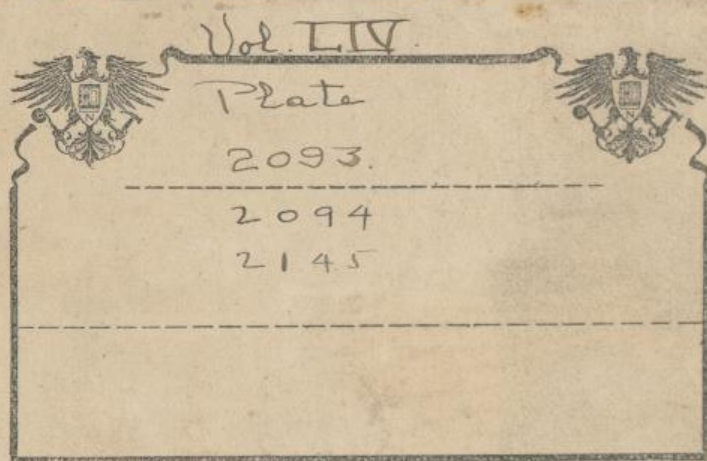


KG
11366
n930



Harvard Lunar Plates

Measures and Reductions

Mary Fowler.

Volume LIV.

Plate No.	Date	Page
2093	1912 Nov. 2.	1
2094	1912 Nov. 2	11
2145	1912 Nov. 18	20

2093

Star Measures

1913 Dec. 23.

1

	d	Y	N	d	Z	N
V	19568		16160	18535		16930
10.9	17420	18	8276	17561	70	787080
W.3	20		65	61		71
	54		40	28		15
	<u>252146</u>		<u>2127</u>	<u>10.9030</u>		<u>.9042</u>
2	12481		9812	18160		15537
27.3	12136	38	17	11320	20	1235
28.0	40		9462	25		56
				47		20
	<u>28.0343</u>		<u>.0350</u>	<u>27.3171</u>		<u>.3177</u>
3	16596		19800	16532		19775
31.3	12296		14079	19681	77	1659999
9.5	00	94	78	85		00
	68		00	07		78
	<u>9.4287</u>		<u>.4229</u>	<u>31.3166</u>		<u>.3177</u>

Grade 3 or 4.

2033

Star Measures

1913 Dec. 23.

1

	α	γ	δ	α	δ	γ
1	19568		16160	18535	16930	
109	17420	18	827672	1756170	787080	
253	20		65	61	71	
	54		40	28	15	
	<u>252146</u>		<u>2127</u>	<u>189030</u>	<u>9042</u>	
2	12481		981212	18160	15537	
273	1213638		17	1132020	1235555	
280	40		9462	25	5655	
				47	20	
	<u>280343</u>		<u>0350</u>	<u>27.3171</u>	<u>.3177</u>	
3	16596		19800	16532	19775	
313	12296		1407980	968177	1659999	
915	0099		78	8577	00	
	68		00	07	78	
	<u>94287</u>		<u>4279</u>	<u>31.3166</u>	<u>.3177</u>	

Grade 3 or 4.

2093

Moon - measures

2

d

u

n

d

sc

w

1/18

y - min about 16.9100

1

18.7

17.0

very oblique

15270

1276250

8290

56

18.7505

18259

1068590

6898

40

.7560

2

19.0

9125

1204040

17.7

824750

3340

40

11160

17.0879.0878

scratch

3

19819

18130

17390

17783

19.5

1578081

1216057

1262015

1256550

17.4

79

49

10

5550

03

20

75

69

17.4033403119.5233.5221

4

1352020

14137

20.0

20

1379380

17.9

13175

8798

17.9655.9647

5

20.1

18.0

1180004

0904

11590

17410

1722010

0010

200214.0200

2093

Moon measures

2

d

u

v

d

2c

v

1/4
18.y-min about 16.9100

1

15270

18259

187

very

1276250

1068590

170

oblique

8290

6898

56

40

18.7505.7560

2

190

9125

1204040

174

824750

3340

40

11160

17.0879.0878

small

3

19819

14130

17390

17783

191

1578081

1216057

1262015

1256550

179

79

49

10

5550

03

20

75

69

17.9833.403119.52335221

4

1352020

14137

200

20

1379380

179

13175

8798

17.96559647

5

11800

17410

20.1

0904

1722010

180

11590

0010

20.02140200

2093 moon-measures

$\frac{6}{w}$	d	y	r	d	x	w
20.3				17280		19240
19.0				10139		16378
max				2931		8070
$\frac{1}{w}$				707		30
sc				<u>202857</u>		<u>2861</u>

$\frac{7}{w}$	12119	16501
20.0	1128975	8900
	6092	15672

20.0840.0825

$\frac{8}{w}$	scratch				
19.5	16270	15645	14965	15260	
20.5	10100	11812	10510	9712	14
	8990	21	1520	02	
	57	32	40	42	
	<u>20.6169</u>	<u>.6175</u>	<u>19.5558</u>	<u>5542</u>	

additional point near unity (scratch)

14520	13286	189.19	17448
2927	1248305	1171922	1447370
13730	9997	17	70
		29	58
<u>16.9205</u>	<u>.9210</u>	<u>18.2993</u>	<u>2980</u>

2093 *lunar measures*

3

<u>6</u>	<u>a</u>	<u>y</u>	<u>x</u>	<u>d</u>	<u>x</u>	<u>n</u>
20.3				17250		19240
19.0				1013931		1637870
max				29		80
-				75		30
2				<u>20.2857</u>		<u>2861</u>

<u>7</u>	20	12119	1650100
20	1128975	8900	
	6092	15672	

<u>200840</u>	<u>.0825</u>
---------------	--------------

<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>0</u>
16270	15645	14965	15260			
195 10100	11812	10510	9712			
205 8990	21	1520	0214			
57	32	40	42			
<u>20.6169</u>	<u>.6175</u>	<u>19.5558</u>	<u>1542</u>			



2093

Times etc.

Exp to stars 1912 Nov. 2, 8^h 02^m - 8^h 14^m
 Moon 8 08 30.0 - 8 08 30.2^v
 Clock slow 0 13.2^v

H. Sid T.	8	08	43.3 ^v	$\Theta - \alpha = -1^h 55^m$
H. long	4	44	31.05 ^v	
G. Sid T.	12	53	14.35 ^v	
Sid T. in Moon	14	45	33.65 ^v	
Interval	22	07	40.70 ^v	
Reduction		3	37.51 ^v	
G. M. T.	22	04	03.19 ^v	

from hand Alman R. A. Decl.
 Moon 22^m 10^h 03^m 16.55^v + 15 52 51.0^v
 Motion in 1^m = 2.2429^v 14.466^v
 " .. +4.0532^v + 9.09^v - 58 58.6^v
 Tabular place 10 03 25.61^v + 15 51 52.4^v

Moon's age 24 days.

$934 = 127$
 $971 = 138$

" parallel	59'	16".9 ^v
" semidiam	16	10.8 ^v
R		970.8 ^v
Augmentation		+ 13.8 ^v
Irradiation (3/4)		- 0.8 ^v
R		983.8 ^v
R		2.1089 ^v
(1+a)/R		2.1085 ^v
R ²		4.4458 ^v

a --- 2.0

(1+a)/R

R²

2093

Times etc.

Exp. H. H. 1912 Nov 2 8^m 02^m - 8^m 14^m
 Moon 8 08 30.0 - 8 08 30.2
 Clock slow 0 132

H. J. d. T. 8 08 43.3 6-α = 1^m 55^m
 H. H. 4 44 31.05^m
 G. H. 12 53 14.31^m
 S. H. T. in hour 14 45 33.65^m
 Interval 22 07 40.70
 Radiation 3 37.51
 G. H. T. 22 04 03.19

from bank Alu

R. G.

Black

Moon 22^m 10^m 03^m 16.55^m 2 + 15^m 52^m 17.0
 Motion 1^m 22.29^m 14.466
 + 40532 + 9.09 - 58 58.6
 Tabular place 10 03 25.61 + 15 51 52.9

Moon age 24 days.

parallax

59' 16"9

semidiam

16 10.8

R

970.8

Amplification

+ 13.8

Irradiation 3/4

- 0.8

R

983.8

R

2.1089

1/2 R

2.1085

R²

4.4458

934 = 127
 971 = 138

α = -20

2093

Plate Constants

5

α	δ	R.A.	Decl.
10.9036	25.2136	10 00 55	+16 11 08
27.3174	28.0346	09 45	16 34 31
31.3177	9.4283	11 57	14 10 04
3/6954	62.68	20 157	16 55 43
23.18	20.89	10 07 32	+15 38 34
-18.00	-22	- 2 40	+ 8 38
5.18	1.11	10 04 52	+15 47 12
31	46.62	$A = 10^h 04^m 52^s$	
160	518"	$D = +15^\circ 47' 12''$	

$$\begin{array}{rclclcl}
 \alpha - 3 & -119.44 & +1.9x & +1x & +606 & \\
 +2383 & -3011 & = -628 + 21 & = -607 + 1 & = -606 & = 0 \\
 +2686 & -334.7 & = -661 + 52 & = -609 + 3 & = -606 & = 0 \\
 +458 & -1126 & = -668 + 59 & = -609 + 3 & = -606 & = 0 \\
 18.1764 & -2272 & +34 & +2 & = 18.0134 &
 \end{array}$$

$$\begin{array}{rclclcl}
 \gamma - 7 & +119.4x & +1.2y & -1.2 & -2499 & \\
 +1168 & +1302 & = +2470 + 30 & = +2500 - 1 & = +2499 & = 0 \\
 -795 & +3262 & = +2467 + 34 & = +2501 - 3 & = +2498 & = -1 \\
 -1248 & +3739 & = +2491 + 11 & = +2502 - 3 & = +2499 & = 0 \\
 19.0258 & +2170 & +23 & -2 & = 18.9950 &
 \end{array}$$

Tables	$a = -1.0$	$e = -2.1$	$a - e = +1.1$	$b + a = +1.5$
Obs	$a = -2.0$	$e = -1.2$	$a - e = -0.8$	$b + a = +0.1$

2093

Plate constants

5

	x	y	R	G	B	Red
10.9036	252136	10	00	55	116	11 08
27.3174	280346		09	45	16	34 31
<u>31.3172</u>	<u>94283</u>		<u>11</u>	<u>52</u>	<u>14</u>	<u>10 04</u>
316954	6268	1	20	157	116	55 43
23.18	2089	10	07	32	15	38 39
-18			-2	40		+8 39
<u>518</u>	<u>111</u>	10	04	52	15	47 12
31	466					
1600	518					

$$A = 10^h 44^m 52^s$$

$$D = +15^\circ 47' 12''$$

$$x-3 = 119.44 \quad +1.92 \quad +12 \quad +606$$

$$+2383 - 3011 = -628 - 21 = -607 + 1 = -606 = 0$$

$$+2686 - 3347 = -661 + 53 = -609 + 3 = -606 = 0$$

$$+458 - 1126 = -668 + 54 = -609 + 3 = -606 = 0$$

$$18.1764 - 2272 \quad +34 \quad +2 \quad = 18.0134$$

$$y-7 = 119.42 \quad +1.24 \quad -12 \quad -2499$$

$$+1168 - 1302 = -2470 + 30 = -2499 = 0$$

$$-795 + 3262 = +2467 + 34 = +2501 - 3 = +2498 = -1$$

$$-1248 - 3739 = -2491 + 11 = -2502 - 3 = -2499 = 0$$

$$19.0218 + 2170 \quad +23 \quad -2 \quad = 18.9950$$

Tables $a = 1.0$ $a = 2.1$ $a = 4 = +1.1$ $b + a = +1.1$

lbs $a = 2.0$ $a = -1.2$ $a = 2 = +0.8$ $b + a = +0.1$

2093 Standard Coordinates

Cape No. 1377 mag 6.3				Cape No. 1398 mag 7.3				Cape No. 1403 mag 7.5			
C	10 ^h	00 ^m	15.40	10 ^h	09 ^m	06.43		10 ^h	11 ^m	18.74	
L			39			46				73	
E			34			51				72	
Mean	10	00	15.38	10	09	06.47		10	11	18.73	
Prece			+ 39.12			+ 39.08				+ 38.68	
α	10	00	54.50	10	09	45.55		10	11	57.41	
A	10	04	52	10	04	52		10	04	52	
A-A		- 3	57.50		+ 4	53.55			+ 7	05.41	
sin(A-A)			- 237.49			+ 293.53				+ 425.34	
log...			237564 m			246766				262874	
"WS			998243			998157				998659	
"30			086531 m			095647				112257	
30			- 7.3335			+ 9.0462				+ 13.2609	
31			- 12			+ 26				+ 105	
3			10.6653			27.0488				31.2714	
20C			10.9036			27.3174				31.3172	
20-3			+ 2383			+ 2686				+ 458	
C	+ 16°	14'	37.5	+ 16°	38'	04.6		+ 14°	13'	37.5	
L			37.6			04.1				37.2	
E			36.9			03.9				37.0	
Mean	+ 16	14	37.3	+ 16	38	04.2		+ 14	13	37.2	
Prece		- 3	28.9		- 3	33.1			- 3	33.5	
S	+ 16	11	08.4	+ 16	34	31.1		+ 14	10	03.7	
D	+ 15	47	12	+ 15	47	12		+ 15	47	12	
S-D		+ 23	56.4		+ 47	19.1			- 1	37	08.3
tan(S-D)			+ 1436.4			+ 2839.3				- 5829.9	
log...			3.15727			3.45322				3.76566 m	
"m			0.48842			0.78437				1.09681 m	
tan S			94628			94737				94022	
"32			17306			19129				22451	
"m			82468			84400				87007	
η_0			+ 3.0791			+ 6.0866				- 1.24971	
η_1			+ 177			+ 275				+ 502	
η			25.0968			28.1141				9.5531	
η			25.2136			28.0346				9.4283	
η			+ 1168			- 795				- 1248	

2093 Standard Coordinates

Cape No. 1377 mag 6.3				Cape No. 1398 mag 7.3				Cape No. 1463 mag 7.1			
C	10°	00'	15.40	10°	09'	06.43		10°	11'	18.74	
L			39			46				73	
E			34			51				72	
mean	10	00	15.38	10	09	06.47		10	11	18.73	
Prece			+ 39.12			+ 39.08				+ 38.68	
S	10	00	54.50	10	09	45.55		10	11	57.41	
D	10	04	52	10	04	52		10	04	52	
A-A			- 3 57.50			+ 4 53.55				+ 7 05.41	
alt. alt.			- 237.49			+ 293.53				+ 425.34	
log			2.37564m			2.46766				2.62874	
cos			998243			998157				998659	
3			086531m			095647				1.12257	
3 ₀			- 7.3335			+ 9.0462				+ 13.2609	
3 ₁			- 12			- 26				- 105	
3 ₂			10.6653			27.0488				31.2714	
3 ₃			109036			27.3174				31.3172	
3 ₄			+ 2383			+ 2686				+ 458	
C	+ 16°	14'	37.5	+ 16°	38'	04.6		+ 14°	13'	37.5	
L			376			04.1				372	
E			369			03.9				370	
mean	+ 16	14	37.3	+ 16	38'	04.2		+ 14	13	37.2	
Prece			- 3 289			- 3 33.1				- 3 33.5	
S	+ 16	11	084	+ 16	34	31.1		+ 14	10	03.7	
D	+ 15	47	12	+ 15	47	12		+ 15	47	12	
A-A			+ 23 56.4			+ 47 19.1		- 1	37	08.3	
alt. alt.			+ 1436.4			+ 2839.3				- 5829.9	
log			3.15727			3.45322				3.76166m	
3			048842			078437				109681m	
tan S			9.9628			9.4737				9.4022	
3 ₁			17306			19129				22451	
3 ₂			82468			84400				87007	
3 ₃			+ 30791			+ 60866				- 124971	
3 ₄			+ 177			+ 275				+ 502	
3 ₅			250968			281141				9.5531	
3 ₆			252136			280346				9.4253	
3 ₇			+ 1168			- 785				- 1245	

pt.	prob.	resid.
9	176.7	+4
1	164.1	-85
2	157.0	-108
3	140.3	+3
4	120.2	+55
5	119.1	+83
6	90.0	+50
7	59.8	-27
8	40.9	-124

2093

Invaris Center

7

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	18.7532	+0.5772	+3	0.3335	4.4313	-145
2	19.0000	+0.8290	+3	0.6795	4.4295	-163
3	19.5227	+1.3467	+2	1.8141	4.4420	-38
4	20.0000	+1.8240	+2	3.3277	4.4494	+36
5	20.0207	+1.8447	+1	3.4033	4.4523	+65
+6	20.2859	+2.1099	+0	4.4517	4.4523	+65
7	20.0000	+1.8240	-2	3.3263	4.4478	+20
8	19.5550	+1.3790	-2	1.9011	4.4390	-68
	18.2986	+0.1226	+3	0.0151	4.4398	-60
Comp $R^2 =$					4.4458	

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.0000	-2.0242	-1	4.0978
2	17.0878	-1.9364	-1	3.7500
3	17.4032	-1.6210	-1	2.6279
4	17.9651	-1.0591	0	1.1217
5	18.0000	-1.0242	0	1.0490
6	19.0000	0.0242	0	0.0006
7	20.0832	+1.0590	0	1.1215
8	20.6172	+1.5930	+1	2.5379
	16.9208	-2.1034	-1	4.4247

Aph. Center $x = 20.0$ $y = 17.9651$ 20.0832

38.0483

mean $y = 19.0242$ $y_{\text{min}} = 16.9130$ $R = 21142$ $x_{\text{max}} = 20.2859$ $x_0 = 18.1747$

Center $\left\{ \begin{array}{l} x_0 = 18.1760 \\ y_0 = 19.0242 \end{array} \right.$

2093

Invious Center

7

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	18.7532	+0.5772	+3	0.3333	4.4313	-145
2	19.0000	+0.8240	+3	0.6795	4.4295	-163
3	19.5227	+1.3467	+2	1.8191	4.4420	-38
4	20.0000	+1.8240	+2	3.3277	4.4494	+36
5	20.0207	+1.8447	+1	3.4033	4.4523	+65
6	20.2859	+2.1099	+0	4.4517	4.4523	-10
7	20.0000	+1.8240	-2	3.3263	4.4478	+20
8	19.5550	+1.3790	-2	1.9011	4.4390	-68

Comp K : 44458

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.0000	-2.0242	-1	4.0978
2	17.0878	-1.9364	-1	3.7500
3	17.4032	-1.6210	-1	2.6279
4	17.9651	-1.0591	0	1.1217
5	18.0000	-1.0242	0	1.0490
6	19.0000	0.0242	0	0.0006
7	20.0832	+1.0590	0	1.1215
8	20.6172	+1.5930	+1	2.5379

After Center $x = 20.0$ $y = 17.9651$

20.0832

38.0483

mean $y = 19.0242$ $y - \text{mean} = 16.9130$ $R = 2.1142$ $y - \text{mean} = 20.2859$ $x = 18.1747$ Center $\left\{ \begin{array}{l} x_0 = 18.1760 \\ y_0 = 19.0242 \end{array} \right.$

Formation of Kounals

	ab	am	bm
1	- 1.17	- 82.8	+ 293.0
2	- 1.59	- 133.5	+ 316.0
3	- 2.19	- 51.3	+ 61.6
4	- 1.93	+ 65.6	- 38.2
5	- 1.88	+ 119.9	- 66.4
6	- 0.04	+ 137.0	- 1.3
7	+ 1.93	+ 36.4	+ 21.2
8	+ 220	- 94.0	- 108.0
	- 4.67	- 2.7	+ 477.9
	- 0.25	- 7.2	+ 126.0

2093

Luvor's center.

8

Conditional Equations.

			c	0-c
(1)	$+ 0.12 - 2.10 = - 20$	$+ 1 - 65 = - 64$		$+ 4$
1	$+ 0.58 - 2.02 = - 145$	$+ 4 - 64 = - 60$		$- 85$
2	$+ 0.82 - 1.94 = - 163$	$+ 6 - 61 = - 55$		$- 106$
3	$+ 1.35 - 1.62 = - 38$	$+ 10 - 51 = - 41$		$+ 3$
4	$+ 1.82 - 1.06 = + 36$	$+ 14 - 33 = - 19$		$+ 55$
5	$+ 1.84 - 1.02 = + 65$	$+ 14 - 32 = - 18$		$+ 83$
6	$+ 2.11 - 0.02 = + 65$	$+ 16 - 1 = + 15$		$+ 50$
7	$+ 1.82 + 1.06 = + 20$	$+ 14 + 33 = + 47$		$- 27$
8	$+ 1.38 + 1.59 = - 68$	$+ 10 + 50 = + 60$		$- 128$

Average = 67

Normal Equations.

$$+ 19.24 - 4.67 = - 3$$

$$- 4.67 + 16.31 = + 478$$

$$+ 4.67 - 1.13 = - 1$$

$$+ 15.18 = + 477$$

$$b = + 31.4$$

$$+ 19.24a = - 3 + 478 = + 444$$

$$a = + 7.5$$

Normals with additional pt.

$$+ 19.26 - 4.92 = - 10$$

$$- 4.92 + 20.73 = + 604$$

$$+ 4.92 - 1.26 = - 3$$

$$+ 19.47 = + 601$$

$$b = + 30.9$$

$$+ 19.26 = - 10 + 602 = + 442$$

$$a = + 7.4$$

2093

Lunar's Center

8

Conditional Equations

	a	b	c		c	a - c
1	+0.58	-202	-145	+4	-64	-60
2	+0.52	-194	-163	+6	-61	-55
3	+1.35	-162	-38	+10	-51	-41
4	+1.82	-106	+36	+14	-33	-19
5	+1.84	-102	+65	+14	-32	-18
6	+2.11	-002	+65	+16	-1	+15
7	+1.82	+106	+20	+14	+33	+47
8	+1.38	+159	-68	+10	+50	+60

Average = 67

Normal Equations

$$+1929 - 967 = -3$$

$$-967 + 1631 = +478$$

$$+467 - 113 = -1$$

$$+1518 = +477$$

$$b = +31.4$$

$$+1929 = -3 + 147 = +144$$

$$a = +7.5$$

Red. ad. b. app.

$$\begin{array}{rcl}
 H + \alpha_0 & 13^L & 13^m = 198^\circ 15' \\
 H & 3 & 08'' \\
 \alpha_0 & 10 & 05'' \\
 G & 21 & 56'' \\
 G + \alpha & 8 & 01'' = 120^\circ 15'
 \end{array}$$

$$S = +15^\circ 24''$$

$$\begin{array}{rcl}
 \log i & & 0.7912 \\
 \dots \cos S & = & 9.9841 \\
 \dots (i) & & 0.7753
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos(G + \alpha_0) & = & 9.7022 \\
 \dots q & & 1.2464 \\
 \dots \sin(G + \alpha_0) & = & 9.9364 \\
 \dots \tan S & = & 9.4400 \\
 \dots \frac{q}{i} & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \dots (S') & & 0.9486 \\
 \dots (S) & & 9.4467
 \end{array}$$

$$\begin{array}{rcl}
 b & = & +230'' \\
 \left\{ \begin{array}{l} q \\ h \end{array} \right\} & = & +028'' \\
 & & -042'' \\
 \hline
 & & +216''
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S & = & 9.4248 \\
 \dots \cos(H + \alpha_0) & = & 9.9776 \\
 \dots h & = & 1.2903 \\
 \dots \sin(H + \alpha_0) & = & 9.4958 \\
 \dots \sec S & = & 0.0159 \\
 \dots \frac{h}{i} & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log(h') & = & 0.6921 \\
 \dots (h) & = & 9.6259
 \end{array}$$

$$\begin{array}{rcl}
 \left\{ \begin{array}{l} q \\ h' \end{array} \right\} & = & -8.88'' \\
 & = & -4.92'' \\
 (i) & + & 5.96'' \\
 \hline
 & = & -7.84''
 \end{array}$$

2093 Moon's Mean Position (1912.0)

9

$$\begin{array}{r} X_0 = 18.1760 \\ \frac{1}{2}a = +4 \\ \hline 18.1764 \end{array} \quad \begin{array}{r} Y_0 = 19.0242 \\ \frac{1}{2}b = +16 \\ \hline 19.0258 \end{array}$$

From plate constants $X = 18.0134$ $Y = 18.9950$

$$\xi = + 0.0134$$

$$\eta = - 3.0050$$

$$\begin{array}{ll} \log \xi = & 8.12710 \\ \cos \delta & 9.98412 \\ \text{const.} & 8.50724 \end{array}$$

$$\begin{array}{ll} \log \tan \delta = & 9.4430 \\ \text{const.} & 6.2542 \\ \eta = & 2.7506 \end{array}$$

$$(X - A) = 9.6357$$

$$\begin{array}{ll} \log \eta_0 = & 0.47784 \\ \text{const.} & 7.33115 \end{array}$$

$$X - A = + 0.43$$

$$(X - D) = 3.14669$$

$$A = 10 \ 04 \ 52$$

$$\delta - D = - 23 \ 21.8$$

$$X_0 = 10 \ 04 \ 52.43$$

$$D = + 15 \ 47 \ 12$$

$$\text{Red. ad l. app.} = + 2.16$$

$$S_0 = + 15 \ 23 \ 50.2$$

$$X' = 10 \ 04 \ 54.59$$

$$\text{Red.} = - 7.8$$

$$\delta' = + 15 \ 23 \ 42.4$$

2093 known mean position (1912.0)

9

$$\begin{array}{rcl}
 X_0 & = & 18.1760 \\
 + a & = & + 4 \\
 \hline
 & = & 18.1764
 \end{array}
 \qquad
 \begin{array}{rcl}
 Y_0 & = & 19.0242 \\
 + b & = & + 16 \\
 \hline
 & = & 19.0258
 \end{array}$$

From plate constants, $X = 18.0134$ $Y = 18.9950$

$$z = + 0.0134$$

$$\eta = - 3.0050$$

$$\log S = 8.12710$$

$$\cos S = 9.98412$$

$$\sin S = 8.50724$$

$$\log \tan S = 9.44302$$

$$\tan S = 6.2542$$

$$\log \eta = 2.75062$$

$$(X - A) = 9.63574$$

$$\log \eta_0 = 0.477842$$

$$\eta_0 = 7.33115$$

$$X - A = + 0.43$$

$$(X - D) = 3.146692$$

$$A = 10 \quad 09 \quad 52$$

$$D = - 23 \quad 21.8$$

$$X_0 = 10 \quad 04 \quad 52.43$$

$$D = + 15 \quad 47 \quad 12$$

$$\text{Reduced } \ell \text{ apply} = + 2.16$$

$$S_0 = + 15 \quad 23 \quad 50.2$$

$$X' = 10 \quad 04 \quad 54.59$$

$$\text{Red.} = - 7.8$$

$$D' = + 15 \quad 23 \quad 42.4$$

2093

Lunar Parallax.

$$\begin{aligned} \alpha' &= 10^h 04^m 54.59^s \\ \theta &= 8 \quad 08 \quad 43.3 \\ \alpha - \alpha' &= -1 \quad 56 \quad 11.29 \\ &= -29^\circ 02' 49'' \end{aligned}$$

$$-11 \quad 04$$

$$-28 \quad 51 \quad 45$$

$$9.95727$$

$$0.00000$$

$$0.05760$$

$$\text{Tang} \delta - 0.01487$$

$$\delta = +45^\circ 58' 50.5''$$

$$\delta = +15 \quad 23 \quad 42.4$$

$$30 \quad 35 \quad 08.1$$

$$9.82640$$

$$8.23663$$

$$9.70657$$

$$0.14321$$

$$7.91281$$

$$\delta - \delta' = +28 \quad 07.5''$$

$$\delta = +15 \quad 51 \quad 49.9''$$

$$\text{Ann Eph } \delta = +15 \quad 51 \quad 52.4''$$

$$\alpha - \alpha' = -2.5''$$

$$\delta' = +15^\circ 23' 42.4''$$

$$\mu = 59' 16.9''$$

$$9.86913$$

$$8.23663$$

$$9.68621$$

$$0.01686$$

$$7.80883 \text{ m} = \sin(\alpha - \alpha')$$

$$\alpha - \alpha' = -22' 08.18''$$

$$= -1'' 28.55''$$

$$\alpha = 10^h 03^m 26.04^s$$

$$\alpha = 10 \quad 03 \quad 25.61$$

$$+0.43$$

2093

Lunar Parallax.

$$\begin{aligned} \alpha' &= 10^{\circ} 04' 54.59'' \\ \delta &= 8^{\circ} 08' 43.3'' \\ \alpha - \alpha' &= -1^{\circ} 56' 11.29'' \\ &= -29^{\circ} 02' 49'' \end{aligned}$$

$$= 11^{\circ} 04'$$

$$-28^{\circ} 51' 45''$$

$$995727$$

$$000000$$

$$005760$$

$$\text{Aug. } 001487$$

$$\gamma = 45^{\circ} 58' 50.5''$$

$$\delta = 15^{\circ} 23' 42.4''$$

$$30^{\circ} 35' 08.1''$$

$$982640$$

$$823663$$

$$970657$$

$$014321$$

$$791281$$

$$S - S' = +28^{\circ} 07.5''$$

$$\delta = +15^{\circ} 51' 49.9''$$

$$\text{Ann. Eph. } \delta = +15^{\circ} 51' 52.4''$$

$$O - C = -2.5''$$

$$\delta' = +15^{\circ} 23' 42.4''$$

$$\pi = 59' 16.9''$$

$$986913$$

$$823663$$

$$968621$$

$$001686$$

$$780883 \text{ m} = \sin(\alpha - \alpha')$$

$$\alpha - \alpha' = 22^{\circ} 08.18''$$

$$= 1^{\text{m}} 28.55''$$

$$\alpha = 10^{\circ} 03' 26.04''$$

$$\alpha = 10^{\circ} 03' 25.61''$$

$$+0.43''$$

1
8
262
28
283
29
12

2094 Broken Plate.

1914 Jan. V.

11

Stan - minimum.

$\begin{array}{r} \text{d } 4 \\ 1 \quad 1022620 \\ 8.9 \quad 27 \\ 16.0 \quad 10060 \\ \hline 28.9536 \end{array}$
 $\begin{array}{r} \text{d } 4 \\ 9606 \\ 9439_{30} \\ 3430 \end{array}$

28.95369527

$\begin{array}{r} 2 \quad 18286 \\ 15.3 \quad 1054246 \\ 18.7 \quad 40 \\ 53 \\ \hline 18.7717 \end{array}$
 $\begin{array}{r} 19580 \\ 1730009 \\ 0602 \\ 69 \\ \hline 17726 \end{array}$

18.771717726

$\begin{array}{r} 3 \quad 16668 \\ 29.3 \quad 1508983 \\ 10.2 \quad 83 \\ 30 \\ \hline 10.1577 \end{array}$
 $\begin{array}{r} 18281 \\ 981526 \\ 2015 \\ 50 \\ \hline 1164 \end{array}$

10.15771164

Grade 4.

$\begin{array}{r} \text{d } 70 \\ 19481 \\ 18325 \\ 29_{30} \\ 01 \\ \hline 8.8845 \end{array}$
 $\begin{array}{r} \text{d } 70 \\ 14831 \\ 600104 \\ 97 \\ 61 \\ \hline 8856 \end{array}$

8.88458856

$\begin{array}{r} 17929 \\ 10959_{50} \\ 50 \\ 99 \\ \hline 25.3045 \end{array}$
 $\begin{array}{r} 19011 \\ 15940_{51} \\ 40_{50} \\ 81 \\ \hline 3057 \end{array}$

25.30453057

$\begin{array}{r} 16664 \\ 9290 \\ 9290 \\ 22 \\ \hline 29.2657 \end{array}$
 $\begin{array}{r} 19258 \\ 1658080 \\ 8080 \\ 30 \\ \hline 2671 \end{array}$

29.26572671

2094 Broken Plate.

1914 Jan 5.

11

Stan. Hermann.

1	1022620	9606
89	27	943930
260	10060	3930

2895369827

2	18286	19180
253	1054246	1730009
287	40	0602
	53	69
	<u>187717</u>	<u>7726</u>

3	16668	18281
293	1508983	981726
102	83	2011
	30	50
	<u>101577</u>	<u>1164</u>

Grade 4.

19481	14831
18325	600104
2930	979
01	61
<u>88845</u>	<u>8836</u>

17929	19011
1095710	1194051
50	4050
99	81
<u>253045</u>	<u>3057</u>

16664	19215
9290	1618050
9290	8050
22	30
<u>292657</u>	<u>2671</u>

2094

known-measures.

12

d		v	d	20	v
1	19932	16870			
17.0	17218	960000			
17.4	20	92			
min	32	85			
17.2714		2716			

min in γ = about 17.2650

2	18900	16932
18.0	12597	1323930
17.7	95-95	39
	88	48
	<u>17.6297</u>	<u>6298</u>

3
18.3
18.0

18662	17612
1272720	1356770
28	78
62	20
<u>18.4063</u>	<u>4045</u>

4
18.9
19.0

17628	18729
1647278	990010
20	00
24	41
<u>18.8845</u>	<u>8837</u>

5
18.9
19.4
max
w
56

14650	1307570
1382030	80
30	12255

<u>18.9173</u>	<u>9180</u>
----------------	-------------

6
18.8
20.0

17710	19340
1593036	1115050
35	59
13	60
<u>18.8223</u>	<u>8003</u>

2094
 19932 16870
 170 17218 960000
 174 2011 92
 32 85
 17.2714 2716

min 7 = about 17.2680

15900 16932
 18.0 12597 1323930
 17.7 91 39
 88 48
17.6297 6298

3
 18.3
 18.0

4
 189
 190

5
 189
 194
 max
 20

6
 188
 200

18662
 1272720
 28
 62
18.4063

17628
 1647278
 70
 24
18.8841

14650
 1382030
 30

18.9173

17710
 1593036
 35
 13
18.8222

17612
 1306770
 78
 20
4045

18729
 990010
 00
 41
8837

1307570
 80
 12255

9180

19340
 1115050
 59
 60
8203

2

7

18

20

8

18.

21.

9

18.

21.

2094

moon-measures.

d

n

d

x

v

7 scratch.

18.6 16300

19603

18175

14824

20.5 1166170

1421009

14330

873530

70

20

4030

3930

14

18

75

40

20.4640.460318.6158 ✓16089V

8

18.2

21.0

1227558

12910

6260

1142240

10742

20

18.15221483

9

18.0 11640

879000

21.2 1049191

0900

90

7733

21.11491067possibly on
termination.

2

7

18

20

8

18

21

9

18

21

2094

known measures

d

n

d

x

n

2 scratch.

186 16300

19603

18175

14824

205 1166170

1421009

14330

8735

70

20

4030

3930

14

18

75

90

2046404605186158 ✓16089 ✓

8

18.2

21.0

1227158

6260

10742

12910

114224

20

18.15221483

9

18.0 11640

879000

21.2 1049191

0900

90

7733

21.11491067possibly in
terminal.

2094 Times etc.
 Eph to stars 1912 Nov. 2 $8^h 16^m \checkmark$ - $8^h 28^m \checkmark$
 " Moon $8 22 30.0 \checkmark$ - $8 22 30.2 \checkmark$
 clock slow $0 13.2 \checkmark$

H. Sid T. $8 22 43.3 \checkmark$ $0 - \alpha = -1^h 41^m \checkmark$
 Sid T. in Moon H. long $4 44 31.0 \checkmark$
 G. Sid T. $13 07 14.35 \checkmark$
 Sid T. in Moon $14 45 33.65 \checkmark$
 Interval $22 21 40.70 \checkmark$
 Reduction $3 39.80 \checkmark$
 G. M. T. $22 18 00.90 \checkmark$

Fromvant Allen. R. A. Mech.
 Moon $22^h 10^m 03^s 16.52 \checkmark$ $+15^\circ 52' 51.0 \checkmark$
 Motion at $2.2423 \checkmark$ $14.475 \checkmark$
 $18.015 \checkmark$ $+ 40.40 \checkmark$ $- 4 20.8 \checkmark$
 Tabular place $10 03 56.92 \checkmark$ $+15 48 30.2 \checkmark$

Moon's age
 " parallel $59 16.9 \checkmark$
 " semidiameter $16 10.8 \checkmark$
 $934 = 12.9 \checkmark$ R $970.8 \checkmark$
 $971 = 14.0 \checkmark$ R $+14.0 \checkmark$
 Augmentation $-0.8 \checkmark$
 Irradiation R $984.0 \checkmark$
 R $2.1093 \checkmark$
 $a = -1.5$ $(1+a) R$ $2.1090 \checkmark$
 R^2 $4.4479 \checkmark$

2094

Times etc

Exp. 1912 Nov. 2 8^h 16^m - 8^h 28^m
 Moon 8 22 300.8 22 302
 clock slow 0 13.2

H. ind. T 8 22 433 9-8: -1^h 41^m
~~Exp. 1912 Nov. 2~~ 4 44 310.5
 G. light 13 07 143.5
 ind. in Moon 14 45 33.65
 Interval 22 21 40.70
 Reduction 3 39.80
 G. in T 22 18 00.90

From hand Alun.

R G

black

Moon 22^h 10^h 03^m 16^s 52^{ms} +15° 52' 51"0
 Motion 1^m 2 2423 14471^m
 18.015 + 40.40 - 4 208
 Tabular place 10 03 56.92 +15 48 302

Moon's angle

parallel

59 16.9

semicircular

16 10.8

934.129

491.140

Av

R

970.8

Amplitude

+14.0

Inclination (41)

-0.8

R

984.0

R

21093

a = 1.5

(1+a)

R

21090

R²

44479

2094

Plate Constants

2	8.8850	25.3051	29.2664
3	10.6653	27.0488	31.2714
2-3	-1.7803	-1.7437	-2.0050

4	25.9832	28.7722	10.1570
7	25.0968	28.1141	9.5531
4-7	+8864	+6581	+6039

$$\begin{array}{rclcl}
 2-3 & -1404 & & +1.52 & +2.1428 \\
 -1.7803 - 3638 & = -2144.1 & +13 & = -2.1428 & = 0 \\
 -1.7437 - 4028 & = -2146.5 & +38 & = -2.1427 & = +1 \\
 -2.0050 - 1422 & = -2147.2 & +44 & = -2.1428 & = 0 \\
 16.8083 - 2712 & & +25 & & = 18.6824
 \end{array}$$

$$\begin{array}{rclcl}
 4-7 & +1392 & & +.44 & =126 & -1.0108 \\
 +8864 + 1235 & = +10099 & +10 & = +1.0109 & -1 & = +1.0108 = 0 \\
 +6581 + 3518 & = +10099 & +12 & = +1.0111 & -3 & = +1.0108 = 0 \\
 +6039 + 4068 & = +10107 & +4 & = +1.0111 & -3 & = +1.0108 = 0 \\
 19.3716 + 2336 & & +8 & & -2 & = 18.5950
 \end{array}$$

$$\begin{array}{llll}
 \text{Tables } a = -0.9 & a = -2.0 & a - a = +1.1 & b + a = +1.2 \\
 \text{Obs } a = -1.5 & a = -0.4 & a - a = -1.1 & b + a = +1.1
 \end{array}$$

2094

Plate Constant

2	8.8850	25.3051	29.2664
3	10.6653	27.0488	31.2714
2-3	-1.7803	-1.7437	-2.0050
4	25.9832	28.7722	10.1570
7	25.0968	28.1141	9.5531
4-7	+8864	+6581	+6039

2-3	-1904	+1.52	+2.1428
-1.7803	-3638	-2144	1 + 13 = -21428 = 0
-1.7437	-4028	-21465	+38 = -21427 = +1
-2.0050	-1422	-21472	+49 = -21428 = 0
168083	-2712	+25	= 186824
4-7	+1392	+44	+120 = 10108
+8864	+1235	+10099	+10 = +10109 - 1 = +10108 = 0
+6581	+3518	+10099	+12 = +10111 - 3 = +10108 = 0
+6039	+4068	+10107	+4 = +10111 - 3 = +10108 = 0
19.3716	+2336	+8	-2218.5-950

Tables $a = -0.9$ $a = -2.0$ $a = -1.1$ $b+a = +1.2$
 $a = -1.5$ $a = -0.4$ $a = -1.1$ $b+a = +1.1$

pt	pos. 2	resid.
1	174.8	+ .3
2	145.5	+ 6.4
$\frac{1}{2}$ 3	130.9	- 1.59
4	100.3	- 1.1
5	90.0	+ 1.1
6	72.7	- 1.4
$\frac{1}{2}$ 7	58.8	- 4.1
8	39.6	+ 3.9
9	34.5	- 2.9

see next page

2094 Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) \mp (y - y_0)^2$	$0 - c$
1	17.0000	+0.1910	+2	0.0366	4.4617	+138
2	18.0000	+1.1910	+2	1.4190	4.4647	+168
3	18.4054	+1.5964	+1	2.5488	4.4394	-85 ^{1/2}
4	18.8841	+2.0751	+0	4.3060	4.4466	-13
5	18.9176	+2.1086	0	4.4462	4.4462	-17
6	18.8213	+2.0123	-1	4.0489	4.4395	-84
7	18.6124	+1.8034	-1	3.2519	4.4339	-140 ^{1/2}
8	18.1502	+1.3412	-2	1.7983	4.4389	-90
9	18.0000	+1.1910	-2	1.4180	4.4314	-165

$$\text{comp } R^2 = 4.4479$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.2715	-2.1035	-1	4.4251
2	17.6298	-1.7452	0	3.0457
3	18.0000	-1.3750	0	1.8906
4	19.0000	-0.3750	0	0.1406
5	19.3750	0.0000	0	0.0000
6	20.0000	+0.6250	0	0.3906
7	20.4622	+1.0872	0	1.1820
8	21.0000	+1.6250	0	2.6406
9	21.1108	+1.7358	+1	3.0134

Appl. Center

$$x = 18.0 \quad y = 17.6298$$

$$21.1108$$

$$38.7406$$

$$\text{mean } y = 19.3703$$

$$y_{\text{min}} = 17.2680$$

$$R = 2.1023$$

$$y = \text{min} = 17.2680$$

$$\text{comp } R = 2.1090$$

$$y_0 = 19.3770$$

$$x = \text{max} = 18.9176$$

$$\text{comp } R = 2.1090$$

$$x_0 = 16.8086$$

$$\text{Center } \begin{cases} x_0 = 16.8090 \\ y_0 = 19.3750 \end{cases}$$

2094 Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$0 - 0$
1	17.0000 + 0.1910	+ 2	0.0366	4.4617	+ 1.38	
2	18.0000 + 1.1910	+ 2	1.4190	4.4647	+ 1.68	
3	18.4054 + 1.5964	+ 1	2.5488	4.4394	- 85	
4	18.8841 + 2.0751	+ 0	4.3060	4.4466	- 13	
5	18.9176 + 2.1086	0	4.4462	4.4462	- 17	
6	18.8213 + 2.0123	- 1	4.0489	4.4395	- 84	
7	18.6124 + 1.8034	- 1	3.2519	4.4339	- 1.90	
8	18.1502 + 1.3412	- 2	1.7483	4.4389	- 90	
9	18.0000 + 1.1910	- 2	1.9180	4.4314	- 1.65	

Comp R = 4.4479

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.2715	-2.1035	-1	4.4251
2	17.6298	-1.7452	0	3.0457
3	18.0000	-1.3750	0	1.8906
4	19.0000	-0.3750	0	0.1406
5	19.3750	0.0000	0	0.0000
6	20.0000	+0.6250	0	0.3906
7	20.4622	+1.0872	0	1.1820
8	21.0000	+1.6250	0	2.6406
9	21.1108	+1.7358	+1	3.0134

Apfr Center

$$x = 18.0 \quad y = 17.6298$$

$$21.1108$$

$$38.7406$$

$$\text{mean } y = 19.3703$$

$$y_{\text{min}} = 17.2680$$

$$R = 21023$$

$$y_{\text{max}} = 17.2680$$

$$\text{Comp } R = 21090$$

$$y_0 = 19.3770$$

$$x_{\text{max}} = 18.9176$$

$$\text{Comp } R = 21090$$

$$x_0 = 16.8086$$

$$\text{Center } \begin{cases} x_0 = 16.8090 \\ y_0 = 19.3750 \end{cases}$$

Formation of normal ab

	ab	cul	bln
1	-0.40	+ 26.2	- 290.0
2	- 208	+ 200.5	- 294.0
3	- 0.55	- 34.0	+ 29.3
4	- 0.79	- 27.1	+ 4.9
5	+ 0.00	- 35.9	- 0.0
6	+ 1.24	- 168.8	- 52.0
7	+ 0.49	- 63.0	- 38.1
8	+ 2.17	- 120.5	- 146.0
9	+ 208	- 196.8	- 287.5
	+ 2.16	- 419.4	- 1073.4
	+ 1.47	- 189.0	- 114.7
	+ 3.63	- 608.4	- 1188.1

giving (7) full wt.

Period. giving 7 full wt.

	D	C	D-C
1	+ 138	- 3 + 125 = - 152	- 14
2	+ 168	- 19 + 129 = - 110	+ 58
3	- 85	- 25 + 102 = - 77	- 162 (81)
4	- 13	- 33 + 28 = - 5	- 8
5	- 17	- 34 - 0 = - 34	+ 17
6	- 84	- 32 - 46 = - 78	- 6
7	- 140	- 29 - 81 = - 110	- 30
8	- 90	- 21 - 120 = - 141	+ 51
9	- 165	- 19 - 129 = - 148	- 17
			+ 126 = 156 - 81
			Average = 33

2094

Moon's Center

Conditional Equations

	a	b	0		c	0-c
1	+0.19	-2.10	= +1.38	-	3 + 144 = +141	-3
2	+1.19	-1.75	= +1.68	-	16 + 120 = +104	+64
3	+1.60	-1.38	= -85	-	21 + 95 = +74	-159
4	+2.08	-0.38	= -13	-	28 + 26 = -2	-11
5	+2.11	+0.00	= -17	-	28 - 0 = +28	+11
6	+2.01	+0.62	= -84	-	27 - 43 = -70	-14
7	+1.80	+1.09	= -140	-	24 - 75 = -99	-41
8	+1.34	+1.62	= -90	-	18 - 111 = -129	+39
9	+1.19	+1.74	= -165	-	16 - 120 = -136	-29
Average						41

Normal Equations

$$\begin{aligned}
 +20.37a + 2.16b &= -419 \\
 +2.16a + 15.19b &= -7073 \\
 -2.16a - 0.23b &= +44 \\
 +14.96b &= -1029 \\
 +20.37a &= -419 + 149 = -270
 \end{aligned}$$

$$\begin{aligned}
 b &= -68.8 \\
 a &= -13.3
 \end{aligned}$$

Giving (7) full wt.

$$\begin{aligned}
 +21.36a + 3.63b &= -608 \\
 +3.63a + 15.31b &= -1188 \\
 -3.63a - 0.62b &= +103 \\
 +14.69b &= -1085 \\
 +21.36a &= -608 + 268 = -340 \\
 a &= -16.0
 \end{aligned}$$

$$b = -74.0$$

$$a = -16.0$$

2094 known Centers Conditional Equations

	a	b	0		c	0-c
1	+0.19	-2.10	+1.38	=	3+144 = +141	-3
2	+1.19	-1.75	+1.64	=	16+120 = +104	+64
3	+1.60	-1.38	-8.5	=	21+95 = +74	-159
4	+2.08	-0.38	-13	=	28+26 = -2	-11
5	+2.11	+0.00	-17	=	28-0 = +28	+11
6	+2.01	+0.62	-84	=	27-43 = -70	-19
7	+1.80	+1.09	-140	=	24-75 = -99	-41
8	+1.34	+1.62	-90	=	18-111 = -129	+39
9	+1.19	+1.74	-165	=	16-120 = -136	-29
Average						91

Normal Equations

$$\begin{aligned}
 +20.37a + 2.16b &= -419 \\
 +2.16a + 15.19b &= -7073 \\
 -2.16a - 0.23b &= +94 \\
 +14.96b &= -1029 \\
 +20.37a &= -419 + 149 = -270
 \end{aligned}$$

$$\begin{aligned}
 b &= -68.8 \\
 a &= 13.3
 \end{aligned}$$

Giving (T) full wt

$$\begin{aligned}
 +21.36a + 3.63b &= -608 \\
 +3.63a + 15.31b &= -1158 \\
 -3.63a - 0.62b &= +103 \\
 +14.69b &= -1085 \\
 +21.36a &= -608 + 268 = -340
 \end{aligned}$$

$$\begin{aligned}
 b &= -74.0 \\
 a &= -16.0
 \end{aligned}$$

2094. Moon's mean Position (1912.0)

$$\begin{array}{rcl}
 X_0 & = & 16.8090^{\circ} \\
 \frac{1}{2}a & = & -7^{\circ} \\
 \hline
 & & 16.8083^{\circ} \\
 & & (16.8082)
 \end{array}
 \qquad
 \begin{array}{rcl}
 Y_0 & = & 19.3750^{\circ} \\
 \frac{1}{2}b & = & -34^{\circ} \\
 \hline
 & & 19.3716^{\circ} \\
 & & (19.3713)
 \end{array}$$

leaving (7) full wt.

$$\begin{array}{rcl}
 \text{from Plate Constants } X & = & 18.6824 \\
 & & (18.6823)
 \end{array}
 \qquad
 \begin{array}{rcl}
 Y & = & 18.5950 \\
 & & (18.5947)
 \end{array}$$

$$\begin{array}{rcl}
 Z & = & +0.6824^{\circ} \quad (0.6823) \\
 \eta & = & -3.4050^{\circ} \quad (-3.4053)
 \end{array}$$

$$\begin{array}{rcl}
 \log \xi & = & 9.83404^{\circ} \quad (9.83398) \\
 \log S & = & 9.98423^{\circ} \\
 \text{const} & = & 8.50724
 \end{array}$$

$$\begin{array}{rcl}
 \log \tan S & = & 9.4405 \\
 \log \xi^2 & = & 9.6681 \\
 \eta_1 & = & 6.1620
 \end{array}$$

$$\begin{array}{rcl}
 \dots (d-A) & = & 1.34257^{\circ} \quad (1.34251)
 \end{array}$$

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

$$d-A \quad + \quad 22.01^{\circ}$$

$$\eta_0 = -3.4051^{\circ} \quad (-3.4054)$$

$$A \quad 10 \quad 04 \quad 52^{\circ}$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 0.53213^{\circ} \quad (0.53217) \\
 \text{const} & = & 7.33115^{\circ}
 \end{array}$$

$$d_0 \quad 10 \quad 05 \quad 14.01^{\circ}$$

$$\dots (d-D) = 3.20098^{\circ} \quad (3.20102)$$

$$\text{Red} \quad + \quad 2.16^{\circ}$$

$$S-D = - \quad 26' \quad 28.5'' \quad (28.6)$$

$$d' \quad 10 \quad 05 \quad 16.17^{\circ}$$

$$D = +15 \quad 47 \quad 12^{\circ}$$

$$\text{Corr to star } \alpha = -0.2$$

$$S_0 = +15 \quad 20 \quad 43.5^{\circ} \quad (43.4)$$

$$\text{Red.} \quad - \quad 7.8^{\circ}$$

$$S' = +15 \quad 20 \quad 35.7^{\circ} \quad (35.6)$$

$$\text{Corr to star } \alpha = +0.2$$

2094 Moon's mean Position (1912.0)

$$X_0 = 16.8090 \quad Y_0 = 19.3750$$

$$\dot{X}_0 = -7 \quad \dot{Y}_0 = -34$$

$$16.8083 \quad 19.3716$$

$$(16.8082) \quad (19.3713)$$

Moon (7) full wt

$$\text{from Plate Constants } X = 18.6824$$

$$(18.6823)$$

$$Y = 18.5950$$

$$(18.5947)$$

$$S = +0.6824 \quad (0.6823)$$

$$\eta = -3.4050 \quad (-3.405)$$

$$\log S = 9.83404 \quad (9.83398)$$

$$\log \tan S = 9.4405$$

$$\log S = 9.98423$$

$$S = 9.6681$$

$$\text{const. } 8.50724$$

$$\eta = 6.1620$$

$$(X-A) \quad 1.34257 \quad (1.34251)$$

$$\eta = +1$$

$$X-A \quad + \quad 22.01$$

$$\eta = -3.4051 \quad (-3.405)$$

$$A \quad 10 \quad 04 \quad 52$$

$$\log \eta = 0.53213 \quad (0)$$

$$\alpha_0 \quad 10 \quad 05 \quad 14.01$$

$$\text{const. } 7.33115$$

$$(D-D) \quad 3.20098 \quad (3.201)$$

$$\text{Red.} \quad + \quad 2.16$$

$$S-D = - \quad 26' \quad 28.5'' \quad (-26)$$

$$\alpha' \quad 10 \quad 05 \quad 16.17$$

$$D = +15 \quad 47 \quad 12$$

$$S_0 = +15 \quad 20 \quad 43.5 \quad (43)$$

$$\text{Red.} \quad - \quad 7.8$$

$$S' = +15 \quad 20 \quad 35.7 \quad (35)$$

2094 Lunar Parallax.

$$\begin{aligned} \alpha' &= 10^h 05^m 16.17^s \\ \delta &= 8 \quad 22 \quad 43.3 \\ G-\alpha &= -1 \quad 42 \quad 32.87 \\ &= -25^\circ 38' 14'' \end{aligned}$$

$$\begin{aligned} &= 9 \quad 52 \\ &= -25 \quad 28 \quad 22 \end{aligned}$$

$$9.95727$$

$$0.00000$$

$$0.04441$$

$$\tan f = 0.00168$$

$$\gamma = 45 \quad 06 \quad 38.5$$

$$15 \quad 20 \quad 35.7$$

$$29 \quad 46 \quad 02.8$$

$$9.82640$$

$$8.23663$$

$$9.69590$$

$$0.14968$$

$$\sin(\delta-d') = 7.90861$$

$$\delta - \delta' = +27 \quad 51.2$$

$$\delta = +15^\circ 48' 26.9'' (26.8) \quad \alpha = 10^h 03^m 57.28^s$$

$$\text{Ann Eph } \delta = +15 \quad 48 \quad 30.2$$

$$\alpha = 10 \quad 03 \quad 56.92$$

$$O-C = -3.3$$

$$+0.36$$

$$\text{Living (7) full wt } (-3.4)$$

$$\text{Corr to stand radius } +0.2$$

$$-0.2$$

$$O-C = -3.2$$

$$+0.34$$

$$T_1 = 59' 16.9''$$

$$9.86913$$

$$8.23663$$

$$9.63616$$

$$0.01675$$

$$\sin(\alpha-\alpha') = 7.75867$$

$$\alpha - \alpha' = -19' 43.30''$$

$$= -1^m 18.89^s$$

209.4 Lunar Parallaxes.

$$\alpha' = 10^{\circ} 05' 16.17''$$

$$\delta = 8^{\circ} 22' 43.3''$$

$$G-\alpha = -1^{\circ} 42' 32.87''$$

$$= -25^{\circ} 38' 14''$$

$$= 9^{\circ} 52'$$

$$- 25^{\circ} 28' 22''$$

$$9.95727$$

$$000000$$

$$004441$$

$$\tan \delta = 000168$$

$$\gamma = 45^{\circ} 06' 38.5''$$

$$15^{\circ} 20' 35.7''$$

$$29^{\circ} 46' 02.8''$$

$$9.82640$$

$$8.23663$$

$$9.69590$$

$$0.14968$$

$$\sin(\delta - \delta') = 790861$$

$$\delta - \delta' = +27^{\circ} 51.2''$$

$$\delta = +15^{\circ} 48' 26.9'' (26.8'') \quad \alpha = 10^{\circ} 03' 57.28''$$

$$\text{Circ Eph } \delta = +15^{\circ} 48' 30.2''$$

$$\alpha = 10^{\circ} 03' 56.92''$$

$$O-C = -3.3$$

$$(-3.4)$$

$$+0.36$$

$$\text{admiral} +0.2$$

$$-0.2$$

$$-3.2$$

$$+0.34$$

$$\delta = +15^{\circ} 20' 35.7'' (35.6'')$$

$$T_1 = 59' 16.9''$$

$$9.86913$$

$$8.23663$$

$$9.63616$$

$$001675$$

$$\sin(\alpha - \alpha') = 775867$$

$$\alpha - \alpha' = -19' 43.30''$$

$$= -1^{\circ} 18.89''$$

2145 Star-Measures

	d	μ
1	16263	18865
2.9	981810	1539094
226	20	9294
	65	59

22.6548.6532

2	913642	12869
14.4	32	1212020
99	8388	29

9.9251.9254

3	19989	17181
27.7	1443631	1272029
19.5	30	25
	79	83

19.5551.5543

Grade 3.

Additional Stars

4	19728	17435
19.4	1201218	1515044
27.7	08	43
	28	45

27.7715.7709

1914 January 6.

20

d	μ
11289	1263840
1060305	32
01	11963

7.9314.9326

15390	17090
904043	1342019
48	20
92	80

14.3653.3666

19681	17330
1691922	1007064
3031	65
68	20

27.7248.7257

14622	18783
875045	1466964
40	70
21	91

19.4124.4118

2195 Stars - Measures

	d	x		d	x
1	16363	18865			
79	9818	15390			
226	2010	9294			
	65	59			
	<u>22.6548</u>	<u>6132</u>			
2	9136	12869			
144	3242	12120			
99	8388	29			
	<u>9.9251</u>	<u>9254</u>			
3	19989	17181			
277	14436	12720			
141	3031	2529			
	79	43			
	<u>19.5551</u>	<u>5543</u>			

1917 January 6.

	d	x		d	x
	11289	1263840			
	1060305	32			
	01	11963			
	<u>7.9314</u>	<u>9326</u>			
	15390	17090			
	904043	1342019			
	48	2019			
	92	80			
	<u>143653</u>	<u>3666</u>			
	19681	17330			
	1691922	1007064			
	3031	6164			
	68	20			
	<u>277248</u>	<u>7217</u>			

Grade 3.

Additional Stars

1	19728	17435
194	12012	15150
277	0818	4349
	28	41
	<u>27.7715</u>	<u>7709</u>

14622	18783
8750	14669
4045	7064
21	91
<u>19.4124</u>	<u>4118</u>

2145 moon - measures.

	<u>1</u>	1894.1		1979.6
19.4		1402936		1468300
16.5		33		9091
min		41		86
$\bar{x}$		16.4908		.4900

<u>2</u>		1849.4		1977.0
19.0		1301725		152218
16.6		19		2018
		95		64
		16.5475		.5453

<u>3</u>		182		17358
17.0				891120
				20
				61
				151556

		15150
		13665
		6565
		38
		1483

<u>4</u>		180		15570
17.2		1379080		709095
		72		8595
		50		70
		17.1571		.1520

<u>5</u>		17.6		17638
18.0				1333133
				30
				32
				175696

		17923
		1222523
		30
		22
		5696

<u>6</u>		17.5		14800
18.3				1000500
min				00
$\bar{x}$				90
				17.5206

		17959
		1273032
		39
		59
		5225

2145 Moon - measures

21

$$\begin{array}{r}
 1 \\
 194 \quad 18941 \\
 165 \quad 1402936 \\
 \quad \quad 33 \\
 \quad \quad 41 \\
 \hline
 16.4908
 \end{array}
 \qquad
 \begin{array}{r}
 19796 \\
 1468300 \\
 9091 \\
 86 \\
 \hline
 4900
 \end{array}$$

$$\begin{array}{r}
 2 \\
 190 \quad 18994 \\
 166 \quad 1301725 \\
 \quad \quad 19 \\
 \quad \quad 95 \\
 \hline
 16.5475
 \end{array}
 \qquad
 \begin{array}{r}
 19770 \\
 152218 \\
 2018 \\
 64 \\
 \hline
 5453
 \end{array}$$

$$\begin{array}{r}
 3 \\
 182 \\
 170 \\
 \hline
 17358 \\
 891120 \\
 20 \\
 61 \\
 \hline
 151556
 \end{array}
 \qquad
 \begin{array}{r}
 15150 \\
 1365555 \\
 6555 \\
 38 \\
 \hline
 1483
 \end{array}$$

$$\begin{array}{r}
 4 \\
 180 \quad 15352 \\
 172 \quad 1379080 \\
 \quad \quad 72 \\
 \quad \quad 50 \\
 \hline
 17.1571
 \end{array}
 \qquad
 \begin{array}{r}
 15570 \\
 709091 \\
 8591 \\
 70 \\
 \hline
 1520
 \end{array}$$

$$\begin{array}{r}
 5 \\
 176 \\
 180 \\
 \hline
 17638 \\
 1333133 \\
 30 \\
 32 \\
 \hline
 175696
 \end{array}
 \qquad
 \begin{array}{r}
 17923 \\
 1222523 \\
 30 \\
 22 \\
 \hline
 15696
 \end{array}$$

$$\begin{array}{r}
 6 \\
 17.5 \\
 183 \\
 \hline
 14800 \\
 1000500 \\
 00 \\
 90 \\
 \hline
 17.5206
 \end{array}
 \qquad
 \begin{array}{r}
 17959 \\
 1273032 \\
 39 \\
 59 \\
 \hline
 5225
 \end{array}$$

2145-

d moon-measures

22

7

17.6
19.0d²14750
10809
0005-
5017.6055

N

19005
12950
1550
08.6055

8

18.0 19558

17813

19.6 12490 05-

14853

86

50.49

51

10

19.7060.7039

9

18.4

20.0

19285-

19150

1247052

16010.2

2938

15.2

75-

85

18.3169.3170

2145

Harvard - measures

21

I

176

19.0

d^m

14750

10809

0005

50

176055

N

19005

12950

1550

08

6055

8

180

19558

17813

196

12490

14453

86

5049

51

10

1970607039

9

184

200

19285

1247052

2938

75

183169

19180

16010

1512

85

3170

2145 Trines etc.

Exp to star 1912 Nov. 18 23^h 22^m - 23^h 34^m
 " Moon 23 27 34.6 - 23 27 34.9^v
 Clock glass 0 01.4^v

H. Sid T. 23 27 33.35^v $\theta - \alpha = +0^{\circ} 5''$
 H. long 4 44 31.0^v
 G. Sid T. 28 12 04.40^v
 Sid T. in Moon 15 48 38.55^v
 Interval 12 23 25.85^v
 Reduction 2 01.79^v
 G. M. T. 12 21 24.06^v

From Kant Alm R. A. Decl.
 Moon 12^h 23^h 21^m 38^s 32^v - 6^h 19^m 05^s 9^v
 Motion in $\alpha = 1.7927^{\circ}$ 14.146^v
 " 21.401^v + 38.37^v + 5 02.7^v
 Tabular place 23 22 16.69^v - 6 14 03.2^v

Moon age 10 days.

parallax 54' 48.0^v
 semidiam 14 57.5^v
 R 897.5^v
 Augmentation +9.6^v
 Irradiation (3) -0.7^v
 R 906.4^v
 R 1.9430^v
 a = 2.1 (1+R) R 1.9426^v
 R² 37737^v

2145	Truncs etc						
Exp to stan 19.2 Nov. 15	23	22			- 23	34	
known	23	27	346	- 23	27	349	
clock float		0	014				
H Sid. i.	23	27	33.35		0 - x - + 0	5	
H long	9	44	31.05				
G Sid. i.	28	12	0440				
Sid. Th known	15	48	38.55				
Interval	12	23	25.85				
Reduction		2	01.79				
G M T.	12	21	24.06				

From Hunt Alman			R A.		Decl.		
known 12	23	21	38.32		- 6	19	05.9
known at 1.7927					14.146		
21.401			+ 38.37		+ 5	027	
Tubular place	23	22	16.69		- 6	14	032

known age 10 days.

434: 10.9	procellae	54	480
4475 96	separation	14	575
	R		897.5
	Augmentation.		+ 96
	Irradiation (3)		- 07
	R		906.4
	R		1.9430
2.1	(1+2) R		1.9426
	R ²		37737

194121 277712

2145

Plate Constants.

24

x	y	$R.A.$	$Decl.$
7.9320	22.6540	23 ^h 16 ^m 09 ^s	-6° 23' 18"
14.3660	9.9252	19 32	-8 02 02
27.7252	19.5547	26 29	-6 46 22
350.02	52.13	61 70	20 71 42
16.67	17.38	23 20 43	-7 03 54
-18	-22	+ 41	+ 35 50
1.33	4.62	23 21 24	-6 28 04
31	465		
41 ^s	2150"		

$$A = 23^h 21^m 24^s$$

$$D = -6^\circ 28' 04''$$

$$\begin{aligned}
 &2-3 \quad -6884 \quad +2.1x \quad +1390 \\
 &+62-1559 = -1497 +17 = -1480 \\
 &-737-683 = -1420 +30 = -1390 = 0 \\
 &+480-1911 = -1431 +41 = -1390 = 0 \\
 &-104-1345 = -1449 +58 = -1391 = -1 \\
 &9.4640-1268 = \quad +41^v = 19.4803^v
 \end{aligned}$$

$$\begin{aligned}
 &y-m \quad +68.5x \quad +3.7y \quad -1185 \\
 &+542+543 = +1085 +84 = +1169 \\
 &+164+984 = +1148 +37 = +1185 = 0 \\
 &-297+1330 = +1083 +103 = +1186 = +1 \\
 &-787+1899 = +1112 +72 = +1184 = -1 \\
 &18.4318+1333^v \quad +68^v = 18.4534^v
 \end{aligned}$$

$$\begin{aligned}
 \text{Taken } a &= +0.9 & c &= -2.9 & a-c &= +3.8 & b+a &= -0.0 \\
 \text{Obs } a &= -2.1 & c &= -3.7 & a-c &= +1.6 & b+a &= +0.3
 \end{aligned}$$

2145

Plate Constants

29

x	y	$R.A.$	$Decl.$
79320	226540	23° 16' 09"	-6° 23' 18"
143660	99252	19 32	-8 02 02
277252	195547	26 29	-6 46 22
35002	5213	61 20	20 71 42
1667	1738	23 20 43	-7 03 54
-18	-22	+ 41	+ 35 50
133	462	23 21 24	-6 28 04
31	465		
41	2150		

$$A = 23^{\circ} 21' 24''$$

$$D = -6^{\circ} 28' 04''$$

$$\begin{aligned}
 &2.3 - 6884 + 2.12 + 1390 \\
 &+ 62 - 1559 = -1497 - 17 = -1480 \\
 &- 737 - 683 = -1420 - 30 = -1390 = 0 \\
 &+ 480 - 1911 = -1431 - 41 = -1390 = 0 \\
 &- 104 - 1395 = -1449 - 58 = -1391 = -1 \\
 &194640 - 1268 = +41 = 194803
 \end{aligned}$$

$$\begin{aligned}
 &y - y + 6852 + 374 - 1185 \\
 &+ 542 - 543 + 1085 - 84 + 1169 \\
 &+ 164 - 989 + 1148 - 37 + 1185 = 0 \\
 &- 297 + 1330 + 1083 + 103 + 1186 = +1 \\
 &- 787 + 1899 + 1112 + 72 + 1184 = -1 \\
 &184318 + 1333 + 68 = 184534
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a &= +0.9 & c &= -2.9 & a - c &= +3.8 & b + a &= -0.0 \\
 \text{Obs } a &= -2.1 & c &= -3.7 & a - c &= +1.6 & b + a &= +0.3
 \end{aligned}$$

Cape W. 3275 mag 8.6

23 21 29.46

53

49

23 21 29.49

+ 3714

23 22 06.63

23 21 24

+ 0 42.63

+ 42.63

1.62972

9.99783

0.13479

+ 1.3640

+ 1

3 19.3641

2 19.4121

2-3 + 480

-5 46 57.8

57.5

57.1

-5 46 57.5

+ 3 57.2

-5 43 00.3

-6 28 04

+ 45 03.7

+ 2703.9

3.43199

0.76314

9.0005m

0.2696

6.3235m

+ 5.7961

- 2

277959

4 277712

4-m - 247

Standard Coordinates.

25-

2145				Cape No. 3255 mag 6.3				Cape No. 3269 mag 7.5				Cape No. 3288 mag 6.4			
C	23	15	31.54	23	18	54.92		23	18	54.92		23	25	51.70	
L			57			96				96				72	
B			59			98				98				69	
mean	23	15	31.57	23	18	54.95		23	18	54.95		23	25	51.70	
Proc		+	37.22		+	37.27			+	37.27			+	37.15	
Q	23	16	08.79	23	19	32.22		23	19	32.22		23	26	28.85	
A	23	21	24	23	21	24		23	21	24		23	21	24	
A-A		- 5	15.21		- 1	51.78			+	5	04.85		+	5	04.85
Std(A)		- 3	15.18		- 1	1.78			+	3	04.83		+	3	04.83
log..		2.49856	m		2.04836	m			2.48406				2.48406		
cos		9.99730			9.99572				9.99696				9.99696		
3.		1.00310	m		0.55132	m			0.98826				0.98826		
3.		- 10.0716			- 3.5589				+	9.7332			+	9.7332	
3.		- 26			- 14				+	24			+	24	
3		7.9258			14.4397				27.7356				27.7356		
2		7.9320			14.3660				27.7252				27.7252		
2-3		+	62		- 737				- 104				- 104		
C	- 6°	27'	14.4	- 8°	05'	58.6		- 6°	50'	19.9		- 6°	50'	19.9	
L			14.7			59.2				19.9				19.9	
B			13.9			59.3				20.1				20.1	
mean	- 6	27	14.3	- 8	05	59.0		- 6	50	20.0		- 6	50	20.0	
Proc		+ 3	56.1		+ 3	56.8			+	3	57.9		+	3	57.9
S	- 6	23	18.2	- 8	02	02.2		- 6	46	22.1		- 6	46	22.1	
D	- 6	28	04	- 6	28	04		- 6	28	04		- 6	28	04	
S-D		+ 4	45.8	- 1	33	58.2			- 18	18.1			- 18	18.1	
tan(G-A)		+	285.8		- 5639.6				- 1098.1				- 1098.1		
log..		2.45606			3.75125	m			3.04064	m			3.04064	m	
no		9.78721			1.08240	m			0.37179	m			0.37179	m	
stans		9.0491	m		9.1497	m			9.0747	m			9.0747	m	
82		20062			11026				19765				19765		
ay,		8.1087	m		73057	m			8.1046	m			8.1046	m	
40		+ 0.6126			- 12.0892				- 2.3539				- 2.3539		
2.		- 128			- 20				- 127				- 127		
17		22.5998			9.9088				19.6334				19.6334		
7		22.6540			9.9252				19.5547				19.5547		
4-2		+	542		+	164			- 787				- 787		

2145				Albion and Coma Berenices				2145			
Cape Wm. 3257 mag 6.3				Cape Wm. 3269 mag 7.8				Cape Wm. 3288 mag 6.9			
C	23	15	31.54	23	18	54.92	23	25	51.70		
L			57			96			72		
E			59			98			69		
Mean	23	15	32.57	23	18	54.95	23	25	51.70		
Prec			37.22			37.27			37.15		
Q	23	16	08.79	23	19	32.22	23	26	28.85		
A	23	21	24	23	21	24	23	21	24		
S-H		-5	15.21		-1	51.78		+5	04.85		
S-G-A		-3	15.18		-1	11.78		+3	04.83		
Mag			2.49856			2.04836			2.48406		
WCS			9.99730			9.99572			9.99696		
S			1.00310			0.55132			0.98826		
S			-10.0716			-3.5389			+9.7332		
S			26			14			24		
S			7.9258			14.4397			27.7356		
S			7.9320			14.3660			27.7252		
S-S			+62			-737			-104		
C	-6	27	19.4	-8	05	58.6	-6	50	19.9		
L			147			592			199		
E			139			593			201		
Mean	-6	27	143	-8	05	590	-6	50	200		
Prec		+3	56.1		+3	56.8		+3	57.9		
S	-6	23	18.2	-8	02	02.2	-6	56	22.1		
D	-6	28	04	-6	28	04	-6	28	04		
S-D		+4	45.8	-1	33	58.2		-18	18.1		
S-G-A		+2	85.8		-5	639.6		-1	098.1		
Mag			2.45606			3.75125			3.04064		
WCS			9.78721			1.08240			0.37179		
WCS			9.0491			9.1497			9.0747		
S			20062			11026			19765		
WCS			8.1087			73057			8.1046		
WCS		+0.6126			-1	2.0892			-2.3539		
S		-	128		-	20			-127		
WCS			22.5998			9.9088			19.6334		
S			22.6540			9.9252			19.5547		
WCS			+542			+164			-787		

pt	pos. L	resid.
1	180.0	-19
2	193.8	-13
3	222.5	-10
4	228.9	+19
5	257.2	+15
6	270.0	-9
7	287.1	+33
8	311.1	-83
9	323.8	+33

2145

Lunar Center

266

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	19.4620	0.0000	0.0000	3.7648	- 89
2	19.0000	-0.4620	0.2134	3.7640	- 97
3	18.1520	-1.3100	1.7161	3.7625	- 112
4	18.0000	-1.4620	2.1374	3.7653	- 84
5	17.5696	-1.8924	3.5812	3.7663	- 74
6	17.5216	-1.9404	3.7652	3.7652	- 85
7	17.6055	-1.8565	3.4466	3.7717	- 20
8	18.0000	-1.4620	2.1374	3.7643	- 94
9	18.3170	-1.1450	1.3110	3.7781	+ 44

Comp R^2 3.7737

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.4904	-1.9396	-7	3.7648
2	16.5464	-1.8836	-7	3.5506
3	17.0000	-1.4300	-5	2.0464
4	17.1546	-1.2754	-5	1.6279
5	18.0000	-0.4300	-2	0.1851
6	18.4300	0.0000	0	0.0000
7	19.0000	+0.5700	+2	0.3251
8	19.7050	+1.2750	+5	1.6269
9	20.0000	+1.5700	+7	2.4671

Upper Center

$$x = 18.0 \quad y = 17.1546$$

$$\begin{array}{r} 19.7050 \\ \hline 36.8596 \end{array}$$

$$y_0 = 18.4298$$

$$y = \min \quad 16.4904$$

$$R = 1.9394$$

$$x = \min = 17.5216$$

$$x_0 = 19.4610$$

Center $\left\{ \begin{array}{l} x_0 = 19.4620 \\ y_0 = 18.4300 \end{array} \right.$

2145

Luminous Centes

26

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	19.4620	0.0000	0.0000	3.7648	-6.9
2	19.0000	-0.4620	0.2134	3.7640	-9.7
3	18.1520	-1.3100	1.7161	3.7625	-11.2
4	18.0000	-1.4620	2.1374	3.7653	-8.4
5	17.5696	-1.8924	3.5812	3.7663	-7.4
6	17.5216	-1.9404	3.7652	3.7652	-8.5
7	17.6055	-1.8565	3.4466	3.7717	-2.0
8	18.0000	-1.4620	2.1374	3.7643	-9.4
9	18.3170	-1.1450	1.3110	3.7781	-4.4

Comp R^2 3.7737

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.4904	-1.9396	-7	3.7648
2	16.5464	-1.8836	-7	3.5506
3	17.0000	-1.4300	+5	2.0464
4	17.1546	-1.2754	+5	1.6279
5	18.0000	-0.4300	-2	0.1851
6	18.4300	0.0000	0	0.0000
7	19.0000	+0.5700	+2	0.3251
8	19.7050	+1.2750	+5	1.6269
9	20.0000	+1.5700	+7	2.4671

Upper Centes

$$x = 18.0 \quad y = 17.1546$$

$$19.7050$$

$$3.68596$$

$$y_0 = 18.4298$$

$$y_{\text{min}} = 16.4904$$

$$R = 1.9394$$

$$y_{\text{max}} = 17.5216$$

$$x_0 = 19.4610$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 19.4620 \\ y_0 = 18.4300 \end{array} \right.$$

Formation of kornuak.

	at	an	bu
1	- 0.00	- 0.0	+ 172.5
2	+ 0.84	+ 44.6	+ 177.2
3	+ 1.87	+ 146.9	+ 160.1
4	+ 1.87	+ 122.6	+ 107.5
5	+ 0.81	+ 140.0	+ 31.8
6	- 0.00	+ 165.0	- 0.0
7	- 1.06	+ 37.2	- 11.4
8	- 1.87	+ 137.2	- 120.3
9	- 1.79	- 50.1	+ 69.0
	+ 0.67	+ 743.4	+ 586.4

2145

Moon's Center

Conditional Equations

	a	b	c	0 - c	
1	0.00	-1.94	= -89	+ 0 - 70 = -70	-19
2	-0.46	-1.83	= -97	-18 - 66 = -84	-13
3	-1.31	-1.43	= -112	-51 - 51 = -102	-10
4	-1.46	-1.28	= -84	-57 - 46 = -103	+19
5	-1.89	-0.43	= -74	-74 - 15 = -89	+15
6	-1.94	+0.00	= -85	-76 + 0 = -76	-9
7	-1.86	+0.57	= -20	-73 + 20 = -53	+33
8	-1.46	+1.28	= -94	-57 + 46 = -11	-83
9	-1.14	+1.57	= +44	-45 + 56 = +11	+33

Average = 26

Normal Equation

$$\begin{aligned}
 + 18.31 + 0.67 &= +743 \\
 + 0.67 + 15.59 &= +586 \\
 - 0.67 - 0.02 &= -27 \\
 + 15.57 &= +559 \\
 + 18.31 a &= +743 - 24 = +719
 \end{aligned}$$

$$b = +35.9$$

$$a = +39.2$$

2145

Innova Center

27

Conditional Equations

	a	b	c	d	e	f	g	h
1	0.00	-1.94	-	-89	+ 0 - 70	- 70	- 19	
2	-0.46	-1.83	-	-97	- 18 - 66	- 84	- 13	
3	-1.31	-1.43	-	-112	- 51 - 51	- 102	- 10	
4	-1.46	-1.28	-	-84	- 57 - 46	- 103	+ 19	
5	-1.89	-0.43	-	-74	- 74 - 15	- 89	+ 15	
6	-1.94	+0.00	-	-85	- 76 + 0	- 76	- 9	
7	-1.86	+0.57	-	-20	- 73 + 20	- 53	+ 33	
8	-1.46	+1.28	-	-94	- 57 + 46	- 11	- 83	
9	-1.14	+1.57	-	+44	- 45 + 56	+ 11	+ 33	

Average = 26

Normal Equations

$$\begin{aligned}
 + 18.31 + 0.67 &= + 743 \\
 + 0.67 + 15.59 &= + 586 \\
 - 0.67 - 0.02 &= - 27 \\
 + 15.57 &= + 559 \\
 + 18.31 + 0.67 - 24 &= - 719
 \end{aligned}$$

$$b = + 35.9$$

$$a = + 39.2$$

145 Moon's Mean Position (1912.0)

$$\begin{array}{r} Y_0 = 19.4620^\circ \\ + 20^\circ \\ \hline 19.4640^\circ \end{array}$$

$$\begin{array}{r} Y_0 = 18.4300^\circ \\ + 18^\circ \\ \hline 18.4318^\circ \end{array}$$

From Plate Constant $X = 19.4803^\circ$ $Y = 18.4534^\circ$

$$\bar{z} = +1.4803^\circ$$

$$\eta = -3.5466^\circ$$

$$\log \bar{z} = 0.17035^\circ$$

$$\log S = 9.99682^\circ$$

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

$$(\alpha - A) = 1.66629^\circ$$

$$\alpha - A = +46.38^\circ$$

$$A = 23^\circ 21' 24''$$

$$q_0 = 23^\circ 22' 10.38''$$

$$\text{Red} = +3.05^\circ$$

$$q_1 = 23^\circ 22' 13.43''$$

$$\log \tan S = 9.0786^\circ$$

$$\log \bar{z} = 0.3407^\circ$$

$$\log \eta = 6.4727^\circ$$

$$\eta = -3^\circ$$

$$\eta_0 = -3.5463^\circ$$

$$\log \eta_0 = 0.54978^\circ$$

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

$$(\delta - D) = 3.21863^\circ$$

$$S - D = -27^\circ 34.3'$$

$$D = -6^\circ 28' 04''$$

$$S_0 = -6^\circ 55' 38.3''$$

$$\text{Red} = +16.6'$$

$$\delta' = -6^\circ 55' 21.7''$$

2145 moons mean Position (1912.0)

28

$$X_0 = 194620$$

$$Y_0 = 184300$$

$$a = +20$$

$$b = +18$$

$$194640$$

$$184318$$

From Plate constant $X = 194803$ $Y = 184534$

$$z = 14803$$

$$\eta = -3.5466$$

$$\log z = 0.17035$$

$$\log \tan S = 9.0786$$

$$\cos S = 9.99682$$

$$S = 0.3407$$

$$\cos z = 8.50724$$

$$\eta = 6.4727$$

$$(z - A) = 166629$$

$$\eta = -3$$

$$A - A = 4638$$

$$\eta_0 = -3.5463$$

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

$$\log \eta_0 = 0.54978$$

$$q_0 = 23 \quad 22 \quad 10.38$$

$$\cos z = 7.33115$$

$$(z - A) = 3.21863$$

$$Red = +3.05$$

$$S - A = -27 \quad 34.3$$

$$X_1 = 23 \quad 22 \quad 1343$$

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

$$S_0 = -6 \quad 55 \quad 38.3$$

$$Red = +16.6$$

$$S = -6 \quad 55 \quad 21.7$$

2145

Red. ad e. aph.

29

$$\begin{array}{rcl}
 H+K & 1 & 27^\circ = 21^\circ 45' \\
 H & 2 & 05' \\
 A & 23 & 22' \\
 G & 22 & 04' \\
 G+K & 21 & 26' = 321^\circ 30'
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos(G+K) & = & 9.8935 \\
 \log & & 1.2631 \\
 \sin(H+K) & = & 9.7942 \\
 \tan S & = & 9.0846 \\
 \frac{1}{\tan} & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 S' & = & 1.1566 \\
 S & = & 89658
 \end{array}$$

$$\begin{array}{rcl}
 h & = & +246 \\
 (g) & = & +0.09 \\
 (h) & = & +0.50 \\
 \hline
 & = & +305
 \end{array}$$

$$\begin{array}{rcl}
 S & = & 6^\circ 56' \\
 \log(L) & = & 0.6544 \\
 \cos S & = & 9.9968 \\
 - (L) & = & 0.6512
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S & = & 9.0814 \\
 \cos(H+K) & = & 9.9679 \\
 h & = & 1.3003 \\
 \sin(H+K) & = & 9.5689 \\
 \sec S & = & 0.0032 \\
 \frac{1}{\tan} & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log(h') & = & 0.3496 \\
 (h) & = & 9.6963
 \end{array}$$

$$\begin{array}{rcl}
 (g') & = & +14.34 \\
 (h') & = & -2.24 \\
 (L) & = & +4.48 \\
 \hline
 & = & +16.58
 \end{array}$$

21.45

Red and E aph.

29

$$H+K \quad 1 \quad 27 = 21^\circ 45'$$

$$H \quad 2 \quad 05$$

$$\lambda \quad 23 \quad 22$$

$$G \quad 22 \quad 04$$

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

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

$$\log \sin(G+K) = 1.2631$$

$$\log \cos(H+K) = 9.7942$$

$$\log \sin(H+K) = 9.0846$$

$$\log \tan(H+K) = 8.8239$$

$$S' = 11566$$

$$S = 89658$$

$$S = 6^\circ 56'$$

$$\log \cos S = 0.6544$$

$$\log \sin S = 9.9968$$

$$\log \tan S = 0.6512$$

$$\log \cos S = 9.0814$$

$$\log \sin(H+K) = 9.9679$$

$$\log \tan(H+K) = 1.3003$$

$$\log \cos(H+K) = 9.5689$$

$$\log \sin S = 0.0032$$

$$\log \tan S = 8.8239$$

$$\log \tan(H+K) = 0.3496$$

$$\log \tan S = 9.6963$$

$$h = +246$$

$$g = +009$$

$$b = +0.50$$

$$+3.05$$

$$g' = +14.34$$

$$b' = -229$$

$$l = +448$$

$$+16.58$$

145-

Lunar Parallax.

$$\begin{array}{rcl}
 \alpha' = 23^h & 22^m & 13^s.43 \checkmark \\
 \delta = 23 & 27 & 33.35 \checkmark \\
 \alpha - \alpha' = & + & 5 \quad 19.92 \checkmark \\
 & + & 1^0 \quad 20' \checkmark \\
 & + & \\
 & + &
 \end{array}$$

$$\begin{array}{r}
 9.95727 \checkmark \\
 0.00000 \\
 \hline
 000012 \checkmark
 \end{array}$$

$$\tan \gamma = 9.95739 \checkmark$$

$$\gamma = 42 \quad 11 \quad 38.5 \checkmark$$

$$- \quad 6 \quad 55 \quad 21.7$$

$$49 \quad 07 \quad 00.2$$

$$\begin{array}{r}
 9.82640 \checkmark \\
 8.20249 \checkmark \\
 9.87855 \checkmark \\
 \hline
 0.17286 \checkmark
 \end{array}$$

$$\sin(\delta - \delta') = 8.08030 \checkmark$$

$$\delta - \delta' = +41 \quad 21.6 \checkmark$$

$$\delta = -6 \quad 14 \quad 00.1 \checkmark$$

$$\text{Sun Eph } \delta = -6 \quad 14 \quad 03.2 \checkmark$$

$$O - C \quad + \quad 3.1 \checkmark$$

$$\delta' = -6 \quad 55 \quad 21.7 \checkmark \quad 30$$

$$\pi = 54' \quad 48.0 \checkmark$$

$$\begin{array}{r}
 9.86913 \checkmark \\
 8.20249 \checkmark \\
 8.36678 \checkmark \\
 \hline
 000258 \checkmark
 \end{array}$$

$$\sin(\alpha - \alpha') = 6.44098 \checkmark$$

$$\alpha - \alpha' = + \quad 0' \quad 56.94 \checkmark$$

$$= \quad + \quad 3.80 \checkmark$$

$$\alpha = 23^h \quad 22^m \quad 17.23 \checkmark$$

$$\alpha = 23 \quad 22 \quad 16.69 \checkmark$$

$$+ \quad 0.54 \checkmark$$

21.45

Lunar Parallax

$$S' = -6 \quad 55 \quad 21.7$$

$$\begin{array}{r} \alpha' = 23 \quad 22 \quad 13.43 \\ \delta = 23 \quad 27 \quad 33.35 \\ C - \alpha \quad + \quad 5 \quad 19.92 \\ = \quad + \quad 1 \quad 20 \end{array}$$

$$\pi = 59 \quad 48.0$$

$$\begin{array}{r} 9.86913 \\ 8.20249 \\ 8.36678 \\ \hline 000258 \end{array}$$

$$\sin(\alpha - \alpha') \quad 644098$$

$$\begin{array}{r} 995727 \\ 000000 \\ \hline 000012 \end{array}$$

$$\tan \delta = 995739$$

$$\alpha - \alpha' = + 0 \quad 56.94$$

$$= + 3.80$$

$$\delta = 42 \quad 11 \quad 38.5$$

$$- 6 \quad 55 \quad 21.7$$

$$49 \quad 07 \quad 00.2$$

$$\begin{array}{r} 982640 \\ 820249 \\ 987855 \\ \hline 017286 \end{array}$$

$$\sin(\delta - \delta') \quad 808030$$

$$\delta - \delta' = + 41 \quad 21.6$$

$$S = -6 \quad 14 \quad 00.1$$

$$\text{Sun Eph } S = -6 \quad 14 \quad 03.2$$

$$O - C \quad + \quad 3.1$$

$$\alpha = 23 \quad 22 \quad 17.23$$

$$\alpha = 23 \quad 22 \quad 16.69$$

$$+ 0.54$$

