

KG

11366

v.919

XLIII



1796

1801

1802



Harvard Lunar Plates.

Measures and Reductions

Mary Fowler.

Volume XLIII.

Plate No.	Date	Page
1796	1912 Apr. 27	1
1801	1912 Apr. 30	10
1802	" " "	22

1
1
4
27
3
1
17
3
11
14
4
20
25
5
28
14

1796 Stars - Measures - 1913 Nov. 4.

1.

α	δ	α	δ	α	δ	α	δ
1	18895	19448	13955	18746			
4.1	1314341	15199	476054	1790560			
27.5	39	8080	60	99			
	91	30	49	28			
	27.5752	5744	4.0809	0843			
2	19978	15728	17138	19290			
1.8	1092928	1478073	1440005	1100004			
17.4	30	75	00	08			
	70	20	30	70			
	17.9042	9049	9.7266	7272			
3	16740	20116	16812	19825			
11.3	1344036	1339798	992114	1669893			
14.4	53	04	20	91			
	39	93	00	08			
	14.3297	3299	11.3114	3126			
4	15590	18200	15886	19127			
20.1	1183220	1195660	713021	1786969			
25.4	50	60	28	65			
	82	00	68	11			
	25.3760	3759	20.1256	1257			
5	19605	15634	18520	16964			
28.3	1410000	1113230	593030	1452066			
14.5	97	40	30	10			
	00	33	08	50			
	14.5503	5500	28.2420	2446			

Grade (2) or (1)

1796

Star - Measures - 1913 Nov. 4.

1.

α	α	α	α
1 18895	19448	13955	18746
41 1314341	15199	476059	1790560
275 39	8080	60	99
91	30	49	28
<u>27.5752</u>	<u>1744</u>	<u>40809</u>	<u>0843</u>
3 19978	15728	17138	18290
98 1092928	1478073	1440005	1100004
179 30	75	00	08
70	20	30	70
<u>179042</u>	<u>9049</u>	<u>97266</u>	<u>7272</u>
3 16740	20116	16812	19825
113 1344036	1339798	992114	1669893
144 53	04	20	91
39	93	00	08
<u>143297</u>	<u>3299</u>	<u>113114</u>	<u>3126</u>
4 15590	18200	15886	19127
201 1183220	1195660	713021	1786969
259 50	60	28	65
82	00	68	11
<u>253760</u>	<u>5759</u>	<u>201256</u>	<u>1257</u>
5 19605	15684	13520	16964
283 1410000	1113230	593030	1452066
145 97	40	30	10
00	33	08	50
<u>145503</u>	<u>5300</u>	<u>282420</u>	<u>2446</u>

Gravel (2) or (1)

1796 *moon - measures.*

	18564	15470
17.0	13535	10458
17.5	30	55
	66	56
	<u>17.5036</u>	<u>.4997</u>

2
16.5
18.0

18110	14920
12588	10440
80	30
00	20
<u>16.4485</u>	<u>.4486</u>

3 *scratch*

16.2	17291	19480	18129	13882
18.8	13578	13219	10340	11664
	77	05	42	68
	90	70	16	70
	<u>18.3714</u>	<u>.3738</u>	<u>16.2222</u>	<u>.2212</u>

4
16.0
14.2
min
in
20

11465	14945
58	14735
11280	39

5
16.3
20.0

<u>16.0181</u>	<u>.0208</u>
17470	17890
9031	16300
29	09
60	81
<u>16.1571</u>	<u>.1586</u>

17.0	10310	12820
21.0+	10070	0909
	60	12550
	<u>21.0243</u>	<u>.0263</u>

1796 *uncon - measures*

$$\begin{array}{r}
 1 \\
 17.0 \\
 17.5 \\
 \hline
 18564 \\
 1353522 \\
 30 \\
 66 \\
 \hline
 17.5036
 \end{array}
 \qquad
 \begin{array}{r}
 15470 \\
 1045868 \\
 55 \\
 56 \\
 \hline
 4997
 \end{array}$$

$$\begin{array}{r}
 2 \\
 16.5 \\
 18.0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 18110 \\
 1258800 \\
 80 \\
 00 \\
 \hline
 16.4485
 \end{array}$$

$$\begin{array}{r}
 14920 \\
 1044033 \\
 30 \\
 20 \\
 \hline
 4486
 \end{array}$$

3 *scratch*

$$\begin{array}{r}
 162 \\
 185 \\
 \hline
 17291 \\
 1357875 \\
 77 \\
 90 \\
 \hline
 18.3714
 \end{array}
 \qquad
 \begin{array}{r}
 19480 \\
 1321910 \\
 05 \\
 70 \\
 \hline
 3738
 \end{array}$$

$$\begin{array}{r}
 18129 \\
 1034040 \\
 42 \\
 16 \\
 \hline
 16.2222
 \end{array}$$

$$\begin{array}{r}
 13882 \\
 1166470 \\
 68 \\
 70 \\
 \hline
 2212
 \end{array}$$

$$\begin{array}{r}
 4 \\
 14.0 \\
 14.2 \\
 14.4 \\
 14.6 \\
 14.8 \\
 15.0 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 1146559 \\
 58 \\
 11280
 \end{array}$$

$$\begin{array}{r}
 14945 \\
 1473537 \\
 39
 \end{array}$$

$$\begin{array}{r}
 16.0181
 \end{array}$$

$$\begin{array}{r}
 0208
 \end{array}$$

$$\begin{array}{r}
 17470 \\
 903138 \\
 29 \\
 60
 \end{array}$$

$$\begin{array}{r}
 17890 \\
 1630000 \\
 09 \\
 81
 \end{array}$$

$$\begin{array}{r}
 16.1471
 \end{array}$$

$$\begin{array}{r}
 1586
 \end{array}$$

$$\begin{array}{r}
 6 \\
 17.0 \\
 21.0 \\
 \hline
 10310 \\
 1007071 \\
 60
 \end{array}$$

$$\begin{array}{r}
 1282009 \\
 0909 \\
 12510
 \end{array}$$

$$\begin{array}{r}
 210243
 \end{array}$$

$$\begin{array}{r}
 0263
 \end{array}$$

1796 moon-measures.

α	δ
2 14840	17911
18.7 1150099	1124856
21.3 95	43
max 48	00
μ 21,3345	3345
γ	

8 zeroatch.

18.8 14600	16980	14760	16380
21.2 1234552	923010	1227068	888070
53	10	69	70
00	75	56	60
<u>21.2250</u>	<u>2241</u>	<u>7510</u>	<u>7492</u>

1796 motion - measures

2	14840	17911
18.0	1150099	1124852
21.5	95	43
with	48	00
in	<u>21.3345</u>	<u>3.345</u>
y		

8 scratch

188	14600	16980	14760	16380
21.2	1234552	923010	1227068	888070
	53	10	69	70
	00	75	56	60
	<u>212250</u>	<u>2241</u>	<u>7510</u>	<u>7492</u>

1796 Times etc. 4.

Sept 1912 Apr. 27	12 ^h	19 ^m	-	-	12 ^h	31 ^m	
moon	12	25	05.5		12	25	05.6
clock slow		1	40.3				
H Sid T.	12	26	45.85				
H long.	4	44	31.05				
G Sid T.	17	11	16.90				
Sid T. in moon	2	20	24.53				
Interval	14	50	52.37				
Reduction		2	25.95				
G.M.T.	14	48	26.42		0 ^h	1 ^m	37

From Nant Allen	R.A.	Decl.
moon 15 ^h	11 ^h 50 ^m 28.04	+3° 28' 23.0
moon in $\mu = 2.0247$		16.262
" -11.5597		23.40
Tabular place	11 50 04.64	+3 31 31.0

moon's age	10.5 days.
parallax	58' 17.2
semidiameter	15 54.5
R =	954.5
Amplification	+12.7
Irradiation 2/11	-0.4
R =	966.8
R =	2.0725
(+a) R =	2.0723
R =	42945
a = -1.0	

1796 Times etc.
 Oct 1912 Apr 27 12^h 19^m - - 12^h 31^m
 known 12 25 05.5 - 12 25 05.6
 clock slow 1 40.3

H Sid T. 12 26 45.85
 H hour 4 44 31.05
 G Sid T. 17 11 16.90
 Sid T in hour 2 20 24.53
 Interval 14 50 52.37
 Reduction 2 25.95
 G M.T. 14 48 26.42

From Hunt Alm. R.A. decl.
 known 15^h 11^m 50^s 28.04 + 3° 28' 23.0
 known 15^h 11^m 50^s 28.04 + 3° 28' 23.0
 known 15^h 11^m 50^s 28.04 + 3° 28' 23.0
 Tabular place 11 50 04.64 + 3 31 31.0

known age 10.5 days.
 parallax 58' 17.2
 semidiam 15 54.5
 R = 954.5
 augmentation + 12.7
 irradiation 21.1 - 0.4
 R = 966.8
 R = 2072.5
 1 + a) R = 2072.3
 R = 4294.5
 a = -1.0

1796

	1	2	3	4	5
x	4.0826	9.7269	11.3120	20.1256	28.2433
y	5.6451	18.4124	13.0419	21.7155	29.9746
x-3	-1.5625	-1.6855	-1.7299	-1.5899	1.7313
y	27.5748	17.9046	14.3298	25.3760	14.5503
y	26.7368	17.1415	13.5815	24.7562	14.0289
y-n	+8380	+7631	+7483	+6198	+5214

Preliminary Reduction

x-3	-1304	+19191
-1.5625	-3585	-1.9210
-1.6855	2328	-1.9183
-1.7299	1863	-1.9162
-1.5899	3299	-1.9198
-1.7313	1892	-1.9205
18.0923	-2504	19.7610

y-n	+134x	+94	-9130
+8380	+547	+8927	+249
+7631	+1308	+8934	+161
+7483	+1516	+8999	+129
+6198	+2697	+8895	+228
+5214	+3785	+8999	+131
19.2624	+2425	+173	18.6092

Tabl. a = +0.9 e = -1.5 a-e = +2.4 b+a = -0.9

Obs a = -1.0 e = -6.3 a+e = +5.3 b+a = -6.7

c = 0 +1.9 +48 -29 +5.8

1796

	1	2	3	4	5
x	4.0826	9.7269	11.3120	20.1256	28.2433
y	5.6451	18.4124	13.0419	21.7155	29.9746
x-3	-1.5625	-1.6855	-1.7299	-1.5899	1.7313
y-3	27.5748	17.9046	14.3298	25.3760	14.5503
y-4	26.7368	17.1415	13.5815	24.7562	14.0289
y-5	8.880	+7631	+7483	+6198	+5214

Preliminary Reduction

x-3	-1.304	+1.9191
-1.5625	-3.585	-1.9210
-1.6855	-2.328	-1.9183
-1.7299	-1.863	-1.9162
-1.5899	-3.299	-1.9198
-1.7313	-1.892	-1.9205
18.0923	-2504	19.7610

y-3	+1.342	+94	-9130
+8380	+547	+8927	+249
+7631	+1303	+8434	+161
+7483	+1516	+8999	+129
+6198	+2697	+8895	+228
+5214	+3785	+8999	+131
192624	+2425	+173	186092

Subline $a = +0.9$ $b = -1.5$ $a - b = +2.4$ $b + a = -0.9$
 Obs $a = -1.0$ $b = -6.3$ $a - b = +5.3$ $b + a = -6.7$
 $c - 0$ $+1.9$ $+4.8$ -2.9 $+5.8$

ket.	pos. c	resid.
1	2 1 1.7	+ 2
2	2 3 2.5	+ 1 4
3	2 4 4.5	- 3 5
4	2 7 0.0	+ 2 4
5	2 9 0.8	- 7 9
6	3 2 8.3	+ 7 0
7	0.0	+ 8
8	1 8.6	- 1 0 0

1796

Moon's Center

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$o - c$
1	17.0000	-1.0905	-1	1.1899	4.2944	-1
2	16.4486	-1.6419	0	2.6959	4.2926	-1.9
3	16.2217	-1.8688	0	3.4924	4.2861	-8.4
-4	16.0194	-2.0711	0	4.2894	4.2894	-5.1
5	16.1578	-1.9327	0	3.7353	4.2781	-16.4
6	17.0000	-1.0905	+1	1.1890	4.2946	-5
7	18.0905	0.0000	+1	0.0000	4.2911	-3.4
8	18.7501	+0.6596	+1	0.4351	4.2829	-11.6
9						

$$R^2 = 4.2945$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.5016	-1.7618	-3	3.1050
2	18.0000	-1.2634	-2	1.5967
3	18.3726	-0.8908	-1	0.7937
4	19.2634	0.0000	0	0.0000
5	20.0000	+0.7366	+1	0.5428
6	21.0253	+1.7619	+3	3.1050
7	21.3345	+2.0711	+4	4.2911
8	21.2246	+1.9612	+4	3.8478

Approximate Center

$$x = 17.0 \quad y = 17.5016$$

$$21.0253$$

$$38.5269$$

$$\text{mean } y = 19.2634$$

$$y - \text{max} = 21.3345$$

$$R = 2.0711$$

$$x = \text{min} = 16.0194$$

$$x_0 = 18.0905$$

$$\text{Center } \begin{cases} x_0 = 18.0905 \\ y_0 = 19.2634 \end{cases}$$

1396

moons center

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17 0000	-10905	-1	11899	42944	-1
2	16 4486	-16419	0	26959	42926	-19
3	16 2217	-18688	0	34924	42861	-84
4	16 0194	-20711	0	42899	42894	-51
5	16 1578	-19327	0	37353	42781	-164
6	17 0000	-10905	+1	11890	42948	-5
7	18 0905	00000	+1	00000	42911	-39
8	18 7501	+06596	+1	04351	42829	-116
9						

$$R^2 = 42945$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.5016	-17618	-3	31050
2	18.0000	-12634	-2	15967
3	18.3726	-08908	-1	07937
4	19.2634	00000	0	00000
5	20.0000	+07366	+1	05428
6	21.0253	+18619	+3	31050
7	21.3345	+20711	+4	42911
8	21.2246	+19612	+4	38478

Approximate Center

$$x = 170 \quad y = 175016$$

$$210253$$

$$385269$$

$$\text{mean } y = 192634$$

$$y - \text{max} = 213345$$

$$R = 20711$$

$$x - \text{min} = 160199$$

$$x_0 = 180905$$

$$\text{Center } \begin{cases} x_0 = 180905 \\ y_0 = 192634 \end{cases}$$

Formation of Normal

	ab	ban	bn	
1	+ 1.92	+ 1.1	+ 1.8	
2	+ 2.06	+ 31.2	+ 23.9	
3	+ 1.66	+ 157.0	+ 74.8	
4	- 0.00	+ 105.5	- 0.0	
5	- 1.43	+ 316.5	- 121.3	
6	- 1.92	+ 5.4	- 8.8	
7	+ 0.00	- 0.0	- 70.4	
8	+ 1.29	- 76.5	- 227.5	full wt
	+ 3.58	+ 540.2	- 327.5	

1796

Moon's Centre Constitutional Equations

7

	a	b	c	0-c	
1	-1.09	-1.76	-1	-43+49 = +6	-7
2	-1.64	-1.26	-19	-65+35 = -30	+11
3	-1.87	-0.89	-84	-74+25 = -49	-35
4	-2.07	+0.00	-51	-82-0 = -82	+31
5	-1.93	+0.74	-164	-76-21 = -97	-67
6	-1.09	+1.76	-5	-43-49 = -92	+87
7	+0.00	+2.07	-39	+0-58 = -58	+24
8	+0.66	+1.96	-116	+26-55 = -29	-87

Average: 44

Mean Equations

$$- 6.67 - 3.91 = -10.58$$

$$- 2.69 + 5.55 = +2.86$$

$$+ 2.69 + 1.58 = +4.27$$

$$+ 7.13 = -1.99$$

$$b = -28.0$$

$$- 6.67 = -15.5 - 10.9 = -26.4$$

$$a = +39.6$$

Normal Equations

$$+ 17.03 + 3.58 = +20.61$$

$$+ 3.58 + 17.28 = +20.86$$

$$- 3.58 - 0.75 = -4.33$$

$$+ 16.53 = -3.39$$

$$b = -20.5$$

$$+ 17.03 = +20.61 + 7.4 = +28.01$$

$$a = +36.0$$

Residuals

	a	b	c	0-c
1	-1	-39 + 36 =	-3	+2
2	-19	-59 + 26 =	-33	+14
3	-84	-67 + 18 =	-49	-35
4	-51	-75 - 0 =	-75	+24
5	-164	-70 - 15 =	-85	-79
6	-5	-39 - 36 =	-75	+70
7	-34	+ 0 - 42 =	-42	+8
8	-116	+ 24 - 40 =	-16	-100

Average: 41

1796

Munroe Center

7

Constitutional Equations

	a	b	c	0-c	
1	-1.09	-1.76	-1	-43+99 = +6	-7
2	-1.64	-1.26	-19	-65+35 = -30	+11
3	-1.47	-0.89	-84	-74+25 = -49	-35
4	-2.07	+0.00	-51	-82-0 = -82	+31
5	-1.93	+0.74	-164	-76-21 = -97	-67
6	-1.04	+1.76	-5	-43-99 = -92	+87
7	+0.00	+2.07	-34	+0-58 = -58	+29
8	+0.66	+1.96	-116	+26-55 = -29	-87

Average 44

Mean Equations

$$- 6.67 - 3.91 = -10.58$$

$$- 2.69 + 5.55 = +2.86$$

$$+ 2.69 + 1.58 = +4.27$$

$$+ 7.13 = +7.13$$

$$b = -28.0$$

$$- 6.67 = -10.58 - 10.9 = -21.48$$

$$a = +39.6$$

Normal Equation

$$+ 17.03 - 3.58 = +13.45$$

$$- 3.58 + 17.28 = +13.70$$

$$- 3.58 - 0.75 = -4.33$$

$$+ 16.53 = +16.53$$

$$b = -20.5$$

$$+ 17.03 = +13.45 + 7.9 = +21.35$$

$$a = +36.0$$

Residuals

1	-1	-39 + 36 =	-3
2	-19	-59 + 26 =	-33
3	-84	-67 + 18 =	-49
4	-51	-75 - 0 =	-75
5	-164	-70 - 15 =	-85
6	-5	-39 - 36 =	-75
7	-34	+ 0 - 42 =	-42
8	-116	+ 29 - 40 =	-16

Red. ad l. app.

S + 2° 55'

$$H + \alpha \quad 3 \quad 10 = 47^{\circ} 30'$$

$$H \quad 15 \quad 20$$

$$K \quad 11 \quad 50$$

$$G \quad 19 \quad 30$$

$$G + \alpha \quad 7 \quad 20 = 110^{\circ}$$

$$\cos S \quad 9.9994$$

$$i \quad 0.8102 \text{ m}$$

$$(i) \quad 0.8096 \text{ m}$$

$$\sin S \quad 8.7066$$

$$\cos(H + \alpha) \quad 9.8297$$

$$h \quad 1.2884$$

$$\sin \quad 9.8676$$

$$\sec S \quad 0.0006$$

$$i' \quad 8.8239$$

$$g' \quad 0.5126 \text{ m}$$

$$g \quad 8.4826$$

$$h' \quad 9.8247$$

$$h \quad 9.9805$$

$$f \quad +0.55$$

$$g \quad +0.03$$

$$h \quad +0.96$$

$$\hline +1.54$$

$$g' \quad -3.26$$

$$h \quad +0.67$$

$$i \quad -6.45$$

$$\hline -9.04$$

1796 Moon's mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 = 18.0905^{\circ} & Y_0 = 19.2639^{\circ} \\
 \Delta\alpha = +18^{\circ} & \Delta\delta = +10^{\circ} \\
 \hline
 18.0923^{\circ} & 19.2624^{\circ}
 \end{array}$$

from Plate Constants $X = 19.7610^{\circ}$ $Y = 18.6092^{\circ}$

$$\begin{array}{rcl}
 a_x = +20 & a_y = +8 \\
 b_x = +43 & b_y = -54 \\
 c = -61 & c = +44 \\
 \hline
 X = 19.7612^{\circ} & Y = 18.6096^{\circ}
 \end{array}$$

$$\begin{array}{l}
 \bar{z} = +1.7612^{\circ} \\
 \log \bar{z} = 0.24581^{\circ} \\
 \log S = 9.99944^{\circ} \\
 \log w = 8.50724^{\circ}
 \end{array}$$

$$(d-A) = 1.73913^{\circ}$$

$$X-A = +54.84^{\circ}$$

$$A = 11^{\circ} 48' 41''$$

$$\alpha_0 = 11^{\circ} 49' 35.84''$$

$$\text{Red cell. app.} = +1.54^{\circ}$$

$$\alpha' = 11^{\circ} 49' 37.38''$$

$$\eta = -3.3914^{\circ}$$

$$\log \tan S = 8.6945^{\circ}$$

$$\log \eta = 0.4917^{\circ}$$

$$\eta_1 = -6.2396^{\circ}$$

$$\eta_2 = +1^{\circ}$$

$$\eta_0 = -3.3911^{\circ}$$

$$\log \eta_0 = 0.53034^{\circ}$$

$$\log w = 7.33115^{\circ}$$

$$(d-D) = 3.19919^{\circ}$$

$$\delta-D = -26.279^{\circ}$$

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

$$\delta_0 = +2^{\circ} 54' 43.1''$$

$$\text{Red cell. app.} = -9.0^{\circ}$$

$$\delta' = +2^{\circ} 54' 34.1''$$

1796 known mean Perihelion (1912.0)

$$\begin{array}{r}
 X_0 = 18.0905 \quad Y = 19.2639 \\
 -a = \quad + 20 \quad -19 \\
 \hline
 18.0925 \quad 19.2620
 \end{array}$$

$$\begin{array}{r}
 \text{from Plate constant } X = 19.7612 \quad Y = 18.6092 \\
 \Delta x = \quad + 20 \quad \Delta y = \quad + 8 \\
 \Delta y = \quad + 43 \quad \Delta x = \quad - 54 \\
 c = \quad - 61 \quad c = \quad + 44 \\
 \hline
 X = 19.7614 \quad Y = 18.6090
 \end{array}$$

$$\begin{array}{l}
 S = +1.7612 \\
 \log S = 0.2458 \\
 \log S = 999944 \\
 \text{const} = 8.50724
 \end{array}$$

$$(X-A) = 1.73913$$

$$X-A = \quad + \quad 5484$$

$$A = 11 \quad 48 \quad 41$$

$$X_0 = 11 \quad 49 \quad 3584$$

$$\text{Red cell app} \quad + \quad 1.54$$

$$X' = 11 \quad 49 \quad 3738$$

$$\eta = -3.3919$$

$$\log \tan S = 8.6945$$

$$S^2 = 0.4917$$

$$\eta_1 = 62396$$

$$\eta_1 = +1$$

$$\eta_0 = -33918$$

$$\log \eta_0 = 0.53084$$

$$\text{const} = 733115$$

$$(S-D) = 319949$$

$$S-D = \quad - \quad 26 \quad 219$$

$$D = +3 \quad 21 \quad 05$$

$$S_0 = +2^\circ 54' 43.4''$$

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

$$S' = +2^\circ 54' 34.6''$$

1796 Lunar Parallax

$$\alpha' = 11^h 49^m 37.38^s$$

$$\delta = 12^{\circ} 26' 45.85''$$

$$+ 0^{\circ} 37' 08.45''$$

$$+ 9^{\circ} 17' 07'''$$

$$+ 3^{\circ} 32'$$

$$+ 9^{\circ} 13' 38''$$

$$9.95727$$

$$0.00000$$

$$0.00565$$

$$\tan \delta = 9.96292$$

$$+ 42^{\circ} 33' 25''$$

$$+ 2^{\circ} 54' 34''$$

$$+ 39^{\circ} 38' 51''$$

$$9.82640$$

$$8.22927$$

$$9.80487$$

$$0.16985$$

$$\cos \delta = 8.03039$$

$$\delta - \delta' = +36^{\circ} 52.2''$$

$$\delta = +3^{\circ} 31' 26.3''$$

$$\text{Amplitude} = +3^{\circ} 31' 31.0''$$

$$O-C = -4.7''$$

$$\delta' = +2^{\circ} 54' 34.1''$$

$$\pi = 58' 17.2''$$

$$9.86913$$

$$8.22927$$

$$9.20777$$

$$0.00083$$

$$\sin (\delta - \delta') = 7.30700$$

$$\alpha - \alpha' = +6^{\circ} 58.24''$$

$$= +27.88''$$

$$\alpha = 11^h 50^m 05.26^s$$

$$\alpha = 11^h 50^m 04.64^s$$

$$+0.62$$

1796 Lunar Parallax

$$\begin{array}{r} \alpha' = 11^h 49^m 37.90 \\ \delta = 12^{\circ} 26' 45.85 \\ + 0 \quad 37 \quad 08.45 \\ + \quad 9 \quad 17 \quad 7 \end{array}$$

$$+ 3 \quad 29$$

$$+ 5 \quad 49$$

$$995727$$

$$000000$$

$$000223$$

$$\text{true } \delta = 995950$$

$$+ 42^{\circ} 19' 55.2$$

$$+ 2 \quad 54 \quad 33.6$$

$$= 39 \quad 25 \quad 21.6$$

$$9.82640$$

$$822927$$

$$980284$$

$$0.17171$$

$$\text{true } (\delta - \delta') = 803018$$

$$\delta - \delta' = +36 \quad 51.1$$

$$\delta = +3 \quad 31 \quad 24.7$$

$$\alpha = 11 \quad 50 \quad 05.26$$

$$\text{true } \delta = +3^{\circ} 31' 31.0$$

$$\alpha = 11^h 50^m 04.64$$

$$O-C$$

$$- 6.3$$

$$+ 0.62$$

$$\delta' = +2^{\circ} 54' 33.6$$

$$\pi = 5.8' 17.2$$

$$986913$$

$$822927$$

$$920777$$

$$00008.3$$

$$\sin(\alpha - \alpha') = 730700$$

$$\alpha - \alpha' = +6' 58.24$$

$$= +27.88$$

1
5.8
23.
2
15.
9.
7.
3
2.8
30
7
1
7.8
24
2
1

180

Starry measures.

1913 Nov. 5.

10

	a	n	d	n
1	9185	10040	14020	17214
5.8	905152	5057	1258080	867570
23.0	49	9930	82	68
mg			10	30
8.0	23.0134	0117	5.8562	5.557
2				
15.5	19656	15968	18090	14670
9.7	1286064	1272226	1466771	808089
mg	61	27	67	84
7.7	30	70	90	66
	96777	6756	15.6575	6.584
3				
2.856	17310	19729	17432	13860
30.4	1396056	1307880	1401068	727070
mg	60	76	11	70
7.3	10	30	33	60
	30.3351	3348	28.6578	6.590

Grade 2.

1	1176360	10115	1094052	11541
7.0	68	1009806	3852	1064040
4.0	11751	07	10079	42
	20.9987	9989	7.0864	0900

very indistinct image.

2	15647	19255	15570	17909
	794033	1694951	1096568	1245982
	35	49	70	80
	40	50	80	99
	9.7705	7696	15.5393?	5420
1				
	810512	7272	14342	13488
	10	726064	785042	995570
	8098	61	50	66
			40	90
	29.9959	9990	11.3506	3522

501 stars, measures

1913 Nov. 5

10

	α	δ	α	δ
8	9185	1004057	14029	17214
0	905152	50	1258080	867570
9	49	9930	82	68
0			10	30
	<u>230134</u>	<u>0119</u>	<u>58562</u>	<u>8557</u>
5	19656	15968	18090	14670
7	1286064	1272226	1466771	808089
9	61	77	67	84
7	30	70	90	66
	<u>96777</u>	<u>6756</u>	<u>156578</u>	<u>6584</u>
1	17310	19729	17432	13860
86	1396056	1307880	1401068	727070
00	60	76	11	70
99	10	30	33	60
13	<u>303351</u>	<u>3348</u>	<u>286578</u>	<u>6590</u>

Grade 2.

1	1176360	10115	1094052	11541
7.8	68	1009806	38	1064040
99	11751	07	10079	42
	<u>209987</u>	<u>9989</u>	<u>70864</u>	<u>0900</u>

very indistinct image

2	15647	19255	15570	17909
	794033	1694951	10965	124898
	35	49	7068	80
	40	50	80	99
	<u>91705</u>	<u>7696</u>	<u>155393</u>	<u>5420</u>
1	810512	7272	14342	13488
	10	726064	785042	996576
	8098	61	50	66
	<u>299989</u>	<u>9990</u>	<u>40</u>	<u>90</u>
			<u>183506</u>	<u>3522</u>

1801

noon - measures.

d

y

w

d

w

w

1 17095
 17.6 1304041
 17.5 41
 min 05
 17.4058

17875
 1192923
 27
 88
 .4043

possibly on termination

2
 17.0 17480
 17.6 1204970
 6147
 94
 17.5430

16853
 1224860
 58
 65
 .5396

3
 16.9
 18.0

16040
 915860
 64
 50
 16.3114
 16354
 1324848
 50
 50
 .3104

4
 16.0 15078
 18.5 1108070-
 65-70-
 88
 18.4009

16860
 1085876
 7052
 70
 .3998

5
 15.8
 19.0

15600
 1331012
 10
 10
 15.7709
 16620
 890010
 00
 25
 .7721

6
 15.7
 19.5
 min
 2

14586
 1183024
 30
 78
 15.7244
 15642
 839510
 98
 52
 .7248

1801

Nixon - measures

11

	d	y	v	d	v	v
1	17095		17875			
7.8	1304041		1192923			
17.5	41		27			
mm	05		88			
1	<u>174058</u>		<u>4043</u>			
2						
170	17480		16853			
170	1204970		1224860			
	6147		58			
	94		65			
	<u>17.5430</u>		<u>5396</u>			

possibly on
termination3
110
180

16040	16359
915860	1324848
64	50
50	50
<u>163114</u>	<u>3104</u>

4

120	15078	16860
185	1108075	1085876
	6575	7052
	88	70
	<u>184009</u>	<u>3998</u>

5
158
190

15600	16620
1331012	890010
10	00
10	25
<u>157709</u>	<u>7721</u>

6
157
191
mm
2

14586	15642
1183024	839510
30	98
78	52
<u>157244</u>	<u>7248</u>

1801

moon-measures

12

$\frac{7}{15.8}$ 20.0	α	δ	α	δ
			13554	15665
			11650 50	756460
			50	68
			60	75
			<u>158099</u>	<u>8109</u>

$\frac{8}{16.0}$ 20.4	19654	19840
	15398 90	14085 90
	09	90
	58	40
	<u>20.4259</u>	<u>4245</u>

$\frac{9}{16.5}$ 21.0		18150	20070
		13078 78	15152 52
		77	59
		54	80
		<u>16.4926</u>	<u>4921</u>

$\frac{10}{17.0}$ 21.3	17220	19217
	14320 09	12137 34
	10	35
	20	27
	<u>21.2907</u>	<u>2911</u>

$\frac{11}{17.8}$ 21.4	17188	19240
max	12919 12	13498 10
	20	00
in	92	40
$\frac{1}{2}$	<u>21.4273</u>	<u>4263</u>

$\frac{12}{18.0}$ 21.0	12219 18	12580
	12	12295 00
	11930	90
	<u>20.9714</u>	<u>9715</u>

1801

moon - measures

d

4

v

d

v

v

7
15.8
200

13554

15665

1165050

756460

50

68

60

75

1580998109

8
16.0 19659
209 15398 90
09
58
20.4259

19840
14085 90
90
40
4245

9
16.5
21.0

18150

20070

1307878

1515252

77

59

54

80

1649264921

10
17.0 17220
213 14320 09
10
20
21.2907

19217
1213734
35
27
2911

11
17.5 17188
214 1291912
max 20
92
21.4273

19240
1399810
00
40
4263

12
19.0 1221918
210 12
11930
20.9714

12580
1229500
90
9715

1801.	Times etc.						
Epistatus 1912 Apr 30	12 ^h 51 ^m			- 13 ^h 03 ^m			
moon	12 57	02.5		12 57	02.9		
clock slow	1	40.0					
Mid T.	12 58	4 27					
H. long	4	44	31.05				
S. sid T.	17	43	13.75				
Sid T. by moon	2	32	14.19				
Interval	15	10	59.56				
Reduction		2	29.24				
G. M. T.	15	08	30.32		- 1 ^h 17 ^m		

from Kant Alm			R. A.				
Moon 15 ^h	14 ^m	15 ^m	31.18	- 15 ^h 03'	03.7		
Motion in 1 ^m = 2.0644 ^v				13.535 ^v			
" 8.5053 ^v			17.56 ^v	- 1	55.1		
Tabular place	14	15	48.74 ^v	- 15	04	58.8 ^v	

Moon's age 13.5 days. 7^h 11^m before full.

734 + 78 ^v	R =	930.6 ^v
9312 78 ^v	Augmentation:	+ 7.8 ^v
	Irradiation (2):	- 0.5 ^v
	R =	937.9 ^v
	R =	20105 ^v
a = + 0.2	R ² =	4.0421 ^v

1912. Times etc.

Exp. times 1912 Apr 30	12 ^m 51 ^m	- 13 ^m 03 ^m
known	12 57	02.5 - 12 57 02.9
look down	1	40.0

#1 id T.	12 58	4 27
id T.	4 44	3 1.05
G id T.	17 43	13 75
id T in known	2 32	14.19
Interval	15 10	59.56
Reduction	2	29.24
G id T.	15 08	30.32 6-8 - 1 ^m 17 ^m

from hant Alm R A

known 15 ^m	14 ^m 15 ^m	31.18 - 15 ^m 03' 03.7
interval - 1 - 2.0644		13.535
8.5053		17.56 - 1 55.1
Tabular place	14 15	4874 - 15 04 58.8

known age 13.5 days. 7^m 11^m before full.

parallax 56' 49.7

lunation 15 30.6

934 = 78

R = 930.6

931 = 78

Augmentation: +7.8

Irradiation (2): -0.5

R = 937.9

R = 2.0105

a = +0.2

R = 4.0421

	α	γ
1	7.0882	20.9988
1	11.3514	29.9990
2	15.5406	9.7700
3	28.6584	30.3350

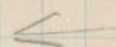


Plate Constants

14

x	y	$R.A.$	$Decl.$
5.8560	230126	14 11 02	-15 40 20
15.6581	96766	15 37	-17 07 28
28.6584	303350	22 34	-14 26 31
35017	6302	48 73	16 73 79
16.72	2101	14 16 24	-15 44 46
-18	-22	+ 40	+ 7 41
1.28	0.99	14 17 04	-15 37 05
31	465		
40	461		

$$A = 1.4^h \quad 17^m \quad 04^s$$

$$D = -15^\circ \quad 37' \quad 05''$$

$x-3$	-79.44	-0.22	-1445
+3112	-1667	1 = +1444	= -1
+3826	-2382	2 = +1442	= -3
+2224	-776	3 = +1445	= 0
+3863	-2409	6 = +1448	= +3
17.7351	-1542	- 4	174360

$y-n$	$+75.62$	$+6.04$	$+4767$
-5432	$+536$	-4896	$+126 = -4770 = -3$
-5802	$+858$	-4944	$+180 = -4764 = +3$
-6003	$+1175$	-4828	$+59 = -4769 = -2$
-7113	$+2167$	-4946	$+181 = -4765 = +2$
19.4169^v	$+1341^u$	$+116^u$	$= 20.0395$

Tables	$a = -0.8$	$x = -8.4$	$a - x = +7.6$	$b + a = +5.0$
Obs	$a = +0.2$	-6.0	+6.2	+3.8
$c - 0$	-1.0	-2.4	+1.4	+1.2

Plate Constant

14

x	y	R	a	b	c	d	e
5.8560	230126	14	11	02	-15	40	20
15.6581	96766		15	37	-17	07	28
28.6584	303350		22	34	-14	26	31
5017	6302		48	73	16	73	79
1672	2101	14	16	24	-15	44	46
18	22		+	40		+	7
128	099	14	17	04	-15	37	05
31	465						
40	461						

$$A = 14^h 17^m 04^s$$

$$D = -15^\circ 37' 05''$$

$x-3 = 79.44$	$-0.2x$	-1445
$+3112 = 1667$	$= +1445$	$= -1$
$+3826 = 2382$	$= +1444$	$= -3$
$+2224 = 776$	$= +1448$	$= 0$
$+3863 = 2409$	$= +1454$	$= +3$
177351	-1542	-4
		17.4368

$y-n = 75.6x$	$+6.0y$	$+4767$
$-5432 + 536 = -4896$	$+126 = -4770$	$= -3$
$-5802 + 858 = -4944$	$+180 = -4764$	$= +3$
$-6003 + 1175 = -4828$	$+59 = -4769$	$= -2$
$-7113 + 2167 = -4946$	$+181 = -4765$	$= +2$
19.4169	+1341	+116
		20.0398

Tables	$a = 00$	$b = -8.0$	$c = +8.0$	$d + a = +48$
Obs	$a = +02$	-6.0	$+6.2$	$+38$
$e = 0$			$+1.8$	$+1.0$

1912phae.proj.1
Cape No 1942 mag 8.6

C	14	12	39.01
L			09
E			04
Mean	14	12	39.05
Proc		+	39.14
α	14	13	18.19
A	14	17	04
$\alpha-A$		- 3	45.81
$\sin(\alpha-A)$			- 225.80
log	2.35372		m
$\log S$	9.98593		
$\log S_0$	0.84689		m
$\log S_1$	- 7.0290		
$\log S_2$	-	22	
$\log S_3$	10.9688		
$\log S_4$	11.3514		
$\log S_5$	+	3826	

C	- 14	26	55.4
L			54.9
E			55.9
Mean	- 14	26	55.4
Proc	-	3	21.2
S	- 14	30	16.6
D	- 15	37	05
S-D	+	1	06
$\tan(\theta-D)$		+	4008.9
log	3.60303		m
$\log S_0$	0.93418		m
$\log S_1$	9.4128		m
$\log S_2$	1.6938		
$\log S_3$	8.1600		m
$\log S_4$	+	8.5937	
$\log S_5$	-	145	
$\log S_6$	30.5792		
$\log S_7$	29.9990		
$\log S_8$	-	5802	

1801

Standard Coordinates

15

Cape No. 1935 mag 8.0

Cape No. 1948 mag 7.7

Cape No. 1964 mag 7.3

C	14	10	22.25	14	14	57.14	14	21	54.66
L			30			16			69
B			28			16			63
Mean	14	10	22.28	14	14	57.15	14	21	54.66
Par			+ 39.29			+ 39.61			+ 39.11
X	14	10	01.57	14	15	36.76	14	22	33.77
A	14	17	04	14	17	04	14	17	04
k-A	-	6	02.43	-	1	27.24	+	5	29.77
sin(k-A)			- 362.39			- 872.4			+ 329.74
log			2.55918			1.94072			2.51817
cos			9.98355			9.98031			9.98605
"3.			1.04997			0.42822			1.01146
3.			- 11.2195			- 2.6808			+ 10.2674
3.			- 35			- 10			+ 47
3			6.7770			1531.82			2827.21
X			70882			155406			286584
2-3			+ 3112			+ 2224			+ 3863
C	- 15	36	57.8	- 17	04	07.7	- 14	23	15.1
L			58.1			07.4			15.0
B			58.1			08.4			14.9
Mean	- 15	36	58.0	- 17	04	07.8	- 14	23	15.0
Par			- 3 22.5			- 3 19.9			- 3 16.2
S	- 15	40	20.5	- 17	07	27.7	- 14	26	31.2
D	- 15	37	05	- 15	37	05	- 15	37	05
S-D			- 3 15.5	- 1	30	22.7	+	1 10	33.8
tan(k-A)			- 195.5			- 5424.0			+ 4234.4
log			2.29115			3.73432			3.62679
"70			9.62130			1.06547			0.95794
tan S			9.4480			9.4887			9.4108
"52			21023			0.8565			20229
"71			86034			73986			84871
"70			- 0.4181			- 11.6272			+ 5.0770
"71			- 399			- 25			- 307
"72			215420			103703			310463
"73			209988			9.7700			303350
"74			- 5432			- 6003			- 7113

1501

Standard Coordinates

15

Cape W. 1935 mag 8.0

Cape W. 1948 mag 7.7

Cape W. 1969 mag 7.3

C	14	10	22.25	14	19	57.14	14	21	54.66
L			30			16			69
E			28			16			63
Mean	14	10	22.28	14	14	57.15	14	21	54.66
Proc		+	39.29			+39.61			+39.11
α	14	10	01.57	14	15	36.76	14	22	33.77
A	14	17	04	14	17	04	14	17	04
(A-A)	-	6	02.43	-	1	27.24	+	5	29.77
$\sin(A-A)$		-	363.39		-	87.24		+	329.74
log			2.55918			1.94072			2.51817
cos			998355			998031			998605
$\bar{z}$			1.04997			0.42827			1.01146
$\bar{z}$		-	11.2195		-	2.6808		+	10.2674
$\bar{z}$		-	35		-	10		+	47
$\bar{z}$			6.7772			15.3182			28.2721
$\bar{z}$			7.0882			15.5406			28.6584
$\bar{z}$			+3.112			+2.224			+3.863

C	-15	36	57.8	-17	04	07.7	-14	23	15.1
L			58.1			07.4			15.0
E			58.1			08.4			14.9
Mean	-15	36	58.0	-17	04	07.8	-14	23	15.0
Proc		-	3.225		-	3.199		-	3.162
S	-15	40	20.5	-17	07	27.7	-14	26	31.2
D	-15	37	05	-15	37	05	-15	37	05
S-D		-	3.155	-	1.30	22.7	+	1.10	33.8
$\sin(S-D)$		-	195.5		-	54.240		+	423.44
log			2.29115			3.73432			3.62679
γ_0			962130			1.06547			0.95794
tan S			94480			9.4887			94108
γ_2			21023			0.8565			20229
γ_1			86037			73986			84871
γ_0		-	0.4181		-	11.6272		+	5.0770
γ_1		-	399		-	25		-	307
γ_2			215420			10.3703			37.0463
γ_3			209988			9.7700			30.3350
γ_4		-	5432		-	6003		-	7113

pt.	mag - L	resid.
1	180.0	+115
2	201.4	+201
3	225.3	-48
4	239.7	+16
5	258.2	-130
6	270.0	0
7	286.9	+40
8	300.1	-133
9	321.9	+140
10	338.6	+167
11	0.0	+38

1801 Moon's Center 16

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.7364	0.0000	+9	0.0000	4.0461	+40
2	17.0000	-0.7364	+8	0.5411	4.0571	+150
3	16.3109	-1.4255	+6	2.0303	4.0357	-64
4	16.0000	-1.7364	+5	3.0134	4.0444	+23
5	15.7715	-1.9649	+2	3.8600	4.0325	-96
6	15.7246	-2.0118	0	4.0473	4.0473	+52
7	15.8104	-1.9260	-3	3.7106	4.0533	+112
8	16.0000	-1.7364	-5	3.0168	4.0375	-46
9	16.4924	-1.2440	-7	1.5492	4.0652	+231
10	17.0000	-0.7364	-8	0.5435	4.0677	+256
11	17.7364	0.0000	-9	0.0000	4.0534	+113
~~12~~	~~19.0000~~	~~+1.2636~~	~~-7~~	~~1.5449~~	~~4.0216~~	
$R^2 =$					4.0421	

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.4050	-2.0100	-15	4.0461
2	17.5413	-1.8737	-14	3.5160
3	18.0000	-1.4150	-11	2.0054
4	18.4004	-1.0146	-8	1.0310
5	19.0000	-0.4150	-3	0.1725
6	19.4150	0.0000	0	0.0000
7	20.0000	+0.5850	+4	0.3427
8	20.4253	+1.0103	+8	1.0207
9	21.0000	+1.5850	+12	2.5160
10	21.2909	+1.8759	+14	3.5242
11	21.4268	+2.0118	+15	4.0534
~~12~~	~~20.9714~~	~~+1.5564~~	~~+12~~	~~2.4261~~

Approximate Center

$$\begin{aligned}
 x &= 17.0 & y &= 17.5413 & x &= 16.0 & y &= 18.4004 \\
 & & & 21.2909 & & & & 20.4243 \\
 & & & \hline & & & 388322 & & & & 388247 \\
 Y_0 &= & 19.4161 & [19.4150] & Y_0 &= & 19.4124 \\
 & & y = \max & 21.4268 & & & & \\
 & & R &= 2.0118 & & & & \\
 x = \min &= & 15.7246 & & \text{Center} &= & \begin{cases} 17.7364 \\ 19.4150 \end{cases} \\
 X_0 &= & 17.7364 & & & & &
 \end{aligned}$$

1801

Movons Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)^2$	$0 - 6$
1	17.7364	0.0000	+9	0.0000	4.0461	+40
2	17.0000	-0.7364	+8	0.5411	4.0571	+150
3	16.3109	-1.4255	+6	2.0303	4.0357	+64
4	16.0000	-1.7364	+5	3.0134	4.0449	+23
5	15.7715	-1.9649	+2	3.8600	4.0325	-96
6	15.7246	-2.0118	0	4.0473	4.0473	+52
7	15.8104	-1.9260	-3	3.7106	4.0533	+112
8	16.0000	-1.7364	-5	3.0168	4.0375	-46
9	16.4924	-1.2440	-7	1.5492	4.0652	+231
10	17.0000	-0.7364	-8	0.5435	4.0677	+256
11	17.7364	0.0000	-9	0.0000	4.0534	+113
12	19.0000	+1.2636	-7	1.5949	4.0216	
				$R^2 =$	4.0421	

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	17.4050	-2.0100	-15	4.0461
2	17.5413	-1.8737	-14	3.5160
3	18.0000	-1.4150	-11	2.0054
4	18.4004	-1.0146	-8	1.0310
5	19.0000	-0.4150	-3	0.1725
6	19.4150	0.0000	0	0.0000
7	20.0000	+0.5850	+4	0.3427
8	20.4253	+1.0103	+8	1.0207
9	21.0000	+1.5850	+12	2.5160
10	21.2909	+1.8759	+14	3.5242
11	21.4268	+2.0118	+15	4.0534
12	20.9719	+1.5564	+10	2.4261

Approximate Center

$$\begin{array}{rcl}
 x = 17.0 & y = 17.5413 & z = 16.0 \quad y = 18.4004 \\
 & 21.2909 & 20.4243 \\
 & \hline
 & 388322 & 388247 \\
 Y_0 = & 19.4161 [19.4150] & X_0 = 19.4124 \\
 & y = \max 21.4268 & \\
 & R = 20118 & \\
 & x = \min 15.7246 & \text{Center} \begin{cases} 17.7364 \\ 19.4150 \end{cases} \\
 X_0 = & 17.7364 &
 \end{array}$$

Formation of Normal Equations

	ab	ac	bc
1	- 0.00 ^v	+ 0.00 ^v	- 80.4 ^v
2	+ 1.38 ^v	- 111.0 ^v	- 280.5 ^v
3	+ 2.03 ^v	+ 91.5 ^v	+ 90.9 ^v
4	+ 1.76 ^v	- 40.0 ^v	- 23.2 ^v
5	+ 0.82 ^v	+ 188.2 ^v	+ 40.3 ^v
6	- 0.00 ^v	- 104.5 ^v	+ 0.0 ^v
7	- 1.12 ^v	- 216.2 ^v	+ 65.0 ^v
8	- 1.76 ^v	+ 80.0 ^v	- 46.5 ^v
9	- 1.97 ^v	- 286.4 ^v	+ 367.3 ^v
10	- 1.39 ^v	- 189.4 ^v	+ 481.3 ^v
11	+ 0.00 ^v	+ 0.0 ^v	+ 227.1 ^v
	- 0.25 ^v	- 587.8	+ 841.3

Normal Equations

$$+ 22.31 - 0.25 = - 588$$

$$- 0.25 + 22.23 = + 841$$

$$+ 0.25 - 0.00 = - 7$$

$$+ 22.23 = + 834$$

$$+ 22.31 = - 588 + 9 = - 579$$

$$b = + 37.5$$

$$a = - 25.9$$

Residuals

	O	C	O-C
1	+ 40	- 0 - 75 = - 75	+ 115
2	+ 150	+ 19 - 70 = - 51	+ 201
3	- 64	+ 37 - 53 = - 16	- 48
4	+ 23	+ 45 - 38 = + 7	+ 16
5	- 96	+ 50 - 16 = + 34	- 130
6	+ 52	+ 52 + 0 = + 52	0
7	+ 112	+ 50 + 22 = + 72	+ 40
8	- 50	+ 45 + 38 = + 83	- 133
9	+ 231	+ 32 + 59 = + 91	+ 140
10	+ 256	+ 19 + 70 = + 89	+ 167
11	+ 113	- 0 + 75 = + 75	+ 38

Average = 94

1801

Moon's Center Conditional Equations

17

	a	b	0		c	0 - c
1	0.00	-2.01	+4.0		0 - 87 = -87	+127
2	-0.74	-1.87	+15.0	+	40 - 81 = -41	+191
3	-1.43	-1.42	-6.4	+	77 - 61 = +16	-80
4	-1.74	-1.01	+2.3	+	94 - 44 = +50	-27
5	-1.96	-0.42	-9.6	+	106 - 18 = +88	-184
6	-2.01	+0.00	+5.2	+	109 + 0 = +109	-57
7	-1.93	+0.58	+1.2	+	105 + 25 = +130	-18
8	-1.74	+1.01	-4.6	+	94 + 44 = +138	-188
9	-1.24	+1.59	+2.31	+	67 + 69 = +136	+95
10	-0.74	+1.88	+2.56	+	40 + 81 = +121	+135
11	0.00	+2.01	+1.13		0 + 87 = +87	+26

Mean Equations

Average 103

$$\begin{aligned} 5) & -5.87 - 6.73 = +5.3 \\ 6) & -7.66 + 7.07 = +7.14 \end{aligned}$$

$$\begin{aligned} +7.66 + 8.78 &= -6.9 \\ +15.85 &= +6.45 \end{aligned}$$

$$b = +40.7$$

$$-5.87 = +5.3 + 27.4 = +32.7$$

$$a = -55.8$$

$$\begin{aligned} 6) & -7.88 - 6.73 = +10.5 \\ 5) & -5.65 + 7.07 = +6.62 \end{aligned}$$

$$\begin{aligned} +5.65 + 5.65 &= -7.5 \\ +12.72 &= +58.7 \end{aligned}$$

$$b = +46.1$$

$$-7.88 = +10.5 + 31.1 = +41.6$$

$$a = -52.8$$

$$\begin{aligned} b &= +43.4 \\ a &= -54.3 \end{aligned}$$

see opp. page.

1801

Moon's Center. Conditional Equations

17

	a	b	c		c	o-c
1	0 0 0 - 2 0 1 =	+ 4 0		0 - 8 7 =	- 8 7	+ 1 2 7
2	- 0 7 4 - 1 8 7 =	+ 1 5 0		+ 4 0 - 8 1 =	- 4 1	+ 1 9 1
3	- 1 4 3 - 1 4 2 =	- 6 4		+ 7 7 - 6 1 =	+ 1 6	- 8 0
4	- 1 7 4 - 1 0 1 =	+ 2 3		+ 9 4 - 4 4 =	+ 5 0	- 2 7
5	- 1 9 6 - 0 4 2 =	- 9 6		+ 1 0 6 - 1 8 =	+ 8 8	- 1 8 4
6	- 2 0 1 + 0 0 0 =	+ 5 2		+ 1 0 9 + 0 =	+ 1 0 9	- 5 7
7	- 1 9 3 + 0 5 8 =	+ 1 1 2		+ 1 0 5 + 2 5 =	+ 1 3 0	- 1 8
8	- 1 7 4 + 1 0 1 =	- 4 6		+ 9 4 + 4 4 =	+ 1 3 8	- 1 4 8
9	- 1 2 4 + 1 5 9 =	+ 2 3 1		+ 6 7 - 6 9 =	+ 1 3 6	+ 9 5
10	- 0 7 4 + 1 8 8 =	+ 2 5 6		+ 4 0 + 8 1 =	+ 1 2 1	+ 1 3 5
11	0 0 0 + 2 0 1 =	+ 1 1 3		0 - 8 7 =	- 8 7	+ 2 6

mean Equations

$$\begin{aligned} 5) & - 5 8 7 - 6 7 3 = + 5 3 \\ & - 7 6 6 + 7 0 7 = + 7 1 4 \end{aligned}$$

$$\begin{aligned} & + 7 6 6 + 8 7 8 = - 6 9 \\ & + 1 5 8 5 = + 6 4 5 \end{aligned}$$

$$b = + 4 0.7$$

$$- 5 8 7 = + 5 3 + 2 7 4 = + 3 2 7$$

$$a = - 5 5.8$$

$$\begin{aligned} 6) & - 7 8 8 - 6 7 3 = + 1 0 5 \\ & - 5 6 5 + 7 0 7 = + 6 6 2 \end{aligned}$$

$$\begin{aligned} b & = + 4 3.9 \\ a & = - 5 4.3 \end{aligned}$$

$$\begin{aligned} & + 5 6 5 + 5 6 5 = - 7 5 \\ & + 1 2 7 2 = + 5 8 7 \end{aligned}$$

$$b = + 4 6.1$$

$$- 7 8 8 = + 1 0 5 + 3 1 1 = + 4 1 6$$

$$a = - 5 2.8$$

1801 Moon's Mean Position (1912.0)

$$\begin{array}{r} X_0 = 17.7364'' \\ \frac{1}{2}a = -13'' \\ \hline 17.7351'' \end{array}$$

$$\begin{array}{r} Y_0 = 19.4150'' \\ \frac{1}{2}b = +19'' \\ \hline 19.4169'' \end{array}$$

From Plate Constants $X = 17.9360''$ $Y = 29.0395''$

$$\xi = -0.5640''$$

$$\log \xi = 9.75128''$$

$$-\cos \delta = 9.98312''$$

$$\text{const} = 8.50724''$$

$$\mu(A) = 1.26092''$$

$$\alpha - A = 18.24''$$

$$A = 14 \quad 17 \quad 04''$$

$$\alpha_0 = 14 \quad 16 \quad 45.76''$$

$$\text{Radial alt.} = +1.82''$$

$$\alpha' = 14 \quad 16 \quad 47.58''$$

$$\eta = -1.9607''$$

$$\log \tan \delta = 9.4527''$$

$$\xi^2 = 9.5047''$$

$$\eta_1 = 6.0108''$$

$$\eta_1 = -1$$

$$\eta_0 = -1.9606''$$

$$\log \eta_0 = 0.29239''$$

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

$$\mu(D) = 2.96124''$$

$$\delta - D = -15 \quad 14.6''$$

$$D = -15 \quad 37 \quad 05''$$

$$\delta_0 = -15 \quad 52 \quad 19.6''$$

$$\text{Radial alt.} = -14.7''$$

$$\delta' = -15 \quad 52 \quad 34.3''$$

501 Inverse Mean Position (1912.0)

$$\begin{array}{r} X_0 = 177364 \\ \text{corr} = -213 \\ \hline 177351 \end{array}$$

$$\begin{array}{r} Y_0 = 194150 \\ \text{corr} = +19 \\ \hline 194169 \end{array}$$

Inverse Plate Constants $X = 17.9360$ $Y = 20.0395$

$$S = -0.5640$$

$$\gamma = -1.9877$$

$$\log S = 9.75228$$

$$\text{corr} S = 9.98343$$

$$\text{corr} = 8.50724$$

$$\log \tan S = 9.4527$$

$$\text{corr} = 9.5047$$

$$\text{corr} = 6.0108$$

$$(N.A.) = 126093$$

$$X - A = 18.24$$

$$\eta = -1$$

$$4 \quad 14 \quad 17 \quad 04$$

$$\eta = -1.9606$$

$$X_0 = 14 \quad 16 \quad 45.76$$

$$\log \eta = 0.29239$$

$$\text{corr} = 7.33115$$

$$\text{Redupl. alt.} = +1.82$$

$$(N.D.) = 3.96124$$

$$X' = 14 \quad 16 \quad 47.58$$

$$S + D = -15.446$$

$$D = -15.3705$$

$$S_0 = -15.52496$$

$$\text{Redupl. alt.} = -1.47$$

$$S' = -15.52343$$

1801-2 Reduction to Apparent place.

$\alpha_0 = 14$	17	04	$\delta_0 = 15$	55	38
$G = 19$	33	6	$H = 15$	08	24
$G + \alpha_0 = 9$	50	10	$H + \alpha_0 = 5$	25	28
$=$	14.7°	$32' 30''$	$=$	81°	$22'$

$\log \frac{1}{r} = 8.8239$	$\log \frac{1}{r} = 8.8239$	$\log \frac{1}{r} = 0.7923$
$\log q = 0.9748$	$\log h = 1.2902$	$\log \delta_0 = 9.9830$
$\sin(G + \alpha_0) = 9.7297$	$\sin(H + \alpha_0) = 9.9950$	$(L) = 0.7753$
$\tan \delta_0 = 9.4554$	$\sec \delta_0 = 0.0170$	
$(g) = 8.9838$	$(h) = 0.1261$	

$\log g = 0.9748$	$\log h = 1.2902$
$\cos(G + \alpha_0) = 9.9262$	$\cos(H + \alpha_0) = 9.1764$
$(g') = 0.9010$	$\sin \delta_0 = 9.4384$
	$(h') = 9.9050$

$f = +0.58$	$(g) = -7.96$
$(g) = -0.10$	$(h) = -0.80$
$(h) = +1.34$	$(L) = -5.96$
Red in $\alpha = +1.82$	Red in $\delta = -14.72$

$$\alpha' = 14^h 16^m 47.54^s \quad \delta' = 15^\circ 55' 02.2''$$

1801-2 Reduction to Apparent place

$X = 14$	17	04	$S_0 = +15$	55	38
$G = 19$	33	6	$H = 15$	08	24
$G+X = 9$	50	10	$H+X_0 = 5$	25	28
	147	32		51	22

$\log \frac{1}{r} = 8.8239$	$\log \frac{1}{h} = 8.8239$	$\log c = 0.7923$
$g = 0.9748$	$h = 1.2902$	$\cos S_0 = 9.9830$
$\sin(G+X) = 9.7297$	$\sin(H+X) = 9.9950$	$(c) = 0.7753$
$\tan S_0 = 9.9554$	$\sec S_0 = 0.0170$	
$(g) = 8.9838$	$(h) = 0.1261$	

$\log g = 0.9748$	$\log h = 1.2902$
$\cos(G+X) = 9.9262$	$\cos(H+X) = 9.1764$
$(g') = 0.9010$	$\sin S_0 = 9.4384$
	$(h') = 9.9050$

$f = +0.58$	$(g') = -7.96$
$(g) = -0.10$	$(h') = +0.80$
$(h) = +1.34$	$(c) = -5.96$
$\text{Red. } \alpha = +1.82$	$\text{Red. } \delta = -14.72$

$$\alpha' = 14^h 16^m 47.54 \quad \delta' = -15^\circ 55' 02.2$$

1801

Lunar Parallax

20

$$\begin{aligned} \alpha' &= 14^h 16^m 47.58^s \\ \delta &= 12^{\circ} 58' 42.7'' \\ G - \alpha' &= -1^h 18^m 04.8^s \\ &= -19^{\circ} 31' 12'' \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = 7 \quad 16$$

$$z - \frac{1}{2}(\alpha - \alpha') = 19 \quad 23 \quad 56$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \therefore \cos \frac{1}{2}(\alpha - \alpha') &= 0.00000 \\ \therefore \cos z - \frac{1}{2}(\alpha - \alpha') &= 9.97461 \\ \therefore \tan \gamma &= 9.98266 \end{aligned}$$

$$\gamma = 43 \quad 51 \quad 24.0$$

$$\delta' = 15 \quad 52 \quad 34.3$$

$$\gamma - \delta' = 59 \quad 43 \quad 58.2$$

$$\begin{aligned} \log \sin \phi' &= 9.82640 \\ \therefore \sin \gamma &= 8.21827 \\ \therefore \sin(\gamma - \delta') &= 9.93636 \\ \therefore \sin \gamma &= 9.84064 \\ \therefore \sin(\gamma - \delta') &= 8.14039 \end{aligned}$$

$$\delta - \delta' = + 47 \quad 29.9$$

$$\delta = 15 \quad 05 \quad 04.2$$

$$\text{Am Eph } \delta = -15^{\circ} 04' 58.8''$$

$$O - C = - 5.6$$

$$S' = -15^{\circ} 52' 34.3''$$

$$\pi = 56 \quad 49.7$$

$$\begin{aligned} \log \cos \phi' &= 9.86913 \\ \therefore \sin \pi &= 8.21827 \\ \therefore \sin \delta &= 9.52392 \\ \therefore \cos \delta &= 9.98477 \\ \therefore \sin(\alpha - \alpha') &= 7.62655 \end{aligned}$$

$$\alpha - \alpha' = - 14 \quad 32.92$$

$$= -58.19$$

$$\alpha = 14 \quad 15 \quad 49.39$$

$$\alpha = 14^h 15^m 48.74^s$$

$$+ 0.65$$

1501

Lunar Parallax

22

$$\alpha' = 14^{\text{h}} 16^{\text{m}} 47.58^{\text{s}}$$

$$\delta = 12^{\circ} 58' 42.7''$$

$$G - \alpha' = -1^{\text{h}} 18^{\text{m}} 04.8^{\text{s}}$$

$$= -19^{\circ} 31' 12''$$

$$\frac{1}{2}(\alpha - \alpha') = 7 16$$

$$z = \frac{1}{2}(\alpha - \delta') = 19 23 54$$

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

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

$$\cos z = \frac{1}{2}(\alpha - \delta') = 9.97461$$

$$\tan \gamma = 9.98266$$

$$\gamma = 43 51 24.0''$$

$$\delta' = 15 52 34.3$$

$$\gamma - \delta' = 59 43 58.2$$

$$\log \sec \phi' = 9.82640$$

$$\sec \gamma = 8.21827$$

$$\cos(\gamma - \delta') = 9.93636$$

$$\sin \gamma = 9.89064$$

$$\sin(\gamma - \delta') = 8.14039$$

$$\delta - \delta' = + 47 29.9$$

$$\delta = 15 05 04.4$$

$$\text{Ann. Eph. } \delta = 15^{\circ} 09' 18.8''$$

$$O - C = - 56$$

$$\delta' = -15^{\circ} 52' 34.3''$$

$$IT = 56' 49.7$$

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

$$\cos \gamma = 8.21827$$

$$\sec \gamma = 9.52392$$

$$\cos \delta = 9.98472$$

$$\sin(\alpha - \alpha') = 7.62650$$

$$\alpha - \alpha' = 14 32.92$$

$$= -58.79$$

$$\alpha = 14 15 49.39$$

$$\alpha = 14^{\text{h}} 11^{\text{m}} 48.74^{\text{s}}$$

$$+ 0.65$$

1
10
30
2
1
1
2
2
2
1
6
21

1802

Stars - measures 1913 Nov. 6

22

	d	q	v
1	17582		18710
10.9	16109	07	1018180
30.2	08		88
	74		12
	<u>30.1473</u>		<u>.1471</u>

	d	q	v
	16636		19711
	15751	64	1057676
	51		7576
	30		20
	<u>10.9120</u>		<u>.9143</u>

2	903848	11538
15.2	37	1091610
10.0	8470	20
	<u>9.9429</u>	<u>.9377</u>

	15551	16314
	723542	1462010
	3048	19
	95	10
	<u>15.1648</u>	<u>.1698</u>

3	19000	16833
26.2	1356961	1226060
30.5	65	67
	82	41
	<u>30.5427</u>	<u>.5425</u>

	18695	16145
	1086568	1392010
	59	20
	90	30
	<u>28.2173</u>	<u>.2204</u>

Grade 3 or 2

Images 1 + 2 very fr.

1	18775	15310
67	1741014	664659
21.2	10	50
	20	02
	<u>21.1364</u>	<u>21.1349</u>

	19950	15868
	16880	900078
	9292	8840
	60	70
	<u>6.6835</u>	<u>6.6882</u>

Remeasure (2)

1207065	9870
61	925064
11490	60
<u>9.9425</u>	<u>.9388</u>

19141	14628
1081002	1293227
98	28
55	40
<u>15.1657</u>	<u>.1700</u>

1902

Star measures

1913 Nov. 6

22

	a	u
1	17582	18710
109	1610907	1015180
302	08	88
	74	12
	<u>30.1473</u>	<u>1.471</u>

	a	u
2	903848	11538
112	37	1091610
100	8470	20
	<u>9.9429</u>	<u>9377</u>

	a	u
3	19000	16833
282	1356961	1226060
305	65	67
	82	40
	<u>30.5427</u>	<u>1.425</u>

Grade 3 or 2

	a	u
1	18775	15310
67	1741014	664615
212	108	50
	75	02
	<u>1364</u>	<u>21.1349</u>

Remeasure (2)

	a	u
	1207065	9870
	61	925064
	11490	60
	<u>9425</u>	<u>9388</u>

	a	u
	16636	19711
	1575164	1057676
	51	75
	30	20
	<u>10.9120</u>	<u>9143</u>

	a	u
	15581	16314
	723842	1462010
	3048	19
	95	10
	<u>15.1648</u>	<u>1698</u>

	a	u
	18695	16115
	1086568	1392015
	59	20
	90	30
	<u>28.2173</u>	<u>2204</u>

Images 1 + 2 very fr.

	a	u
	199150	15868
	1678092	900078
	92	880
	60	70
	<u>6835</u>	<u>66882</u>

	a	u
	19141	14628
	1081002	1293227
	98	28
	55	40
	<u>1657</u>	<u>1700</u>

1802

Moon measures

23

	α	δ	α	δ	α	δ
1	17394		19516			
18.0	15855	47	11039	42		
17.2	51		40			
min	09		11			
h	17.1545		1528			

2	16448		19162			
17.0	12751	38	12845	30		
17.9	35		30			
	54		74			
	17.3704		3667			

3			16570		18300
16.3			9270	77	15598
16.0			59		94
			63		00
			162704		12706

	α	δ	α	δ	α	δ
4	14660		15930		11620	
18.8	737069		13240	40	11090	80
	69		40		80	
	60		40			
	18.7291		7307		159463	

5			8550		11575	73
15.9			7534	35	69	
14.3			41		10520	
min						
h			158987		28998	

6			8335	39	12540	
16.1			40		11680	75
16.0			7512		69	
			150826		0865	

1802

Moon measures

23

	a	b	c	d	e
1	17394	19516			
180	1585547	1103942			
172	51	40			
mm	09	11			
7	<u>171545</u>	<u>1528</u>			

3	16448	19162
170	1275138	1284830
179	35	30
	59	74
	<u>173709</u>	<u>3667</u>

3		16570	18300
165		927077	1559889
180		59	94
		63	00
		<u>162704</u>	<u>2706</u>

4	scratched			
59	14660	15930	11620	1389080
88	737069	1324040	1109080	80
	69	40	80	13862
	60	40		
	<u>187291</u>	<u>7307</u>	<u>159463</u>	<u>9479</u>

5		8550	1157573
159		753935	6973
173		41	10570

6		<u>158987</u>	<u>8998</u>
161		833539	12540
180		40	1168075
		7512	69
		<u>160826</u>	<u>0865</u>

80 ~

moon - measures

24

	d	h	d	h	m
2	8860	42	10451		
17.0	48		10040	30	
20.9	8420		30		

20.9570.9582

8	19200	15825
18.0	1747060	752736
21.1	70	23
max	96	28

21.1732.1702

not very clear image of moon

180~

moon-measures

24

	d	h	n	d	n
2	8860	42	10451		
170	48		1004030		
209	8420		30		

2095709582

4	15200	15825
180	1747060	752736
211	70	23
min	96	28

2117321702

not very clear image of moon.

parallel	56'	49.3
semicircular	15	30.55

93428.0 R = 930.55

$$R = 937.9$$

$R = 2.0105$

$$a = -4.2 \quad (1+n)R = 20097$$
$$R^2 = 4.0389$$

1802

Exp. station 1912 Apr 20 13^h 05^m - 13^h 17^m

known	13	10	47.2	-13	10	47.5
clock slow		1	40.0			
H. S. T.	13	12	27.35			
H. long	4	44	31.05			
G. S. T.	17	56	58.40			
S. T. in known	2	32	14.15			
Interval	15	24	44.21			
Reduction		2	31.50			
G. M. T.	15	22	12.71	0-X	-1	04

from Mount Wilson	R. A.	Decl
known 15 ^m	14 ^h 15 ^m 31 ^s 18	-15 ^m 03 ^s 03.7
motion in 1 ^m 20647		13.526
" " 22.2118	+ 95.86	- 5 00.4
Tabular distance	14 16 17.04	-15 08 09.1
moon's age	13.51 days	
parallel	56' 49.3	
standard	15 30.55	
R =	930.85	
Augmentation	+ 7.95	
Irradiation	- 0.6	
R =	937.9	
R =	20111	
(1+a)R =	20103	
R ² =	4.0413	

734 = 8.0

431 = 8.0

6. = 4.2

$$\begin{array}{rclcl}
 -5 & -4654 & +282 & +1901 & \\
 912 - 983 = -1895 + 19 = -1876 & & & +25 & \\
 556 - 1402 = -1958 + 31 = -1927 & & & -26 & \\
 -1508 - 462 = -1970 + 42 = -1928 & & & -27 & \\
 -533 - 1429 = -1953 + 79 = -1874 & & & +27 & \\
 179091 - 891 = & +50 & & -180151 &
 \end{array}$$

$$\begin{array}{rclcl}
 \eta - m & +4082 & +189 & +3583 & \\
 -4064 + 273 = -3791 + 207 = -3584 & & & -1 & \\
 -4320 + 441 = -3879 + 295 = -3584 & & & +2 & \\
 -4298 + 619 = -3679 + 97 = -3582 & & & +1 & \\
 -5037 + 1151 = -3886 + 299 = -3587 & & & -4 & \\
 191629 + 731 & +188 & & 196131 &
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables } a & -0.6 & 2 & -80 & a - 2 = +74 & w + a = +90 \\
 \text{Obs } a & -28 & 2 & -98 & a - 2 = +70 & w + a = +57 \\
 a - 0 & +22 & +18 & & +04 & -17
 \end{array}$$

large residuals in (7-5) probably due to error in observations.

1802

Rate Constants

20

x	66858 [✓]	10.9132 [✓]	15.1674 [✓]	28.2188 [✓]
5	6.7770 [✓]	10.9688 [✓]	15.3182 [✓]	28.2721 [✓]
x-5	-912 [✓]	-556 [✓]	-15.08 [✓]	-533 [✓]

y	211356 [✓]	30.1472 [✓]	9.9405 [✓]	30.5426 [✓]
y	21.5420 [✓]	30.5792 [✓]	10.3703 [✓]	31.0463 [✓]
y-2	-4064 [✓]	-4320 [✓]	-4298 [✓]	-5037 [✓]

Rejecting (2)

x-3	-504	+42x	+1941
-912	-1057	= -1969 + 28	= -1941 = 0
-1508	-497	= -2005 + 64	= -1941 = 0
-533	-1527	= -2060 + 119	= -1941 = 0
17.9097	-958 [✓]	+ 75 [✓]	= 18.0149

y-4	+4072	+10y	+3582
-4064	+272 [✓]	= -3792 + 211	= -3581 = +1
-4298	+617 [✓]	= -3681 + 99	= -3582 = 0
-5037	+1149 [✓]	= -3888 + 305	= -3583 = -1
19.1629	+729 [✓]	+192 [✓]	= 19.6132

Tables	a = -0.6	c = -8.0	a - c = +7.4	b + d = +9.0
Obs	-4.2	-10.0	+5.8	+9.3
c - 0			+1.6	-5.3

$$\begin{array}{rclcl}
 x - \bar{x} & -46.54 & & +2.82 & +1901 \\
 -912 & -983 & = -1895 & +19 & = -1876 & = +25 \\
 -556 & -1402 & = -1958 & +31 & = -1927 & = -26 \\
 -1508 & -462 & = -1970 & +42 & = -1928 & = -27 \\
 -533 & -1420 & = -1953 & +79 & = -1874 & = +27 \\
 179091 & -891 & = & +50 & & = 180151
 \end{array}$$

$$\begin{array}{rclcl}
 y - \bar{y} & & +40.82 & +1.54 & +3583 \\
 -4064 & +273 & = -3791 & +207 & = -3584 & = -1 \\
 -4320 & +445 & = -3875 & +295 & = -3580 & = +2 \\
 -4298 & +619 & = -3679 & +97 & = -3582 & = +1 \\
 -15037 & +1151 & = -3886 & +299 & = -3587 & = -4 \\
 191629 & +731 & & +188 & & 196131
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Tables } a = -0.6 & c = -8.0 & a - c = +7.4 & b + a = +4.0 \\
 \text{obs } a = -2.8 & c = -9.8 & a - c = +7.0 & b + a = +5.7
 \end{array}$$

$$c - 0 \quad +2.2 \quad +1.8 \quad +0.4 \quad -1.7$$

large residuals in $(x - \bar{x})$ probably due to very br. stars.

1802

Rate constants

26

x	6.6858	10.9132	15.1674	28.2188
3	6.7770	10.9688	15.3182	28.2721
3-5	-912	-556	-1508	-533

y	211356	30.1472	9.9405	30.5426
y	21.5420	30.5792	10.3703	31.0463
y-y	-4064	-4320	-4298	-5037

Rejecting (2)

~~-3~~	~~-504~~	~~+422~~	~~+1941~~	
~~-912~~	~~-1057~~	~~-1969~~	~~+28 = -1941~~	~~= 0~~
~~-1508~~	~~-497~~	~~-2005~~	~~+64 = -1941~~	~~= 0~~
~~-533~~	~~-1527~~	~~-2060~~	~~+119 = -1941~~	~~= 0~~
179097	-958	+75		= 180149

y-m	+4072	+104	+3582		
-4064	+2272	-3793	+211	= -3581	= +1
-4298	+617	-3481	+99	= -3582	= 0
-5037	+1149	-3888	+305	= -3583	= -1
191629	+729	+192			= 19182

Tables	a = -0.6	b = -8.0	a - b = +7.4	b + a = +4.0
Obs	-4.2	-10.0	+5.8	+9.3
c - d			+7.6	+5.3

pt.	mag. L	resid.
1	17 7.5	+ 1.27
2	20 7.0	+ 9.6
3	23 4.7	- 1.1
4	25 7.6	- 2.6
5	27 0.0	- + 5
6	29 4.5	- 7.5
7	33 3.0	+ 14.2
8	2.5	+ 10.5

1802

Moon's Center

27

	x	$(x-x_0)$	Δx	$(x-x_0)^2$	$(x-x_0)^2 + (y-y_0)^2$	$O-C$
1	18.0000	+0.0885	+7	0.0079	4.0516	+1.27
2	17.0000	-0.9115	+7	0.8295	4.0533	+1.44
3	16.2701	-1.6410	+4	2.6916	4.0460	+7.1
4	15.9471	-1.9644	+2	3.8581	4.0460	+7.1
5	15.8992	-2.0123	0	4.0493	4.0493	+1.04
6	16.0846	-1.8269	-3	3.3386	4.0402	+1.3
7	17.0000	-0.9115	-7	0.8321	4.0573	+1.84
8	18.0000	+0.0885	-7	0.0077	4.0486	+9.7

$$\text{Comp } R^2 = 4.0389$$

	y	$y-y_0$	Δy	$(y-y_0)^2$
1	17.1536	-2.0094	-15	4.0437
2	17.3688	-1.7942	-13	3.2238
3	18.0000	-1.1630	-8	1.3544
4	18.7299	-0.4331	-3	0.1879
5	19.1630	0.0000	0	0.0000
6	20.0008	+0.8370	+6	0.7016
7	20.9576	+1.7946	+13	3.2252
8	21.1717	+2.0087	+15	4.0409

Approximate Center

$$x = 17.0 \quad y = 17.3688$$

$$\begin{array}{r} 20.9576 \\ \hline 38.3264 \\ y_0 = 19.1632 \end{array}$$

$$x = 18.0 \quad y = 17.1536$$

$$\begin{array}{r} 21.1717 \\ \hline 38.3253 \\ y_0 = 19.1626 \end{array}$$

$$y_0 = 19.1630$$

$$y - \text{min} = 17.1536$$

$$R = 2.0092$$

$$x - \text{min} = 15.8992$$

$$y_0 = 17.9086$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 17.9086 \\ y_0 = 19.1630 \end{array} \right. \quad 17.9115$$

1802

Moon's Center

27

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	180000	+0.0888	+7	0.0077	4.0516	+127
2	170000	-0.9115	+7	0.8295	4.0533	+144
3	162705	-1.6410	+4	2.6916	4.0460	+71
4	159471	-1.9644	+2	3.8581	4.0460	+71
5	158992	-2.0123	0	4.0493	4.0493	+144
6	160846	-1.8269	-3	3.3386	4.0402	+13
7	170000	-0.9115	-7	0.8321	4.0573	+189
8	180000	+0.0888	-7	0.0077	4.0486	+92

$$\text{Cumb-R}^2 = 4.0389$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	171536	-2.0094	-15	4.0437
2	173688	-1.7942	-13	3.2238
3	180000	-1.1630	-8	1.3544
4	187299	-0.4331	-3	0.1879
5	191630	0.0000	0	0.0000
6	200000	+0.8370	+6	0.7016
7	209576	+1.7946	+13	3.2252
8	211717	+2.0087	+15	4.0409

Approximate Center

$$x = 170 \quad y = 173688$$

$$\begin{array}{r} 209576 \\ 383264 \\ \hline y_0 = 191632 \end{array}$$

$$x = 180 \quad y = 171536$$

$$\begin{array}{r} 211717 \\ 383252 \\ \hline y_0 = 191626 \end{array}$$

$$y_0 = 191630$$

$$y - \text{min} = 171536$$

$$R = 2.0092$$

$$x - \text{min} = 158992$$

$$x_0 = 179086$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 179086 \\ y_0 = 191630 \end{array} \right. \quad 17.9115$$

Formation of Normals.

	ab	am	bm
1	- 0.18	+ 10.4	- 255.0
2	+ 1.63	- 131.0	- 257.5
3	+ 1.90	- 116.5	- 82.5
4	+ 0.84	- 139.0	- 30.5
5	- 0.00	- 209.0	+ 00
6	- 1.54	- 23.8	+ 10.9
7	- 1.63	- 168.0	+ 230.0
8	+ 0.18	+ 87	+ 195.5
	<u>+ 1.20</u>	<u>- 767.2</u>	<u>- 89.1</u>

1802

Moon's Center

1913-

28

Conditional Equations

	a	b	0	c	0-c
1	+0.09	-2.01	= +127	-6 + 6 = 0	+103
2	-0.91	-1.79	= +144	+62 + 6 = +68	+52
3	-1.64	-1.16	= +71	+111 + 4 = +115	-68
4	-1.96	-0.43	= +71	+133 + 1 = +134	-87
5	-2.01	+0.00	= +104	+136 - 0 = +136	-56
6	-1.83	+0.89	= +13	+124 - 2 = +122	-133
7	-0.91	+1.79	= +184	+62 - 6 = +56	+104
8	+0.09	+2.01	= +97	-6 - 6 = -12	+85

Mean Equations

Average = 86

$$-442 - 539 = +317$$

$$-466 + 464 = +302$$

$$+466 + 569 = -334$$

$$+10.33 = -32$$

$$b = -31$$

$$-442 = +317 - 17 = +300$$

$$a = -68.0$$

Normal Equations

$$+15.61 + 1.20 = -767$$

$$+1.20 + 16.78 = -89$$

$$-1.20 - 0.09 = +59$$

$$+16.69 = -30$$

$$b = -1.8$$

$$+15.61 = -767 + 2 = -765$$

$$a = -49.0$$

	0	c	0-c	0-c
1	+127	-4 + 4 = 0	+102	+127
2	+144	+45 + 3 = +48	+85	+96
3	+71	+80 + 2 = +82	-12	-11
4	+71	+96 + 1 = +97	-23	-26
5	+104	+99 - 0 = +99	+10	+5
6	+13	+90 - 2 = +88	-73	-75
7	+184	+45 - 3 = +42	+131	+142
8	+97	-4 - 4 = -8	+80	+105

Average = 64. Average = 73

1802

Innovis Center

1912

28

Conventional Equations

	a	b	0	c	0-c
1	+0.09	-2.01	+1.27	-6 + 6 = 0	+1.03
2	-0.91	-1.79	+1.44	+6 - 6 = 0	+5.2
3	-1.64	-1.16	+7.1	-11.1 - 4 = -15.1	+6.3
4	-1.96	-0.43	+7.1	+13.3 - 1 = +12.3	-8.7
5	-2.01	+0.00	+1.09	+13.6 - 0 = +13.6	-5.6
6	-1.83	+0.89	+1.3	+12.4 - 2 = +10.4	-1.33
7	-0.91	+1.79	+1.84	+6.2 - 6 = 0	+1.09
8	+0.09	+2.01	+9.7	-6 - 6 = -12	+8.5

Mean Equations

Average = 86

$$-4.42 - 5.39 = +3.17$$

$$-4.66 + 4.64 = +3.02$$

$$+4.66 + 5.69 = -3.34$$

$$+10.33 = -3.2$$

$$b = -3.1$$

$$-4.42 + 3.17 = -1.25$$

$$a = -6.80$$

Normal Equations

$$+15.61 + 1.20 = -7.67$$

$$+1.20 + 16.78 = -8.9$$

$$-1.20 - 0.09 = +5.9$$

$$+16.69 = -3.0$$

$$b = -1.8$$

$$+15.61 = -7.67 + 2 = -7.65$$

$$a = -49.0$$

	0	c	0-c	0-c
1	+1.27	-4 + 4 = 0	+1.02	+1.27
2	+1.44	-4.5 + 3 = -1.5	+8.5	+9.6
3	+7.1	-8.0 + 2 = -6.0	-1.2	-1.1
4	+7.1	-9.6 + 1 = -8.6	-2.3	-2.6
5	+1.09	-9.9 - 0 = -9.9	+1.0	+5
6	+1.3	-9.0 - 2 = -11.0	-7.3	-7.5
7	+1.84	-4.5 - 3 = -7.5	+1.51	+1.42
8	+9.7	-4 - 4 = -8	+8.0	+1.05

Average = 64. Average = 73

1802 Moon's Mean Position (1912.0)

$$\begin{array}{r}
 X_0 = 17.9115'' \\
 \frac{1}{2}a = -24 \\
 \hline
 17.9091''
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 19.1630'' \\
 \frac{1}{2}b = -1'' \\
 \hline
 19.1629''
 \end{array}$$

From Rate Constants. $X = 18.0149''$ $Y = 19.6132''$

$$\begin{array}{r}
 \bar{X} = +0.0149'' \\
 \log \bar{X} = 8.17319'' \\
 \log S = 9.98300'' \\
 \log \text{const} = 8.50724''
 \end{array}$$

$$(X-A) = 9.68295''$$

$$(X-A) = +0.48''$$

$$A = 14.17.04''$$

$$X_0 = 14.17.04.48''$$

$$\text{Redtaph place} +1.82''$$

$$X' = 14.17.06.30''$$

$$\eta = -2.3868''$$

$$\begin{array}{r}
 \log \tan S = 9.4337'' \\
 \log 32 = 6.2734'' \\
 \log \eta = 2.7599''
 \end{array}$$

$$\begin{array}{r}
 m_0 = 0.37781'' \\
 \log \text{const} = 7.33115''
 \end{array}$$

$$(S-D) = 3.04666''$$

$$S-D = -18' 33.4''$$

$$D = -15.37.05''$$

$$S_0 = -15.55.38.4''$$

$$\text{Redtaph place} -14.7''$$

$$S_1 = -15.55.53.1''$$

1802 known mean Position (1912.0)

29

$$\begin{array}{r} X = 17.9115 \\ - 24 \\ \hline 17.9091 \end{array}$$

$$\begin{array}{r} Y = 19.1630 \\ - 2 \\ \hline 19.1628 \end{array}$$

From Plate Constants $x = 18.0149$ $y = 19.6132$

$$\bar{z} = +0.0149$$

$$\eta = -2.3868$$

$$\log \bar{z} = 8.19819$$

$$\log \tan \delta = 9.4331$$

$$\cos \delta = 9.98300$$

$$\log \tan \delta = 6.2734$$

$$\cos \delta = 8.50724$$

$$\log \tan \delta = 2.7599$$

$$(d-A) = 9.68298$$

$$m_0 = 0.37787$$

$$(d-A) = + 0.48$$

$$\cos \delta = 7.33115$$

$$A = 14.17.09$$

$$(d-B) = 3.04666$$

$$d = 14.17.0448$$

$$\delta - D = -18' 33'' F$$

$$\text{Redraff place} + 1.82$$

$$D = -15.37.05$$

$$d' = 14.17.06.30$$

$$\delta = -15^{\circ} 55' 38''$$

$$\text{Redraff place} = 14.7$$

$$\delta' = -15^{\circ} 55' 53.2$$

1802

Lunar Parallax

20

$$\begin{aligned} \alpha' &= 14^h 17^m 06^s 30'' \\ \delta &= 13 \quad 12 \quad 27 35'' \\ \delta - \alpha' &= -1 \quad 04 \quad 38 97'' \\ &= -16^\circ 09' 44.55'' \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = -6 \quad 03.65''$$

$$\delta - \alpha' - \frac{1}{2}(\alpha - \alpha') = -16 \quad 03 \quad 40.9''$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \cos \frac{1}{2}(\alpha - \alpha') &= 0.00000 \\ \cos(\delta - \alpha' - \frac{1}{2}(\alpha - \alpha')) &= 9.98270 \\ \tan \phi &= 9.97457 \end{aligned}$$

$$\phi = 43 \quad 19 \quad 24.0''$$

$$\delta' = -15 \quad 55 \quad 53.2''$$

$$\phi - \delta' = 59 \quad 15 \quad 44.2''$$

$$\begin{aligned} \log \sin \phi' &= 9.82640 \\ \sin \pi &= 8.21822 \\ \sin(\phi - \delta') &= 9.93422 \\ \sin \phi &= 9.83640 \end{aligned}$$

$$\sin(\delta - \delta') = 8.19244$$

$$\delta - \delta' = 1 \quad 47 \quad 43.4''$$

$$\delta = -15 \quad 08 \quad 09.7''$$

$$\alpha = 14 \quad 16 \quad 17.81''$$

$$\text{Am Eph } \delta = -15^\circ 08' 04.1'' \quad \alpha = 14^h 16^m 17.04''$$

$$\delta - \alpha = -15.6''$$

$$+ 0.77''$$

1902

Lunar Parallax

20

$$\begin{aligned}
 \alpha' &= 19^h 17^m 06^s 30 \\
 \theta &= 13 \quad 12 \quad 27.55 \\
 G-X' &= -1 \quad 04 \quad 38.91 \\
 &= -16^m 09^s 43.65
 \end{aligned}$$

$$\delta = -15^\circ 55' 53.1''$$

$$\pi = 56' 49.3''$$

$$\frac{1}{2}(\alpha - \alpha') = -6 \quad 03 \quad 65$$

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

$$\sin \pi = 8.21822$$

$$(G-X') = 9.44460$$

$$\cos \delta' = 9.98466$$

$$7.54729$$

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

$$G-X' - \frac{1}{2}(\alpha - \alpha') = -16 \quad 03 \quad 40.9$$

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

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

$$\alpha - \alpha' = -12' 07.30''$$

$$\cos(G-X' - \frac{1}{2}(\alpha - \alpha')) = 9.98279$$

$$= -48.49'$$

$$\tan f = 9.97457$$

$$f = 43 \quad 29 \quad 24.0$$

$$\delta' = -15^\circ 55' 53.2''$$

$$\delta - \delta' = 59 \quad 15 \quad 44.2$$

$$\log \sec \phi' = 9.82640$$

$$\sin \pi = 8.21822$$

$$\sin(\delta - \delta') = 9.93422$$

$$\sin f = 9.83640$$

$$\sin(\delta - \delta') = 8.14244$$

$$\delta - \delta' = 1 \quad 45 \quad 43.4$$

$$\delta = -15^\circ 08' 09.9''$$

$$\alpha = 14 \quad 16 \quad 17.81$$

$$\text{Ann. Eph. } \delta = -15^\circ 08' 09.1''$$

$$\alpha = 14^h 16^m 17.04^s$$

$$G - G = 56$$

$$+ 0.77$$

