

KG

11366

917

XLI



1759

1760

1790



Harvard Lunar Plates.

Measures and Reductions

Mary Fowler.

Volume. ~~XLII~~.

Plate no.	Date	Page
1759	1912 Apr. 3.	1
1760	1912 Apr. 3	12.
1790	1912 Apr. 25	20.

1759

1913 Oct 27.

1.

Stars - Measures.

	d	N	d^2	N
1	15507	16208	18810	16192
7.6	1027780	1043531	1538378	962016
25.5	80	35	82	20
mg	20	10	17	80
7.8	<u>25.5235</u>	<u>.5225</u>	<u>7.6569</u>	<u>.6569</u>
2	17388	19585	18810	14360
11.3	959090	1738080	1198390	1118080
9.8	8590	80	8390	80
mg	90	78	10	55
7.2	<u>9.7802</u>	<u>.7796</u>	<u>11.3175</u>	<u>.3178</u>
3	17738	18540	15880	19100
20.5	1094045	1534040	1060064	1437073
21.6	41	42	2012	72
mg	44	50	70	02
6.8	<u>21.6800</u>	<u>.6798</u>	<u>30.4734</u>	<u>.4729</u>

Grade 3 or 4.

1759

1913 Oct 27

1.

Stars - Measures

	d	n	d	n
1	15507	16208	18810	16192
7.6	1027780	10435	1538378	962016
25.5	80	3531	82	20
mg	20	10	17	80
7.8	<u>25.5235</u>	<u>5225</u>	<u>7.6569</u>	<u>6569</u>
2	17388	19585	18810	14360
11.3	959090	1738080	1198390	1118080
7.8	8590	80	83	80
mg	90	78	10	55
7.2	<u>9.7802</u>	<u>7796</u>	<u>11.3175</u>	<u>3178</u>
3	17738	18540	15880	19100
30.5	1094045	1534040	1060004	1437073
21.6	41	42	2012	72
mg	44	50	70	02
6.8	<u>21.6800</u>	<u>6798</u>	<u>30.4734</u>	<u>4729</u>

Grade 304

1759

Moon's measures

 $\frac{1}{17.5}$
 16.9
 min
 $\frac{1}{8}$
 944238
 $35-38$
 8823
 13643
 1302220
 20
probably on
termination16.938616.9378
 $\frac{2}{18.0}$
 16.9
 908084
 $85-84$
 8820
 13655
 1338880
 90
16.973716.9731
 $\frac{3}{19.0}$
 17.5
 19265
 $1433135-$
 36
 61
 16551
 1142650
 4850
 55
17.492917.4896
 $\frac{4}{19.4}$
 18.0
 20188
 1402040
 26
 78
19.3841
 16881
 1303580
 3880
 80
19.3847
 $\frac{5}{19.6}$
 19.0
 max
 $\frac{1}{2}$
 19120
 1533840
 40
 30
19.6213
 15888
 964842
 40
 82
19.6241
 $\frac{6}{19.3}$
 20.0
 18080
 1128280
 90
 74
19.3209
 15902
 1267060
 50
 00
19.3241

175-9

Moon Measures

 $\frac{1}{175}$
 $\frac{169}{175}$
 $\frac{169}{175}$
 $\frac{169}{175}$
 944233
 $35-33$
 8823
 13643
 1302220
 20
possibly on
terminator16.935616.9378
 $\frac{2}{18.0}$
 $\frac{16.9}{18.0}$
 908054
 $85-4$
 8820
 13655
 1338880
 90
16.97379731
 $\frac{3}{19.0}$
 $\frac{17.5}{19.0}$
 19265
 $1433135-$
 36
 61
 16551
 1142650
 4850
 55
17.49294896
 $\frac{4}{19.4}$
 $\frac{18.0}{19.4}$
 20188
 1402020
 26
 78
19.3841
 16881
 1303530
 3830
 80
3897
 $\frac{5}{19.6}$
 $\frac{19.0}{19.6}$
 $\frac{19.0}{19.6}$
 $\frac{19.0}{19.6}$
 19120
 1533840
 40
 30
19.6213
 15888
 964842
 40
 82
6241
 $\frac{6}{19.3}$
 $\frac{20.0}{19.3}$
 18080
 1128280
 90
 74
19.3209
 15902
 1267060
 50
 00
3241

1759 d 4 moon -
 19.0 16855 19090
 w4 1284053 1309260
 655-3 50
 50 857
20.4000 .3974

8 scratch.
 18.5 17270 18080 16785 19450
 w.6 991812 1544549 1195055 1429884
 20 52
 78 80
20.7359 .7369 18.5169 .5160

175-9 4 moon -
 16855- 19090
 19.0 1284053 1307260
 w4 655-3 50
 50 85-
20.4000 3974

8 scratch
 185 17270 18080 16785- 19450
 w6 991812 1544549 1195053- 1429884
 20 52 55- 90
 78 80 82 53
20.7359 7369 18.5169 5160

1759

Times etc.

Exp. stars 1912 Apr 3, $13^h 38^m$ ✓ $-13^h 50^m$ ✓
 Moon $13 \quad 44 \quad 20.3$ ✓ $-13 \quad 44 \quad 20.6$ ✓
 clock slow $1 \quad 44.1$ ✓

H Sid T. $13 \quad 46 \quad 04.55$ ✓
 H long $4 \quad 44 \quad 31.05$ ✓
 G Sid T. $18 \quad 30 \quad 35.60$ ✓
 Sid T. in hour $0 \quad 45 \quad 47.22$ ✓
 Interval $17 \quad 44 \quad 48.38$ ✓
 Reduction $2 \quad 54.44$ ✓
 B. M. T. $17 \quad 41 \quad 53.94$ ✓ $\theta - X = -6^h 53^m 10^s$ ✓

From Kant. Alm. $R.A.$ $Black.$
 Moon 18^h $14^h 39^m$ 52.68 ✓ $-17^h 36'$ 37.6 ✓
 Moon $1^m = 2.1063$ ✓ 12.600 ✓
 Moon -18.101 ✓ -38.13 ✓ $+3 \quad 48.1$ ✓
 Tabular place $14 \quad 39 \quad 14.55$ ✓ $-17 \quad 32 \quad 49.5$ ✓

Moon's age 16 days.

Parallax $56'' \quad 45''$ ✓
 Semidiameter $15' \quad 29.6$ ✓
 $934 = 7.5$ ✓ $R = 9 \quad 29.6$ ✓
 $9296 = 7.4$ ✓ $Augmentation +7.4$ ✓
 Irradiation (3) -0.7 ✓
 $R = 9 \quad 36.3$ ✓
 $R = 2.0071$ ✓
 $(1+a)R = 2.0069$ ✓
 $R = 4.0276$ ✓
 $a = -1.1$

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Times etc.

Exp. to stars 1912 Apr. 3, $13^h 38^m$ - $13^h 50^m$
 Moon $13 \quad 44 \quad 20.3 - 13 \quad 44 \quad 20.6$
 clock slow $1 \quad 44.1$

H. Incl. T. $13 \quad 46 \quad 04.55$
 H. long $4 \quad 44 \quad 31.05$
 G. Incl. T. $18 \quad 30 \quad 35.60$
 Incl. T. in Moon $0 \quad 45 \quad 47.22$
 Incl. Incl. $17 \quad 44 \quad 48.38$
 Reduction $2 \quad 54.44$
 B. in T. $17 \quad 41 \quad 53.94$ $G-X = -6^h 53^m 10^s$

From hant. Alm. $R.A.$ $Black$
 Moon 18^h $14^h 39^m$ 52.68 - $17^h 36^m 37.6$
 Moon $1^m = 2.1063$ 12.600
 -18.101 - 38.13 + $3 \quad 48.1$
 Tabular place $14 \quad 39 \quad 14.55$ - $17 \quad 32 \quad 49.5$

Moon's age 16 days.

Parallax $56 \quad 45.5$
 Semidiameter $15' 29.6$
 $934 = 7.5$ $R = 929.6$
 $9296 = 7.9$ $Augmentation + 7.9$
 Irradiation (3) $- 0.7$
 $R = 936.3$
 $R = 20071$
 $(1+a)R = 20069$
 $R = 40276$
 $a = -1.1$

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Plate Constants

x	y	K.A.	Recl.
7.6569	25.5230	14	34
11.3176	9.7799	36	33
30.4732	21.6799	46	55
3 49.45	156.98	116	117
1648	1899	14	39
-18	-22	+	47
1.52	3.01	14	40
31	465	06	-17
47	1405	57	37

$$A = 14^L 40^m 06^s$$

$$D = -17^\circ 57' 37''$$

$$\begin{aligned}
 x-3 &= 39.54 & +1.1x & & +114.6 \\
 -146 & -1008 = -1154 & +8 & = -1146 & = 0 \\
 -771 & -386 = -1157 & +12 & = -1145 & = +1 \\
 -324 & -856 = -1180 & +34 & = -1146 & = 0 \\
 17.6170 & -748 & +19 & & = 17.6587 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 y-4 &= 34.52 & +11.8y & & -1233 \\
 +668 & +264 = +932 & +301 & = +1233 & = 0 \\
 +727 & +390 = +1117 & +115 & = +1232 & = -1 \\
 -72 & +1050 = +978 & +256 & = +1234 & = +1 \\
 18.9437 & +608 & +224 & & = 18.9036 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a &= -0.3^* & c &= -9.6 & a-c &= +9.3 & b+a &= +3.8 \\
 \text{Obs } a &= -1.1 & c &= -11.8 & a-c &= +10.7 & b+a &= +5.0
 \end{aligned}$$

$$c-a = +0.8 \quad +22 \quad -1.4 \quad -12$$

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Plate Constants

5

2		4		K C		Reel	
7 6569	25.5230	14	34	29	-17	30	27
11 3176	9.7799		36	33	-19	33	02
30 4732	216799		46	55	-17	59	36
14945	15698		116	117	-54	62	65
1648	1899	14	39	19	-18	21	02
-18	-22		+	47		+	23
1.52	301	14	40	06	-17	57	37
31	465	$\left. \begin{aligned} A &= 14^{\circ} 40' 06'' \\ D &= -17^{\circ} 57' 37'' \end{aligned} \right\}$					
47	1405						

$$\begin{aligned}
 2-3-39.54 & \quad +1.12 & \quad +114.6 \\
 -146-1008 & = -1154 + 8 & = -1146 & = 0 \\
 -771-386 & = -1157 + 12 & = -1145 & = +1 \\
 -324-856 & = -1180 + 34 & = -1146 & = 0 \\
 176170-748 & +19 & & = 176587
 \end{aligned}$$

$$\begin{aligned}
 4-7+3452 & \quad +1184 & \quad -1233 \\
 +668+264 & = +932 + 301 & = +1233 & = 0 \\
 +727+390 & = +1117 + 115 & = +1232 & = -1 \\
 -72+1050 & = +978 + 256 & = +1234 & = +1 \\
 18.9437+608 & +224 & & = 18.9036
 \end{aligned}$$

$$\begin{aligned}
 \text{ables } a &= -0.3 & a &= -9.6 & a-2 &= +9.3 & b+d &= +3.8 \\
 \text{Obs} &= -1.1 & &= -11.8 & &= +10.7 & &= +5.0 \\
 c &= 0 & & & &= -1.4 & &= -1.2
 \end{aligned}$$

1759 Standard Coordinates

Cape No. 1985 mag 7.8 Cape No. 1990 mag 7.2 Cape No. 2013 mag 6.8

C	14	33	49.20	14	35	47.62	14	46	14.53
L			23			69			55
b			25			65			58
mean	14	33	49.23	14	35	47.65	14	46	14.55
Prece			+40.02			+40.45			+40.27
X	14	34	29.25	14	36	28.10	14	46	54.82
A	14	40	06	14	40	06	14	40	06
1-A	-	5	36.75	-3	37.90		+6	48.82	
sin(X-A)			-336.72			-217.89			+408.76
log	2.5	27	27 m	2.3	38	24 m	2.6	11	47
"cos	9.9	79	40	9.9	74	21	9.9	78	23
"S.	1.0	13	91 m	0.8	19	69 m	1.0	9	694
S.	-10.3	25	5	-6.6	02	2	+12.5	00	9
S ₁	-		30	-		31	+4		47
S	7.6	71	5	11.3	94	7	30.5	05	6
X	7.6	56	9	11.3	17	6	30.4	73	2
S-S	-14	6		-17	71		-32	4	

C	-17°	27'	18".8	-19°	29'	55".3	-17°	56'	35".4
L			18.5			55.5			36.3
b			19.0			54.2			35.7
mean	-17	27	18.8	-19	29	55.0	-17	56	35.8
Prece	-	3	08.2	-3	06.9		-3	00.4	
S	-17	30	27.0	-19	33	01.9	-17	59	36.2
D	-17	57	37	-17	57	37	-17	57	37
S-D	+27	10.0		-1	35	24.9	-	01	59.2
sin(S-D)			+1630.0			-5726.4			-119.2
log	3.2	12	19	3.7	57	88 m	2.0	76	28 m
" ₀	0.5	43	34	1.0	89	03 m	9.4	07	43 m
tan S	9.4	98	9 m	9.5	50	4 m	9.5	11	6 m
S ₂	2.0	27	8	1.6	39	4	2.1	93	9
" ₁	8.5	80	1 m	8.2	43	2 m	8.7	58	9 m
" ₀	+3.4	94	2	-12.2	75	3	-0.2	55	5
" ₁	-		380	-		175	-		574
" ₂	25.4	56	2	9.7	07	2	21.6	87	1
" ₃	25.5	23	0	9.7	79	9	21.6	79	9
" ₄	+6	68		+7	27		-		72

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Standard Coordinates

Cape W. 1985 mag 7.8 Cape W. 1990 mag 7.2 Cape W. 2013 mag 6.8

C	14	33	49	20	14	35	47	62	14	46	14	53
L				23				69				55
b				25				65				58
mean	14	33	49	23	14	35	47	65	14	46	14	55
Prece				+40.02				+40.45				+40.27
X	14	34	29	25	14	36	28	10	14	46	54	82
A	14	40	06		14	40	06		14	40	06	
k-4	-	5	36	75	-	3	37	90				+6 48 82
sin(x-A)				-336.72				-217.89				+408.76
log	2.5	27	27	m	2.3	38	24	m	2.6	11	47	
cos	9.9	79	40		9.9	74	21		9.9	78	23	
" 3.	1.0	13	91	m	0.8	19	69	m	1.0	96	94	
3.	-10.3	25	5		-6.6	02	2		+12.5	00	9	
3.	-		30		-		31		+1		47	
3.	-7.6	71	5		11.3	94	7		30.5	05	6	
2.	7.6	56	9		11.3	17	6		30.4	73	2	
2.-3	-14	6			-77	71			-3	24		

C	-17°	27'	18.8	-19°	29'	55.3	-17°	56'	35.4
L			18.5			55.5			36.3
L			19.0			54.2			35.7
mean	-17	27	18.8	-19	29	55.0	-17	56	35.8
Prece	-	3	08.2	-	3	06.9	-	3	00.4
S	-17	30	27.0	-19	33	01.9	-17	59	36.2
D	-17	57	37	-17	57	37	-17	57	37
S-D	+27	10.0	-1	35	24.9	-	01	59.2	
(S-D)	+16	30.0	-	57	26.4	-	11	9.2	
log	3.2	12.19		3.7	57.88	m	2.0	76.28	m
η	0.5	43.34		1.0	89.03	m	9.4	07.43	m
tan S	9.4	98.9	m	9.5	50.4	m	9.5	11.6	m
3	20	27.8		16	39.4		21	9.39	
4	8.5	80.1	m	8.2	43.2	m	8.7	58.9	m
70	+3.4	94.2		-12.2	75.3		-0.2	55.5	
71	-	38.0		-	19.5		-	57.4	
72	25.4	56.2		9.7	07.2		21.6	87.1	
73	25.5	23.0		9.7	79.9		21.6	79.9	
74	+6.6	8		+7.2	7		-	70	

ret.	pos. $\angle$	resid.
1	180.0	+17
2	169.0	+89
3	136.4	0
4	118.1	-107
5	88.4	-15
6	58.4	-26
7	43.6	+46
8	26.6	-5

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Luvon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.6159	0.0000	+7	0.0000	4.0345	+69
2	18.0000 + 0.3841		+7	0.1481	4.0424	+148
3	19.0000 + 1.3841		+5	1.9171	4.0344	+68
4	19.3844 + 1.7685		+3	3.1287	4.0232	-44
+5	19.6227 + 2.0068		-0	4.0272	4.0302	+26
6	19.3225 + 1.7066		-4	2.9111	4.0260	-16
7	19.0000 + 1.3841		-5	1.9144	4.0314	+38
8	18.5164 + 0.9005		-7	0.8096	4.0244	-32

Compt $R^2 = 4.0276$

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	16.9382	-2.0068	-18	4.0345
2	16.9734	-1.9716	-18	3.8943
3	17.4912	-1.4538	-13	2.1173
4	18.0000	-0.9450	-8	0.8945
5	19.0000	+0.0550	+0	0.0030
6	20.0000	+1.0550	+9	1.1149
7	20.3987	+1.4537	+13	2.1170
8	20.7364	+1.7914	+16	3.2148

Approximate Center

$$x = 19.024 : 17.4912$$

$$20.3987$$

$$37.8899$$

$$y = \text{mean} = 18.9450$$

$$y = \text{min} = 16.9382$$

$$R = 2.0068$$

$$x = \text{max} = 19.6227$$

$$x_0 = 17.6159$$

$$\text{Center} \begin{cases} x_0 = 17.6159 \\ y_0 = 18.9450 \end{cases}$$

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homon Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	17.6159	0 0 0 0 0	+7	0 0 0 0 0	4.0345	+69
2	18.0000 + 0.3841		+7	0 1 4 8 1	4.0424	+148
3	19.0000 + 1.3841		+5	1 9 1 7 1	4.0344	+68
4	19.3844 + 1.7685		+3	3 1 2 8 7	4.0232	-44
+5	19.6227 + 2.0068		-0	4 0 2 7 2	4.0302	+26
6	19.3225 + 1.7066		-4	2 9 1 1 1	4.0260	-16
7	19.0000 + 1.3841		-5	1 9 1 4 4	4.0314	+38
8	18.5164 + 0.9005		-7	0 8 0 9 6	4.0244	-32
Compl $K^2 =$				4.0276		

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
-1	16.9382	-2.0068	-18	4.0345
2	16.9734	-1.9716	-18	3.8943
3	17.4912	-1.4538	-13	2.1173
4	18.0000	-0.9450	-8	0.8945
5	19.0000	+0.0550	+0	0.0030
6	20.0000	+1.0550	+9	1.1149
7	20.3987	+1.4537	+13	2.1170
8	20.7364	+1.7914	+16	3.2148

Approximate Center

$$\begin{aligned}
 x &= 19.024 : 17.4912 \\
 &\quad \underline{20.3987} \\
 &\quad 3.78899 \\
 y - \text{mean} &= 18.9450 \\
 y - \text{min} &= 16.9382 \\
 K &= 2.0068 \\
 x - \text{max} &= 19.6227 \\
 x_0 &= 17.6159
 \end{aligned}$$

$$\text{Center } \begin{cases} x_0 = 17.6159 \\ y_0 = 18.9450 \end{cases}$$

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Moon's Center -
Conditional Equations

	a	b	0	c	0-c
1	0.00	-2.01	+69	0 + 52 = +52	+17
2	+0.38	-1.97	+148	+8 + 51 = +59	+89
3	+1.38	-1.45	+68	+30 + 38 = +68	0
4	+1.77	-0.95	-44	+38 + 25 = +63	-107
5	+2.01	+0.06	+26	+43 - 2 = +41	-15
6	+1.71	+1.06	-16	+37 - 27 = +10	-26
7	+1.38	+1.45	+38	+30 - 38 = -8	+46
8	+0.90	+1.79	-32	+19 - 46 = -27	-5

Average = 38.

Mean Equations.

$$\begin{aligned}
 -a \\
 +3.53 - 6.38 &= +2.41 \\
 +6.00 + 4.36 &= +10.36
 \end{aligned}$$

$$\begin{aligned}
 -6.00 + 10.85 &= +4.85 \\
 +15.21 &= +39.4
 \end{aligned}$$

$$+3.53 = +2.41 - 165 = +76$$

$$b = -25.9$$

$$a = +21.5$$

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Moons Center -
Conditional Equations

	a	b	0	c	0-c
1	0 00 - 201 :		+ 69	0 + 52 = + 52	+ 17
2	+ 0 38 - 197 :		+ 148	+ 8 + 51 = + 59	+ 89
3	+ 1 38 - 145 :		+ 68	+ 30 + 38 = + 68	0
4	+ 1 77 - 0 95 :		- 44	+ 38 + 25 = + 63	- 107
5	+ 2 01 + 0 06 :		+ 20	+ 43 - 2 = + 41	- 15
6	+ 1 71 + 1 06 :		- 16	+ 37 - 27 = + 10	- 26
7	+ 1 38 + 1 45 :		+ 38	+ 30 - 38 = - 8	+ 46
8	+ 0 90 + 1 79 :		- 32	+ 19 - 46 = - 27	- 5

Average = 38

Mean Equations

$$\begin{aligned}
 - a & \\
 + 353 - 638 & = + 241 \\
 + 600 + 436 & = + 16
 \end{aligned}$$

$$\begin{aligned}
 - 600 + 1085 & = - 410 \\
 + 1521 & = - 394
 \end{aligned}$$

$$+ 353 = + 241 - 165 = + 76$$

$$b = - 259$$

$$a = + 21.5$$

1759 Moon's Mean Position (1912.0)

$$\begin{array}{r} X_0 = 17.6159 \\ + 11 \\ \hline 17.6170 \end{array} \quad \begin{array}{r} Y_0 = 18.9450 \\ - 13 \\ \hline 18.9437 \end{array}$$

From Plate Constants $X = 17.6587$ $Y = 18.9036$

$$\begin{array}{r} \xi = -0.3413 \\ \log S = 9.53314 \\ \text{const} = 9.97731 \\ \text{const} = 8.50724 \end{array}$$

$$\therefore (X-A) = 10.4859$$

$$Y-A = -$$

$$11.18$$

$$A = 14 \ 40 \ 06$$

$$X_0 = 14^h \ 39^m \ 54.82^s$$

$$\text{Red} = + 1.45$$

$$X' = 14 \ 39 \ 56.27$$

$$\eta = -3.0964$$

$$\log \tan S = 9.5212$$

$$\text{const} = 9.0663$$

$$\eta_1 = 5.6409$$

$$\log \eta_0 = 0.49086$$

$$\text{const} = 7.3311$$

$$\therefore (X-D) = 3.15971$$

$$S-D = -24 \ 04.5$$

$$D = -17 \ 57 \ 37$$

$$S_0 = -18 \ 21 \ 41.5$$

$$\text{Red} = -12.6$$

$$S' = -18 \ 21 \ 54.1$$

1759 Moon's Mean Position (1912.0)

9

$$\begin{array}{r}
 X_0 = 17.6159 \\
 + 11 \\
 \hline
 17.6170
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 18.9450 \\
 - 13 \\
 \hline
 18.9437
 \end{array}$$

From Plate Constants $\lambda = 17.6587$ $\gamma = 18.9036$

$$\begin{array}{ll}
 \xi = -0.3413 & \eta = -3.0964 \\
 \log \xi = 9.53314 & \\
 \text{wv} \xi = 9.97731 & \log |\lambda \xi| = 9.5212 \\
 \text{wv} \eta = 8.50724 & \text{" } \xi^2 = 9.0663 \\
 & \text{" } \eta^2 = 5.6409
 \end{array}$$

$$\begin{array}{ll}
 (\lambda - \lambda_0) = 1.04859 & \\
 \lambda - \lambda_0 = -11.18 & \log \eta_0 = 0.49086 \\
 & \text{wv} \eta_0 = 7.33115
 \end{array}$$

$$A = 14 \ 40 \ 06 \quad (\lambda - \lambda_0) = 3.15971$$

$$\alpha_0 = 14^h 39^m 54.82^s \quad \delta - D = -24 \ 04.5$$

$$\text{Red} = +14.5 \quad D = -17 \ 57 \ 37$$

$$\alpha' = 14 \ 39 \ 56.27 \quad \delta_0 = -18 \ 21' 41.5''$$

$$\text{Red} = -12.6$$

$$\delta' = -18 \ 21 \ 54.1$$

175-9 Red. ad 0. aph.

$\alpha_0 = 14^h 40^m$

$\delta_0 = -18^\circ 22'$

$H + \alpha \quad 7^h 39^m : 144^\circ 45'$

$H \quad 16 \quad 59$

$\alpha \quad 14 \quad 40$

$G \quad 18 \quad 59$

$G + \alpha \quad 9 \quad 39 : 144^\circ 45'$

$\ell \cos(G + \alpha) \quad 9.9120m$

$\eta \quad 0.9672$

$\sin \quad 9.7613$

$\tan S \quad 9.5212m$

$\tan \quad 8.8239$

$g' \quad 0.8792m$

$g \quad 9.0736m$

$b \quad +0.37$

$g \quad -0.12$

$k \quad +1.20$

$+1.45$

$\log \cos S \quad 9.9773$

$\ell \quad 0.8977m$

$\ell \quad 0.8750m$

$\ell \sin S \quad 9.4984m$

$-\cos(H + \alpha) \quad 9.6219m$

$\ell \quad 1.2761$

$\sin \quad 9.9582$

$\sec S \quad 0.0227$

$\tan \quad 8.8239$

$h' \quad = \quad 0.3964$

$h \quad = \quad 0.0809$

$g' \quad -7.57$

$h' \quad +2.49$

$\ell \quad -7.50$

-12.58

175-9 Red. ad 0. aph.

 $X_0 = 14^h 40^m$ $S_0 = -18^\circ 22'$ $H + x \quad 7 \quad 39 : 144^\circ 45'$ $H \quad 16 \quad 59$ $x \quad 14 \quad 40$ $G \quad 18 \quad 59$ $G + x \quad 9 \quad 39 - 144^\circ 45'$ $\ell \cos(G+x) \quad 99120m$ $q \quad 09672$ $\sin \quad 97613$ $\tan S \quad 95212m$ $\tan \quad 88239$ $q' \quad 08792m$ $q \quad 90736m$ $b \quad 7037$ $g \quad -012$ $h \quad +120$ $+145$ $\log \cos S \quad 99773$ $i \quad 08977m$ $i \quad 08750m$ $\ell \sin S \quad 94984m$ $-\cos(A+x) \quad 96219m$ $\tan \quad 12761$ $\sin \quad 99582$ $\sec S \quad 00227$ $\tan \quad 88239$ $h' \quad 03964$ $h \quad 00809$ $g' \quad -757$ $h' \quad +249$ $i \quad -750$ -1258

1759 Lunar Parallax.

$$\alpha' = 14^\circ 39' 56.27''$$

$$\delta = 13^\circ 46' 04.55''$$

$$- 53.52.7''$$

$$- 13^\circ 29' 55''$$

$$- 5^\circ 08''$$

$$- 13^\circ 22' 52''$$

$$9.95727''$$

$$0.00000''$$

$$0.01196''$$

$$7.96923''$$

$$f = 42^\circ 58' 20''$$

$$- 18^\circ 21' 54''$$

$$61^\circ 20' 14''$$

$$9.82640''$$

$$8.21774''$$

$$9.94323''$$

$$0.16644''$$

$$8.15381''$$

$$\delta - \delta' = +48^\circ 59.3''$$

$$\delta = -17^\circ 32' 54.8''$$

$$\text{Nautical } \delta = -17^\circ 32' 49.5''$$

$$\delta - c = -5^\circ 3''$$

$$\delta' = -18^\circ 21' 54.1''$$

$$\pi = 56' 45.5''$$

$$9.86913''$$

$$8.21774''$$

$$9.36709''$$

$$0.02069''$$

$$74.7469''$$

$$\alpha - \alpha' = -10^\circ 15.31''$$

$$= -41.02''$$

$$\alpha = 14^\circ 39' 15.25''$$

$$\alpha = 14^\circ 39' 14.55''$$

$$+0.70''$$

17 59 Lunar Parallax

$$\alpha = 14^{\circ} 39' 56.27''$$

$$\delta = 13^{\circ} 46' 04.55''$$

$$- 53.52$$

$$- 13^{\circ} 28' 00''$$

$$- 5.08$$

$$- 13.22.52$$

$$995727$$

$$000000$$

$$001196$$

$$796923$$

$$\alpha = 42.58.20$$

$$- 18.21.54$$

$$61.20.14$$

$$982640$$

$$821774$$

$$994323$$

$$016644$$

$$815381$$

$$\delta - \delta' = +48.593$$

$$\delta = -17.32.54.8$$

$$\alpha = 14.39.15.25$$

$$\text{Haukkinen } \delta = -17.32.49.5$$

$$\alpha = 14.39.14.55$$

$$\delta - \delta'$$

$$- 5.3$$

$$+ 0.70$$

$$\delta = -18^{\circ} 21' 54.1''$$

$$\alpha = 56^{\circ} 45.5'$$

$$986913$$

$$821774$$

$$936713$$

$$002069$$

$$747469$$

$$\alpha - \alpha' = 10' 15.34$$

$$= -41.02$$

6
2
2
10.
10
3
29
20

1760

Star Measures

1913 Oct. 28.

12

	α	δ	μ	μ	μ	μ
1	15470	18854	17374	18443		
6.8	13772.69	10546.45	1599690	9804.60		
26.2	70	40	8588	91-60		
	70	45	58	27		
	<u>26.1700</u>	<u>1696</u>	<u>6.8618</u>	<u>8626</u>		
2						
10.6	14116	17136	16608	17890		
10.5	9655	11590	12850.50	11632		
	5555	8490	50	3830		
	12	38	93	80		
	<u>104459</u>	<u>4451</u>	<u>10.6245</u>	<u>.6251</u>		
3						
29.6	19255	17481	14810	16420		
22.5	14566.58	12149.50	11890.00	9330.20		
	60	4850	90	18		
	40	79	98	11		
	<u>22.4687</u>	<u>4669</u>	<u>29.7087</u>	<u>7091</u>		

grade (3) or (4)

1760

Stars measures

1913 Oct 28

12

	α	δ	α	δ	α	δ	α	δ
1	15470		18854		17374		18443	
6.8	1377269		1054645		1599690		980900	
26.2	70		40		8588		01-00	
	70		45		58		27	
	<u>26.1700</u>		<u>1696</u>		<u>6.8618</u>		<u>8626</u>	
2								
10.6	14116		17136		16608		17890	
10.5	96555		11590		1285050		1163230	
	5555		8490		50		3830	
	12		38		93		80	
	<u>104459</u>		<u>4451</u>		<u>106245</u>		<u>6257</u>	
3								
29.6	19255		17481		19810		16420	
22.5	1456658		12149		1189000		933020	
	60		4850		90		18	
	40		79		98		11	
	<u>22.4687</u>		<u>4669</u>		<u>29.7087</u>		<u>7091</u>	

Grade (3 or 4)

1760

Moon-Measures

d

y

n

d

x

n

1

17945

15318

17.6

1548080

776958

17.8

75

50

mm

40

09

in

172466

2448

8

2

17940

15310

18.0

1471820

855045

17.4

20

44

47

05

173223

3239

3

1278085

10080

19.0

92

984130

18.0

12517

30

189731

9754

4

17965

14718

19.5

1236568

1030410

19.0

70

00

55

12

194408

4410

5

16964

13721

19.5

11546

909300

19.2

5049

90

48

25

194592

4629

6

17475

19640

19.4

10650

1649090

20.0

44

84

62

40

193180

3152

1760

Moon-Measures

d

4

n

d

n

1	17945	15318
17.6	1546080	776958
178	75	50
min	40	09
7	<u>172466</u>	<u>2448</u>

2	17940	15310
180	1471820	855045
174	20	49
	47	05
	<u>173223</u>	<u>3239</u>

3	1275085	10080
19.0	92	984130
180	12517	30
	<u>179731</u>	<u>9754</u>

4	17965	14718
19.5	12365	1030410
190	7068	00
	55	12
	<u>194408</u>	<u>4410</u>

5	16964	13721
19.5	1154649	909300
192	50	90
not	48	25
76	<u>194592</u>	<u>4629</u>

6	17475	19640
19.4	1065045	1649090
20.0	44	84
	62	40
	<u>193180</u>	<u>3152</u>

1760

Moon-measures.

14

	d	n
2	16849	16275
19.0	1150109	1162810
20.6	00	3910
	50	89
	<u>20.5347</u>	<u>.5340</u>

8
18.4
21.0

15779	19194
10190	14765
0598	2062
64	00
<u>18.4427</u>	<u>.4431</u>

1760

moon-measures

14

	d	n
2	16849	16275
190	1150109	1162810
20.6	00	3910
	50	89
	<u>20.5347</u>	<u>5340</u>

8
184
21.0

15779	19194
10190	14765
0598	7062
64	00
<u>18.4427</u>	<u>4431</u>

1760	Times	etc.					
End to stars 1912 Apr. 3	13 ^h 52 ^m			-14 ^h 04 ^m			
" " Moon	13 58	20.8	-13	58	21.2		
Clock slow		1	44.1				
H. Sid T.	14 00	05.1					
Along	4 44	31.05					
G. Sid T.	18 44	36.15					
Sid T. to Moon	0 45	47.22					
Interval	17 58	48.93					
Reduction		2	56.74				
G. M. T.	17 55	52.19		-14 - 0 ^h 39 ^m 39 ^s			

From Kant Alm		R.A.		local			
moon 18 ^h	14 ^h 39 ^m	52.68	-17 ^h 36'	37.6			
Motion 1 ^m = 2.1066				12.588			
" " -4.1302		-8.70		+	52.0		
Tabular place	14 39	43.98	-17 35		45.6		

moon's age 16+ days.

parallel

semidiameter

$$934 = 7.7$$

$$9295 = 7.6$$

R =

Augmentation

Parallax 3009

R =

R =

(a+1) R =

R =

$$a = +1.5$$

1760	Times	etc.						
End of 1st Am	1912 Apr. 3	13 ^h 52 ^m			-14 ^h 04 ^m			
known		13 58	20.8	-13	58	21.2		
Clock slow		1	44.1					
H. Sid T.		14 00	05.1					
Along		4 44	31.05					
G. S. d T.		18 44	36.15					
Sid T. known		0 45	47.22					
Interval		17 58	48.93					
Reduction		3	06.57					
G. T. T.		17 55	42.36	4-12	-0 ^m 39 ^m 39 ^s			

From Kant Alman	R. A.	Decl.			
known 18 ^h	14 ^h 39 ^m 52.68	-17 ^h 36'	37.6		
known 1 ^m - 2.1066		12.589			
-4.294	-9.05	+	54.1		
Tabular place	14 39 43.63	-17 35	43.5		

known age 16+ days.

	parallel	56'	45.1
	semidiam	15'	29.5
39 = 7.7	R =	929.5	
1295 = 7.6	Amplitude	+76	
	Trachinotus 3019	-0.7	
	R =	936.4	
	R =	20073	
a = +1.5	(a+1) R =	20076	
	R ² =	40305	

1760

Plato constants.

2	6.8622	10.6250	297089
3	7.6715	11.3947	30.5056
2-3	-8093	-7697	-7967

4	26.1698	10.4455	224678
7	254562	9.7072	21.6871
4-7	+7136	+7383	+7797

$$\begin{array}{rclcl}
 2-3 & +24.94 & -1.52 & +7452 & \\
 -8093 & +652 & -7441 & -10 & -7451 = +1 \\
 -7697 & +260 & -7437 & -16 & -7453 = -1 \\
 -7967 & +559 & -7408 & -45 & -7453 = -1 \\
 17.4537 & +479 & -26 & & = 18.2442 \checkmark
 \end{array}$$

$$\begin{array}{rclcl}
 4-7 & -27.42 & +9.14 & -7187 & \\
 +7136 & -188 & +6948 & +238 & +7186 = -1 \\
 +7383 & -291 & +7092 & +95 & +7187 = 0 \\
 +7797 & -814 & +6983 & +204 & +7187 = 0 \\
 19.2534 & -478 & +175 & & = 18.5044 \checkmark
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Tables} & a = -0.4 & c = -9.6 & a - c = +9.2 & b + d = +2.7 \\
 \text{obs} & a = +1.5 & c = -9.1 & a - c = +10.6 & b + d = +2.5 \\
 c - a = & & & -1.4 & +0.2
 \end{array}$$

1760

Plate Constants

2	6.8622	10.6250	29.7089
3	7.6715	11.3947	30.5056
2-3	-8093	-7697	-7967

4	26.1698	10.4455	22.4678
7	25.4562	9.7072	21.6871
4-7	+7136	+7383	+7797

2-3	+24.94	-1.52	+7452
-8093	7652	-7441	-10
-7697	+260	-7437	-16
-7967	+559	-7408	-45
17.4537	+479	-26	
			+7451 = +1
			-7453 = -1
			-7453 = -1
			= 18.2442

4-7	+27.42	+9.14	-7187
+7136	-188	+6948	+238
+7383	-291	+7092	+95
+7797	-814	+6983	+204
19.2534	-478	+175	
			+7186 = -1
			+7187 = 0
			+7187 = 0
			= 18.5044

Tables	$a = -0.4$	$b = +9.6$	$a - b = +9.2$	$b + a = +2.7$
Obs	$c = +1.5$	$d = -9.1$	$a - d = +10.6$	$b + d = +2.5$
	$c - d =$		-1.4	$+0.2$

pt.	pos. α	resid.
1	180.0	+74
2	164.2	+3
3	129.6	+7
4 $\frac{1}{2}$ wt.	[97.3	-169]
5	90.0	-13
6	68.2	-26
7	50.4	+14
8	29.6	+27

1760 *lunar's Center.*

17

	x	$y - Y_0$	Δy	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$0 - c$
1	17.4524	0.0000	+5	0.0000	4.0413	+108
2	18.0000	+0.5476	+5	0.2999	4.0356	+51
3	19.0000	+1.5476	+3	2.3960	4.0375	+70
4	19.4409	+1.9885	+1	3.9545	4.0193	-112
5	19.4610	+2.0086	0	4.0345	4.0345	+40
6	19.3166	+1.8642	-2	3.4745	4.0315	+70
7	19.0000	+1.5476	-3	2.3923	4.0338	+33
8	18.4429	+0.9905	-5	0.9801	4.0328	+23

Comp. $R^2 = 4.0305$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
-1	17.2457	-2.0086	-17	4.0413
2	17.3231	-1.9312	-16	3.7357
3	17.9742	-1.2801	-11	1.6415
4	19.0000	-0.2543	-2	0.0648
5	19.2543	0.0000	0	0.0000
6	20.0000	+0.7457	+6	0.5570
7	20.5344	+1.2801	+11	1.6415
8	21.0000	+1.7457	+16	3.0527

Approximate Center

$$x = 19.0 \quad y = 17.9742$$

$$\underline{20.5344}$$

$$38.5086$$

$$\text{mean } y = 19.2543$$

$$y - \text{min} = 17.2457$$

$$R = 2.0086$$

$$x - \text{max} = 19.4610$$

$$X_0 = 17.4524$$

$$\text{Center } \begin{cases} X_0 = 17.4524 \\ Y_0 = 19.2543 \end{cases}$$

1760 known center

17

	x	y	$x - y_0$	Δx	$(x - y_0)^2$	$(x - y_0)^2 + (y - y_0)^2$	$0 - 6$
1	17.4524	0.0000	+5	0.0000	4.0413	+108	
2	18.0000	+0.5476	-5	0.2999	4.0356	+51	
3	19.0000	+1.5476	-3	2.3960	4.0375	+70	
4	19.4409	+1.9885	-1	3.9545	4.0193	-112	
5	19.4610	+2.0086	0	4.0345	4.0345	+40	
6	19.3166	+1.8642	-2	3.4745	4.0315	+10	
7	19.0000	+1.5476	-3	2.3923	4.0338	+33	
8	18.4429	+0.9905	-5	0.9801	4.0328	+23	
					Comp K^2	4.0305	

	y	x	$y - y_0$	Δy	$(y - y_0)^2$
-1	17.2457	-2.0086	-17	4.0413	
2	17.3231	-1.9312	-16	3.7357	
3	17.9742	-1.2801	-11	1.6415	
4	19.0000	-0.2543	-2	0.0648	
5	19.2543	0.0000	0	0.0000	
6	20.0000	+0.7457	+6	0.5570	
7	20.5344	+1.2801	+11	1.6415	
8	21.0000	+1.7457	+15	3.0527	

Approximate center

$$x = 19.0 \quad y = 17.9742$$

$$\underline{20.5344}$$

$$385.086$$

$$\text{mean } y = 19.2543$$

$$y - \text{min} = 17.2457$$

$$12 = 2.0086$$

$$x - \text{max} = 19.4610$$

$$X = 17.4524$$

$$\text{Center} \begin{cases} X = 17.4524 \\ Y = 19.2543 \end{cases}$$

1760

Moon's Center

18

Conditional Equations

	a	b	0	C	0-C
1	0.00	-2.01	= +108	0 + 34 = +34	+74
2	+0.55	-1.93	= +51	+45 + 33 = +48	+3
3	+1.55	-1.28	= +70	+41 + 22 = +63	+7
4	+1.99	-0.25	= -112	+53 + 4 = +57	-169
5	+2.01	+0.00	= +40	+53 - 0 = +53	-13
6	+1.86	+0.75	= +10	+44 - 13 = +36	-26
7	+1.55	+1.28	= +33	+41 - 22 = +19	+14
8	+0.99	+1.75	= +23	+26 - 30 = -4	+27

Average 42

Mean Equations

$$+3.10 - 5.34 = +1.73$$

$$+6.41 + 3.78 = +10.6$$

$$-6.41 + 11.02 = +4.61$$

$$+14.80 = -25.2$$

$$b = -17.05$$

$$+3.10 = +1.73 - 91 = +82$$

$$a = +26.5$$

1760

Moon's Center
Conditional Equations

18

	a	b	0	c	0-c
1	0.00	-2.01	+1.08	0+34 = +34	+74
2	+0.55	-1.93	+1.51	+45 + 33 = +48	+3
3	+1.55	-1.28	+1.70	+41 + 22 = +63	+7
4	+1.99	-0.25	-1.12	+53 + 4 = +57	-169
5	+2.01	+0.00	+4.0	+53 - 0 = +53	-13
6	+1.86	+0.75	-1.0	+44 - 13 = +36	-26
7	+1.55	+1.28	+1.33	+41 - 22 = +19	+14
8	+0.99	+1.71	-2.3	+26 - 30 = -4	+27
					average 42

Mean Equations

$$+3.10 = 5.34 = +1.73$$

$$+6.41 + 3.78 = +10.6$$

$$-6.41 + 11.02 = +3.58$$

$$+14.80 = -2.52$$

$$+3.10 = +1.73 = 91 = +82$$

$$b = -17.05$$

$$a = +26.5$$

1760 Lunar Parallax.

$$\begin{aligned} \alpha' &= 14^\circ 40' 15.45'' \\ \theta &= 14^\circ 00' 05.1'' \\ \theta - \alpha &= -40' 10.3'' \\ &= -10^\circ 02' 35'' \end{aligned}$$

$$- \quad \quad \quad 3 \quad 50$$

$$- \quad 9 \quad 58 \quad 45$$

$$\begin{array}{r} 9.95727 \\ 0.00000 \\ 0.00662 \\ \hline 9.96389 \end{array}$$

$$\gamma = 42 \quad 37 \quad 14$$

$$-18 \quad 25 \quad 00$$

$$61 \quad 02 \quad 14$$

$$\begin{array}{r} 9.82640 \\ 8.21768 \\ 9.94198 \\ 0.16932 \\ \hline 8.15538 \end{array}$$

$$S - \delta' = +49 \quad 10.0$$

$$S = -17 \quad 35 \quad 50.3 \quad \alpha = 14 \quad 39 \quad 44.72$$

$$\text{Nautical } S = -17 \quad 35 \quad 45.6 \quad \alpha = 14 \quad 39 \quad 43.98$$

$$O - C \quad \quad \quad -4.7 \quad \quad \quad 0.74$$

$$\delta' = -18^\circ 25' 00.3''$$

$$\pi = 56' 45.1''$$

$$\begin{array}{r} 9.86913 \\ 8.28768 \\ 9.24151 \\ 0.02091 \\ \hline 7.34923 \end{array}$$

$$\alpha - \alpha' = -7 \quad 40.95$$

$$= -30.73$$

1760 Moon's mean Position (1912.0)

19

$$\begin{array}{rcl}
 X_0 & = & 17.4524 \\
 Y_0 & = & 19.2543 \\
 \frac{1}{2}a & = & +13 \\
 \frac{1}{2}b & = & -9 \\
 \hline
 & & 17.4537 \quad 19.2534
 \end{array}$$

From Plate Constants $X = 18.2442$ $Y = 18.5044$

$$\begin{array}{rcl}
 \bar{z} & = & +0.2442 \\
 \log \bar{z} & = & 9.38775 \\
 \log S & = & 9.97718 \\
 \text{const} & = & 8.50724 \\
 (x-A) & = & 0.90333
 \end{array}$$

$$x-A + 8.00$$

$$A = 14.40.06$$

$$X_0 = 14.40.14.00$$

$$\text{Red} = +1.45$$

$$X' = 14.40.15.45$$

$$\eta = -3.4956$$

$$\begin{array}{rcl}
 \log \tan S & = & 9.52224 \\
 \log^2 & = & 8.7755 \\
 \eta_1 & = & 5.3513
 \end{array}$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 0.54352 \\
 \text{const} & = & 7.33115
 \end{array}$$

$$(d-D) = 3.21237$$

$$S-D = -27.10.7$$

$$D = -17.57.37$$

$$S_0 = -18.24.47.7$$

$$\text{Red} = -12.6$$

$$S' = -18.25.00.3$$

Red. ad. locum apt

S $-18^{\circ} 29'$

$$H + \alpha \quad 7^{\circ} \quad 39' = 114^{\circ} 45'$$

$$H \quad 16 \quad 59$$

$$\alpha \quad 14 \quad 40$$

$$G \quad 18 \quad 59$$

$$G + \alpha \quad 9 \quad 39' = 144^{\circ} 45'$$

$$l \cos(G + \alpha) \quad 9.9120m$$

$$g \quad 0.9674$$

$$h \quad 9.7613$$

$$\tan S \quad 9.5220m$$

$$t \quad 8.8239$$

$$g' \quad 0.8794m$$

$$g \quad 9.0746m$$

$$h \quad +0.37$$

$$g \quad -0.12$$

$$h \quad +1.20$$

$$\quad +1.45$$

$$l \cos S \quad 9.9772$$

$$i \quad 0.8978m$$

$$(i) \quad 0.8750m$$

$$l \sin S \quad 9.4992m$$

$$l \cos(H + \alpha) \quad 9.6219m$$

$$h \quad 1.2760$$

$$\sin S' \quad 9.9582$$

$$\sec S \quad 0.0228$$

$$t \quad 8.8239$$

$$h' \quad 0.3971$$

$$h \quad 0.0809$$

$$g' \quad -75.8$$

$$h' \quad +2.50$$

$$l \quad -75.0$$

$$\quad -12.58$$

1760 moons mean Position (1912.0)

19

$$\begin{array}{r}
 X_0 = 17.4524 \quad Y_0 = 19.2543 \\
 \hline
 \quad \quad \quad + 13 \quad \quad \quad - 9 \\
 \hline
 17.4137 \quad \quad \quad 19.2534
 \end{array}$$

From Plate Constant $X = 18.2442 \quad Y = 18.5044$

$$\begin{array}{l}
 \bar{z} = +0.2442 \quad \eta = -3.4956 \\
 \log \bar{z} = 9.38775 \\
 \log S = 9.97718 \\
 \log \eta = 8.50724 \\
 \log \eta_1 = 9.5224 \\
 \log \eta_2 = 8.7755 \\
 \log \eta_3 = 5.3513 \\
 (X-A) = 0.90333 \\
 X-A = +8.00 \\
 A = 14.4006 \\
 X_0 = 14.4014.00 \\
 Red = +1.45 \\
 X = 14.4015.45 \\
 \log \eta_4 = 0.54352 \\
 \log \eta_5 = 7.33115 \\
 (S-D) = 3.21237 \\
 S-D = -27.10.7 \\
 D = -17.57.37 \\
 S = -18.24.477 \\
 Red = -1.26 \\
 S = -18.25.003
 \end{array}$$

1
10
27

1790	Stars - measures		1913 Oct. 28	20
λ	α	δ	α^x	δ^x
10.1	16453	19914	10830	10208
227	9775	16555	30	9430
	85-80	8281		3034
	40	15	10050	
	<u>22.6664</u>	<u>.6669</u>	<u>10.0779</u>	<u>0.777</u>
Σ	15132	17878	15271	17945
15.8	713030	15881	13553	9660
128	2630	8480	53	55
	10	80	50	30
	<u>12.7985</u>	<u>.8004</u>	<u>19.8285</u>	<u>.8276</u>
Σ	19820	16905	19863	16090
26.5	13935	12787	14590	11360
25.5	2830	9292	9090	60
	10	09	58	20
	<u>25.5883</u>	<u>.5883</u>	<u>26.4730</u>	<u>.4730</u>

Grade (3)

1790	Star	Measure	1913 Oct 28	W.
1	d	v	d ²	v
10.1	16453	19914	1083027	10208
227	977580	16555	30	943034
	8580	8281	10050	3034
	40	15		
	<u>22.6664</u>	<u>.6669</u>	<u>10.0779</u>	<u>0.777</u>
2	15132	17878	15271	17945
15.4	713030	15881	1355350	9660
128	2630	8450	53	5555
	10	80	50	30
	<u>12.7985</u>	<u>.8004</u>	<u>19.8285</u>	<u>.8276</u>
3	19820	16905	19863	16090
21.5	1393530	1278792	1419090	1136060
251	28	92	9090	60
	10	09	58	20
	<u>25.5883</u>	<u>.5883</u>	<u>26.4730</u>	<u>.4730</u>

Grades (3)

1790

known measures

21

period	α	δ	α	δ	α	δ
1	18780		15412		18624	
17.6	15300	90	88788	12	14710	12
17.3	90		90		10	
	50		18		20	
	17.3487		.3468		17.6089	
					6065	

2	17810	19450
17.0	9249	18010
17.8	60	23
	00	50
	17.8546	.8562

3	18442	18690
16.6	13711	13386
19.2	20	90
17.2	36	92
2	16.5275	.5302

4	17400	19840
16.7	14426	12820
20.0	10	21
	92	50
	16.7017	.7025

5	15460	17165
17.0	10435	12177
20.5	39	00
	70	61
	20.5029	.5023

6	16195	17178
17.6	11982	11735
21.0	00	51
	89	78
	17.5805	.5820

1790

moon measures

21

parental	a	n	a	n
1	18780	15912	18624	16012
176	1530090	887881	14710.12	9948
173	90	90	10	5250
	50	18	20	18
	<u>17.3487</u>	<u>3468</u>	<u>17.6089</u>	<u>6065</u>

3	17810	19450
170	924958	1802013
178	60	23
	00	50
	<u>17.8546</u>	<u>8562</u>

3	18442	18690
166	13711.10	1338690
142	20	90
max	36	92
2	<u>16.5275</u>	<u>5302</u>

4	17400	19840
167	14426.10	1282026
200	10	21
	92	50
	<u>16.7017</u>	<u>7025</u>

5	11460	17165
17.0	1043545	1217782
20.5	39	00
	70	61
	<u>20.5029</u>	<u>5023</u>

6	16193	17178
176	1198200	1175558
21.0	00	51
	89	78
	<u>17.5805</u>	<u>5820</u>

1790

Moon-measures

22

$$\begin{array}{r}
 2 \quad 15415 \\
 18.0 \quad 13595 \\
 21.3 \quad 8890 \\
 \quad 15 \\
 \hline
 21.1834
 \end{array}$$

$$\begin{array}{r}
 15699 \\
 751740 \\
 \quad 20 \\
 \quad 86 \\
 \hline
 .1838
 \end{array}$$

$$\begin{array}{r}
 8 \\
 18.5 \quad 15398 \\
 21.3 \quad 12550 \\
 \quad 5861 \\
 \quad 00 \\
 \hline
 21.2843
 \end{array}$$

$$\begin{array}{r}
 15706 \\
 8510 \\
 \quad 22 \\
 \quad 00 \\
 \hline
 .2814
 \end{array}$$

$$\begin{array}{r}
 9 \quad 14380 \\
 19.0 \quad 11900 \\
 27.3 \quad 05 \\
 \quad 88 \\
 \hline
 21.2475
 \end{array}$$

$$\begin{array}{r}
 14715 \\
 717570 \\
 \quad 80 \\
 \quad 10 \\
 \hline
 .2464
 \end{array}$$

possibly on
terminal

1790

Moon - measures

22

$$\begin{array}{r}
 2 \quad 15415 \\
 180 \quad 13595 \\
 21.3 \quad 8890 \\
 \quad 15 \\
 \hline
 21.1834
 \end{array}$$

$$\begin{array}{r}
 15699 \\
 751740 \\
 20 \\
 86 \\
 \hline
 1838
 \end{array}$$

$$\begin{array}{r}
 8 \\
 185 \quad 15398 \\
 21.3 \quad 1255061 \\
 \quad 5861 \\
 \quad 00 \\
 8 \quad 21.2843
 \end{array}$$

$$\begin{array}{r}
 15706 \\
 851015 \\
 22 \\
 00 \\
 \hline
 2814
 \end{array}$$

$$\begin{array}{r}
 9 \quad 14350 \\
 19.0 \quad 1190015 \\
 27.3 \quad 0515 \\
 \quad 88 \\
 \hline
 21.2475
 \end{array}$$

$$\begin{array}{r}
 14715 \\
 717570 \\
 80 \\
 10 \\
 \hline
 2464
 \end{array}$$

possibly on
terminal

1790 Times etc.

23

Sept 25 1912 Apr 25	11 ^h	05 ^m	- 11 ^h	17 ^m
moon	11	10	58.6	11 10 59.1 ^v
clock slow		1	40.5 ^v	
H. Sidt.	11	12	39.35 ^v	
W. Hong	4	44	31.05 ^v	
G. Sidt.	15	57	10.40 ^v	
Sid T. M. Hour	2	12	31.42 ^v	
Interval	13	44	38.98 ^v	
Reduction		2	15.10 ^v	
G. M. T.	13	42	23.88 ^v	$\Delta x = +1^h 06^m 14.25^s$

from pant. Alen	K. A.	Wheel
moon 14 ^m	10 07 ^m	04 ^s 32 ^v + 16 ^s 07' 10.9 ^v
motivic 1 ^m = 2.2281 ^v		14.091 ^v
-17.602 ^v	-39.22	+ 4 08.0 ^v
Tabula place.	10 06	25.10 ^v + 16 11 18.9 ^v

moon's age	8.5 days.
" parallel	58' 56.5 ^v
" semi-diam.	16' 05.2 ^v
934213.6	R = 965.2
965 = 14.5	Augmentation +14.5
	Irradiation (3) -0.7
	R = 97.90 ^v
	R = 2.0986 ^v
a = -2.7	(1+a) R = 2.0980 ^v
	R ² = 4.4016 ^v

1790 Times etc

Alt. telam 1912 Apr. 25	11° 05"	- 11° 17"
moon	11 10	58.6 - 11 10 59.1
clock slow	1	40.5"
H. lat T.	11 12	39.35
H. long	4 44	31.05
G. lat T.	15 57	10.40
Sid. T. in hour	2 12	31.42
Interval	13 44	38.98
Reduction	2	15.10
G. H. T.	13 42	23.88 $\alpha = +1^h 06^m 14^s$

Iron part	Alum.	K. A.	Reel
hiron 14"	10 07	04.32	+16° 07' 10.9
motion 1" : 2 2 2 41		14.091	
-17.602		-39.22	+ 4 08.0
Tabula place	10 06	25.10	+16 11 18.9

moon's age	8.5 days
parallax	58' 56.5"
semidiameter	16' 05.2"
R =	9652
Augmentation	+14.5
Irradiation (3)	-0.7
R =	9790
R =	20986
(1+a) R =	20980
R ² =	44016

434 - 13.6
9652 - 14.5

0 - -27

1790-

Plate constants

24

	x	y	$K \cdot Q$		head	
1	10.0778	22.6666	10	00	54	416
2	19.8280	12.7994		06	12	14
3	26.4730	25.5883		09	46	16
3	56.38	61.05		15	182	16
	18.79	20.35	10	05	41	+15
	-18	-22		-	24	+12
	0.79	1.65	10	05	17	16
	31	465				06
	24	770				23

$A = 10^h 05^m 17^s$
 $D = +16^\circ 06' 23''$

$$\begin{aligned}
 2-3 & -544 & +2.8x & +14-.12 & -649 \\
 +1844 & -1224 & +620+28 & +648+2+1 & =+649=0 \\
 +1286 & -691 & +595+56 & +651+1+2 & =+650=+1 \\
 +1957 & -1382 & +575+74 & +649+3-3 & =+649=0 \\
 18.6277 & -1036 & +52 & +2-2 & =18.4644
 \end{aligned}$$

$$\begin{aligned}
 4-1 & +52.5x & +24 & -906 \\
 +332 & +529 & +861+45 & =+906=0 \\
 -161 & +1041 & +880+26 & =+906=0 \\
 -535 & +1390 & +855+51 & =+906=0 \\
 9.1818 & +978 & +38 & =19.1928
 \end{aligned}$$

Tables $a = +0.8$ $e = -0.1$ $a-e = +0.9$ $b+a = -0.5$
 Obs $a = -2.7$ $e = -2.0$ $a-e = -0.7$ $b+a = +1.6$

$c = 0$ $+1.6$ -2.1

1740-

Plate constants

24

	α	η	K	G	H	h	h	h	h
1	10.0778	22.6666	10	00	54	+16	11	08	
2	19.8280	12.7994		06	12	14	14	19	
3	26.4730	25.5883		09	46	16	34	31	
3	56.38	61.05		15	122	16	99	98	
	18.79	20.35	10	05	41	+15	53	33	
	-1.8	-2.2		-	29		7	12	50
	0.79	1.65	10	05	17	16	06	23	
	31	465							
	24	770							

$A = 10^{\circ} 05' 17''$
 $D = +16^{\circ} 06' 23''$

$$\begin{aligned}
 & -5 \quad -544 \quad +282 \quad +14-12 \quad -649 \\
 & +1844 -1224 +620 +28 +648 +2 -1 = +649 = 0 \\
 & +1286 -691 +595 -56 +651 +1 -2 = +650 = +1 \\
 & +1957 -1382 +575 +79 +649 +3 -3 = +649 = 0 \\
 & 186277 -1036 \quad +52 \quad +2-2 \quad = 184649
 \end{aligned}$$

$$\begin{aligned}
 & 4-\eta \quad +52.52 \quad +24 \quad -906 \\
 & +332 +529 +861 +45 +906 = 0 \\
 & -161 +1041 +880 +26 +906 = 0 \\
 & -535 +1390 +855 -51 -906 = 0 \\
 & 19.1818 + 983 \quad +38 \quad = 19.1928
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a &= +0.8 \quad e = -0.1 \quad a-e = +0.9 \quad b+a = -0.5 \\
 \text{Obs } a &= -2.7 \quad e = -2.0 \quad a-e = -0.7 \quad b+a = +1.6
 \end{aligned}$$

$$C = 0 \quad +1.6 \quad -2.1$$

1790

Standard Coordinates

21

Cape W. 1377 mg 6.3	Cape W. 1390 mg 8.8	Cape W. 1398 mg 7.3
C 10 ^h 00 ^m 15.40 ^v	10 05 32.79	10 09 06.43
L 39	79	46
E 34	74	51
m 10 00 15.38 ^v	10 05 32.77	10 09 06.47
rec + 39.12 ^v	+ 38.91	+ 39.08
S 10 00 54.50 ^v	10 05 11.68	10 09 45.55
A 10 05 17	10 05 17	10 05 17
-A -4 22.50 ^v	+0 54.68	+ 4 28.55
(A-A) -2624.8	+546.8	+268.53
log 2.41910 ^v	1.73783	2.42899
log 9.98243 ^v	9.98511	9.98157
log 0.90877 ^v	0.23018	0.91780
30 -8.1053 ^v	+1.6990	+8.2756
31 -13	+4	+17
32 19.8934 ^v	19.6994	26.2773
33 10.0778	19.8280	26.4730
34 +1844 ^v	+1286	+1957
C +16° 14' 37.5 ^v	+14° 58' 30.3	+16 38 04.6
L 37.6	30.1	04.1
E 36.9	29.2	03.9
m +16 14 37.3 ^v	+14 58 29.9	+16 38 04.2
rec -3 28.9 ^v	-3 31.3	-3 33.1
S +16 11 08.4 ^v	+14 54 58.6	+16 34 31.1
D +16 06 23 ^v	+16 06 23	+16 06 23
-D +4 45.4 ^v	-1 11 24.4	+28 08.1
(A-D) +2854 ^v	-4285.0	+1688.1
log 2.45545 ^v	3.63195 ^v	3.22740
log 9.78660 ^v	0.96310 ^v	0.55855
tan S 9.4628 ^v	9.4255	9.4737
S ² 1.8175 ^v	0.4604	1.8356
m 8.3337 ^v	6.9393	8.3627
40 +0.6118 ^v	-9.1854	+3.6187
41 +216 ^v	+9	+231
42 226334 ^v	12.8155	25.6418
43 226666	12.7994	25.5883
44 +332	-161	-535

1390

Standard Coordinates

20

Cape W. 1377 mag 6.3

Cape W. 1390 mag 8.8

Cape W. 1398 mag 7.3

C 10^h 00^m 15.40

10 05 32.79

10 09 06.43

L 39

79

46

E 39

74

51

mag 10 00 15.38

10 05 32.77

10 09 06.47

P_{mag} + 39.12

+ 38.91

+ 39.08

A 10 00 54.50

10 06 11.68

10 09 45.55

H 10 05 17

10 05 17

10 05 17

S-A -4 22.50

+0 54.68

+4 28.55

m(A) -262.48

+54.68

+268.53

log 2.41910m

1.73783

2.42899

cos 9.98243

9.98511

9.98157

I₀ 0.90877m

0.23018

0.91780

S₀ -8.1053

+1.6990

+8.2756

S₁ -13

+4

-17

S₂ 18.8934

19.6994

26.2773

S₃ 10.0778

19.8280

26.4730

S₄ +18.44

+12.86

+19.57

S₅ +16° 14' 37.5"

+14° 58' 30.3"

+16.38 04.6

L 37.6

30.1

04.1

E 36.9

29.2

03.9

mag +16 14 37.3

+14 58 29.9

+16 38 04.2

P_{mag} -3 28.9

-3 31.3

-3 33.1

S +16 11 08.4

+14 54 58.6

+16 34 31.1

D +16 06 23

+16 06 23

+16 06 23

S-D +4 45.4

-1 11 24.4

+28 08.1

m(A-D) +285.4

-4285.0

+1688.1

log 2.45545

3.63195m

3.22740

I₀ 9.78660

0.96310m

0.55855

S₀ 9.4628

9.4255

9.4737

S₁ 1.8175

0.4604

1.8356

S₂ 8.3337

6.9393

8.3627

S₃ +0.6115

-9.1854

+3.6187

S₄ +216

+9

+231

S₅ 22.6334

12.8155

25.6418

S₆ 22.6666

12.7994

25.5883

S₇ +332

-161

-535

S₈ +332

-161

-535

S₉ +332

-161

-535

S₁₀ +332

-161

-535

S₁₁ +332

-161

-535

S₁₂ +332

-161

-535

S₁₃ +332

-161

-535

S₁₄ +332

-161

-535

S₁₅ +332

-161

-535

S₁₆ +332

-161

-535

S₁₇ +332

-161

-535

S₁₈ +332

-161

-535

S₁₉ +332

-161

-535

S₂₀ +332

-161

-535

S₂₁ +332

-161

-535

S₂₂ +332

-161

-535

S₂₃ +332

-161

-535

S₂₄ +332

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S₂₅ +332

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-535

S₂₆ +332

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S₂₇ +332

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S₂₈ +332

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S₅₈ +332

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S₆₀ +332

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S₆₁ +332

-161

-535

S₆₂ +332

-161

-535

S₆₃ +332

-161

-535

S₆₄ +332

-161

-535

S₆₅ +332

-161

-535

S₆₆ +332

-161

-535

S₆₇ +332

-161

-535

S₆₈ +332

-161

-535

S₆₉ +332

-161

-535

S₇₀ +332

-161

-535

S₇₁ +332

-161

-535

S₇₂ +332

-161

-535

S₇₃ +332

-161

-535

S₇₄ +332

-161

-535

S₇₅ +332

-161

-535

S₇₆ +332

-161

-535

S₇₇ +332

-161

-535

S₇₈ +332

-161

pt.	pos. L	resid.
1	209.0	+32
2	231.0	+80
3	270.0	+39
4 ^{1/2} mt.	293.0	-242
5	309.1	-79
6	330.0	-7
7	342.5	-4
8	0.0	+127
9	10.1	+21

1790

Moon's Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$o - c$
1	17.6077	-1.0249	-1	1.0506	4.4043	+27
2	17.0000	-1.6326	-1	2.6657	4.4179	+163
3	16.5288	-2.1038	0	4.4260	4.4260	+244
4	16.7021	-1.9305	0	3.7269	4.4009	-7
5	17.0000	-1.6326	+1	2.6650	4.4172	+156
6	17.5812	-1.0514	+1	1.1052	4.4216	+200
7	18.0000	-0.6326	+1	0.4000	4.4188	+172
8	18.6326	0.0000	+1	0.0000	4.4264	+248
9	19.0000	+0.3674	+1	0.1350	4.4120	+104

$$\text{Comp. } R^2 = 4.4016$$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.3478	-1.8312	-1	3.3537
2	17.8554	-1.3236	-1	1.7522
3	19.1790	0.0000	0	0.0000
4	20.0000	+0.8210	0	0.6740
5	20.5026	+1.3236	+1	1.7522
6	21.0000	+1.8210	+1	3.3164
7	21.1836	+2.0046	+1	4.0188
8	21.2828	+2.1038	+1	4.4264
9	21.2470	+2.0680	+1	4.2770

Approximate Center

$$x = 17.0 \quad y = 17.8554$$

$$20.5026$$

$$38.3580$$

$$\text{mean } y = 19.1790$$

$$y - \text{max} = 21.2828$$

$$c = 2.1038$$

$$x = \text{min} = 16.5288$$

$$X_0 = 18.6326$$

$$\text{Center} \begin{cases} X_0 = 18.6326 \\ Y_0 = 19.1790 \end{cases}$$

1790

Lunar Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	17.6077	-1.0249	-1	1.0506	4.4043	+27
2	17.0000	-1.6326	-1	2.6657	4.4179	+163
3	16.5288	-2.1038	0	4.4260	4.4260	+244
4	16.7021	-1.9305	0	3.7269	4.4009	-7
5	17.0000	-1.6326	+1	2.6650	4.4172	+156
6	17.5812	-1.0514	+1	1.1052	4.4216	+200
7	18.0000	-0.6326	+1	0.4000	4.4188	+172
8	18.6326	0.0000	+1	0.0000	4.2264	+248
9	19.0000	+0.3674	+1	0.1350	4.4120	+104

$$\text{Comp. } 10^2 = 44016$$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.3478	-1.8312	-1	3.3537
2	17.8554	-1.3236	-1	1.7522
3	19.1790	0.0000	0	0.0000
4	20.0000	+0.8210	0	0.6740
5	20.5026	+1.3236	+1	1.7522
6	21.0000	+1.8210	+1	3.3164
7	21.1836	+2.0046	+1	4.0188
8	21.2828	+2.1038	+1	4.4264
9	21.2470	+2.0680	+1	4.2770

Approximate Center

$$x = 17.0 \quad y = 17.8554$$

$$20.5026$$

$$38.3580$$

$$\text{mean } y = 19.1790$$

$$y - \text{mean} = 21.2828$$

$$e = 2.1038$$

$$x = \text{min} = 16.5288$$

$$X_0 = 18.6326$$

$$\text{Center} \begin{cases} X = 18.6326 \\ Y = 19.1790 \end{cases}$$

Formation of Normal

	ab	an	bn
1	+ 1.87	- 27.5	- 49.4
2	+ 2.15	- 26.57	- 215.2
3	- 0.00	- 51.24	+ 0.0
$\frac{1}{4}w$ 4	- 0.49	+ 1.0	- 0.4
5	- 2.15	- 25.43	+ 205.9
6	- 1.91	- 21.00	+ 364.0
7	- 1.26	- 10.84	+ 344.0
8	+ 0.00	+ 0.0	+ 520.8
9	+ 0.77	+ 38.5	+ 215.3
	- 0.63	- 1338.8	+ 1385.0

179.0

Moon's Center Conditional Equations

27

	a	b	c	0 - c	
1	-1.02	-1.83	+27	+100 - 105 = -5	+32
2	-1.63	-1.32	+163	+159 - 76 = +83	+80
3	-2.10	+6.00	+244	+205 - 0 = +205	+39
4	-1.93	+0.82	-7	+188 + 47 = +235	-242
5	-1.63	+1.32	+156	+159 + 76 = +235	-79
6	-1.05	+1.82	+200	+102 + 105 = +207	-7
7	-0.63	+2.00	+172	+61 + 115 = +176	-4
8	+0.00	+2.10	+248	- 0 + 121 = +121	+127
9	+0.37	+2.07	+104	- 36 + 119 = +83	+21

Average = 70

without 4 = 48

Normal Equations

$$\begin{aligned}
 +13.38 - 0.63 &= -1339 \\
 -0.63 + 23.07 &= +1385
 \end{aligned}$$

$$\begin{aligned}
 +0.63 - 0.03 &= -63 \\
 +23.04 &= +1322
 \end{aligned}$$

$$b = +574$$

$$\begin{aligned}
 -0.02 + 0.63 &= +38 \\
 +13.36 &= -1301
 \end{aligned}$$

$$a = -975$$

1790

Normal Equation

$$\begin{array}{r} +13.38 - 0.63 = -13.39 \\ -0.63 + 23.07 = +13.85 \end{array}$$

$$+ \quad 0.63 - 0.03 = - \quad .63$$

$$+ 23.04 = + 13.22$$

$$\begin{array}{r} - 002 + 063 = + 38 \\ + 1336 \quad \quad \quad = - 1301 \end{array}$$

$$6 \rightarrow 57.4$$

$$a = 97.5^\circ$$

1790. Moon's mean Position (1912.0)

$$\begin{array}{r}
 X_0 = 18.6326 \\
 \Delta = -49 \\
 \hline
 18.6277
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 19.1790 \\
 \frac{1}{2} \Delta = +28 \\
 \hline
 19.1818
 \end{array}$$

From Plate Constants $X = 18.4644$ $Y = 19.1928$

$$\xi = +0.4644$$

$$\log \dots = 9.66689$$

$$\dots \text{ws} = 9.98340$$

$$\dots \text{Const} = 8.50724$$

$$\dots (X-A) = 1.17625$$

$$\dots d-A = +15.01$$

$$A = 10 \ 05 \ 17$$

$$\alpha_0 = 10^h \ 05^m \ 32.01^s$$

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

$$\alpha' = 10 \ 05 \ 33.26$$

$$\eta = -2.8072$$

$$\dots \text{Tan } \delta = 9.4527$$

$$\dots \xi^2 = 9.3338$$

$$\dots \eta_1 = 5.8399$$

$$\eta_1 = +1$$

$$\eta_2 = -2.8073$$

$$\log \eta_0 = 0.44829$$

$$\dots \text{const} = 7.33115$$

$$\dots (d-D) = 3.11714$$

$$S-D = -21 \ 49.6$$

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

$$S_0 = +15^\circ \ 44' \ 33.4''$$

$$\text{Red} = -0.5$$

$$S' = +15 \ 44 \ 32.9$$

1790 Unknown Mean Position (1912.0)

$$\begin{array}{r}
 X_0 = 18.6326 \\
 - 49 \\
 \hline
 18.6277
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 19.1790 \\
 + 28 \\
 \hline
 19.1818
 \end{array}$$

From Plate Constants $X = 18.4644$ $Y = 19.1928$

$$z = +0.4644$$

$$\log \mu = 9.66689$$

$$\mu_{\alpha} = 9.98340$$

$$\mu_{\delta} = 2.50724$$

$$(X - A) = 1.17625$$

$$A - A = + 15.01$$

$$A = 10 \ 05 \ 17$$

$$a_0 = 10 \ 05 \ 32.01$$

$$R_{\alpha} = + 12.5$$

$$a = 10 \ 05 \ 33.26$$

$$\eta = -2.8072$$

$$\mu_{\alpha} = 9.4527$$

$$\mu_{\delta} = 9.3338$$

$$\eta_1 = 5.8399$$

$$\eta_2 = + 1$$

$$\eta_3 = -2.8073$$

$$\log \eta_4 = 0.44829$$

$$\mu_{\alpha} = 7.33115$$

$$(D - D) = 3117.4$$

$$S - D = - 21 \ 49.6$$

$$D = -16 \ 06 \ 23$$

$$S_0 = +15^{\circ} \ 44' \ 33.4''$$

$$R_{\delta} = - 0.5$$

$$S = +15 \ 44 \ 32.9$$

1790

Reduction to apparent place

$$\begin{aligned}
 \alpha_0 &= 10^h 05^m 32.01^s \\
 G &= 19^h 29^m 30^s \\
 G + \alpha_0 &= 5^h 35^m 08.5^s \\
 &= 83^\circ 17.5'
 \end{aligned}$$

$$\begin{aligned}
 \delta_0 &= +15^\circ 44' 33.6'' \\
 H &= 15^h 27^m 36^s \\
 H + \alpha_0 &= 25^h 33^m 08.5^s \\
 &= 23^\circ 17.5'
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{\sin i} &= 8.8239 \\
 \log g &= 0.9763 \\
 \sin(G + \alpha_0) &= 9.9974 \\
 \tan \delta_0 &= 9.4504 \\
 (g) &= 9.2487
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{\sin i} &= 8.8239 \\
 \log h &= 1.2879 \\
 \sin(H + \alpha_0) &= 9.5969 \\
 \sec \delta_0 &= 0.0166 \\
 (h) &= 9.7244
 \end{aligned}$$

$$\begin{aligned}
 \log i &= 0.8211 \\
 \cos \delta_0 &= 9.9839 \\
 &= 0.8045
 \end{aligned}$$

$$\begin{aligned}
 \log g &= 0.9766 \\
 \cos(G + \alpha_0) &= 9.0328 \\
 (g') &= 0.0094
 \end{aligned}$$

$$\begin{aligned}
 \log h &= 1.2871 \\
 \cos(H + \alpha_0) &= 9.9627 \\
 \sin \delta_0 &= 9.4335 \\
 (h') &= 0.6833
 \end{aligned}$$

$$\begin{aligned}
 i &= +0.54'' \\
 (g) &+ 0.18'' \\
 (h) &+ 0.53'' \\
 \text{Red } \alpha_0 &= +1.25''
 \end{aligned}$$

$$\begin{aligned}
 (g') &+ 1.02'' \\
 (h') &+ 4.82'' \\
 (i') &- 6.38'' \\
 \text{Red } \delta &= -0.54''
 \end{aligned}$$

$$\alpha' = 10^h 05^m 33.26^s$$

$$\delta' = +15^\circ 44' 32.9''$$

1790

Reduction to apparent place

$$\begin{aligned}
 \alpha_0 &= 10^h 05^m 32.01^s \\
 \delta &= 19^\circ 29' 42'' \\
 G + \lambda_0 &= 5'' 35'' 14'' \\
 &= 83'' 48.5''
 \end{aligned}$$

$$\begin{aligned}
 S_0 &= +15^\circ 44' 33.6'' \\
 H &= 15^h 28^m 06^s \\
 H + \alpha_0 &= 25^\circ 33' 38'' \\
 &= 23^\circ 24.5''
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{r} &= 8.8239 \\
 g &= 0.9766 \\
 \sin(G + \lambda_0) &= 9.9975 \\
 \tan S_0 &= 9.4508 \\
 (g) &= 9.2481
 \end{aligned}$$

$$\begin{aligned}
 \log \frac{1}{r} &= 8.8239 \\
 h &= 1.2871 \\
 \sin(H + \alpha_0) &= 9.9991 \\
 \sec S_0 &= 0.0166 \\
 (h) &= 9.7267
 \end{aligned}$$

$$\begin{aligned}
 \log i &= 0.8211 \\
 \cos S_0 &= 9.9839 \\
 &= 0.8095
 \end{aligned}$$

$$\begin{aligned}
 \log g &= 0.9766 \\
 \cos(G + \lambda_0) &= 9.0328 \\
 (g') &= 0.0099
 \end{aligned}$$

$$\begin{aligned}
 \log h &= 1.2871 \\
 \cos(H + \alpha_0) &= 9.9627 \\
 \tan S_0 &= 9.4335 \\
 (h') &= 0.6833
 \end{aligned}$$

$$\begin{aligned}
 p &= +0.545 \\
 (g) &+ 0.18 \\
 (h) &+ 0.53 \\
 \text{Reduction} &= 11.25
 \end{aligned}$$

$$\begin{aligned}
 (g') &+ 1.02 \\
 (h') &+ 4.82 \\
 (i) &- 6.38 \\
 \text{Reduction} &= +0.54
 \end{aligned}$$

$$\alpha' = 10^h 05^m 33.26^s$$

$$\delta' = +15^\circ 44' 32.9''$$

1790

Lunar Parallax.

$$\alpha' = 10^h 05^m 33^s 26''$$

$$\delta = 11 \quad 12 \quad 39 \quad 31''$$

$$\alpha - \alpha' = +1 \quad 07 \quad 06 \quad 09''$$

$$= +16^{\circ} 46' 31''$$

$$\frac{1}{2}(\alpha - \alpha') = + \quad 6 \quad 33''$$

$$\alpha - \alpha' - \frac{1}{2}(\alpha - \alpha') = +16 \quad 39 \quad 58''$$

$$\log \tan \phi' = 9.91727$$

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.0000$$

$$\cos(\alpha - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.98136$$

$$\tan \phi = 9.97591$$

$$\gamma = +43^{\circ} 24' 43.2''$$

$$\delta' = +15^{\circ} 44' 32.9''$$

$$\gamma - \delta' = +27 \quad 40 \quad 10.3''$$

$$\log \sin \phi' = 9.82640$$

$$\sin \pi = 8.23413$$

$$\sin(\gamma - \delta') = 9.66686$$

$$\sin \gamma = 9.83717$$

$$\sin(\delta - \delta') = 7.89027$$

$$\delta - \delta' = +26' 42.2''$$

$$\delta = +16 \quad 11 \quad 15.1'' \quad \alpha = 10 \quad 06 \quad 25.68''$$

$$\text{Ann Eph } \delta = +16 \quad 11 \quad 18.9'' \quad \alpha = 10^h 06 \quad 25.10''$$

$$\alpha - \alpha' = -3.8'' \quad +0.58''$$

$$\delta' = +15^{\circ} 44' 32.9''$$

$$\pi = 58' 56.1''$$

$$\log \cos \phi' = 9.86913$$

$$\sin \pi = 8.23413$$

$$\sin(\alpha - \alpha') = 9.46033$$

$$\cos \delta' = 9.88243$$

$$\sin(\alpha - \alpha') = 7.58116$$

$$\text{Approx } (\delta - \delta') = +13' 06.29''$$

$$\log \cos \delta$$

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

$$\alpha - \alpha' = +52.42''$$

1790 Human Parallax

$$\begin{aligned}
 \alpha' &= 10^{\text{h}} 05^{\text{m}} 33^{\text{s}} 26 \\
 \delta &= 11 \quad 12 \quad 39 \quad 31^+ \\
 \alpha - \alpha' &= +1 \quad 07 \quad 06 \quad 09 \\
 &= +16^{\circ} 46' 31''
 \end{aligned}$$

$$\delta' = +15^{\circ} 44' 32.9''$$

$$\eta = 58' 56.5''$$

$$\frac{1}{2}(\alpha - \alpha') = +6 \quad 33$$

$$\log \cos \phi' = 9.86913$$

$$\log \sin \eta = 8.23413$$

$$\log (\delta - \delta') = 9.46033$$

$$- \cos \delta' = 9.98293$$

$$\delta - (\delta') - \frac{1}{2}(\alpha - \alpha') = +16 \quad 39 \quad 58$$

$$\log \tan \phi' = 9.91727$$

$$\log \sin (\alpha - \alpha') = 0.0020$$

$$- \cos (\delta - \delta') - \frac{1}{2}(\alpha - \alpha') = 9.98136$$

$$\tan \phi = 9.97591$$

$$\sin (\alpha - \alpha') = 7.58116$$

$$\text{Apex } (\alpha - \alpha') = +13' 06.29$$

$$\log \cos \delta$$

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

$$\gamma = +43^{\circ} 24' 43.3$$

$$\delta' = +15^{\circ} 44' 32.9$$

$$\gamma - \delta' = +27 \quad 40 \quad 10.2$$

$$\alpha - \alpha' = +52^{\circ} 42'$$

$$\log \sin \phi' = 9.82640$$

$$\log \sin \eta = 8.23413$$

$$\log (\delta - \delta') = 9.46033$$

$$- \sin \phi = 9.93712$$

$$\sin (\delta - \delta') = 7.89027$$

$$\delta - \delta' = +26 \quad 42.2$$

$$\delta = +16 \quad 11 \quad 15.7 \quad \alpha = 10 \quad 06 \quad 25.68$$

$$\text{Sun Eph } \delta = +16 \quad 11 \quad 18.9 \quad \alpha = 10^{\text{h}} 06 \quad 25.10$$

$$\alpha - \alpha' = -3.6 \quad +0.58$$

