

KG

11366

v. 913

XXXVII



Plates

1697.

1702

1703



551

Harvard Lunar Plates.

Measures and Reductions.

Mary Fowler

Volume XXXVII

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MC 1697

1913 Oct 10.

1

Stars - Mercator.

α	δ	α	δ	α	δ	α	δ
1	16970	19712	19275	19122			
11.8	12888	13809	17130	11270			
31.5	83	0909	20	7973			
	77	15	82	30			
	<u>31.4086</u>	<u>.4095</u>	<u>11.7849</u>	<u>.7854</u>			
2	18129	17110	17818	16751			
12.1	17565	13690	8929	15650			
12.6	7072	0502	3030	4650			
	29	20	28	60			
	<u>12.6560</u>	<u>.6586</u>	<u>12.1103</u>	<u>1103</u>			
3	15510	16779	14950	16240			
27.8	8145	14150	12550	8625			
18.7	3545	6065	5050	2920			
	10	88	55	6250			
	<u>18.7368</u>	<u>.7373</u>	<u>27.7599</u>	<u>.7623</u>			

Grade 2

Additional Stars

4	19097	15830	11900	17580
27.9	14765	10172	11450	8099
32.5	7166	7571	5045	0990
	87	42		
	<u>32.4326</u>	<u>.4336</u>	<u>27.9548</u>	<u>.9571</u>

MC1697

1913 Period

1

Stars - measures

	d	N	d ²	N
1	16970	19712	19275	19122
11.5	12885	13809	17130	11270
11.5	83	6909	20	7973
	77	15	82	30
	<u>314086</u>	<u>4095</u>	<u>117849</u>	<u>7854</u>
2	18129	17110	17818	16751
12.1	12565	13690	8929	15650
12.6	7072	0502	30	46
	29	20	28	60
	<u>126560</u>	<u>6586</u>	<u>121103</u>	<u>1103</u>
3			14910	16240
27.8	15510	16779	12550	8625
18.7	8145	14150	50	29
	35-45	60	55	6250
	10	88	2775	7623
	<u>187368</u>	<u>7373</u>	<u>277599</u>	

Grade 2

Additional Stars

4	19097	15830	11900	17580
27.9	14765	10172	11450	8009
32.5	71	75-71	50	6910
	87	42		
	<u>324326</u>	<u>4336</u>	<u>279548</u>	<u>9571</u>

MC1697

known-measures.

2

$\frac{1}{16.0}$ 15520 18900
 $\frac{18.8}{16.0}$ 742840 1696060
 $\frac{18.8}{16.0}$ 34 60
 $\frac{18.8}{16.0}$ 55-10 94
18.8078 8061

$\frac{2}{15.8}$
 $\frac{19.0}{15.8}$

$\frac{14885}{1356060}$
 $\frac{14885}{1356060}$ 5060
 $\frac{14885}{1356060}$ 00
15.8670

$\frac{19676}{1000820}$
 $\frac{19676}{1000820}$ 15-20
 $\frac{19676}{1000820}$ 90
8674

$\frac{3}{15.6}$
 $\frac{20.0}{15.6}$

$\frac{18838}{1437195}$
 $\frac{18838}{1437195}$ 85-95
 $\frac{18838}{1437195}$ 60
15.5536

$\frac{18671}{1313030}$
 $\frac{18671}{1313030}$ 30
 $\frac{18671}{1313030}$ 99
5555

$\frac{4}{15.6}$
 $\frac{20.1}{15.6}$
 $\frac{21.0}{15.6}$

$\frac{17845}{133826870}$
 $\frac{17845}{133826870}$ 60
15.5521

$\frac{18680}{1314144}$
 $\frac{18680}{1314144}$ 5044
 $\frac{18680}{1314144}$ 00
5545

$\frac{5}{15.7}$
 $\frac{21.0}{15.7}$

$\frac{16850}{1435550}$
 $\frac{16850}{1435550}$ 4050
 $\frac{16850}{1435550}$ 62
15.7495

$\frac{17665}{1020595}$
 $\frac{17665}{1020595}$ 9595
 $\frac{17665}{1020595}$ 80
7478

$\frac{6}{16.0}$
 $\frac{21.5}{16.0}$

$\frac{15500}{1161126}$
 $\frac{15500}{1161126}$ 26
 $\frac{15500}{1161126}$ 16
21.4186

$\frac{17400}{1160085}$
 $\frac{17400}{1160085}$ 95-85
 $\frac{17400}{1160085}$ 94
4196

MC1697

known - measures

2

	<u>1</u>	<u>15520</u>	<u>18900</u>
160	742840	1696060	
188	34	60	
	95-10	94	
	<u>188078</u>	<u>8061</u>	

2
158
19.0

14885-
1356060
5060
00
158670

17676
1000820
15-20
90
8674

3
116
20.0

18838
1437195-
85-95
60
155536

18671
1313030
30
99
5555

4
156
20.1
20.1
20.1

17845-
1338270
6870
60
155521

18680
1314144
5044
00
5545

5
157
21.0

16850
1435550
4050
62
157495

17665-
1020595-
95-95
80
7478

6
160
21.5

	<u>15500</u>	<u>17400</u>	1
160	1161126	1160085-	
21.5	26	95-85	
	16	94	
	<u>214186</u>	<u>4196</u>	

MC1697

4

known

3

7
16.6
22.0

cl
16635
13450
3440
60
16.6798

w
16570
972310
29
80
6856

8
17.0 14818 15080
22.7 1350060 643550
85 47
26 70
22.1324 1373

9
17.8 14830 14073
22.2 1230566 660500
10 60
max 35 80
w 22.2524 12524

10
18.6 possibly on
22.0 terminator

14268 14760
1114250 791510
0945 00
81 80
18.6864 6866

11
19.0 18473 18344
21.8 1042841 1635660
30 53
75 52
21.8042 8010

18354 17681
14640 113579
3832 6059
68 80
19.6274 6321

12
19.6
21.0

MC 1697 a 7 known

7
166
220

cl
16635
13450
3440
60
166795

16570
972310
29
80
6856

8
170 14818 15080
228 1350060 643550
8560 47
26 70
221324 1373

9
178 14830 14073
222 1230560 660500
1060 60
max 35 80
222524 2524

10
186 possibly on
220 terminator

14268
1114250
0945
81
186864

14760
791510
00
80
6866

11
190 18473 18344
218 1042841 1635660
30 53
75 52
218042 8010

12
19.6
21.0

18359
14640
3832
68
196274

176.81
1135959
6059
80
6321

MC1697 Times etc.

Eph to stars	1912 Mar 2, 12 ^h 04 ^m	- 12 ^h 16 ^m
... Moon	12 10 25.4	- 12 10 25.8
Clock Slow	1 45.7	
H Sid T.	12 12 11.3	
H long	4 44 31.05	
G. Sid T.	16 56 42.35	
Sid T. Method	22 39 37.50	
Interval	18 17 04.85	
Reduction	2 59.73	
G. M. T.	18 14 05.12	$\delta - \alpha = 1^h 21^m 28^s$

From Hunt Alm. R. A. Decl.

Moon 18 ^h	10 ^h 50 ^m	11 ^h 9 ^m 1 ^s	+ 11 ^h 10 ^m 41 ^s
Motion in T = 2.2298			16.128
14.0853	+	31.41	- 3 47.2
Tabular place	10 50	43.32	+ 11 06 53.9

Moon's parallax 60' 01.7

939 = 12.7	- semi diam.	16' 22.8
983 = 14.1	Augment	R = 982.8
	Argument	+ 14.1
	Irradiation (2)	- 0.5
	R =	996.4
	R =	2135.9
a = -2.8	(1+a) R =	2135.3
	R ² =	4559.5

MC1697 *Taurus etc*
 Exh. stars 1912 Mar 2, 12^h 04^m - 12^h 16^m
 Moon 12 10 254 - 12 10 258
 Clock show 1 457

H Ind T 12 12 113
 H long 4 44 3105
 G Ind T 16 56 4235
 Sid T Ind T 22 39 3750
 Ind T 18 17 0485
 Radiation 2 5973
 G Ind T 18 14 0512 0-4-1^h 21^m 28^s

from bank Alms R G black
 Moon 18^h 10^h 50^m 11^h 91^m + 11^h 10^m 41^s
 Motion = 2 2298 - 16.128
 140853 + 3141 - 3 472
 Tabular place 10 50 4332 + 11 - 06 539

Moon's parallax
 semidiam 16' 22"
 430 = 127
 483 = 141
 semidiam R = 9828
 semidiam R = 9964
 semidiam R = 21359
 (1+a) R = 21353
 R = 95595
 a = -2.8

Repeating star (3)

$$\begin{array}{rclcl}
 10 - \frac{1}{3} & -0.34 & +2.8x & +1.0241 & \\
 -1.0264 - 9 & = -1.0273 + 33 & = -1.0240 & = +6 & \\
 -1.0271 - 4 & = -1.0275 + 34 & = -1.0241 & = 0 & \\
 -1.0309 - 10 & = -1.0319 + 78 & = -1.0241 & = 0 & \\
 \text{mean} & 17.6895 - 6 & +49 & = 18.7179 & \\
 & & 71 & &
 \end{array}$$

$$\begin{array}{rclcl}
 4 - 71 & +3.3x & +0.74 & -2858 & \\
 +2796 + 39 & = +2835 + 22 & = +2857 & = -1 & \\
 +2808 + 40 & = +2848 + 9 & = +2857 & = -1 & \\
 +2744 + 92 & = +2836 + 23 & = +2859 & = +1 & \\
 \text{mean} & 20.1145 + 58 & +14 & = 19.8359 & \\
 & & 71 & &
 \end{array}$$

MC1697

Plate constants

5

	1	2	3	4
x	117852	121103	277611	279560
y	128116	131374	287945	289869
$x-3$	-10264	-10271	-10334	-10309
y	314090	126573	187370	324331
η	311294	123765	184630	321587
$y-\eta$	+2796	+2808	+2740	+2744

Preliminary Red.

$x-3$	-0.59	+32	+1.0247
-1.0264 - 16 = -1.0280 + 35 = -1.0245			= +2
-1.0271 - 6 = -1.0277 + 36 = -1.0241			= +6
-1.0334 - 9 = -1.0343 + 83 = -1.0260			= -13
-1.0309 - 16 = -1.0325 + 84 = -1.0241			= +6

$y-\eta$	+42	-2851
+2796 + 47 = +2843		= -8
+2808 + 48 = +2856		= +5
+2740 + 111 = +2851		= +0
+2744 + 112 = +2856		= +5

Tables	$a = 0.0$	$e = -1.6$	$a - e = +1.6$	$b + a = -1.1$
Obs.	$a = -3.6$	$a = -0.2$	$a - e = -3.4$	$b + a = -2.8$
$C - O =$			$a - e = +5.0$	$b + a = +1.7$

Rejecting star 3)

Obs	$a = -2.8$	$e = -0.7$	$a - e = -2.1$	$b + a = -3.0$
$C - O$	$a = +2.8$	$e = -0.9$	$a - e = +3.7$	$b + a = +1.9$

M61697

Plate constants

5

	1	2	3	4
2	117852	121103	277611	279560
3	128116	131374	287945	289869
2-3	-10264	-10271	-10334	-10309
4	314090	126573	187370	324331
7	311294	123765	184630	321587
7-7	+2796	+2808	+2740	+2744

$$\begin{array}{rclcl}
 x-5 & -0.54 & +32 & +1.0247 & 4 \\
 -10264 - 16 = -10280 + 35 = -10245 & = & +2 \\
 -10271 - 6 = -10277 + 36 = -10241 & = & +6 \\
 -10334 - 9 = -10343 + 83 = -10260 & = & -13 \\
 -10309 - 16 = -10325 + 84 = -10241 & = & +6
 \end{array}$$

$$\begin{array}{rclcl}
 y-7 & +42 & -2851 & & \\
 +2796 + 47 = +2843 & = & -8 \\
 +2808 + 48 = +2856 & = & +5 \\
 +2740 + 111 = +2851 & = & +0 \\
 +2744 + 112 = +2856 & = & +5
 \end{array}$$

$$\begin{array}{rclcl}
 \text{Tables} & a = 0.0 & b = -1.6 & a-b = +1.6 & b+a = -1.6 \\
 \text{Obs.} & a = -3.6 & b = -0.2 & a-b = -3.4 & b+a = -3.8 \\
 C-O = & & & C-b = +5.0 & C+a = +1.7
 \end{array}$$

Repeating star 31

$$\begin{array}{rclcl}
 \text{Obs} & a = -2.8 & b = -0.7 & a-b = -2.1 & b+a = -3.5 \\
 C-O & a = +2.8 & b = -0.9 & a-b = +3.7 & b+a = +1.9
 \end{array}$$

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1.	19.0000	+1.3073	+2	1.7096	4.5650	+55
12	19.6298	+1.9371	+2	3.7531	4.5402	-193

	y	$y - y_0$	Δy	$(y - y_0)^2$
11	21.8026	+1.6896	+2	2.8554
12	21.0000	+0.8870	+2	0.7871

	pt.	pos. $\angle$	resid
	1	232.3	+51
	2	238.7	+40
$\frac{1}{2}$ wt	3	267.0	+118
	4	270.0	+38
	5	294.5	-85
	6	307.7	-33
$\frac{1}{2}$ wt	7	331.9	+95
	8	341.1	-19
	9	0.0	+119

NGC 1697

Lagoon's Center

6.

	y	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	16.0000	-1.6927	-1	2.8655	4.5714	+119
2	15.8672	-1.8255	-1	3.3326	4.5718	+123
3	15.5545	-2.1382	0	4.5719	4.5847	+252
4	15.5533	-2.1394	0	4.5770	4.5770	+175
5	15.7486	-1.9441	+1	3.7791	4.5661	+66
6	16.0000	-1.6927	+1	2.8649	4.5710	+115
7	16.6827	-1.0100	+2	1.0197	4.5812	+217
8	17.0000	-0.6927	+2	0.4796	4.5681	+86
9	17.6927	0.0000	+2	0.0000	4.5779	+184
10	18.6865	0.9938	+2	0.9880	4.5495	hole.
Computed R^2				4.5595		

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	18.8070	-1.3060	-1	1.7059
2	19.0000	-1.1130	-1	1.2390
3	20.0000	0.1130	0	0.0128
4	20.1130	0.0000	0	0.0000
5	21.0000	0.8870	+1	0.7870
6	21.4191	+1.3061	+1	1.7061
7	22.0000	+1.8870	+2	3.5615
8	22.1348	+2.0218	+2	4.0885
9	22.2524	+2.1394	+2	4.5779
10	22.0000	+1.8870	+2	3.5615

Approximate Center

$$x = 16.0 \quad y = 18.8070$$

$$21.4191$$

$$40.2261$$

$$\text{mean } y = 20.1130$$

$$y - \text{max} = 22.2524$$

$$R = 2.1394$$

$$z - \text{min} = 15.5533$$

$$y_0 = 17.6927$$

$$y \sim 20. \quad x = 16.6827$$

$$18.6865$$

$$35.3692$$

$$\text{mean } x = 17.6846$$

$$y = 21.0 \quad x = 15.7486$$

$$19.6298$$

$$35.3784$$

$$x_0 = 17.6892$$

$$\text{Center } \begin{cases} x_1 = 17.6927 \\ y_0 = 20.1130 \end{cases}$$

1161697

Linear Center

6.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - 0$
1	160000	-1.6927	-1	2.8655	4.5714	+1.19
2	158672	-1.8255	-1	3.3324	4.5718	+1.23
3	155545	-2.1382	0	4.5717	4.5447	+2.52
4	155533	-2.1394	0	4.5770	4.5770	+1.75
5	157486	-1.9441	+1	3.7791	4.5661	+1.66
6	160000	-1.6927	+1	2.8649	4.5710	+1.15
7	166827	-1.0100	+2	1.0197	4.5812	+2.17
8	170000	-0.6927	+2	0.4796	4.5681	+1.86
9	176927	0.0000	+2	0.0000	4.5779	+1.89
10	186865	0.9932	+2	0.9880	4.5495	
Comp R^2					4.5595	

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	188070	-1.3060	-1	1.7059
2	190000	-1.1130	-1	1.2390
3	200000	-0.1130	-0	0.0128
4	201130	0.0000	0	0.0000
5	210000	0.8870	+1	0.7870
6	219191	-1.3061	+1	1.7061
7	220000	-1.8870	+2	3.5615
8	221398	-2.0218	+2	4.0885
9	222524	-2.1394	+2	4.5779
10	220000	-1.8870	+2	3.5615

Approximate Center

$$x = 160 \quad y = 188070$$

$$214191$$

$$402261$$

$$\text{mean } y = 201130$$

$$y - \text{mean} = 222524$$

$$R = 21394$$

$$x - \text{mean} = 155533$$

$$x_0 = 176927$$

$$y = 220 \quad x = 166827$$

$$186865$$

$$353692$$

$$\text{mean } x = 17.6846$$

$$\text{Center } \begin{cases} x = 176927 \\ y = 201130 \end{cases}$$

Formation of Normals

	ab	an	bn
1	+ 2.21	- 201.1	- 155.9
2	+ 2.03	- 225.1	- 136.5
3	+ 0.06	- 134.8	- 7.6
4	- 0.00	- 374.5	+ 0.0
5	- 1.73	- 128.0	+ 58.7
6	+ 2.21	- 194.4	+ 150.6
7	- 0.49	- 56.2	+ 102.5
8	- 1.39	- 59.3	+ 173.7
9	+ 0.00	+ 0.0	+ 393.8
	- 1.52	- 1373.4	+ 579.3

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Conditional Equations.

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	a	b	0	c	0-c	
1	-1.69	-1.31	-7119	+108-40 = +68	+51	
2	-1.83	-1.11	-7123	+117-34 = +83	+40	
3	-2.14	-0.11	-7252	+137-3 = +134	+118	+59
4	-2.14	+0.00	-7175	+137+0 = +137	+38	
5	-1.94	+0.89	+66	+124+27 = +151	-85	
6	-1.69	+1.31	+115	+108+40 = +148	-33	
7	-1.01	+1.89	+217	+65+57 = +122	+95	+48
8	-0.69	+2.02	+86	+44+61 = +105	-19	
9	+0.00	+2.14	+184	+0+65 = +65	+119	

Average = 66

Normal Equations

$$+20.69 - 1.52 = -1373$$

$$-1.52 + 15.89 = +579$$

$$+1.52 - 0.11 = -101$$

$$+15.78 = +478$$

$$b = +30.3$$

$$-0.15 + 1.52 = +56$$

$$+20.54 = -1317$$

$$a = -64.1$$

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Conditional Equations

7

	a	b	c		c	0-c
1	-1.69	-1.31	-7.119	+108	-40	+68
2	-1.83	-1.11	-7.123	+117	-34	+83
3	-2.14	-0.11	+2.52	+137	-3	+134
4	-2.14	+0.00	+1.75	+137	+0	+137
5	-1.94	+0.89	+6.6	+124	-27	+151
6	-1.69	+1.31	+1.15	+108	+40	+148
7	-1.01	+1.89	+2.17	+165	+57	+122
8	-0.69	+2.02	+5.6	+44	+61	+105
9	+0.00	+2.14	-1.84	+0	+65	-65

Average = 66

Normal Equations

$$\begin{aligned}
 +20.69 - 1.52 &= -137.3 \\
 -1.52 + 15.89 &= +57.9
 \end{aligned}$$

$$\begin{aligned}
 +1.52 - 0.11 &= -10.1 \\
 +15.78 &= +47.8
 \end{aligned}$$

$$b = +30.3$$

$$\begin{aligned}
 -0.15 + 1.52 &= +5.6 \\
 +20.54 &= -131.7
 \end{aligned}$$

$$a = +64.1$$

1697 Rea. ad. l. app.

 $\delta_0 = +10^\circ 35'$

$$H + \alpha \quad 6 \quad 07 = 94^\circ 45'$$

$$H \quad 19 \quad 17$$

$$\alpha_0 \quad 10 \quad 50$$

$$G \quad 18 \quad 28$$

$$G + \alpha \quad 5 \quad 18 = 79^\circ 30'$$

$$\begin{array}{r} \ell \cos S \quad 99926 \\ \dots \quad 0.8899m \\ \hline \dots (2) \quad 08825m \end{array}$$

$$\ell \cos(G + \alpha) \quad 9.2606$$

$$q \quad 0.9522$$

$$\sin \quad 99927$$

$$\tan S \quad 92715$$

$$\frac{1}{\tan} \quad 8.8239$$

$$(S') \quad 02128$$

$$(g) \quad 90403$$

$$\begin{array}{r} \ell \sin S \quad 92640 \\ \dots \cos(H + \alpha) \quad 84848m \end{array}$$

$$h \quad 1.2774$$

$$\sin \quad 99948$$

$$\sec S \quad 00074$$

$$\frac{1}{\sin} \quad 8.8239$$

$$(h') \quad 90262m$$

$$(h) \quad 01085$$

$$\begin{array}{r} f \quad +0.15 \\ S \quad +0.11 \\ h \quad +1.28 \\ \hline \quad +1.54 \end{array}$$

$$\begin{array}{r} g' \quad +1.63 \\ h' \quad -0.11 \\ i \quad -7.63 \\ \hline \quad -6.11 \end{array}$$

1697 Moon's Mean Position (1912.0)

$$\begin{array}{r}
 X_0 = 17\ 69\ 27^{\circ} \quad Y_0 = 20\ 11\ 30^{\circ} \\
 \frac{1}{2}a = -32^{\circ} \quad \frac{1}{2}b = +15^{\circ} \\
 \hline
 17.6895^{\circ} \quad 20.1145^{\circ}
 \end{array}$$

~~From Prelim Reduction~~From Plate Constants $x = 18.7179^{\circ}$ $y = 19.8359^{\circ}$

$$\begin{array}{r}
 z = +0.7179^{\circ} \\
 \log z = 9.85606^{\circ} \\
 \text{ws } \delta = 9.99255^{\circ} \\
 \text{const} = 8.50724
 \end{array}$$

$$\begin{array}{r}
 (x - A) = 1.35627^{\circ} \\
 \text{"}
 \end{array}$$

$$x - A = +22.71^{\circ}$$

~~x~~

$$A = 10\ 49\ 16^{\circ}$$

$$x_0 = 10\ 49\ 38.71^{\circ}$$

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

$$x' = 10\ 49\ 40.25^{\circ}$$

$$\eta = -2.1641^{\circ}$$

$$\begin{array}{r}
 \log \tan \delta = 9.2708^{\circ} \\
 \text{" } \frac{1}{2} = 9.7121^{\circ}
 \end{array}$$

$$\text{" } \eta_1 = 6.0363^{\circ}$$

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

$$\eta_0 = -2.1642^{\circ}$$

$$\begin{array}{r}
 \log \eta_0 = 0.33530^{\circ} \\
 \text{ws } = 7.33115^{\circ}
 \end{array}$$

$$(x - D) = 3.00415^{\circ}$$

$$x - D = -16\ 49.6^{\circ}$$

$$D = +10\ 51\ 51^{\circ}$$

$$S_0 = +10\ 35\ 01.4^{\circ}$$

$$\text{Red } = -6.1^{\circ}$$

$$x' = +10\ 34\ 55.3^{\circ}$$

1697 Moon's mean Position 1912.0

$$X_0 = 17.6927 \quad Y_0 = 20.1130$$

$$\begin{array}{r} \text{2a} = -32 \\ \hline 17.6895 \end{array} \quad \begin{array}{r} \text{2b} = +15 \\ \hline 20.1145 \end{array}$$

~~From Precession Reduction~~From Plate Constants $x = 18.7179 \quad y = 19.8359$

$$z = +0.7179$$

$$\eta = -2.1641$$

$$\log z = 9.85606$$

$$\log \delta = 9.99255$$

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

$$\log \tan \delta = 9.2708$$

$$\log \frac{1}{z} = 9.7121$$

$$\log \eta_1 = 6.0363$$

$$\eta_1 = +1$$

$$\log(x-A) = 1.35627$$

$$d-A = +22.71$$

$$\eta_0 = -2.1642$$

~~x~~

$$\log \eta_0 = 0.33530$$

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

$$A = 10 \quad 49 \quad 16$$

$$(d-D) = 3.00415$$

$$x_0 = 10 \quad 49 \quad 38.71$$

$$S-D = -16 \quad 49.6$$

$$D = +10 \quad 51 \quad 51$$

$$S_0 = +10 \quad 35 \quad 01.4$$

Residuals?

	C	O	O-C
- 4 - 17 + 16 = -5	0	+5	
- 5 - 7 + 16 = +4	0	-4	
- 10 - 10 + 16 = -4	+1	+5	
- 10 - 17 + 16 = -11	-16	-5	

+ 6 + 18 - 19 = +5	-1	-6
+ 7 + 7 - 19 = -5	0	+5
+ 14 + 10 - 19 = +5	0	-5
+ 14 + 18 - 19 = +13	+19	+6

- ~~7~~ + 14 + 2 = +9	+2	-7
- ~~7~~ + ~~8~~ 5 + 2 = 0	+6	+6
- 16 + 8 + 2 = -6	-13	-7
- 16 + 14 + 2 = 0	+6	+6

7)					
+ 4 - 7 - 0 = -3	-8	-5			
+ 4 - 3 - 0 = +1	+5	+4			
+ 9 - 4 - 0 = +5	0	-5			
+ 9 - 8 - 0 = +1	+5	+9			

1696-1697

Plate constants

9

		1696		1697	
a	b	x-3	y-n	x-3	y-n
+12.81	+31.13	0	-1	+2	-6
+13.14	+12.38	0	0	+6	+5
+28.79	+18.46	+1	0	-13	0
+28.99	+32.16	-16	+19	+6	+5
+12.98	+21.76	0.00	-0.50	+4.00	-1.50
+28.89	+25.31	-7.50	+9.50	-3.50	+2.50
+20.96	+15.42	+0.50	0.00	-3.50	+2.50
+20.90	+31.64	-8.00	+9.00	+4.00	-1.50
-15.91	-3.55	+7.50	-10.00	+7.50	-4.00
+0.06	-16.22	+8.50	-9.00	-7.50	+4.00
-0.06	-0.13	+0.28	-0.38	+0.28	-0.15
	-16.35	+8.78	-9.38	+7.22	+3.85
	b =	-0.54	+0.57	+0.44	-0.24
	a =	-0.35	+0.50	-0.57	+0.31

1696

0.0	-7.5	+0.5	-8.0
+4.5	+10.1	+7.3	+7.3
+11.7	+13.6	+8.3	+17.1
+16.2	+16.2	+16.1	+16.4

c for (x-3)

-0.5	+9.5	0.0	+9.0
-6.5	-14.4	-10.5	-10.4
-12.3	-14.4	-8.8	-18.0
-19.3	-19.3	-19.3	-19.4

c for (y-n)

1697

+4.0	-3.5	-3.5	+4.0
+7.4	+16.4	+12.0	+17.9
+9.5	+11.1	+6.8	+13.9
+15.9	+15.8	+1.7	2.0

c for (x-3)

-1.5	+2.5	+2.5	-1.5
-4.0	-9.0	-6.5	-6.5
+5.2	+6.1	+3.7	+7.6
-0.3	-0.4	-0.3	-0.4

c for (y-n)

1696-1697 Plate constants

9

1696				1697			
a		b		x-3		y-4	
+1281	+3113	+11	0	-1		+2	-8
+1319	+1238	+11	0	0		+6	+5
+2879	+1846	+11	+1	0		-13	0
+2899	+3216	+11	-16	+19		+6	+5
+1298	+2176	+11	0.00	-0.50		+4.00	-1.50
+2889	+2531	+11	-7.50	+9.50		-3.50	+2.50
+2096	+1542	+11	+0.50	0.00		-3.50	+2.50
+2090	+3164	+11	-8.00	+9.00		+4.00	-1.50
-1591	-355	=	+7.50	-10.00		+7.50	-4.00
+006	-1622	=	+8.50	-9.00		-7.50	+4.00
-006	-013	=	+0.28	-0.38		+0.28	-0.15
	-1635	=	+8.78	-9.38		+7.22	+3.85
	b =		-0.54	+0.57		+0.44	-0.24
	a =		-0.35	+0.50		-0.57	+0.31

1696

0.0	-7.5	+0.5	-8.0
+4.5	+10.1	+7.3	+7.3
+11.7	+13.6	+8.3	+17.1
+16.2	+16.2	+16.1	+16.4

C for (x-3)

-0.5	+9.5	0.0	+9.0
-6.5	-14.4	-10.5	-10.4
-12.3	-14.4	-8.8	-18.0
-19.3	-19.3	-19.3	-19.4

C for (y-4)

1697

+4.0	-3.5	-3.5	+4.0
+7.4	+10.4	+17.0	+17.9
+9.5	+11.1	+6.8	+13.9
+18.9	+18.8	+11.7	2.0

C for (x-3)

-1.5	+2.5	+2.5	-1.5
-4.0	-9.0	-6.5	-6.5
+10.2	+6.1	-3.7	+7.6
-0.3	-0.4	-0.3	-0.4

C for (y-4)

1197 Linear Parallax

$$\begin{array}{r}
 \alpha' = 10^h 49^m 40.25'' \\
 \delta = 12 \quad 12 \quad 11.3'' \\
 + 1 \quad 22 \quad 31.0'' \\
 + \quad 20 \quad 37' 45'' \\
 + \quad \quad \quad 7 \quad 58'' \\
 + \quad 20 \quad 29 \quad 47''
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.02840 \\
 \hline
 9.98567
 \end{array}$$

$$\begin{array}{r}
 \delta = 44 \quad 03 \quad 17'' \\
 10 \quad 34 \quad 55'' \\
 33 \quad 28 \quad 22''
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.24206 \\
 9.741158 \\
 0.15780 \\
 \hline
 79.6784
 \end{array}$$

$$\delta - \delta' = +31 \quad 55.5''$$

$$\delta = +11 \quad 06 \quad 50.8''$$

$$\text{True } \delta = +11 \quad 06 \quad 53.9''$$

$$0 - c = -3.1''$$

$$\delta' = +10 \quad 34' 55.3''$$

$$\pi = 60' 01.7''$$

$$\begin{array}{r}
 9.86913 \\
 8.24206 \\
 9.54692 \\
 0.00823 \\
 \hline
 7.66634
 \end{array}$$

$$\alpha - \alpha' = +15' 56.67''$$

$$= +1'' 03.78''$$

$$\alpha = 10 \quad 50 \quad 44.03''$$

$$\alpha = 10 \quad 50 \quad 43.32''$$

$$+0.71''$$

1197

Linear Penetration

$$\begin{array}{r} 10^{\circ} \quad 49' \quad 40.25'' \\ 6 - \quad 12 \quad 12 \quad 11.3 \\ - 1 \quad 22 \quad 31.0 \\ + \quad 20^{\circ} \quad 37' \quad 45'' \\ + \quad \quad \quad 7 \quad 58 \\ - \quad 20 \quad 29 \quad 47 \end{array}$$

$$\begin{array}{r} 995727 \\ 000000 \\ 002840 \\ \hline 998567 \end{array}$$

$$\begin{array}{r} 8 - \quad 44 \quad 03 \quad 17 \\ \quad 10 \quad 34 \quad 55 \\ \quad 33 \quad 28 \quad 22 \end{array}$$

$$\begin{array}{r} 982640 \\ 824206 \\ 974158 \\ 015780 \\ \hline 796784 \end{array}$$

$$\delta - \delta' = \quad + 31 \quad 55.5''$$

$$\delta = - 11 \quad 06 \quad 50.8''$$

$$\text{transl. } \delta = + 11 \quad 06 \quad 53.9''$$

$$0 - c \quad \quad \quad - 3.1$$

$$\delta = + 10^{\circ} \quad 34' \quad 51.3''$$

$$\delta = \quad 60' \quad 01.7''$$

$$\begin{array}{r} 986913 \\ 824206 \\ 954692 \\ 009823 \\ \hline 766634 \end{array}$$

$$\delta - \delta' = + 15' \quad 56.67''$$

$$\delta = + 1^{\circ} \quad 03.78''$$

$$\lambda = 10 \quad 50 \quad 44.03$$

$$\lambda = 10 \quad 50 \quad 43.33$$

$$+ 0.7$$

MC 1202 Stars - measures. 1913 Oct 13

11

	d	N	d	N
✓	17110	16710	17388	18079
8.9	11230	12610	16126	9310
11.5	30	10	22	20
18		05	80	71
5.7	11.5885	5903	8.8736	8755
2	11090	11330	16900	16673
12.5	90	11125	12378	11170
29.0	10892	20	80	60
17.7	48.9802	9292	125484	5502
3	18910	19402	16075	14572
27.2	15979	12329	7980	12642
18.4	5285	1936	8990	4041
	08	00	65	70
	18.2927	2927	27.1919	1931

elongated images.
Exposure grade (4)

MC 1702

Star-measures. 1913 Oct 12

11

	d	y	n	d	x	n
✓	17110		16710	17388		18079
8.9	11230	28	12610	16126	20	9310
11.1	30		10	22		2021
	18		05	80		71
✓	<u>115885</u>		<u>5903</u>	<u>88736</u>		<u>8755</u>
2	11090	90	11330	16900		16673
12.5	90		11125	12378	76	11170
29.0	10892		20	80		6070
✓				88		65
77	<u>89802</u>		<u>9792</u>	<u>125484</u>		<u>5502</u>
3	18910		19402	16075		14572
212	15979	85	12329	7980		12642
18.4	82		19	89	90	4041
	08		00	65		70
	<u>182927</u>		<u>2927</u>	<u>271919</u>		<u>1931</u>

elongated images
exposure grade (4)

1101702

a

4 known measures

n

a

x

n

12

1 17687
 17.7 12903 20
 17.5 20
 min 73
 w
 y 17.4766

17720
 1248984
 9184
 12
 4772

2
 18.0 16687
 17.5 11620 26
 25
 73
 17.5056

17725
 1275952
 56
 11
 5038

3
 19.0 11545 40
 17.9 59
 11250

12978
 12720 8
 15

17.9702

9740

4
 19.6
 19.0

16802
 13179
 8185
 02

17320
 10898
 95-99
 00

19.6380

6411

5
 19.7
 19.5
 max
 w
 x

15001
 12090
 8181
 00

16310
 9190
 0000
 98

19.7083

7105

14988
 11502
 05-10
 90

15273
 8720
 35-40
 60

19.6517

6532

1912phae.prj.10

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1912phae.prj.10

Aug 70 ~

known measures

12

 α

4

22

 α

3

$$\begin{array}{r}
 17687 \\
 12903 \quad 20 \\
 20 \\
 73 \\
 \hline
 174766
 \end{array}$$

$$\begin{array}{r} 17720 \\ 12489 \\ 9184 \\ 12 \\ \hline 4772 \end{array}$$
$$\begin{array}{r} 2 \\ \hline 180 - 16687 \\ 175 \quad 1162026 \\ \quad \quad 25 \\ \quad \quad 73 \\ 17.5056 \end{array}$$
$$\begin{array}{r} 17725 \\ 1275952 \\ \hline 56 \\ 11 \\ \hline 2038 \end{array}$$

3
19.0 115-45-40
17.9 59
1125-0

12978
127208
11

179702

9740

4
19.6
19.0

$$\begin{array}{r} 16802 \\ 13775- \\ \hline 02 \end{array}$$
$$\begin{array}{r} 17320 \\ 10898 \\ \hline 95-99 \\ 00 \end{array}$$

19.6380

6911

$\frac{5}{19.7}$
 $\frac{19.5}{19.7}$
 $\frac{19.5}{19.7}$
 $\frac{19.5}{19.7}$
 $\frac{19.5}{19.7}$

$$\begin{array}{r} 15001 \\ 1209081 \\ 8181 \\ 00 \end{array}$$

16310
919000
00
98

19.7083

7105

$$\begin{array}{r} 14988 \\ 11502 \\ \hline 05-10 \\ 90 \end{array}$$
$$\begin{array}{r} 15273 \\ 8720 \\ 35 \\ 60 \\ \hline 40 \end{array}$$

19.65-17

6532

1702

moon.

13

α 4
 2 10315
 19.0 952020
 21.1 30

α 56
 10660
 6074
 9880

21.0792.0785~~8~~ ~~scratched~~

18.5 19211
 21.4 1545150
 38
 10

21.3765

15300

905242

40

90

3751

17370

1279288

90

60

18.5424

15511

1007070

70

99

.5435

1702

moon

13

$\frac{2}{14.0}$ 10315
 21.1 952020
 20

10660
 6074
 9880

21.07920785~~8~~ scratch

18.5 19211
 21.4 1545150
 38
 10

21.3765

15300

905242
 40

90

3751

17370

1279088

90

60

18.5424

15511

1007070

70

99

5435

1702 stars - Standard Coordinates

14

Cape No. 1812 mag 8.7 Cape No. 1818 mag 7.7 Cape No. 1835 mag 5.4

C	13 ^h	18 ^m	03 ^s .14	13 ^h	20	00 ^s .32	13 ^h	27 ^m	41 ^s .96
L						37			97
B						36			96
Mean	13	18	03.14	13	20	00.35	13	27	41.96
Proc			+ 37.87			+ 37.66			+ 37.84
Q	13	18	4101	13	20	38.01	13	28	19.80
A	13	23	28	13	23	28	13	23	28
$\alpha - A$	-	4	46.99	-	2	49.99	+	4	51.80
$\sin(\alpha - A)$			- 286.97			- 169.99			+ 291.78
$\log \mu$			2.45784 ^m			2.23042 ^m			2.46506
$\log S$			9.99255			9.99540			9.99373
$\log \mu$			0.95763 ^m			0.73306 ^m			0.96603
γ_0			- 9.0704			- 540.82			+ 924.76
γ_1			- 41			- 11			123
γ			8.9255			12.5907			27.2499
μ			8.8746 ^v			12.5493 ^v			27.1925 ^v
$\alpha - \gamma$			- 509 ^v			- 414 ^v			- 574 ^v

C	-10°	31'	06".7	-8°	15'	53".2	-9	38	59.3
L						53.3			59.3
B						54.2			59.5
Mean				-8	15	53.6	-9	38	59.4
Proc	-	3	46.6	-	3	45.9	-	3	41.3
S	-10	34	53.3	-8	19	39.5	-9	42	40.7
D	-9	13	58	-9	13	58	-9	13	58
$\alpha - D$	-1	20	55.3	+	54	18.5	-	28	42.7
$\tan(\alpha - D)$			- 4856.1			+ 3258.8			- 1722.7
$\log \mu$			3.68629 ^m			3.51305 ^m			3.23621 ^m
$\log \mu$			1.01744 ^m			0.84420			0.56736 ^m
$\tan S$			9.2714 ^m			9.1655 ^m			9.2333 ^m
μ^2			19153			14661			19321
μ_1			82401 ^m			76850 ^m			82188 ^m
μ_0	-		10.4098	+		6.9855	-		3.6928
μ_1	-		174	-		48	-		166
μ			11.5728			28.9807			18.2906
μ			11.5894			28.9797			18.2927
$\mu - \mu_1$			+ 1.66			- 1.0			+ 2.1

1702 stars - Standard Coordinates

14

Cape No 1812 Inq 57 Cape No 1818 Inq 77 Cape No 1835 Inq 54

C	13 ^h	18 ^m	03 ^s .14	13 ^h	20 ^m	00 ^s .32	13 ^h	27 ^m	41 ^s .96
L						37			97
E						36			96
Mean	13	18	03.14	13	20	00.35	13	27	41.96
Proc		+	37.87		+	37.66		+	37.84
Q	13	18	41.01	13	20	38.01	13	28	19.80
A	13	23	28	13	23	28	13	23	28
x-A		-	4		-	2		+	4
sin(A-A)			-286.97			-169.99			+291.78
log			245784~			223042~			246506
ws			999255			999540			999373
3 ₀			095763~			073306~			096603
3 ₀		-	90704		-	54082		+	92476
3 ₁		-	41		-	11		1	~3
3			89255			125907			272499
p			88746			125493			271925
x-3		-	509		-	414		-	574

C	-10°	31'	06"7	-8°	15'	53"2	-9	38	59.3
L						53.3			59.3
E						54.2			59.5
Mean				-8	15	53.6	-9	38	59.4
Proc		-	3		-	3		-	3
S	-10	34	53.3	-8	19	39.5	-9	42	40.7
D	-9	13	58	-9	13	58	-9	13	58
x-D	-1	20	55.3	+	54	18.5	-	28	42.7
tan(A-D)		-	48565.1		+	32588		-	1722.7
log			368629~			351305			323621~
y ₀			101744~			084420			056736~
tan S			92714~			91655~			92333~
3 ²			19153			14661			19321
y ₁			82401~			76850~			82188~
m ₀		-	10.4098		+	69855		-	36928
y ₁		-	174		-	48		-	166
y			11.5728			28.9807			18.2906
y			11.5894			28.9797			18.2927
y-y		+	166		-	10		+	21

1702

x	y	R.A.			
8.8746	11.5894	13 ^h 18 ^m 41 ^s	-10°	34'	53"
12.5493	28.9797	20 38	-8	19	40
27.1925	18.2927	28 20	-9	42	41
48.62	58.86	66 99		95	134
1621	19.62	13 22 33	-9	32	25
-18	-22	+ 55	+ 18	27	
179	2.38	13 23 28	-9	13	58
31	465				
55	1107				
		A = 13 ^h 23 ^m 28 ^s			
		D = -9° 13' 58"			

Plate constants

x-3	-6.84	+62	+535
-509 - 79	-588 + 53	-535	= 0
-414 - 197	-611 + 75	-536	= -1
-574 - 124	-698 + 163	-535	= 0
17.6625 - 133	+106	-17.7123	

q-y	+4.62	+9.24	-314
+166 + 41	+207 + 107	+314	= 0
-10 + 58	+48 + 267	+315	= +1
+21 + 125	+146 + 168	+314	= 0
19.5254 + 81	+180	= 19.5209	

Tables	a = -0.5	e = -5.0	a - e = +4.5	b + a = +0.8
Oles	a = -6.0	e = -9.2	a - e = +3.2	b + a = +2.2
C - O	+4.5	+4.2	+1.3	-1.4

<u>1702</u>				RA				
8.8746	115894	13 ^h	18 ^m	41 ^s	-10°	34'	53"	
12.5493	289797		20	38	-8	19	40	
27.1925	182927		28	20	-9	42	41	
<u>14862</u>	<u>5886</u>		<u>66</u>	<u>99</u>		<u>95</u>	<u>134</u>	
1621	1962	13	22	33	-9	32	25	
-18	-22		+	55		+	18	27
<u>179</u>	<u>238</u>	13	23	28	-9	13	58	
31	465							
<u>55</u>	<u>1107</u>							
		A = 13 ^h 23 ^m 28 ^s			D = -9° 13' 58"			

Plate constants

x-3	-6.84	+62	+535	
-509	-79	-588	+53	-535 = 0
-414	-197	-611	+75	-536 = -1
-574	-124	-698	+163	-535 = 0
<u>176625</u>	<u>-133</u>	<u>4106</u>		<u>-177128</u>

y-7	+4.62	+9.24	-314	
+166	+91	+207	+107	+314 = 0
-10	+58	+48	+267	+315 = +1
+21	+125	+146	+168	+314 = 0
<u>195254</u>	<u>+81</u>	<u>+180</u>		<u>-195259</u>

Tables	a = -0.6	e = -50	a - e = +45	b + a = +0.8
Obs.	c = -60	e = -92	a - e = +32	b + a = +2.2
C - O	+55	+42	+13	-1.4

MC 1702 Times etc 16.

Exp to stars 1912 Mar. 5	12 ^h	58 ^m	✓	-13 ^h	10 ^m	✓
" " moon	13	03	42.9	-13	03-43.1	✓
clock slow		1	46.1	✓		
H. Sid. T.	13	05	29.1	✓		
H. long	4	44	31.05	✓		
G Sid. T.	17	50	00.15	✓		
Sid. T. m. moon	22	51	27.16	✓		
Interval	18	58	32.99	✓		
Reduction		3	06.52	✓		
G. m. T.	18	55	26.47	✓	$\delta - \alpha = -0^h 17^m 37^s$	

from Kant Alm.	R. a.	h. e. e. l.	✓
moon 19 ^h	13 ^h 23 ^m	15 ^s 17 ^s	-8° 49' 11.8"
motion in 1 ^m = 2.0336"		15.378"	
" " - 4.5588"		-9.27"	+1 10.1"
Tabular place.	13 23	05.90	-8 48 01.7"

moon's age = 17 days.

moon's parallax 57' 50.2"

" semidiameter 15' 47.0"

934 = 9.8

R = 947.0

947 = 10.1

Augmentation +10.1

Irradiation (4) - 0.8

R = 956.3

R = 2.0499

$a = -6.0$

(1+a)R = 2.0487

R² = 4.1972

161702 *Traces etc.* 16

Exp. to stars 1912 Mar 5	12 ^m	58 ^m	-13 ^m	10 ^m
... known	13	03	429	-13 03 -43.1
Clouds show		1	461	
H. Sud T	13	05	29.1	
H. h. g.	9	44	3105	
G. Sud T	17	50	00.15	
Sud T in known	22	51	2716	
Interval	18	58	3299	
Radiation		3	0652	
G. M. T.	18	55	2647	$\theta - \alpha = -0^h 17^m 37^s$

from Kant Alm.	R. A.	Decl.
known 19 ^m	13 ^m 23 ^m 15 ^s 17	-8° 49' 11.8
motion 1 ^m = 2.0336		15.378
-4.5588	-927	+1 10.1
Tabular place.	13 23 0590	-8 48 01.7

known age = 17. days.

known parallax 57 50.2

semidiameter 15' 47" 0

934 = 98

R = 947.0

937 = 101

Cumulative +10.1

Irradiation 41 - 0.8

R = 956.3

R = 2.0499

$\alpha = -6.0$

(1 + α) R = 2.0487

$R^2 = 4.1972$

pt	pos. L	residual
1	150.0	+27
2	170.5	+42
3	139.1	+94
4	104.9	-80
5	90.0	-33
6	76.6	-50
7	40.9	+94
8	25.5	+67

1762

Miron's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	17.6609	0.0000	+1	0.0000	4.2000	+28
2	18.0000	+0.3391	+1	0.1150	4.2019	+47
3	19.0000	+1.3391	+1	1.7934	4.2083	+111
4	19.6396	+1.9787	0	3.9152	4.1915	-57
+5	19.7094	+2.0485	0	4.1963	4.1963	-9
6	19.6524	+1.9915	0	3.9661	4.1945	-27
7	19.0000	+1.3391	-1	1.7929	4.2081	+109
8	18.5430	+0.8821	-1	0.7779	4.2048	+76

$$\text{Comp } R^2 = 4.1972$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	17.4769	-2.0485	-9	4.2000
2	17.5047	-2.0207	-9	4.0869
3	17.9721	-1.5533	-7	2.4149
4	19.0000	-0.5254	-2	0.2763
5	19.5254	0.0000		0.0000
6	20.0000	+0.4746	+2	0.2284
7	21.0788	+1.5534	+7	2.4152
8	21.3758	+1.8504	+8	3.4269

Approximate Center

$$x = 19.0 \quad y = 17.9721$$

$$21.0788$$

$$39.0509$$

$$\text{mean } y = 19.5254$$

$$y - \text{min} = 17.4769$$

$$R = 2.0485$$

$$x - \text{max} = 19.7094$$

$$x - \text{mean} = 17.6609$$

$$\text{Center } \begin{cases} x_0 = 17.6609 \\ y_0 = 19.5254 \end{cases}$$

1702

Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$C - C$
1	17.6609	0.0000	+1	0.0000	4.2000	+28
2	18.0000	+0.3391	+1	0.1150	4.2019	+47
3	19.0000	+1.3391	+1	1.7934	4.2083	+111
4	19.6396	+1.9787	0	3.9152	4.1915	-57
+5	19.7094	+2.0485	0	4.1963	4.1963	-9
6	19.6524	+1.9915	0	3.9661	4.1945	-27
7	19.0000	+1.3391	-1	1.7929	4.2081	+109
8	18.5430	+0.8821	-1	0.7779	4.2048	+76
				Comp $R^2 =$		4.1972

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	17.4769	-2.0485	-9	4.2000
2	17.5047	-2.0207	-9	4.0869
3	17.9721	-1.5533	-7	2.4199
4	19.0000	-0.5254	-2	0.2763
5	19.5254	0.0000		0.0000
6	20.0000	+0.4746	+2	0.2284
7	21.0788	+1.5534	+7	2.4152
8	21.3758	+1.8504	+8	3.4269
9				

Approximate Center

$$x = 19.0 \quad y = 17.9721$$

$$\underline{21.0788}$$

$$39.0509$$

$$\text{mean } y = 19.5254$$

$$y - \text{min} = 17.4769$$

$$R = 2.0485$$

$$x - \text{max} = 19.7094$$

$$x - \text{mean} = 17.6609$$

$$\text{Center } \begin{cases} x_0 = 17.6609 \\ y_0 = 19.5254 \end{cases}$$

normal equations

	ab	an	bn
1	- 0.00	+ 0.0	- 57.5
2	- 0.69	+ 16.0	- 95.0
3	- 2.08	+ 148.8	- 172.0
4	- 1.05	- 112.8	+ 30.2
5	+ 0.00	- 18.4	- 10.0
6	+ 0.94	+ 53.7	- 12.7
7	+ 2.08	+ 146.0	+ 169.0
8	+ 1.63	+ 67.0	+ 140.5
	+ 0.83	+ 192.9	+ 2.5

1702

Innovis Center

18

Conditional Equations

O - C

1	0.00 - 20.5 = +28	+ 0 + 10 = +10	+18
2	+0.34 - 20.2 = +47	+ 9 + 10 = +19	+28
3	+1.34 - 1.55 = +111	+ 36 + 8 = +44	+67
4	+1.98 - 0.53 = -57	+ 53 + 3 = +56	+113
5	+2.05 + 0.00 = -9	+ 55 - 0 = +55	-64
6	+1.99 + 0.47 = -27	+ 53 - 2 = +51	-78
7	+1.34 + 1.55 = +109	+ 36 - 8 = +28	+81
8	+0.88 + 1.85 = +76	+ 24 - 9 = +15	+61

Average = 64.

Mean Equations

$$+ 3.66 - 6.15 = +129$$

$$+ 6.26 + 3.87 = +149$$

$$- 6.26 + 10.52 = -221$$

$$+ 1439 = -72$$

$$b = -5.0$$

$$+ 3.66 = +129 - 31 = +98$$

$$a = +26.8$$

Normal Equations

a

b

$$+ 16.66 + 0.83 = +193$$

$$+ 0.83 + 17.05 = +2$$

$$- 0.83 - 0.04 = -10$$

$$+ 17.01 = -8$$

$$b = -0.5$$

$$+ 16.66 = +193$$

$$a = +11.6$$

	O		C	O - C
1	+28	+ 0 + 1 =	+1	+27
2	+47	+ 4 + 1 =	+5	+42
3	+111	+ 16 + 1 =	+17	+94
4	-57	+ 23 + 0 =	+23	-80
5	-9	+ 24 - 0 =	+24	-33
6	-27	+ 23 - 0 =	+23	-50
7	+109	+ 16 - 1 =	+15	+94
8	+76	+ 12 - 1 =	+9	+67

Average = 61

1707

Innovis Center

18

Conditional Equations

1	0 0 0 - 205 = +28	+	0 + 10 = +10	+	18
2	+034 - 202 = +47	-	9 + 10 = +19	+	28
3	+1.34 - 155 = +111	+	36 + 8 = +44	+	67
4	+1.98 - 053 = -57	+	53 + 3 = +56	-	113
5	+2.05 + 000 = -9	+	55 - 0 = +55	-	64
6	+1.99 + 047 = -27	+	53 - 2 = +51	-	78
7	+1.34 + 1.55 = +109	+	36 - 8 = +28	+	81
8	+0.88 + 1.85 = +76	+	24 - 9 = +15	+	61

Average = 64.

Mean Equations

$$+ 3.66 - 6.15 = +129$$

$$+ 626 + 387 = +149$$

$$- 626 + 10.52 = -221$$

$$+ 1439 = -72$$

$$b = -5.0$$

$$+ 366 = +129 - 31 = +98$$

$$a = +26.8$$

Normal Equations

$$+ 1666 + 083 = +193$$

$$- 083 + 1705 = +2$$

$$- 083 - 004 = -10$$

$$+ 1701 = -8$$

$$b = -0.5$$

$$+ 1666 = +193$$

$$a = +11.6$$

1	+28	+	0	+1	= +1				+27
2	+47	-	4	+1	= +5				+42
3	+111	+	16	+1	= +17				+94
4	-57	+	23	+0	= +23				-80
5	-9	+	24	-0	= +24				-33
6	-27	+	23	-0	= +23				-50
7	+109	+	16	-1	= +15				+94
8	+76	+	10	-1	= +9				+67

Average = 61

Red. aa e. app.

$$\begin{array}{rcl}
 H+K & 8 & 27 = 126^\circ 45' \\
 H & 19 & 04 \\
 \alpha & 13 & 23 \\
 G & 18 & 29 \\
 G+\alpha & 7 & 52 = 118^\circ
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos(G+K) & = & 9.6716m \\
 \log \sin & = & 0.9547 \\
 \log \tan & = & 9.9459 \\
 \log \sec & = & 9.2259m \\
 \log \csc & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log (S') & = & 0.6263m \\
 \log (S) & = & 8.9504m
 \end{array}$$

$$\begin{array}{rcl}
 b & = & +0.17 \\
 g & = & -0.09 \\
 h & = & +1.02 \\
 \hline
 & = & +1.10
 \end{array}$$

$$S = -9 \quad 33$$

$$\begin{array}{rcl}
 \log \cos S & = & 9.9939 \\
 \log (i) & = & 0.8967m \\
 \log (i) & = & 0.8906m
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S' & = & 9.2199m \\
 \log \cos(G+K) & = & 9.7769m \\
 \log h & = & 1.2763 \\
 \log \sin & = & 9.9038 \\
 \log \sec S & = & 0.0061 \\
 \log \csc & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log (h') & = & 0.2731m \\
 \log (h) & = & 0.0101
 \end{array}$$

$$\begin{array}{rcl}
 g' & = & -4.23 \\
 h' & = & +1.88 \\
 i' & = & -7.77 \\
 \hline
 & = & -10.12
 \end{array}$$

No 2 Moon's Mean Position (1912.0)

19.

$$X_0 = 17.6609^\circ$$

$$\frac{1}{2} \Delta = + 6^\circ$$

$$\hline 17.6615^\circ$$

$$Y_0 = 19.5254^\circ$$

$$\frac{1}{2} \Delta = 0^\circ$$

$$\hline 19.5254^\circ$$

Semi Plate Constant $X_0 = 17.7123^\circ$ $Y_0 = 19.5201^\circ$

$$\xi = -0.2877^\circ$$

$$\log \xi = 9.45894^\circ$$

$$\cos \xi = 999394^\circ$$

$$\text{const} = 850724^\circ$$

$$\eta = -24799^\circ$$

$$\log \tan \xi = 9.2110^\circ$$

$$\therefore \xi^2 = 8.9158^\circ$$

$$\therefore \eta_1 = 5.1802^\circ$$

$$(K-A) = 095776^\circ$$

$$K-A = - 9.07^\circ$$

$$\log \eta_0 = 0.39443^\circ$$

$$\therefore \text{const} = 7.33115^\circ$$

$$A = 13^\circ 23' 28.5''$$

$$\therefore (S-D) = 3.06328^\circ$$

$$\alpha_0 = 13^\circ 23' 18.93''$$

$$S-D = - 0^\circ 19' 16.9''$$

$$\text{Red} = + 1.10^\circ$$

$$D = - 9^\circ 13' 58''$$

$$\alpha' = 13^\circ 23' 20.03''$$

$$S_0 = - 9^\circ 33' 14.9''$$

$$\text{Red} = - 10.1''$$

$$S' = - 9^\circ 33' 25.0''$$

1702

Moon's Mean Position (1912.0)

19.

$$\begin{array}{r} X_0 = 17.6609 \\ \text{corr} = +1.6 \\ \hline 17.6615 \end{array}$$

$$\begin{array}{r} Y_0 = 19.5254 \\ \text{corr} = -2 \\ \hline 19.5252 \end{array}$$

from Plate Constant $X_0 = 17.7130$ $Y_0 = 19.5199$

$$\begin{array}{r} \delta = -0.2877 \\ \log \delta = 9.45894 \\ \cos \delta = 9.99394 \\ \text{const} = 8.50729 \end{array}$$

$$(K-A) = 0.95476$$

$$\alpha - A = -9.07$$

$$A = 13^h 23^m 28^s$$

$$\alpha_0 = 13 \ 23 \ 18.95$$

$$\text{Red.} = +1.10$$

$$\alpha' = 13 \ 23 \ 29.05$$

$$\eta = -2.4801$$

$$\begin{array}{r} \log \tan \delta = 9.2110 \\ \delta = 8.9158 \\ \eta = 5.1802 \end{array}$$

$$\begin{array}{r} \log \eta = 0.39443 \\ \text{const} = 7.33115 \end{array}$$

$$(d-D) = 3.06328$$

$$\delta - D = -0^{\circ} 19' 16''$$

$$D = -9 \ 13 \ 58$$

$$\delta_0 = -9 \ 33 \ 14.9$$

$$\text{Red.} = +1.01$$

$$\delta' = -9 \ 33 \ 25.0$$

1702

Lunar Parallax

$$\begin{aligned}
 \alpha' &= 13^h \ 23^m \ 20.03^s \\
 \delta &= 13 \quad 05 \quad 29.1'' \\
 \alpha - \alpha' &= -17 \quad 51.1'' \\
 &= -4^{\circ} \ 27' \ 45''
 \end{aligned}$$

$$\delta' = -9 \quad 33 \quad 25.0''$$

$$\pi = 57' \ 50.2''$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 \hline
 0.00132 \\
 9.95859
 \end{array}$$

$$\begin{aligned}
 \gamma &= 42 \quad 16 \quad 20'' \\
 &= -9 \quad 33 \quad 25'' \\
 &= 51 \quad 49 \quad 45''
 \end{aligned}$$

$$\begin{array}{r}
 9.82640 \\
 8.22591 \\
 9.89551 \\
 \hline
 0.17221 \\
 8.12003
 \end{array}$$

$$\delta - \delta' = +45 \quad 19.4''$$

$$\delta = -8 \quad 48 \quad 05.6''$$

$$\text{Ann Eph } \delta = -8 \quad 48 \quad 01.7''$$

$$O-C = -3.9''$$

$$\begin{array}{r}
 9.86913 \\
 8.22591 \\
 8.89101 \\
 \hline
 0.00514 \\
 6.99119
 \end{array}$$

$$\alpha - \alpha' = -3 \quad 22.12''$$

$$= -13' \ 47''$$

$$\alpha = 13 \quad 23 \quad 06.56''$$

$$\alpha = 13 \quad 23 \quad 05.90''$$

$$+0.66''$$

1702

Lunar Parallax

$$\lambda' = 13^\circ 25' 29.05''$$

$$b = 13^\circ 05' 29.1''$$

$$b - \lambda = -17^\circ 50' 05''$$

$$-4^\circ 27' 45''$$

$$s' = -9^\circ 33' 25.0''$$

$$\pi = 57' 50.2''$$

$$9.86913$$

$$8.22591$$

$$8.89101 \sim$$

$$000514$$

$$6.99189 \sim$$

$$v - \lambda' = -3^\circ 22' 67''$$

$$-13.47$$

$$9.95727$$

$$000000$$

$$000131$$

$$9.95858$$

$$\gamma = 42^\circ 16' 20''$$

$$-9^\circ 33' 25''$$

$$51^\circ 49' 45''$$

$$9.82640$$

$$8.22591$$

$$9.891551$$

$$0.17221$$

$$8.12003$$

$$\delta - s' = +45^\circ 19.4'$$

$$\delta = -8^\circ 48' 05.6''$$

$$\alpha = 13^\circ 23' 06.56''$$

$$\text{Ann Ephs } \delta = -8^\circ 48' 01.7''$$

$$\alpha = 13^\circ 23' 05.90''$$

$$O - C = -3.9''$$

$$+0.66''$$

MC1703

1913 Oct. 14.

21

Stars - measures.

	α	δ	α	δ
1	16850	18925	17757	15248
9.6	1230599	13470	1417070	882430
12.5	109	5865-	70	3030
	50	17	62	50
	<u>12.4545</u>	<u>.4543</u>	<u>9.6411</u>	<u>.6421</u>

2	16343	18110	15928	17782
13.3	283030	1663135-	892112	14780
29.8	30	22	1312	8854
	60	10	32	91
	<u>29.8527</u>	<u>.8519</u>	<u>13.2984</u>	<u>.3004</u>

3	15211	16652	11850	1178089
27.9	13456	840520	1146060	8189
19.2	5961	2120	7060	11405
	10	53		
	<u>19.1752</u>	<u>.1762</u>	<u>27.9613</u>	<u>.9622</u>

elongated images

Grade 3.

MC1703

1912 Oct. 14

21

Star - measures.

	d	N	d	N
1	16850	18925	17757	15248
96	123059	13470	1417070	882430
125	101	5865	70	30
	50	17	62	50
	<u>12.4545</u>	<u>.4543</u>	<u>96411</u>	<u>6421</u>

2	16343	18110	15928	17782
133	7830	1665135	8921	19780
298	30	22	1312	8884
	60	10	32	91
	<u>29.8527</u>	<u>.8519</u>	<u>13.2984</u>	<u>3604</u>
3	15211	16652	11850	1178089
279	13456	8405	11460	81
192	5961	2120	7060	11405
	10	53		
	<u>19.1752</u>	<u>1762</u>	<u>279613</u>	<u>9622</u>

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Grades 3.

1703	4	11268	22
19.0	7135	10275	Remears
17.9	3543	8589	
min	6138		
in			
y	<u>17.9000</u>	<u>9015</u>	
2	19570	15635	
20.0	1792000	730100	
18.2	09	02	
	78	39	
	<u>18.1661</u>	<u>1663</u>	
3		18700	15445
207		16808	74.3645
19.0		2011	42
		00	42
		<u>20.8113</u>	<u>8002</u>
4	Scratch		
209	16519	14360	973640
19.5	11205	965060	3340
	15	5860	9610
	25		
	<u>19.5312</u>	<u>5296</u>	<u>9874</u>
5		12010	10487
20.1		2921	1016074
20.0		11729	70
max		<u>20.0291</u>	<u>0319</u>
in			
22			
6	Scratch	10686	986571
209	16005	1027878	7071
20.5	11155	6778	9469
	5050		
	01		
	<u>20.4851</u>	<u>20.9588</u>	<u>9600</u>
		4848	

1703	4	linear	20	22	Remains
190	7135	11268			
179	3543	10275			
	6138	8559			
mm					
in					
g	<u>179000</u>	<u>9015</u>			
2	19570	15635			
200	1792000	730100			
182	09	02			
	78	39			
	<u>181661</u>	<u>1663</u>			
3					
207		18700	15445		
190		16808	743645		
		2011	42		
		00	42		
		<u>208113</u>	<u>8002</u>		
4	Scratch				
209	16519	14360	17790	973640	
195	11205	9650	1765940	3340	
	15	5860	60	9610	
	25				
	<u>195312</u>	<u>5296</u>	<u>209863</u>	<u>9874</u>	
5					
20+			12010	10487	
200			2921	1016074	
200			11729	70	
20			<u>200291</u>	<u>0319</u>	
6	Scratch				
199	10005	19391	10686	986571	
205	11155	1424049	1027878	70	
	5050	3049	6778	9469	
	01	93			
	<u>204851</u>	<u>4848</u>	<u>199588</u>	<u>9600</u>	

1703

a

y

lincoln

a

a 72

a

23.

2
106
21.0

15790
1323341
4641
08
20.7446

17770
1032012
2012
67
7451

8
10.0
21.7

1.9030
672030
2930
50
21.7318

17330
1465048
5048
38
17317

scratched instead of (1)

123655
6170
11710
17.9345

12455
1180218
10
.9355

17470
1128588
78
88
20.3802

15803
12000
0000
10
3806

1703

a

y

linear

r

a 72

r

23

7
19.6
21.0

15790
1323341
4041
08
197496

17770
10320
2012
67
7451

8
19.0
21.7

14030
672030
2930
50
217318

17330
1965048
5048
38
7317

scratched instead of (1)

12365
6170
11710
179345

12455
1180018
10
9355

17470
1128388
7888
58
203802

11803
12000
0000
10
3806

1703

Plate Constants

24

x	9.6416	13.2992	27.9618
y	8.9255	12.5907	27.2499
z	+7161	+7085	+7119

y	12.4544	29.8523	19.1757
z	11.5728	28.9807	18.2906
$y-z$	+8816	+8716	+8851

$x-z$	+4.54	+0.72	-0.34	-7219
+7161	+56	+7217	+7	+7224 - 4 = +7220 = +1
+7085	+134	+7219	+9	+7228 - 9 = +7219 = 0
+7119	+86	+7205	+20	+7225 - 6 = +7219 = 0
18.9828	+90	+13	-6	= 18.2706

$y-z$	-4.332	+6.64	-8856
+8816	-42 =	+8774 + 82 =	+8856 = 0
+8716	-58 =	+8658 + 197 =	+8855 = -1
+8851	-121 =	+8730 + 127 =	+8857 = +1
19.9480	-82	+132	-19.0674 ✓

Tables	$a = -0.5$	$z = -5.0$	$a - z = +4.5$	$b + a = +0.1$
Obs	$a = -0.7$	$z = -6.6$	$a - z = +5.9$	$b + a = +0.1$

1703

Plate Constants

29

x	9.6416	13.2992	27.9618
y	8.9255	12.5907	27.2499
z	+71.61	+70.85	+71.19

u	12.4544	29.8523	19.1757
v	11.5725	28.9807	18.2906
w	+88.16	+87.16	+88.51

$2-3$	+4.54	+0.72	-0.34	-7.219
$1.7161 + 5.6$	$+72.17 + 7$	$+72.24 - 4$	$+72.20$	$+1$
$+70.85 + 1.34$	$+72.19 - 9$	$+72.28 - 9$	$+72.19$	0
$+71.19 + 8.6$	$+72.05 + 2.0$	$+72.25 - 6$	$+72.19$	0
$18.9828 + 9.0$	$+1.3$	-6	-18.2706	

$4-11$	-4.332	+6.67	-8.856
$+88.16 - 4.2$	$+87.74 + 8.2$	$+88.56$	0
$+87.16 - 5.8$	$+86.58 + 1.97$	$+88.55$	-1
$+88.51 - 1.21$	$+87.30 + 1.27$	$+88.57$	$+1$
$19.9480 - 8.2$	$+1.32$	-19.0674	

Tables $a =$

$b_1 = -0.7$
 $b_2 = -6.6$
 $a - b_1 = +5.9$
 $b + a = +0.1$

1703

25

Times etc.

Ext Stars 1912 Mar 5	13 ^h	11 ^m	-13 ^h	23 ^m
" " Moon	13	17	18.7	-13 17 18.9
clock slow		1	46.1	
H. Sid T.	13	19	049	
R. Long	4	44	31.05	
G. Sid T.	18	03	35.95	
Sid T. in Moon	22	51	27.16	
Interval	19	12	08.79	
Reduction		3	08.75	
G.M.T.	19	09	00.04	$\theta - \kappa = -0^{\circ} 4' 28.6''$

Solar Hunt Alm.	R.A.	Decl.
moon 19 ^h	13 ^h 23 ^m	15.17 ^h -8° 49' 11".8
motion in ^m 2.0336		15.370
" - 9.0007		+18.30
Tabular place	13 23	33.47 -8 51 30.1

Moon's parallax	57' 49.8
semidiam.	15' 47.0
R =	947.0
Augmentation	+10.1
Irradiation (3)	-0.7
R =	956.9
R =	2.0501
(1+a)/R	2.0500
R ² =	4.2025
a = -0.7	
939 = 9.8	
947 = 10.1	

1703

25

Tinnisseta

Exp. Stars 1912 Mar 5	13 ^h	11 ^m	-13 ^s	23 ^m
moon	13	17	187	-13 17 189
clock slow		1	461	
H. Sid T.	13	19	049	
At home	4	44	3105	
G. Sid T.	18	03	3595	
Sid T. to moon	22	51	2716	
Interval	19	12	0879	
Reduction		3	0875	
G. in T.	19	09	0004	6-22-0 ^h 4 ^m 28 ^s .6

From bank Alm.			R.A.		Decl.
moon 19 ^h	13 ^h	23 ^m	15 ^s 17	-8°	49' 11" 8
moon 1 ^m 2.0336				15 ^s 37.0	
9.0007			+ 18.30	- 2	18.3
Tabular place	13	23	3347	-8	51 30.1

Moon's parallel	57' 49.8
perpendicular	15' 47.0
R =	947.0
Augmentation	+ 10.1
Irradiation (3)	- 0.7
R =	956.4
R =	2,050.1
11.00/16	2050.0
R =	4,202.5

pt.	km/s	resid.
1	168.8	+113
2	150.2	+99
3	117.6	+22
4	101.8	-122
5	88.6	-68
6	74.8	-70
7	59.1	+98
8	29.8	+171

1703

Moon's Center.

26

	$x - x_0$	$(x - x_0)^2$	$y - y_0$	$(y - y_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	$19.3808 + 20.8985$	0.0005	4.7889	0.0005	0.0010	$-34 + 158$
2	$20.0000 + 1.0177$	1.0357	4.2170	0.0005	1.0407	$+145$
3	$20.8008 + 1.8185$	3.3070	4.2084	0.0005	3.3120	$+59$
4	$20.9868 + 2.0045$	4.0180	4.1932	0.0005	4.0230	-93
5	$21.0305 + 2.0482$	4.1951	4.1977	0.0005	4.2000	-48
6	$20.9594 + 1.9771$	3.9089	4.1964	0.0005	3.9140	-61
7	$20.7448 + 1.7625$	3.1064	4.2120	0.0005	3.1120	$+95$
8	$20.0000 + 1.0177$	1.0357	4.2170	0.0005	1.0407	$+145$
Compu $R^2 = 42025$						

	$x - x_0$	Δy	$(y - y_0)^2$
-1	$17.9008 - 2.0482$	-9	0.01988
2	$18.1662 - 1.7828$	-8	0.01813
3	$19.0000 - 0.9490$	-4	0.0014
4	$19.5304 - 0.4186$	-2	0.01752
5	$20.0000 + 0.0510$	0	0.00026
6	$20.4850 + 0.5360$	$+2$	0.02875
7	$21.0000 + 1.0510$	$+5$	0.01056
8	$21.7318 + 1.7828$	$+8$	0.01813

Approximate Center

$$x = 20.0 \quad y = 18.1662$$

$$21.7318$$

$$39.8980$$

$$\text{mean } y = 19.9490$$

$$y - \text{min} = 17.9008$$

$$R = 2.0482$$

$$x - \text{max} = 21.0305$$

$$x_0 = 18.9823$$

$$\text{Center } \begin{cases} x_0 = 18.9823 \\ y_0 = 19.9490 \end{cases}$$

1703

unwob center

26

		$(x - x_0)^2$	$(y - y_0)^2$	$O - C$
1	17.90008 + 0.0177	0.00005	4.7489	-24 + 158
2	20.0000 + 1.0177	1.0357	4.2170	+ 1.45
3	20.8008 + 1.8185	3.3070	4.2084	+ 59
4	20.9868 + 2.0045	4.0180	4.1932	- 93
5	21.0305 + 2.0482	4.1951	4.1977	- 48
6	20.9594 + 1.9771	3.9089	4.1964	- 61
7	20.7448 + 1.7625	3.1064	4.2120	+ 95
8	20.0000 + 1.0177	1.0357	4.2170	+ 145
Compo R ² = 42025				

		$(x - x_0)^2$	$(y - y_0)^2$
-1	17.90008 - 2.0482	-9	1.1988
2	18.1662 - 1.7828	-8	3.1813
3	19.0000 - 0.9490	-4	0.9014
4	19.5304 - 0.4186	-2	0.1752
5	20.0000 + 0.0510	0	0.0026
6	20.4850 + 0.5360	+2	0.2875
7	21.0000 + 1.0510	+5	1.1056
8	21.7318 + 1.7828	+8	3.1813

Approximate Center

$$z = 20.0 \quad y = 18.1662$$

$$21.7318$$

$$39.8980$$

$$\text{mean } y = 19.9490$$

$$y - \text{min} = 17.9008$$

$$R = 20.482$$

$$z - \text{max} = 21.0305$$

$$x_0 = 18.9823$$

$$\text{Center } \begin{cases} x_0 = 18.9823 \\ y_0 = 19.9490 \end{cases}$$

Formation of Normals

- 0.80	+ 63.2	- 317.6
- 1.82	+ 147.9	- 258.1
- 1.73	+ 107.4	- 56.0
- 0.84	- 186.0	+ 39.1
+ 0.10	- 98.4	- 2.4
+ 1.07	- 120.8	- 32.9
+ 1.85	+ 167.2	+ 100.7
+ 1.82	+ 147.9	+ 258.1
- 0.35	+ 218.4	- 269.1

Normals

$$+ 20.77 - 0.35 = + 21.8$$

$$- 0.35 + 129.9 = - 26.9$$

$$+ 0.35 - 0.01 = + 4$$

$$+ 129.8 = - 26.5$$

$$b = - 20.4$$

$$- 0.01 + 0.35 = - 7$$

$$+ 20.76 = + 21.1$$

$$a = + 10.2$$

		c	c-c
1	+ 4 + 41 =	+ 45	+ 113
2	+ 10 + 36 =	+ 46	+ 99
3	+ 18 + 19 =	+ 37	+ 22
4	+ 20 + 9 =	+ 29	- 122
5	+ 21 - 1 =	- 20	+ 68
6	+ 20 - 11 =	+ 9	+ 70
7	+ 18 - 21 =	- 3	+ 98
8	+ 10 - 36 =	- 26	+ 171

$$+ 503 - 260$$

$$\text{Average} = 95$$

1703

Conditional Equations

	a	b	c		c	c-c
1	+0.40	-2.01	= +1.58	+12 +43 = +55	+103	
2	+1.02	-1.78	= -1.45	+31 +38 = +69	+76	
3	+1.82	-0.95	= +59	+55 +21 = +76	-17	
4	+2.00	-0.42	= -93	+60 +9 = +69	-162	
5	+2.05	+0.05	= -48	+62 -1 = +61	-104	
6	+1.98	+0.54	= -61	+60 -12 = +48	-104	
7	+1.76	+1.05	= +95	+53 -23 = +30	+65	
8	+1.02	+1.78	= -1.45	+31 -38 = -7	+152	

Average = 99

In case Equations

$$+524 - 5.16 = +269$$

$$+681 + 3.42 = +131$$

$$-681 + 6.72 = -350$$

$$+10.14 = -219$$

$$b = -21.6$$

$$+524 = +269 - 1.11 = +158 \quad a = +30.2$$

1703

Conditional Equations

	a	b	c		c	0-c
1	+0.40	-2.01	+1.58	+12 +43 =	+55	+103
2	+1.02	-1.78	+1.45	+31 +38 =	+69	+76
3	+1.82	-0.95	+5.9	+55 +21 =	+76	-17
4	+2.00	-0.42	-93	+60 +9 =	+69	-162
5	+2.05	+0.05	-48	+62 -1 =	+61	-109
6	+1.98	+0.54	-61	+60 -12 =	+48	-109
7	+1.76	+1.05	+95	+53 -23 =	+30	+65
8	+1.02	+1.78	+1.45	+31 -38 =	-7	+152

Average = 99

Linear Equations

$$+524 - 516 = +269$$

$$+681 + 342 = +1023$$

$$-681 + 672 = -99$$

$$+10.14 = -219$$

$$b = -21.6$$

$$+524 = +269 - 111 = +154 \quad a = +30.2$$

1703

Moon's Mean Position (1912.0)

$$X_1 = 18.9823''$$

$$Y_1 = 1994.90''$$

$$\frac{1}{2}a = +15''$$

$$\frac{1}{2}b = -10''$$

$$X = 18.9828''$$

$$Y = 19.9480''$$

From Plate Constants

$$X = 18.2706''$$

$$Y = 19.0674''$$

$$z = +0.2706''$$

$$\eta = -2.9326''$$

$$\log = 9.43233''$$

$$\cos \delta = 9.99386''$$

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

$$\log \tan \delta = 9.2259''$$

$$\log \frac{1}{\sin} = 8.8663''$$

$$\eta_1 = 5.1456''$$

$$(A-A) = 0.93223''$$

$$\log \eta_2 = 0.46725''$$

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

$$X-A = +8.53''$$

$$A = 13^h 23^m 28.3''$$

$$(A-D) = 3.13610''$$

$$A_0 = 13^h 23^m 36.53''$$

$$\delta-D = -22' 48.0''$$

$$\text{Red} = +1.10$$

$$D = -9' 13.5''$$

$$A' = 13^h 23^m 37.63''$$

$$\delta_0 = -9' 36.46.0''$$

$$\text{Red} = -10.1''$$

$$\delta' = -9' 36.56.1''$$

1702

Brown's Mean Position (1912.0)

$$X_0 = 18.9823$$

$$Y_0 = 19.9490$$

$$u = +1.0$$

$$v = -1.0$$

$$X = 18.9833$$

$$Y = 19.9480$$

True Plate Constant

$$X = 18.2711$$

$$Y = 19.0674$$

$$z = 4.02711$$

$$\eta = -2.9326$$

$$\log \mu = 9.43313$$

$$\log \delta = 9.99386$$

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

$$\log \mu \text{ in } S = 9.2259$$

$$\log \delta = 8.8663$$

$$\log \eta = 5.1456$$

$$(q-A) = 0.93203$$

$$\log \eta_0 = 0.46725$$

$$\log \text{const} = 7.32115$$

$$X-A = +8.55$$

$$A = 13^h 23^m 28^s -$$

$$(d-D) = 3.13610$$

$$A_0 = 13^h 23^m 36.55^s$$

$$S-D = -22' 48''$$

$$Red = +1.10$$

$$D = -9.1358$$

$$a = 13.233765$$

$$S_0 = -9.36460$$

$$Red = +1.01$$

$$S = -9.36561$$

1703

Red. ad. l. aph.

$$\begin{array}{rcl}
 H+K & 8 & 28 = 127^\circ \\
 H & 19 & 04 \\
 K & 13 & 24 \\
 G & 18 & 29 \\
 G+K & 7 & 53 = 118^\circ 15'
 \end{array}$$

$$\begin{array}{rcl}
 \cos(G+K) & = & 9.6752 m \\
 g & = & 0.9548 \\
 \sin & = & 9.9449 \\
 \tan & = & 9.2290 m \\
 & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log(g') & 0.6300 m \\
 g & 8.9526 m
 \end{array}$$

$$\begin{array}{rcl}
 b & +0.17 \\
 a & -0.09 \\
 h & +1.02 \\
 \hline
 & +1.10
 \end{array}$$

$$S_0 -9 \quad 37$$

$$\begin{array}{rcl}
 \log \sin S & 9.9939 \\
 & 0.8965 m \\
 & \hline
 & 0.8904 m
 \end{array}$$

$$\begin{array}{rcl}
 \sin S & 9.2229 m \\
 \cos(H+K) & 9.7795 m \\
 h & 1.2763 \\
 \sin & 9.9024 \\
 \sec & 0.0061 \\
 & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log(h') & 0.2787 \\
 & \hline
 & 0.0087
 \end{array}$$

$$\begin{array}{rcl}
 g' & -4.27 \\
 h' & +1.90 \\
 i & -7.77 \\
 \hline
 & -10.14
 \end{array}$$

1703

Red and Blue

Sv -9 37

H+X 8 28 -127"

A 19 04

X 13 24

G 18 29

G+X 7 53 -118"10"

 $\cos(H+X)$ 9.6752 m $\sin$ 0.9598 $\cos$ 9.9449 $\tan$ 9.2290 m88239 $\log$ 0.6300 m $\log$ 8.9526 m $\log$ +0.17 $\log$ -0.09 $\log$ +1.021.10 $\log$ 9.9989 $\log$ 0.8965 m $\log$ 0.8904 m $\sin$ 9.2229 m $\cos(H+X)$ 9.7795 m $\sin$ 1.2763 $\sin$ 9.9024 $\cos$ 0.006188239 $\log$ 0.2787 $\log$ 0.0087 $\log$ -9.27 $\log$ +1.40 $\log$ -7.77-10.14

1703

Lunar parallax.

$$\begin{array}{rcl}
 \alpha' & = & 13 \quad 23 \quad 37.63'' \\
 \delta & = & 13 \quad 19 \quad 04.9'' \\
 \delta - \alpha' & = & -4 \quad 32.7'' \\
 & = & -1^{\circ} \quad 08' \quad 10''
 \end{array}$$

$$S' = -9^{\circ} \quad 36' \quad 56.1''$$

$$\pi = 57' \quad 49.8''$$

$$\begin{array}{r}
 9.95727 \\
 000000 \\
 000008 \\
 \hline
 9.95735
 \end{array}$$

$$\begin{array}{rcl}
 \gamma & = & 42 \quad 11 \quad 30'' \\
 & - & 9 \quad 36 \quad 56'' \\
 & = & 51 \quad 48 \quad 26''
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.22586 \\
 9.89538 \\
 \hline
 017288 \\
 8.12052
 \end{array}$$

$$S - S' = +45 \quad 22.4''$$

$$S = -8 \quad 51 \quad 33.7''$$

$$\text{Cum Eph} S = -8 \quad 51 \quad 30.1''$$

$$\theta - \epsilon = -3.6''$$

$$\begin{array}{r}
 9.86913 \\
 8.22586 \\
 8.29427 \\
 \hline
 0.00521 \\
 6.39747
 \end{array}$$

$$\alpha - \alpha' = -0' \quad 51.59''$$

$$= -3.43''$$

$$\alpha = 13 \quad 23 \quad 34.20''$$

$$\alpha = 13 \quad 23 \quad 33.47''$$

$$+0.73''$$

1703

inner parallel

 $\alpha = 13 \quad 23 \quad 37 \quad 63$ $\delta = 9 \quad 36 \quad 56 \quad 1$ $\theta = 13 \quad 19 \quad 04 \quad 9$ $\phi = 1 \quad 4 \quad 32.7$ $\pi = 57 \quad 49 \quad 8$ $- 1^{\circ} \quad 08' \quad 10''$

9.95727

000000

000008

9.95735 $\gamma = 42 \quad 11 \quad 30$ $- 9 \quad 36 \quad 56$ $51 \quad 48 \quad 26$

9.82640

8.22586

9.89538

0.17288

8.12052

 $\delta - \delta' = +45 \quad 22.9$ $\delta = -8 \quad 51 \quad 33 \quad 7$ $\alpha = 13 \quad 23 \quad 34 \quad 20$ Ann Eph $\delta = -8 \quad 51 \quad 30 \quad 1$ $\alpha = 13 \quad 23 \quad 33 \quad 47$ $\theta - \theta' = -3.6$ $+0.73$

9.86913

8.22586

8.29621

000521

6.39641

 $\alpha - \alpha' = 0' \quad 51'' \quad 39$ $\dots = 3.43$

