0
A	+ 3 21	05
d-A	+ 36	44.0
tan(d-A)	+ 220	4.1
log	3.34323	
log	0.67438	
tan	8.8406	
32	2.1833	
31	8.0773	
30	+ 4.7248	
31	+ 1.20	
32	26.7368	
31	26.7836	
30	+ 4.68	

C	11° 45'	29.68
L		33
B		26
Mean	11 45	29.22
Prec		+ 37.50
d	11 46	06.72
A	11 48 41	
d-A	- 2	34.28
sin(A)		- 154.28
log	2.18831	
cos	9.99966	
30	0.69521	
30	- 4.9569	
31	-	12
3	13.0419	
2	12.9896	
2-3	- 523	

C	+ 2° 19'	41.4
L		41.1
B		41.2
Mean	+ 2 19	41.2
Prec	- 4	03.4
d	+ 2 15	37.8
A	+ 3 21	05
d-A	- 1 05	27.2
tan(d-A)	- 39	27.7
log	3.59414	
log	0.92529	
tan	8.5963	
32	13.904	
31	7.0409	
30	- 8.4196	
31	+ 1.1	
32	13.5815	
31	13.5979	
30	+ 1.64	

1795

Standard Coordinates

Cape W. 1604 mag 8.4

Cape W. 1611 mag 3.8

C	11° 41'	38.96
L		39.03
E		38.98
mean	11 41	38.99
Prad		+ 36.96
d	11 42	15.95
A	11 48	41
X-A	- 6	25.05
-(X-A)	- -	38.500
log	2.58546	m
cos	9.99896	
30	1.09166	m

30	- 12.3497	
31	-	52
3	5.6451	
2	5.6518	
2-3	+ 67	

C	+ 4° 01'	49.0
L		49.2
E		48.1
mean	+ 4 01	48.8
Prad	- 3	59.8
S	+ 3 57	49.0
D	+ 3 21	05
S-D	+ 36	44.0
tan(S-D)	+ 220	4.1
log	3.34323	
log	0.67438	

tan S	8.8406	
52	2.1833	
71	8.0773	
70	+ 4.7248	
71	+ 1.20	
7	26.7368	
7	26.7836	

+ 2° 19'	41.4	
	41.1	
	41.2	
+ 2 19	41.2	
- 4	03.4	
+ 2 15	37.8	
+ 3 21	05	
- 1 05	27.2	
- 39	27.7	
3.594	14	m
0.925	29	m

8.5963		
13.904		
7.0401		
- 8.9196		
+ 1.1		
13.5815		
13.5979		
4.164		

1795

Standard Coordinates

Cape W. 1620 mag 8.2

Cape W. 1626 mag 7.0

A. 5 (Altany) 4356 mag 7.7

C	11	49	59.83	11	54	16.66	11	43	22.07
L			.91			16.74			
B			.91			.69			
mean	11	49	59.88	11	54	16.70			
Pre		+	36.91		+	36.88		+ 1	53.85
8	11	50	36.79	11	54	53.58	11	45	15.92
A	11	48	41	11	48	41	11	48	41
1-4		+ 1	55.79		+ 6	12.58		- 3	25.08
1-4)		+ 1	55.79		+ 3	72.53		- 2	05.07
log		2.06367			2.57116			2.31190	
cos		9.99909			9.99964			9.99951	
3.		0.57000			1.07804			0.81865	
3.		+ 3.7153			+ 1.9686			- 6.5864	
3.		2			60			-	11
3		21.7155			29.9746			11.4124	
x		21.7120			29.9216			11.3758	
-3		- 1.35			- 5.30			- 3.66	
C	+ 3	46	30.4	+ 2	23	04.5	+ 2	55	37.7
L			31.1			04.3			
B			30.3			04.5			
mean	+ 3	46	30.6	+ 2	23	04.4			
Pre	-	4	00.3	-	4	00.5		- 12	20.2
8	+ 3	42	30.3	+ 2	19	03.9	+ 2	43	17.5
D	+ 3	21	05	+ 3	21	05	+ 3	21	05
1-1)	+ 2	1	25.3	- 1	02	01.1	-	37	47.5
1-1)	+ 1	2	85.3		- 3	72.15		- 2	26.76
log		3.10900			3.57072			3.35556	
log		0.44015			0.90187			0.68671	
tan		8.8117			8.6072			8.6770	
32		11400			21561			16373	
31		7.0051			7.8167			7.3677	
40		+ 2.7552			- 7.9776			- 4.8608	
41		+ 1.0			+ 6.5			+ 23	
4		29.7562			14.0289			17.1415	
4		24.7206			13.9578			17.1618	
4-3		- 3.56			- 7.11			+ 20.3	

1745

Standard Coordinates

Cepheus 1626 mag 7.2

Cepheus 1626 mag 7.0

C. 3 (Albany) 43.6 mag 7.7

C	11	49	59.83	11	54	16.66	11	43	22.07
L			41			16.74			
E			91			69			
mean	11	49	59.88	11	54	16.70			
Proc		+	36.91		+	36.88		+	1 53.85
S	11	50	36.79	11	54	53.58	11	45	15.92
A	11	48	41	11	48	41	11	48	41
S-4		+	1 55.79		+	6 12.58		-	3 25.08
W-41		+	1 15.79		+	3 72.53		-	2 05.07
log		2.06367			2.57116			2.31190	
cos		999909			999964			999951	
S		0.57000			1.07804			0.81865	
S		+	3.7153		+	1.19686		-	6.5865
S		1	2		60			-	11
S		21.7155			29.9746			11.4124	
S		21.7120			29.9216			11.3758	
-3		-	1.35		-	5.30		-	3.66
C	+	3.46	30.4	+	2.23	04.5	+	2.55	37.7
L			31.1			04.3			
E			30.3			04.5			
mean	+	3.46	30.6	+	2.23	04.4			
Proc		-	4.00.3		-	4.00.5		-	1.2 20.2
S	+	3.42	30.3	+	2.19	03.9	+	2.43	17.5
O	+	3.21	0.5	+	3.21	0.5	+	3.21	0.5
S-11		+	2.1 25.3		-	1.02 01.1		-	3.7 47.5
W-11		+	1.285.3		-	3.721.5		-	2.267.6
log		3.10900			3.57072			3.35556	
S		0.44015			0.90187			0.68671	
Thurs		8.81174			8.6072			8.6770	
S		11.400			21.561			16.373	
S		7.0051			7.8167			7.3677	
S		+	2.7552		-	7.9776		-	4.8608
S		+	1.0		+	6.5		+	2.3
S		29.7562			14.0289			17.1415	
S		29.7200			13.9578			17.1618	
-3		-	3.56		-	7.11		+	2.03

	C	O	O - C
- 3 - 22 + 26 = +1	- 3	- 4	
- 6 - 14 + 26 = +6	+ 5	- 1	
- 7 - 11 + 26 = +8	+ 10	+ 2	
- 12 - 21 + 26 = - 7	- 4	+ 3	
- 17 - 12 + 26 = - 3	- 6	- 3	
- 6 + 7 + 14 = +15	+ 20	+ 5	
- 13 + 4 + 14 = +5	- 10	- 15	
- 15 + 3 + 14 = +2	+ 12	+ 10	
- 25 + 6 + 14 = - 5	- 11	- 6	
- 34 + 4 + 14 = -16	- 10	+ 6	
- 6 - 63 + 61 = - 8	- 19	- 11	
- 11 - 40 + 61 = +10	+ 8	- 2	
- 13 - 32 + 61 = +16	+ 29	+ 13	
- 22 - 58 + 61 = -19	- 7	+ 12	
- 30 - 33 + 61 = - 2	- 14	- 12	
- 3 + 73 - 45 = +25	+ 46	+ 21	
- 5 + 47 - 45 = - 3	- 35	- 32	
- 6 + 37 - 45 = - 4	- 2	+ 2	
- 10 + 68 - 45 = + 13	- 7	- 20	
- 14 + 38 - 45 = - 21	0	+ 21	

Plate constants - Conditional equations

16

a		b		1795		1796	
+ 5.65	+ 26.74	+ 1	=	- 3	+ 20	- 19	+ 46
+ 11.41	+ 17.14	+ 1	=	+ 5	- 10	+ 8	- 35
+ 13.04	+ 13.58	+ 1	=	+ 10	+ 12	+ 29	- 2
+ 21.72	+ 24.76	+ 1	=	- 4	- 11	- 7	- 7
+ 29.97	+ 14.03	+ 1	=	- 6	- 10	- 14	0
+ 10.03	+ 19.15	+ 1	=	+ 4.00	+ 7.33	+ 6.00	+ 3.00
+ 25.84	+ 19.40	+ 1	=	- 5.00	- 10.50	- 10.50	- 3.50
+ 18.44	+ 14.92	+ 1	=	+ 3.00	- 2.67	+ 7.67	- 12.33
+ 13.68	+ 25.75	+ 1	=	- 3.50	+ 4.50	- 13.00	+ 19.50
- 15.81	- 0.25	=	+ 9.00	+ 17.83	+ 16.50	+ 6.50	
+ 4.76	- 10.83	=	+ 6.50	- 8.17	+ 20.67	- 31.83	
- 4.76	- 0.08	=	+ 2.71	+ 5.36	+ 4.95	+ 1.95	
	- 10.91	=	+ 9.21	- 2.81	+ 25.62	- 29.88	
	b	=	- 0.84	+ 0.26	- 2.34	+ 2.74	
	a	=	- 0.55	- 1.13	- 1.00	- 0.45	
+ 4.0	- 5.0	+ 3.0	- 3.5	+ 7.3	- 10.5	- 3.7	+ 4.5
+ 5.6	+ 14.3	+ 10.2	+ 7.6	+ 11.3	+ 29.3	+ 20.9	+ 25.5
+ 16.1	+ 16.4	+ 12.5	+ 21.6	- 5.0	- 5.0	- 3.9	- 6.7
+ 25.7	+ 25.7	+ 25.7	+ 25.7	+ 13.6	+ 13.8	+ 13.3	+ 13.3
+ 6.0	- 10.5	+ 7.7	- 18.0	+ 3.0	- 3.5	- 12.3	+ 19.5
+ 10.0	+ 25.8	+ 18.4	+ 13.7	+ 4.6	+ 12.2	+ 8.9	+ 6.2
+ 45.0	+ 45.5	+ 35.0	+ 60.4	- 52.5	- 53.1	- 40.8	- 70.5
+ 61.0	+ 60.8	+ 61.1	+ 61.1	- 44.9	- 44.4	- 44.7	- 44.8

Plate Constant - Conditional Equations

1791				1796			
+565	+2674	+1	= -3	+20	-19	+46	
+1141	+1714	+1	= +5	-10	+8	-35	
+1304	+1358	+1	= +10	+12	+29	-2	
+2172	+2476	+1	= -4	-11	-7	-7	
+2997	+1403	+1	= -6	-10	-14	0	

+1003	+1915	+1	= +900	+733	+600	+300	
+2584	+1940	+1	= -500	-1050	-1050	-350	
+1844	+1492	+1	= +300	-867	+767	+1233	
+1368	+2575	+1	= -350	+450	-1300	+1950	

-1581	-025	= +900	+1783	+1650	+650		
+476	-1083	= +650	-817	+2067	-3183		

-976	-008	= +271	+536	+495	+195		
	-1091	= +921	-281	+2562	-2988		
	b	= -0.84	+026	-239	+279		
	a	= -0.55	+113	-100	-045		

+90	-50	+30	-35	+73	-105	-87	+45
+56	-193	+102	-76	+113	+293	+209	+155
+161	-164	+175	+216	-50	-50	-39	-67
+217	+217	+217	+257	+136	+138	+133	+133

+60	+105	+77	+130	+30	-35	-123	+195
+100	+258	+184	+137	+46	+122	+84	+62
+450	+455	+350	+604	+525	-531	-408	-705
+610	+608	+611	+611	+449	-444	-447	-448

pt	pos. $\angle$	residual
1	21 39.1	+ 6.7
2	23 7.8	+ 4.3
3	27 0.0	- 4.6
4	29 5.6	- 9.0
5	32 6.9	+ 9.3
6	33 6.0	+ 9.1
7	1.0	+ 7.8
8	13.0	+ 3.0

1295

Moores Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	18.0000	-1.1353	1.2889	4.3078	+1.33
2	17.3776	-1.7577	3.0895	4.3079	+1.34
-3	17.0619	-2.0734	4.2990	4.2990	+4.5
4	17.2672	-1.8681	3.4898	4.2935	-1.0
5	18.0000	-1.1353	1.2889	4.3078	+1.33
6	18.2936	-0.8417	0.7085	4.3060	+1.15
7	19.1353	0.0000	0.0000	4.3007	+6.2
8	19.6032	+0.4679	0.2189	4.2937	-8

comp $R^2 = 4.2945$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.3664	-1.7372	-3	3.0189
2	18.0000	-1.1036	-2	1.2184
3	19.1036	0.0000	0	0.0000
4	20.0000	+0.8964	+1	0.8037
5	20.8408	+1.7372	+3	3.0189
6	21.0000	+1.8964	+3	3.5975
+7	21.1770	+2.0734	+4	4.3007
8	21.1218	+2.0182	+4	4.0748

Approximate Center

$$x = 18.0 \quad y = 17.3664$$

$$20.8408$$

$$38.2072$$

$$\text{mean } y = 19.1036$$

$$x - \text{max} = 21.1770$$

$$R = 2.0734$$

$$x - \text{min} = 17.0619$$

$$x_0 = 19.1353$$

$$\text{Center } \begin{cases} x_0 = 19.1353 \\ y_0 = 19.1036 \end{cases}$$

1795

Unbiased Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - c$
1	18.0000	-1.1353	1.2889	4.3078	+1.33
2	17.3776	-1.7577	3.0895	4.3079	+1.34
3	17.0619	-2.0734	4.2990	4.2990	+4.5
4	17.2672	-1.8681	3.4898	4.2935	-1.0
5	18.0000	-1.1353	1.2889	4.3078	+1.33
6	18.2936	-0.8417	0.7085	4.3060	+1.15
7	19.1353	0.0000	0.0000	4.3007	+6.2
8	19.6032	+0.4679	0.2189	4.2937	-8

comp. $R^2 = 4.2945$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.3664	-1.7372	-3	3.0189
2	18.0000	-1.1036	-2	1.2184
3	19.1036	0.0000	0	0.0000
4	20.0000	+0.8964	+1	0.8037
5	20.8408	+1.7372	+3	3.0189
6	21.0000	+1.8964	+3	3.5975
7	21.1770	+2.0734	+4	4.3007
8	21.1218	+2.0182	+4	4.0748

Approximate Center

$$\begin{array}{rcl}
 x = 18.0 & y = 17.3664 & \\
 & 20.8408 & \\
 \hline
 & 38.2072 & \\
 \text{mean } y & 19.1036 & \\
 x = \text{max} & 21.1770 & \\
 R & 20734 & \\
 x = \text{min} & 17.0619 & \\
 X_0 & 19.1353 &
 \end{array}$$

$$\text{Center } \begin{cases} X_0 = 19.1353 \\ Y_0 = 19.1036 \end{cases}$$

Formation of Normals

	ab	~~an~~	bn
1	+ 1.98	- 151.6	- 231.4
2	+ 1.94	- 235.8	- 147.4
3	- 0.00	- 93.2	+ 0.0
4	- 1.68	+ 18.7	- 9.0
5	- 1.98	- 151.6	+ 231.4
6	- 1.60	- 96.6	+ 218.5
7	+ 0.00	+ 0.0	+ 128.3
8	+ 0.95	- 38	- 16.2
	- 0.39	- 713.9	+ 174.2

1795

Moon's Center

Conditional Equations

	Conditional Equations				c	o - c	
1	-1.14	-1.74	= +1.33	+53	+1.3	+66	+67
2	-1.76	-1.10	= +1.34	+82	+9	+91	+43
3	-2.07	+0.00	= +45	+91	-0	+91	-46
4	-1.87	+0.90	= -10	+87	-7	+80	-90
5	-1.14	+1.74	= +1.33	+53	-1.3	+40	+93
6	-0.84	+1.90	= +1.15	+39	-1.5	+24	+91
7	+0.00	+2.07	= +62	-0	-1.6	-16	+78
8	+0.47	+2.02	= -8	-22	-1.6	-38	+30

Average: 67

Normal Equations

$$\begin{array}{rcl}
 +14.38 & - & 0.39 = -714 \\
 -0.39 & + & 20.03 = +174
 \end{array}$$

$$\begin{array}{rcl}
 +0.39 & - & 0.01 = -19 \\
 & + & 20.02 = +155
 \end{array}$$

$$\begin{array}{rcl}
 -0.01 & + & 0.39 = +3 \\
 +14.37 & & = -711
 \end{array}$$

$$b = +7.75$$

$$a = -49.5$$

1795

Invoous Center

Conditional Equations

						C	O - C
1	-1.14	-1.74	= +1.33	+53	+13	= +66	+67
2	-1.76	-1.10	= +1.34	+82	+9	= +91	+43
3	-2.07	+0.00	= +4.5	+91	-0	= +91	-46
4	-1.87	+0.90	= -1.0	+87	-7	= +80	-90
5	-1.14	+1.74	= +1.33	+53	-13	= +40	+93
6	-0.84	+1.40	= +1.15	+39	-15	= +24	+91
7	+0.00	+2.07	= +6.2	-0	-16	= -16	+78
8	+0.47	+2.02	= -8	-22	-16	= -38	+30

Average 67

Normal Equations

$$+ 14.38 - 0.39 = -7.14$$

$$- 0.39 + 20.03 = +17.4$$

$$+ 0.39 - 0.01 = -1.9$$

$$+ 20.02 = +15.5$$

$$- 0.01 + 0.39 = +3$$

$$+ 14.37 = +7.11$$

$$b = +7.75$$

$$a = -49.5$$

1795 Moon's mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 & = & 19.1353^{\circ} \\
 \frac{1}{2}a & = & -25^{\circ} \\
 \hline
 & = & 19.1328^{\circ}
 \end{array}
 \qquad
 \begin{array}{rcl}
 Y_0 & = & 19.1036^{\circ} \\
 \frac{1}{2}b & = & +4^{\circ} \\
 \hline
 & = & 19.1040^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 \text{From Prelim Reduction } X & = & 19.1614^{\circ} \\
 \text{" Plate constant } \alpha_x & + & 11^{\circ} \\
 \text{" } \alpha_y & + & 16^{\circ} \\
 \text{" } c & - & 26^{\circ} \\
 \hline
 & = & 19.1615^{\circ}
 \end{array}
 \qquad
 \begin{array}{rcl}
 Y & = & 19.1228^{\circ} \\
 & + & 22^{\circ} \\
 & - & 5^{\circ} \\
 & - & 14^{\circ} \\
 \hline
 & = & 19.1231^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 \xi & = & +1.1615^{\circ} \\
 \log \xi & = & 0.06502^{\circ} \\
 \cos \delta & = & 9.99941^{\circ} \\
 \cos \eta & = & 8.50724^{\circ}
 \end{array}$$

$$\alpha - A = 1.55837^{\circ}$$

$$\alpha - A = +36.17^{\circ}$$

$$A = 11.4841^{\circ}$$

$$\alpha_0 = 11.4917.17^{\circ}$$

$$\text{Red} = +1.54^{\circ}$$

$$\alpha' = 11.491872^{\circ}$$

$$\eta = -2.8769^{\circ}$$

$$\begin{array}{rcl}
 \log \tan \delta & = & 7.0534^{\circ} \\
 \log \tan \eta & = & 8.7194^{\circ} \\
 \log \tan \delta & - & \log \tan \eta \\
 \hline
 \log \tan \delta & = & 0.1300^{\circ} \\
 \log \tan \eta & = & 5.9028^{\circ}
 \end{array}$$

$$\eta_1 = +1^{\circ}$$

$$\eta_0 = -2.8770^{\circ}$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 0.45894^{\circ} \\
 \log \eta_1 & = & 7.33115^{\circ}
 \end{array}$$

$$\alpha - D = 312.779^{\circ}$$

$$\delta - D = -22.22.1^{\circ}$$

$$D = +3.2105^{\circ}$$

$$\delta_0 = +2^{\circ} 58' 42.9''$$

$$\text{Red} = -9.0$$

$$\delta' = +2.5833.9^{\circ}$$

1795- moon's lunar position (1912.0)

$$\begin{array}{r} X_0 = 19.1353 \\ - 25 \\ \hline 19.1328 \end{array}$$

$$\begin{array}{r} Y_0 = 19.1036 \\ + 4 \\ \hline 19.1040 \end{array}$$

$$\begin{array}{rcl} \text{From Prelim Reduction} & X = 19.1614 & Y = 19.1228 \\ \text{Plate constant } \alpha & + 11 & + 22 \\ \text{by } \gamma & + 16 & - 5 \\ c & - 26 & - 14 \\ \hline & 19.1615 & 19.1231 \end{array}$$

$$\begin{array}{rcl} \bar{x} & = & +1.1615 \\ \log \bar{x} & = & 0.06502 \\ \cos \delta & = & 9.99941 \\ \cos \alpha & = & 8.50724 \end{array}$$

$$(X - A) = 1.55837$$

$$X - A = + 36.17$$

$$A = 11.4841$$

$$A_0 = 11.491717$$

$$\text{Red } = +1.54$$

$$X = 11.491871$$

$$\eta = -2.8769$$

$$\begin{array}{rcl} \log \tan \delta & = & 8.7194 \\ \bar{x}^2 & = & 0.1200 \\ \eta & = & 5.8928 \end{array}$$

$$\eta_1 = + 1$$

$$\eta_0 = -2.8770$$

$$\begin{array}{rcl} \log \eta_0 & = & 0.45894 \\ \text{corr} & = & -7.33115 \end{array}$$

$$(d - D) = 3.12779$$

$$S - D = - 22.22.1$$

$$D = +3.21.05$$

$$\delta_0 = +2^\circ 58' 42''$$

$$\text{Red} = - 7.0$$

$$\delta = +2^\circ 58' 33.9''$$

1295

Reduction to Apparent Place

20

$$\begin{aligned}\alpha_0 &= 11^h 49^m 17.17^s \\ \delta &= 19^\circ 30' 24'' \\ \delta + \alpha_0 &= 7^\circ 19' 41'' \\ &= 109^\circ 55' 15''\end{aligned}$$

$$\begin{aligned}\delta_0 &= +20^\circ 58' 42.9'' \\ H &= 15^h 20^m 30^s \\ H + \alpha_0 &= 3^\circ 09' 47'' \\ &= 47^\circ 26' 45''\end{aligned}$$

$$\begin{aligned}\log \frac{1}{r} &= 8.8239 \\ \therefore q &= 0.9786 \\ \sin(\delta + \alpha_0) &= 9.9732 \\ -\tan \delta_0 &= 8.7163 \\ \therefore (q) &= 8.4920\end{aligned}$$

$$\begin{aligned}\log \frac{1}{r} &= 8.8239 \\ \therefore h &= 1.2883 \\ \sin(H + \alpha) &= 9.8672 \\ -\sec \delta_0 &= 0.0006 \\ \therefore (h) &= 9.9800\end{aligned}$$

$$\begin{aligned}\log i &= 0.8102 \\ \therefore \cos \delta_0 &= 9.9994 \\ &= 0.8096\end{aligned}$$

$$\begin{aligned}\log q &= 0.9786 \\ \cos(\delta + \alpha) &= 9.5329 \\ \therefore (q') &= 0.5110\end{aligned}$$

$$\begin{aligned}\log h &= 1.2883 \\ -\cos(H + \alpha) &= 9.8301 \\ \sin \delta_0 &= 8.7157 \\ \therefore (h') &= 9.8341\end{aligned}$$

$$\begin{aligned}f &= +0.55 \\ (q) &= +0.03 \\ (h) &= +0.96 \\ \text{Red in } \alpha &= +1.54\end{aligned}$$

$$\begin{aligned}(q') &= -3.24 \\ (h') &= +0.68 \\ (l') &= -6.45 \\ \text{Red in } \delta &= -9.01\end{aligned}$$

$$\alpha' = 11^h 49^m 18.77^s$$

$$\delta = +20^\circ 58' 33.9''$$

1795

Reduction to Apparent Place

20

$$\begin{aligned} \alpha_0 &= 11^h 49^m 17.17 \\ G &= 19 \quad 30 \quad 24 \\ G + \lambda_0 &= 7 \quad 19 \quad 41 \\ &= 109^{\circ} 55' 15'' \end{aligned}$$

$$\begin{aligned} S_0 &= +2^{\circ} 58' 42.9'' \\ H &= 15^h 20^m 30.0'' \\ H + \alpha_0 &= 3 \quad 09 \quad 47 \\ &= 47^{\circ} 26' 45'' \end{aligned}$$

$$\begin{aligned} \log \frac{1}{r} &= 8.8239 \\ q &= 0.9786 \\ \sin(G + \lambda_0) &= 9.9732 \\ \tan S_0 &= 8.7163 \\ (q) &= 8.4920 \end{aligned}$$

$$\begin{aligned} \log \frac{1}{r} &= 8.8239 & \log i &= 0.8102 \\ \mu &= 1.2883 & \cos S_0 &= 9.9994 \\ \sin(H + \lambda_0) &= 9.8672 & & 0.8096 \\ \sec S_0 &= 0.0006 \\ (i\mu) &= 9.9800 \end{aligned}$$

$$\begin{aligned} \log q &= 0.9786 \\ \cos(G + \lambda_0) &= 9.5329 \\ (q') &= 0.5110 \end{aligned}$$

$$\begin{aligned} \log \mu &= 1.2883 \\ \cos(H + \lambda_0) &= 9.8301 \\ \sin S_0 &= 8.7157 \\ (i\mu') &= 9.8341 \end{aligned}$$

$$\begin{aligned} f &= +0.55 \\ g &= +0.03 \\ h &= +0.96 \\ \text{Red. } \alpha &= +1.54 \end{aligned}$$

$$\begin{aligned} (q') &= -3.24 \\ (i\mu') &= +0.68 \\ (i') &= -6.45 \\ \text{Red. } S &= -9.01 \end{aligned}$$

$$\alpha = 11^h 49^m 18.72$$

$$\delta = +2^{\circ} 58' 33.9''$$

1795 Lunar Parallax

$$\alpha' = 11^h 49^m 18.71^s \checkmark$$

$$\delta = 12 \quad 12 \quad 12.65^s \checkmark$$

$$\theta - \alpha = + 22 \quad 53.93^s \checkmark$$

$$= + 5^\circ 43' 28.95'' \checkmark$$

$$\frac{1}{2}(\alpha - \alpha') = + 2 \quad 09.30^s \checkmark$$

$$\theta - \alpha' - \frac{1}{2}(\alpha - \alpha') = + 5 \quad 41 \quad 19.65^s \checkmark$$

$$\log \tan \phi' = 9.95727^s \checkmark$$

$$\therefore \cos \frac{1}{2}(\alpha - \alpha') = 0.00000 \checkmark$$

$$\therefore \cos(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.99786^s \checkmark$$

$$\therefore \tan \phi = 9.95941^s \checkmark$$

$$\gamma = + 42^\circ 19' 34.1'' \checkmark$$

$$\delta' = + 2 \quad 58 \quad 33.9^s \checkmark$$

$$\gamma - \delta' = + 39 \quad 21 \quad 00.2^s \checkmark$$

$$\log \sin \phi' = 9.82640^s \checkmark$$

$$\therefore \sin \pi = 8.22930^s \checkmark$$

$$\therefore \sin(\gamma - \delta') = 9.80213^s \checkmark$$

$$\therefore \sin \phi = 9.82824^s \checkmark$$

$$\therefore \sin(\delta - \delta') = 8.02959^s \checkmark$$

$$\delta - \delta' = + 36 \quad 48.1^s \checkmark$$

$$\delta = + 3 \quad 35 \quad 22.0^s \checkmark$$

$$\text{am Elh } \delta = + 3^\circ 35' 27.0'' \checkmark$$

$$O - C = - 5.0^s \checkmark$$

$$\delta' = + 2^\circ 58' 33.9'' \checkmark$$

$$\pi = 58' 17.4'' \checkmark$$

$$\log \cos \phi' = 9.86913^s \checkmark$$

$$\therefore \sin \pi = 8.22930^s \checkmark$$

$$\therefore \sin(\theta - \alpha') = 8.99891^s \checkmark$$

$$\therefore \cos \delta = 0.00085^s \checkmark$$

$$\therefore \sin(\alpha - \alpha') = 7.09819^s \checkmark$$

$$\alpha - \alpha' = + 4' 08.60'' \checkmark$$

$$= + 17.24'' \checkmark$$

$$\alpha = 11 \quad 49 \quad 35.95^s \checkmark$$

$$\alpha = 11^h 49^m 35.24^s \checkmark$$

$$+ 0.71^s \checkmark$$

1795 Lunar Parallax

$$\begin{aligned} \alpha &= 11^{\circ} 49' 18.71 \\ \delta &= 12^{\circ} 12' 12.65 \\ \alpha - \alpha' &= + 22' 53.93 \\ &= + 5^{\circ} 43' 28.95 \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = + 2^{\circ} 09.30$$

$$\delta - \delta' - \frac{1}{2}(\alpha - \alpha') = + 5^{\circ} 41' 19.65$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \cos \frac{1}{2}(\alpha - \alpha') &= 0.00000 \\ \cos(\delta - \delta' - \frac{1}{2}(\alpha - \alpha')) &= 9.99786 \\ \tan \phi &= 9.95941 \end{aligned}$$

$$\phi = + 42^{\circ} 19' 34.1$$

$$\delta' = + 2^{\circ} 58' 33.9$$

$$\phi - \delta' = + 39^{\circ} 21' 00.2$$

$$\begin{aligned} \log \sin \phi' &= 9.82640 \\ \sin \pi &= 8.22930 \\ \sin(\phi + \delta') &= 9.80213 \\ \sin \phi &= 9.82824 \\ \sin(\phi - \delta') &= 8.02959 \end{aligned}$$

$$\delta - \delta' = + 36^{\circ} 48.1$$

$$\delta = + 3^{\circ} 35' 22.0$$

$$\text{Ann. Ecl. } \delta = + 3^{\circ} 35' 92.7'' \text{ } \alpha = 11^{\circ} 49' 35.95$$

$$\alpha - \alpha' = - 5.0 \quad + 0.71$$

$$\delta' = + 2^{\circ} 58' 33.9$$

$$\pi = 58' 17.4$$

$$\begin{aligned} \log \sin \phi' &= 9.86913 \\ \sin \pi &= 8.22930 \\ \sin(\phi - \delta') &= 8.99891 \\ \cos \delta &= 9.99915 \\ \sin(\alpha - \alpha') &= 7.09819 \end{aligned}$$

$$\alpha - \alpha' = + 4' 48.6$$

$$= + 17.24$$

