

KG
11366
v.957

LXXX



4295

4296



Harvard Lunar Plates

Measures and Reductions

Mary Fowler

Volume LXXX

Plate No.	Date	Page
4295	1913 Nov. 12	1

#295 Times etc.

Expt Stars, 1913, Nov. 12 1^h 56 -2^h 08^m
 Moon 2 02 15.2 - 2 02 15.5
 Clock fast 0 30.7

H Sid T. 2 01 44.65 0-2--0^m 26^m
 H. Long 4 44 31.05
 G. Sid T. 6 46 15.70
 Sid. T. m. now 15 24 02.26
 Interval 15 22 13.44
 Reduction 2 31.08
 G. m. T. 15 19 42.36

From Kant. Aluc. R.A. Decl.
 Moon 15^h 2^m 27^m 32.85 + 18 34 39.1
 Motion in 1^m = 2.0073 11.518
 " " 19.706 + 39.56 + 3 47.0
 Tabular Place 2 28 12.41 + 18 38 26.1

Moon's age 14 days. (before full)

" parallax 55' 01.21

" semidiam. 15' 01.3

934 = 14.4

901 = 13.4

R 9 01.3

Augmentation 1 13.4

Irradiation (3) - 0.3

R 9 14.4

a = -500.2

R 1.9601 -934

- 24

(1+a)R 1.8667

- 476.2

R² = 3.4846

#295 Trans etc.
 Exp 1 Stone 1913 Nov 12 1^h 56 - 2^h 08^m
 Moon 2 02 15 2 2 02 15 5
 Clock face 0 30.7

H. Sud T. 2 01 44 6 5
 A. Long 4 44 31 0 5
 S. Sud T. 6 46 15 7 0
 Sud T. in Moon 15 24 02 2 6
 Interval 15 22 13 4 4
 Reduction 2 31 0 8
 S. M. T. 15 19 42 3 6

From Mount. Adams R.A. Dec.
 Moon 15^m 2^h 27^m 32^s 8.5 + 18 34 39.1
 Moon 1^h 20 0 73 11 51 8
 " 19706 + 37.56 + 3 47.0
 Tabular place 2 28 12.41 + 18 38 261

moons age 14 days. (H. from full)
 parallax 55 01 21
 semidiam. 15 01.3
 R 9 01.3
 Augmentation + 13.4
 Irradiation?) - 0.3
 R 9 14.4
 R 19 6 01 - 934
 (1+a)R 18 6 67
 R² 3 48 46

934 = 14.4
 2015 = 13.4
 19706 = 13.4

4295 stars - measures

1915 Jan. 7.

	α	δ	α	δ	α	δ
1	19770	15968	17600	16519		
13.5	11451.5	14270.5	12050.6	12030.3		
28.8	48	61	60	30		
	57	48	93	03		
	<u>28.8308</u>	<u>6297</u>	<u>13.4460</u>	<u>4452</u>		

2	12267	9955	12300	10901		
141	11955.5	6060	12000.1	10223		
13.1	59	96	11627	30		
	<u>13.0312</u>	<u>0303</u>	<u>14.0673</u>	<u>0674</u>		

3	19596	18192				
308	18320	10090				
19.8	21	80				
	98	78				
	<u>19.8734</u>	<u>19.8724</u>	<u>30.8085</u>	<u>30.8096</u>		

4	17203	17909	16337	15369		
378	15351.42	9744	14969	9718		
238	45	52	64	10		
388	83	99	27	59		
	<u>35.1853</u>	<u>1849</u>	<u>23.8629</u>	<u>5645</u>		

or

16082	16585	15860	17850
13220.22	9410.02	9210.10	14473.50
18	11	09	77
70	61	41	30
<u>34.2858</u>	<u>2840</u>	<u>25.3363</u>	<u>3368</u>

4295	Stars - measures	1915 Jan. 7.	
a	n	a	n
1 19770	15968	17600	16319
135 11451	14270	12050	12030
288 48	61	60	30
57	42	93	03
<u>288308</u>	<u>8297</u>	<u>34460</u>	<u>4452</u>
2 12267	9915	12300	10901
141 11915	6060	12000	10220
131 59	9655	11627	3029
<u>130312</u>	<u>0303</u>	<u>140673</u>	<u>0674</u>
3 194734	19596	18192	
308 18320	2119	10090	89
198 98	98	80	78
<u>194734</u>	<u>195724</u>	<u>8085</u>	<u>208096</u>
4 17203	17909	16337	15367
378 15351	9744	14969	9715
213 45	5253	6463	1077
344 83	99	27	59
<u>341813</u>	<u>1849</u>	<u>8629</u>	<u>8645</u>
or			
16082	16581	15860	17850
13220	9410	9210	14473
1822	1102	0910	72
70	61	41	30
<u>342858</u>	<u>2840</u>	<u>253363</u>	<u>3368</u>

3

14

10

5

10

2

2

1

10

2

4

17

2

4295 Moon-Measures

1915 Jan. 7.

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \downarrow \quad 15080 \quad 17441 \\
 18.0 \quad 13749 \quad 8764 \\
 18.2 \quad \quad 4951 \quad 6767 \\
 \quad \quad 76 \quad 41 \\
 \underline{18.1329} \quad \underline{1325}
 \end{array}$$

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \downarrow \quad 15120 \quad 16219 \\
 17.0 \quad 9190 \quad 12100 \\
 18.6 \quad \quad 9908 \quad 0002 \\
 \quad \quad 18 \quad 05 \\
 \underline{18.5920} \quad \underline{5885}
 \end{array}$$

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \downarrow \quad 167 \quad 17566 \quad 19010 \\
 19.0 \quad \quad 1410918 \quad 1245860 \\
 \quad \quad 11 \quad 52 \\
 \quad \quad 54 \quad 10 \\
 \underline{16.6551} \quad \underline{6553}
 \end{array}$$

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \downarrow \quad 16.4 \quad 16519 \quad 19059 \\
 20.0 \quad \quad 1027059 \quad 15321 \\
 \text{min} \quad \quad 50 \quad 1911 \\
 \text{max} \quad \quad 66 \quad 69 \\
 \underline{16.3749} \quad \underline{3764}
 \end{array}$$

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \downarrow \quad 167 \quad 16474 \quad 20150 \\
 21.0 \quad \quad 1325973 \quad 1333540 \\
 \quad \quad 80 \quad 48 \\
 \quad \quad 80 \quad 36 \\
 \underline{166795} \quad \underline{6800}
 \end{array}$$

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \downarrow \quad 19180 \quad 18900 \\
 17.0 \quad 1544659 \quad 1261510 \\
 21.4 \quad \quad 50 \quad 1110 \\
 \quad \quad 66 \quad 84 \\
 \underline{21.3722} \quad \underline{3722}
 \end{array}$$

4295 Snow-Measures

1915 Jan. 7.

	d	"		d	"
1	15080		17441		
180	13749		8764		
182	4951		6767		
	76		41		
	<u>18.1329</u>		<u>1325</u>		

2	15120		16219		
170	9190	08	12100		
186	99		0002		
	18		05		
	<u>18.5920</u>		<u>5885</u>		

3			17566		19010
167			14109	18	1243
190			11		60
			54		52
			<u>16.6551</u>		<u>6553</u>

4			16519		19089
164			10270	59	15321
200			50		19
			66		69
			<u>16.3749</u>		<u>3764</u>

5			16474		20110
167			13259	73	1383
210			80		40
			80		48
			<u>16.6795</u>		<u>6800</u>

6	19180		18900		
70	15446	59	12615		
214	50		11		10
	66		84		
	<u>21.3722</u>		<u>3722</u>		

4295 Moon-Measures 1915 Jan 7.
 α γ η α γ η

7.	18149	19945
140	9820	1825960
217.	2724	55
	30	34
	<u>21.8308</u>	<u>.8311</u>

8.	18320	17440
142	9812	15906
218	3021	1014
max	00	25
γ	<u>21.8452</u>	<u>.8472</u>

Grade 3.

4295 Moon - Measures 1915 Jan 7
 α ~ α ~

7	18149	19945
18.0	9820	18259
21.7	2724	55
	30	34
	<u>21.8308</u>	<u>8311</u>

8	18320	17440
18.2	9812	15906
21.8	3021	4074
max	00	35
	<u>21.8452</u>	<u>8473</u>

made 3.

253366 34.2849

4295

Photo Constants

X	Y	R.A.	Decl.
13.4471 ^v	288302 ^v	2 ^h 25 ^m 45 ^s	+19° 28' 10"
14.0674 ^v	130308 ^v	26 05	17 19 10
(30.8090)	(198729)	35 41	20 19 21
23.8637 ^v	35.1851 ^v	31 49	18 13 32
4 81.18	96.9190	117 140	34 79 73
20.30	24.23	2 29 50	+18 50 03
-18.00	-22	- 1 11	- 17 20
230	225	A = 2 28 39	D = +18 32 43
31	4662		
71530	1040	Center {	A = 2 ^h 28 ^m 39 ^s
	= 17' 20"		D = +18° 32' 43"

2-3	+5204	+8134	+0.2x	-16160
1 + 7085 + 6724 = +13809 + 2344 = +16153 + 5 = +16158 = -2				
2 + 8065 + 7034 = +15099 + 1059 = +16158 + 5 = +16163 = +3				
4 - 868 + 15404 = +14536 + 1616 = +16152 + 6 = +16158 = -2				
3 + 1357 + 11932 = +13289 + 2861 = +16150 + 5 = +16155 = -5				
5 + 706 + 12668 = +13374 + 2787 = +16161 + 5 = +16166 = +6				

4-7	+5204	+82.3x	+2.64	-1.0238
1 - 3139 + 14415 = +11276 - 1107 = +10169 + 75 = +10244 = +6				
2 + 4844 + 6515 = +11359 - 1158 = +10201 + 34 = +10235 = -3				
4 - 2792 + 9936 = +12728 - 2536 = +10192 + 52 = +10244 = +6				
3 - 5486 + 17593 = +12107 - 1964 = +10143 + 91 = +10234 = -4				
5 - 4911 + 17142 = +12231 - 2085 = +10146 + 89 = +10235 = -3				

Tables a: 0.0 e = -0.8 a - e = +0.8 b + a = 0.0
 Obs a = -0.2 e = -2.6 a - e = +2.4 b + a = +1.0
 a = -500.2 e = -502.6

0 - c = -500.2^v -501.8^v +1.6^v +1.0^v

4295

Plate Constants

R.A.

Decl.

X	Y				
13.4471	28.4302	2	25 45	+19 28 10	
14.0674	13.0308		26 05	17 19 10	
(308090)	(198729)		35 41	20 19 21	
22.8637	35.1851		31 49	15 13 32	
481.18	96.9190	1	11 7 140	134 79 73	
20.30	24.23	2	29 50	+18 50 03	
-1.80	22		1 11	- 17 20	
230	225	A	2 28 39	D +18 32 43	
31	40				
71330	1040				
	17'20"				

Center { A. 2^h 28^m 39^s
D: +18° 32' 43"

2-3	+320x	+81.3y	+0.2x	-16160				
1	+ 7 0 8 5 +	6 7 2 4 +	+13809 +	2 3 4 4 +	+16153 +	5 =	+16158 =	- 2
2	+ 8 0 6 3 +	7 0 3 4 +	+15099 +	1 0 5 9 +	+16158 +	5 =	+16163 =	+ 3
3	+ 8 6 8 +	13 4 0 4 +	+14536 +	1 6 1 6 +	+16152 +	6 =	+16158 =	- 2
4	+ 1 3 5 7 +	11 9 3 2 +	+13259 +	2 8 6 1 +	+16150 +	5 =	+16155 =	- 5
5	+ 7 0 6 +	12 6 6 8 +	+13374 +	2 7 8 7 +	+16161 +	5 =	+16166 =	+ 6

4-7	+320y	+82.3x	+2.6y	-1.023x				
1	-3139	+14415	+11276	-1107	+10169	+75	= +1.0244	= +6
2	+4844	+6515	+11359	-1158	+10201	+34	= +1.0235	= -3
4	-2792	+9936	+12728	-2586	+10192	+52	= +1.0244	= +6
3	-1786	+17593	+12107	-1964	+10143	+91	= +1.0234	= -4
5	-4911	+17172	+12231	+2045	+10146	+89	= +1.0235	= -3

Tables a: 0.0 c = -0.8 a - c = +0.8 b + a = 0.0
Obs a: -0.2 c = -2.6 a - c = +2.4 b + a = +1.0
a = -520.2 c = -1026

	ξ	η	$\Delta \xi$	-3.8ξ	$-.8 \eta$	-6		
1	-5.26	+7.13	-10	+20	+10	-3	+7	+1
2	-4.77	-9.76	-13	+18	+5	+7	+9	+3
3	+5.72	+13.72	+32	-21	+11	-4	+6	0
4	+12.89	-2.77	+52	-89	+3	+1	+7	-2
5	+7.27	+12.75	+35	-28	+7	-5	+2	-4
M	-0.30	-2.19		+1	+1			<u>-7</u>
			$\Delta \eta$	-9η	-15		$+3$	
			+15	-28	-13	+5	-8	-16
			-26	+38	+12	+7	+16	+13
			+72	-55	+18	-6	+12	+9
			-11	+10	-1	-13	-17	-17
			+66	-51	+15	-7	+8	+5
			0	+9	0			<u>+6</u>

Without setting top equal.

4295 Standard Coordinates. 6

Cape No. 365 mg 12				Cape No. 367 mg 6.4				Cape No. 378 mg 8.5			
C	2 ⁿ	25 ^m	01.87	2 ⁿ	25 ^m	21.44	2 ⁿ	31 ^m	05.00		
L			88			50			00		
B			80 ^v			46			4.98		
Mean	2	25	01.85	2	25	21.47	2	31	04.99		
Pres		+	43.63 ^v		+	43.19 ^v		+	43.88 ^v		
q	2	25	45.48 ^v	2	26	04.66 ^v	2	31	48.87		
A	2	28	39	2	28	39	2	28	39		
A-A		- 2	53.52 ^v		- 2	34.34 ^v		+	3	09.87	
Sin(A-A)		- 1	73.52 ^v		- 1	54.34 ^v		+	1	89.86	
log...	2.2	39	35 ^m	2.1	88	49 ^m	2.2	78	43		
log...	9.9	74	43 ^v	9.9	79	85 ^v	9.9	72	09		
log...	0.7	21	02 ^m	0.6	75	58 ^m	0.7	57	76		
log...	- 5.2	60	4 ^v	- 4.7	37	8 ^v	+	5.7	24	8	
log...	-		10 ^v	-		13 ^v	+		32		
log...	12.7	38	6 ^v	13.2	60	9 ^v	23.7	28	0		
log...	13.4	47	1 ^v	14.0	67	4 ^v	23.8	63	7		
log...	+	0.7	08	+	0.8	06	+	0.1	35	7	

C	+ 19°	24'	40.8	+ 17	15	41.2	+ 20°	15'	55.5
L			40.6			41.6			55.5
B			40.4			41.3			55.4
Mean	+ 19	24	40.6	+ 17	15	41.4	+ 20	15	55.5
Pres		+ 3	29.6		+ 3	28.5		+ 3	25.7
S	+ 19	28	10.2	+ 17	19	09.9	+ 20	19	21.2
D	+ 18	32	43	+ 18	32	43	+ 18	32	43
S-D	+	55	27.2	- 1	13	33.1	+ 1	46	38.2
tan(S-D)		+ 33	27.5		- 44	13.8		+ 64	00.3
log...	3.5	22	12	3.6	44	81 ^m	3.8	06	20
log...	0.8	53	27	0.9	75	9.6 ^m	1.1	37	35
tan...	9.5	48	4 ^v	9.4	93	9 ^v	9.5	68	6
- S ²	1.4	42	0	1.3	51	2	1.5	15	5
log...	8.0	43	8	7.8	98	5	8.1	37	5
log...	+	7.1	330	- 9.4	61	5	+	13.7	200
log...	+		111	+		79	+		137
log...	29.1	44	1	12.5	46	4	35.7	33	7
log...	28	83	02	13	03	08	35.1	85	1
log...	- 0.3	13	9	+	0.4	84	- 0.5	48	6

4295				Standard Coordinates				b			
Cape W. 365 mag 6.2				Cape W. 367 mag 6.4				Cape W. 378 mag 6.5			
C	2 ^h	25 ^m	01.47	2 ^h	25 ^m	21.44	2 ^h	31 ^m	05.00		
L			88			50			00		
B			80			46			498		
mean	2	25	01.85	2	25	21.47	2	31	04.99		
Pra		+	43.63		+	43.19		-	43.81		
q	2	25	45.48	2	26	04.66	2	31	48.87		
A	2	28	39	2	28	39	2	28	39		
A-A		- 2	53.52		- 2	34.34		+ 3	09.87		
Sub-A)		- 1	73.52		- 1	54.34		+ 1	89.86		
log...	2	2	3935m	2	1	8849m	2	2	7843		
WIS	9	9	7443	9	9	7985	9	9	7209		
g	0	7	2102m	0	6	7558m	0	7	5776		
I ₁	-	5	2604	-	4	7378	-	5	7248		
I ₂	-		10	-		13	-		32		
I ₃	1	2	7386	1	3	2609	1	3	7280		
u	1	3	4471	1	4	0674	1	3	8637		
u-I ₃	+0	7	085	+0	8	065	+0	1	357		
C	+19 ^h	24 ^m	40.8	+17	15	41.2	+20 ^h	15 ^m	55.5		
L			40.6			41.6			55.5		
2			40.4			41.3			55.4		
mean	+19	24	40.6	+17	15	41.4	+20	15	55.5		
Pra		+	329.6		-	328.5		-	325.7		
S	+19	28	10.2	+17	19	09.9	+20	19	21.2		
D	+18	32	43	+18	32	43	+18	32	43		
S-D	+	55	27.2	-	1	1333.1	+1	46	38.2		
Sub-D))		+33	27.5		-44	138		+64	00.3		
log...	3	5	2212	3	6	4481m	3	8	0620		
WIS	0	8	5327	0	9	7596m	1	1	3735		
tan δ	9	5	484	9	4	939	9	5	686		
δ ₁	1	4	420	1	3	512	1	5	155		
δ ₂	8	0	438	7	8	985	8	1	375		
δ ₃	+7	1	330	-9	4	615	+1	3	7200		
u ₁	+		111	+		79	+		137		
u ₂	2	9	1441	1	2	5464	3	5	7337		
q	2	8	8302	1	3	0308	3	5	1851		
q-u	-0	3	139	+0	4	844	-0	5	486		

standard			Carnegie		
4295	Cape W. 389 mag 8.1		A.S. 710 (Berlin) mag 7.4		
C	2 ⁿ	34 ^m	57.62	2 ⁿ	30 ^m 31.48
L			64		
E			57		
Mean	2	34	57.61		
Prec			+ 43.52 ^v	+ 2	08.19
δ	2	35	41.13	2	32 39.67
A	2	28	39	2	28 39
$\delta-A$			+ 7 02.13		+ 4 00.67
$\sin(\delta-A)$			+ 4 22.06		+ 2 40.66
log			2.62538		2.38141
cos			9.97765 ^v		9.97244
30			1.11027		0.86109
Σ_0			+ 12.8906		+ 7.2625
Σ_1			+ 52		+ 35
Σ			30.8958		25.2660
Σ			30.8090		25.3366
2-3			- 868		+ 706

C	+18°	10'	08"6	+20°	01'	49"8
L			08.4			
E			08.7 ^v			
Mean	+18	10	08.6			
Prec			+ 3 23.0 ^v		+ 10 01.3	
δ	+18	13	31.6 ^v	+20	11	51.1
D	+18	32	43	+18	32	43
$\delta-D$			- 19 11.4 ^v		+ 1 39	08.1
$\tan(\delta-D)$			- 1 151.4 ^v			+ 59 49.8
log			3.06123 ^v			3.77450
70			0.39238 ^v			1.10565
$\tan \delta$			9.5176 ^v			9.5657
Σ^2			22205 ^v			17222
Σ_1			8.7915 ^v			8.3413
Σ_0			- 2.4682 ^v			+ 12.7541
Σ_1			+ 619 ^v			+ 219
Σ			19.5937 ^v			34.7760
Σ			19.8729 ^v			34.2849
$\Sigma-\Sigma$			+ 2792 ^v			- 4911

Standard			Carnegie			
Cape W.	389	mg 8.1	A.S. 710	Calculation	7.4	
C	2"	34"	57.62	2"	30"	31.48
L			64			
E			57			
Mean	2	34	57.61			
Proc			+ 43.52	- 2		08.19
S	2	35	41.13	2	32	39.67
A	2	28	39	2	26	39
S-A			+ 7			02.13
S-(S-A)			+ 422.06			+ 240.66
log			2.62538			2.38141
wsb			997765			997244
T ₀			111027			086109
T ₀			+ 12.8906			+ 7.2625
T ₁			+ 52			35
T ₂			30.8958			25.2660
T ₃			30.8090			25.3366
T ₄			- 868			+ 706

C	+18°	10'	08"6	+20°	01'	49"8
L			084			
E			087			
Mean	+18	10	08.6			
Proc		+3	230		+10	01.3
S	+18	13	31.6	+20	11	51.1
D	+18	32	43	-18	32	43
S-D		-19	11.4	+1	39	08.1
tan(S-D)		-	1151.4		+5949.8	
log		3.06123			3.77450	
η_0		039228			110565	
η_1		9.5176			9.5657	
η_2		22205			17222	
η_3		87915			83413	
η_4		-2.4682			+12.7541	
η_5		+ 619			+ 219	
η_6		19.5937			34.7760	
η_7		19.8729			34.2849	
η_8		+2.2792			-4911	

4295 Ononis Center.

	x	x - x ₀	Δx	(x - x ₀) ²	(x - x ₀) ² + (y - y ₀) ²	0 - c
1	18.0000	-0.2410	+1	0.0580	3.4779	-67
2	17.0000	-1.2410	+1	1.5398	3.4764	-82
3	16.6552	-1.5858	+1	2.5144	3.4787	-59
-4	16.3752	-1.8658	0	3.4812	3.4815	-31
5	16.6798	-1.5612	-1	2.4376	3.4739	-107
6	17.0000	-1.2410	-1	1.5403	3.4730	-116
7	18.0000	-0.2410	-1	0.0585	3.4773	-73
8	18.2410	0.0000	-1	0.0000	3.4809	-37

$$R^2 = 3.4846$$

	y	y - y ₀	(y - y ₀) ²		
1	18.1327	-1.8493	3.4199	186	187
2	18.5904	-1.3916	1.9366	222	
3	19.0000	-0.9820	0.9643	249	238
4	20.0000	+0.0180	0.0003	272	270
5	21.0000	+1.0180	1.0363	304	303
6	21.3722	+1.3902	1.9327	318	
7	21.8300	+1.8490	3.4188	353	
+8	21.8477	+1.8657	3.4809	360	

Range 174

Approx. Center.

$$\begin{aligned}
 x &= 18.0 & y &= 18.1327 \\
 & & & \underline{21.8310} \\
 & & & 2 \overline{) 39.9637} \\
 y_0 &= 19.9818 \\
 y - \text{max} &= 21.8477 \\
 R &= 18.659 \\
 x - \text{min} &= 16.3752 \\
 x_0 &= 18.2411
 \end{aligned}$$

$$\begin{aligned}
 x &= 17.04 & y &= 18.5904 \\
 & & & \underline{21.3722} \\
 & & & 39.9626
 \end{aligned}$$

$$\text{Center } \begin{cases} x_0 = 18.2410 \\ y_0 = 19.9820 \end{cases}$$

4295

Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)^2$	$0 - C$
1	18.0000	-0.2410	+1	0.0580	3.4779	-67
2	17.0000	-1.2410	+1	1.5398	3.4764	-82
3	16.6152	-1.5858	+1	2.5144	3.4787	-59
-4	16.3752	-1.8658	0	3.4812	3.4815	-31
5	16.6798	-1.5612	-1	2.4376	3.4739	+107
6	17.0000	-1.2410	-1	1.5403	3.4730	+116
7	18.0000	-0.2410	-1	0.0585	3.4773	-73
8	18.2410	0.0000	-1	0.0000	3.4809	-37

$$R^2 = 3.4846$$

	y	$y - y_0$	$(y - y_0)^2$	
1	18.1327	-1.8493	3.4199	186
2	18.5904	-1.3916	1.9366	222
3	19.0000	-0.9820	0.9643	249
4	20.0000	+0.0180	0.0003	272
5	21.0000	+1.0180	1.0363	304
6	21.3722	+1.3902	1.9327	318
7	21.8300	+1.8490	3.4188	353
+8	21.8477	+1.8657	3.4809	360

Range 176

Approx. Center.

$$\begin{array}{r}
 x = 18.0 \quad y = 18.1327 \\
 \underline{21.8310} \\
 = 39.9637 \\
 y_0 = 19.9818 \\
 y_{\text{max}} = 21.8477 \\
 R = 1.8659 \\
 x_{\text{min}} = 16.3752 \\
 x_0 = 18.2411
 \end{array}$$

$$\begin{array}{r}
 x = 17.0 \quad y = 18.5904 \\
 \underline{21.3722} \\
 = 39.9626
 \end{array}$$

$$\text{Center} \begin{cases} x_0 = 18.2410 \\ y_0 = 19.9820 \end{cases}$$

Formation of Normals

	ab	an	bn
1	+ 0.44	+ 16.1	+ 124.0
2	+ 1.72	+ 101.8	+ 114.0
3	+ 1.56	+ 93.8	+ 57.8
4	- 0.04	+ 58.0	- 0.6
5	- 1.59	+ 166.0	- 109.0
6	- 1.72	+ 143.9	- 161.2
7	- 0.44	+ 17.5	- 135.0
8	+ 0.00	- 0.0	- 69.2
	- 0.07	+ 597.1	- 179.2

-a	-b	+15 + ΔC
- 2	+ 4	+ 17 ✓
- 12	+ 3	+ 6 ✓
- 16	+ 2	+ 1 ✓
- 19	- 0	- 4 ✓
- 16	- 2	- 3 ✓
- 12	- 3	+ 0 ✓
- 2	- 4	+ 9 ✓
- 0	- 4	+ 11 ✓

4295 Conditional Equations

	a	b	c	0-c	Corr.
1	-0.24	-1.85	-67	-12 + 20 = +8	-75 - 58
2	-1.24	-1.39	-82	-63 + 15 = -48	-34 - 28
3	-1.59	-0.98	-59	-81 + 11 = -70	+11 + 12
4	-1.87	+0.02	-31	-96 - 0 = -96	+65 + 61
5	-1.56	+1.02	-107	-80 - 11 = -91	-16 - 19
6	-1.24	+1.39	-116	-63 - 15 = -78	-38 - 38
7	-0.24	+1.85	-73	-12 - 20 = -32	-41 - 32
8	+0.00	+1.87	-37	+0 - 20 = -20	-17 - 6
				+76 - 221	

Average: 37

Normal Equations

$$\begin{aligned}
 +11.63 - 0.07 &= +597 & -7.98 \\
 -0.07 + 16.19 &= -179 & +1.93 \\
 +0.07 - 0.00 &= +4 & -0.04 \\
 +16.19 &= -175 & +1.89 \quad b = -10.8^\circ + 0.12 \\
 +11.63a &= +597 - 1 = +596 & a = +51.2^\circ - 0.68
 \end{aligned}$$

Arc measured = 174° Average (0-c) = -18.1

$$\frac{pc}{m} = 0.28$$

$$\frac{-18.1}{28} = -0.65$$

$$\Delta \alpha = -0.8$$

$$\text{Corr} = -0.2$$

$$\Delta R = -0.6$$

$$-2RC = +0.75 + 15$$

$$DB = +0.09 + 12 \Delta \delta = +0.0$$

$$\Delta a = -0.51 \quad \Delta a = -0.02$$

4295- Conditional Equations.

	a	b	c	0 - c	
1	-0.24	-1.85	-67	-12 + 20 = +8	-75
2	-1.24	-1.39	-82	-63 + 15 = -48	-34
3	-1.59	-0.98	-59	-81 + 11 = -70	+11
4	-1.87	+0.02	-31	-96 - 0 = -96	+65
5	-1.56	+1.02	-107	-80 - 11 = -91	-16
6	-1.24	+1.39	-116	-63 - 15 = -78	-38
7	-0.24	+1.85	-73	-12 - 20 = -32	-41
8	+0.00	+1.87	-37	0 - 20 = -20	-17

+76 = 221

Average = 37

Normal Equations.

$$\begin{aligned}
 +11.63 - 0.07 &= +597 \\
 -0.07 + 16.19 &= -179
 \end{aligned}$$

$$\begin{aligned}
 +0.07 - 0.00 &= T \quad 4 \\
 +16.19 &= -175
 \end{aligned}$$

$$b = -10.8$$

$$+11.63a = +597 - 1 \cdot +596$$

$$a = +5.12$$

Arc measured: 173° Average (0-c) = -18.1

$$\frac{pc}{m} = 0.28$$

$$\frac{-18.1}{28} = -0.65 \quad \Delta z = -0.7$$

4295 Moon's Mean Place (1913.0)

$$X_0 = 182410$$

$$Y_0 = 199820$$

$$\Delta x = +26$$

$$\Delta y = -5$$

$$182436$$

$$199815$$

From Plate Constant

$$X = 182436$$

$$Y = 199815$$

$$+500x = +9122$$

$$+500y = +9991$$

$$+81.3y = +1624$$

$$-82.3x = -1501$$

$$+0.2x = +4$$

$$+2.6y = +52$$

$$+16160$$

$$-10238$$

$$X = 177026$$

$$Y = 198119$$

$$\xi = -0.2974$$

$$\eta = -2.1881$$

$$\log \xi = 9.47334m$$

$$\log \tan \delta = 9.5257$$

$$\log \eta = 9.97755$$

$$9.9467$$

$$8.50724$$

$$7.0534$$

$$(X-A) = 0.98855m$$

$$\eta_1 = 6.5158$$

$$\alpha - A = -9.74$$

$$\eta_1 = +3$$

$$\eta_0 = -2.1884$$

$$A = 228.39$$

$$\log \eta_0 = 0.34013m$$

$$\alpha_0 = 228.29.26$$

$$7.33115$$

$$3.00898m$$

$$\text{Red. add. aff.} = +4.16$$

$$\delta - D = -17.00.9$$

$$\delta' = 228.33.42$$

$$D = +18.32.43$$

$$\delta_0 = +18.15.42.1$$

$$\text{Red.} = +26.2$$

$$\delta = +18.16.08.3$$

4295 known mean place (1913.0)

$$\begin{array}{r}
 X_0 = 18.2410 \\
 + 26 \\
 \hline
 18.2436
 \end{array}$$

$$\begin{array}{r}
 Y_0 = 19.9820 \\
 - 5 \\
 \hline
 19.9815
 \end{array}$$

From plate constant

$$\begin{array}{r}
 X = 18.2436 \\
 + 100x = +.9122 \\
 + 81.34 = +16.24 \\
 + 0.2x = +.4 \\
 \hline
 16.160 \\
 Y = 17.7026
 \end{array}$$

$$\begin{array}{r}
 Y = 19.9815 \\
 + 100y = +.9991 \\
 - 823x = -1.5701 \\
 + 2.6y = +.52 \\
 \hline
 1.0238 \\
 Y = 19.8119
 \end{array}$$

$$\begin{array}{r}
 \bar{x} = -0.2974 \\
 \log S = 9.47334 \\
 \text{mod} = 9.97755 \\
 8.50724
 \end{array}$$

$$(x - A) = 0.98855$$

$$x - A = -9.74$$

$$A = 228.39$$

$$x_0 = 228.2926$$

$$\text{Red add eff.} = +4.16$$

$$x' = 228.3342$$

$$y = -2.1881$$

$$\begin{array}{r}
 \log \tan S = 9.5257 \\
 9.9467 \\
 \hline
 7.0534 \\
 y_1 = 6.5158
 \end{array}$$

$$y_1 = +3$$

$$y_0 = -2.1884$$

$$\begin{array}{r}
 \log y_0 = 0.34013 \\
 7.33115 \\
 \hline
 3.00898
 \end{array}$$

$$S - D = -17.009$$

$$D = +18.3243$$

$$S_0 = +18.15421$$

$$\text{Red} = +26.2$$

$$S' = +18.16083$$

4295

Red. ad. column app.

$$H + \alpha = 4 \quad 58.1 = 74^\circ 30'$$

$$H = 2 \quad 29.6$$

$$\alpha = 2 \quad 28.5$$

$$G = 22 \quad 13.4$$

$$G + \alpha = 0 \quad 41.9 = 10^\circ 30'$$

$$2 \cos(G + \alpha) \quad 9.9927$$

$$\delta \quad 1.2983$$

$$\sin \delta \quad 9.2606$$

$$\tan \delta \quad 9.5185$$

$$8.8239$$

$$\delta' \quad 1.2910$$

$$\delta \quad 8.9013$$

$$f = +2.74$$

$$g = +0.08$$

$$h = +13.4$$

$$+41.6$$

$$\delta = +18^\circ 15' 42''$$

$$2 \cos \delta = 9.9775$$

$$0.7170$$

$$(i) \quad 0.6945$$

$$2 \sin \delta \quad 9.4960$$

$$\cos(H + \alpha) \quad 9.4269$$

$$h \quad 1.2965$$

$$\sin \delta \quad 9.9839$$

$$\sec \delta \quad 0.0225$$

$$8.8239$$

$$\delta' \quad 0.2194$$

$$h \quad 0.1268$$

$$\delta' = +19.54$$

$$\delta = +1.66$$

$$i = +49.5$$

$$+26.15$$

4295

Red ad beam - hp.

11

$$H + \lambda = 4 \quad 58.1 = 74^\circ 30'$$

$$H = 2 \quad 29.6$$

$$\lambda = 2 \quad 28.5$$

$$G = 22 \quad 13.4$$

$$G + \lambda = 0 \quad 41.9 = 10^\circ 30'$$

$$\cos(G + \lambda) = 9.9927$$

$$\sin \quad \quad \quad 1.2983$$

$$\cos \quad \quad \quad 9.2606$$

$$\sin S \quad \quad \quad 9.5185$$

$$8.8239$$

$$8' \quad 1.2910$$

$$8 \quad 8.9013$$

$$f = +274$$

$$g = +0.08$$

$$h = +134$$

$$+416$$

$$S = +18^\circ 15' 42''$$

$$\cos S = 9.9775$$

$$i \quad 0.7170$$

$$(u) \quad 0.6945$$

$$\cos S \quad 9.4960$$

$$\cos(H + \lambda) \quad 9.4269$$

$$h \quad 1.2965$$

$$\cos \quad \quad \quad 9.9839$$

$$\sin S \quad 0.0225$$

$$8.8239$$

$$h' \quad 0.2194$$

$$h \quad 0.1268$$

$$g' = +19.57$$

$$h' = +1.66$$

$$i = +495$$

$$+26.15$$

4295

Lunar parallax

$$\begin{array}{r}
 \alpha' = 2^h 28^m 33.42 \\
 \delta = 2 \quad 01 \quad 44.65 \\
 \delta - \alpha = -26 \quad 48.77 \\
 \quad \quad -6 \quad 42' 12''
 \end{array}$$

$$- \quad \quad \quad 2 \quad 30$$

$$-6 \quad 39 \quad 42$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.00295 \\
 \hline
 996022
 \end{array}$$

$$\delta = 42 \quad 22 \quad 53.0$$

$$\delta = +18 \quad 16 \quad 08.3$$

$$+24 \quad 06 \quad 44.7$$

$$\begin{array}{r}
 9.82640 \\
 820423 \\
 961122 \\
 0.17130 \\
 \hline
 7.81315
 \end{array}$$

$$\delta - \delta' = +22 \quad 21.5$$

$$\delta = +18 \quad 38 \quad 29.8$$

$$\alpha = 2 \quad 28 \quad 13.36$$

$$\text{Naut Alman } \delta = +18 \quad 38 \quad 26.1$$

$$\alpha = 2^h 28^m 12.41$$

$$O - C = +3.7$$

$$\begin{array}{l}
 \text{Cur. of Plate} \\
 \text{2nd ord. ref.}
 \end{array}
 \quad +0.2$$

$$+0.0$$

$$+0.0$$

$$\delta = +18 \quad 38 \quad 29.8$$

$$O - C = +3.7$$

$$+0.95$$

$$\text{Cur.} \quad -0.01$$

$$\text{2nd.} \quad -0.02$$

$$\alpha = 2 \quad 28 \quad 13.34$$

$$O - C = +0.93$$

4295

human parallax.

$$\alpha = 2^h 28^m 33.42$$

$$\delta = 2 \quad 01 \quad 44.65$$

$$\delta - \alpha = -26 \quad 48.77$$

$$-6 \quad 42 \quad 12$$

$$- \quad \quad \quad 2 \quad 30$$

$$-6 \quad 29 \quad 42$$

$$9.95727$$

$$0.00000$$

$$0.00295$$

$$99.6022$$

$$\delta = 42 \quad 22 \quad 53$$

$$S = +18 \quad 16 \quad 08.3$$

$$-2.4 \quad 06 \quad 44.7$$

$$9.82640$$

$$8.20423$$

$$9.61122$$

$$0.17130$$

$$7.81315$$

$$S - S' = +22 \quad 21.5$$

$$\delta = +18 \quad 38 \quad 29.8$$

$$\alpha = 2 \quad 28 \quad 13.36$$

$$\text{Hant. Abund. } S = +18 \quad 38 \quad 26.1$$

$$\alpha = 2^h 28^m 12.41$$

$$O - C = +3.7$$

$$\text{Cur. of Plate} = +0.2$$

$$\text{2nd ord. ref.} = 0.0$$

$$+0.0$$

$$S = +18 \quad 38 \quad 29.8$$

$$O - C = +3.7$$

$$+0.95$$

$$\text{Cur.} = -0.01$$

$$\text{2nd} = -0.02$$

$$\alpha = 2 \quad 28 \quad 13.34$$

$$O - C = +2.93$$

4296 ~~moon~~ Stars Measures 1911 Feb 3.

	α	δ	α	δ
1	16440	15865	18350	16488
132	11950	1032129	1044033	1435963
28.5	4144	26	36	69
	29	59	36	86
	<u>28.4490</u>	<u>4463</u>	<u>13.2097</u>	<u>2124</u>
2	15796	19810	16138	19290
13.5	938178	1621010	1193935	1344040
12.6	84	08	37	41
	88	02	20	68
	<u>12.6411</u>	<u>6402</u>	<u>13.5810</u>	<u>5837</u>
3	19966	18779	(4892)	18600
20.5	1780904	10942	1916068	1427887
19.2	10	3936	70	88
	44	70	4878	88
	<u>19.2154</u>	<u>2167</u>	<u>30.4281</u>	<u>4311</u>

Grade 3

4 296

~~From~~ Stars Measures

1911 Feb 3.

y

x

a

v

a

v

1 10440

15865

14350

16485

132 114954

1032129

1044033

1435468

281 4144

26

36

69

29

59

36

88

28.449044631320972124

2 15796

19810

16133

19290

135 938178

1621010

1193535

1344040

126 84

0810

27

4140

88

02

20

68

12.6411640213581015837

3 19966

18779

(4592)

18600

135 1780904

1094236

1916268

1427887

192 10

39

70

88

44

70

4878

88

19.2154216730.42814311

Grade 3.

4296

Moon measures

19107 at 3.

	α	δ	α	δ
	17891	17338		
18.0	1654929	867769		
18.2	4139	6969		
	85-	28		
	<u>181350</u>	<u>1343</u>		

B scratch

17.5	19191	17440	17731	17809
18.5	14509	1213129	11139	14378
	9500	33	4538	8579
	81	30	21	85-
	<u>184685-</u>	<u>4696</u>	<u>17.3417</u>	<u>3423</u>

3		
17.0	16675	17410
18.8	8460	1558989
	8073	92
	69	06
	<u>188200</u>	<u>8181</u>

4
16.8
19.0

17682	19860
1647072	1102521
66	09
66	85
<u>16.8789</u>	<u>8820</u>

19655	16959
1596563	1062011
56	11
38	47
<u>16.6313</u>	<u>6338</u>
14940	1239590
1457066	00
70	11927
<u>16.9629</u>	<u>9632</u>

5
16.7
20.0
min
21
26

6
16.9
21.0

4296

Onion measures

19157-4-3

	d	n
1	17891	17338
180	1654929	867769
182	4139	6969
	85-	28
	<u>18.1350</u>	<u>1343</u>

3 scratch

75	19191	17440	17731	17809
185	14509	1213129	11139	14378
	9100	33	4338	8579
	81	30	21	85-
	<u>18.4685</u>	<u>4696</u>	<u>17.3417</u>	<u>3423</u>

3	16675	17410
170	8460	1558989
188	8073	92
	69	06
	<u>18.8200</u>	<u>8181</u>

4
168
190

5
167
200
11
16

6
169
210

17682	19860
1647072	1102521
66	09
66	85-
<u>16.8749</u>	<u>8820</u>
19655	16959
15765	1062011
5663	11
38	47
<u>16.6313</u>	<u>6338</u>
14940	1229590
14570	00
7066	11927
<u>16.9629</u>	<u>9632</u>

4296

moon - measures

1915 Feb. 3.

y

x

α

ν

α

ν

7	18360	17101
18.0	1105052	1440895
21.6	42	0095
	52	81
	<u>21.7306</u>	<u>.7306</u>

8	18310	17130
18.5	1033830	1512319
21.7	29	15
mean	10	20
in	<u>21.7978</u>	<u>.7991</u>

9	17639	18145
19.0	1035065	1540004
21.6	58	95
	29	45
	<u>21.7275</u>	<u>.7255</u>

4296

Mars - Measures

1915 Feb 3.

4

x

d

N

d

N

2	18360	17101
180	1105052	1440895
216	42	0095
	52	81
	<u>21.7306</u>	<u>7306</u>

8	18310	17130
185	1033830	1112319
217	29	15
mean	10	20
	<u>21.7978</u>	<u>7991</u>

9	17639	18145
190	1035065	1540004
216	58	95
	29	45
	<u>21.7275</u>	<u>7215</u>

4296	Times Etc			
Epitaph	1913 Nov. 12,	2	13	- 2 25
moon		2	19	157 - 2 19 15.9
clock fast		0	30.7	
H. Sid T.		2	18	45.1
H. long		4	44	310.5
G. Sid T.		7	03	161.5
Sid T. in hour		15	24	022.6
Interval		15	39	13.89
Red			2	33.87
G. M. T.		15	36	40.02

From Kant Alm	R. A.				Decl.	
Moon 15 ^h	2	27	32.85	+ 18°	34'	39"
Moon in 1 ^m : 2.0081				11.508		
36.667	+	1	13.63		+ 7	02.0
Tabular place	2	28	46.48	+ 18	41	41.1

Moon's age 14	(before full.)
Moon's parallax	55' 01" 48
" semidiameter	15' 01.2
934 = 14.35	R
901 = 13.4	901.2
	+ 13.4
	- 0.3
	914.3
	1.9599
	- 933
a = -500.2	1866.6
-2	3.4842
476.2	

4 to 96	Times etc.			
1913 Nov 12	2	13	- 2	25
known	2	19	157	- 2 19 15.9
clock fast		0	30.7	
H. Sid. T.	2	18	451	6 - 2 - 10
H. long	4	44	3105	
G. Sid. T.	7	03	1615	
Sid. T. h. hour	15	24	0226	
Intervel	15	39	1389	
Reed		2	3287	
G. M. T.	15	36	4002	

From hand Allen	R. A.		Reed.	
known 15 ^h	2	27	3285	+ 18° 34' 39"
known h. T. 20081			11508	
36.667	+	1	1363	+ 7 020
Tabular Place	2	28	4648	+ 18 41 41.1

known age 14	(p. p. pull)	
known parallel	55'	01'48"
semidiameter	15	012
R		9012
Augmentation		+ 134
Irregularities (3)		- 03
R		9143
R		19599
AK		- 933
(1+a)/R		12666
R ²		34842

4296

Plate constants.

x	13.2110	13.5824	30.4296
z	12.7386	13.2609	30.8958
$x-z$	+4724	+3215	-4662

y	28.4477	12.6406	19.2160
η	29.1441	12.5464	19.5937
$y-\eta$	-6964	+942	-3777

$x-z$	+500x	-83.84	$\frac{1}{10}x$	-8948
+4724	+6606	=+11330	-2383	=+8947+3
+3215	+6791	=+10006	-1050	=+8946+3
-4662	+15215	=+10553	-1610	=+8943+6
18.4973	+9249	-1670	+4	=18.3607

$y-\eta$	+520y	+84.1x	+2y	-8428
-6964	+14224	=+7260	+1111	=+8371+57
+942	+6320	=+7262	+1142	=+8404+25
-3777	+9608	=+5831	+2559	=+8390+88
19.9324	+9966	+1556	+40	=20.2458

Tables a: 0.0 e: -0.8 a-e: +0.8 b+a: 0.0

obs a: -500.2 z: -502.0 a-z: +1.8 b+d: -0.3

b-e -500.2 -501.2 +1.0 -0.3

4296

Plate constants

$$\begin{array}{rcl}
 x & 132110 & 135824 \quad 304296 \\
 z & 127386 & 132609 \quad 308958 \\
 x-z & +4724 & +3215 \quad -4662
 \end{array}$$

$$\begin{array}{rcl}
 y & 284777 & 126406 \quad 192160 \\
 \eta & 291441 & 125464 \quad 195937 \\
 y-\eta & -6964 & +942 \quad -3777
 \end{array}$$

$$\begin{array}{rcl}
 x-z & +100x & -8381 \quad +12x \quad -8949 \\
 +4724 + 6606x + 11330 - 2383 = +8947 + 3 & +8950 & \\
 -3215 + 6791 = +10006 - 1060 = +8946 + 3 & +8949 & \\
 -4662 + 15215 + 10513 - 1610 = +8943 + 6 & +8949 & 0 \\
 184973 + 9249 & = 1670 & +4 \quad 183607
 \end{array}$$

$$\begin{array}{rcl}
 y-\eta & +1209 & +8412 \quad +24 \quad -8428 \\
 -6964 + 14227 = +7260 + 1111 = +8371 + 57 & +8428 & 0 \\
 +942 + 6320 = +7262 + 1142 = +8404 + 25 = +8429 & +8429 & +1 \\
 -3777 - 9608 = +5831 + 2559 = +3390 + 86 & +8428 & 0 \\
 149324 + 9966 & = 1556 & +40 \quad 202458
 \end{array}$$

1
2
3
4
5
6
7
8
9

1
2
3
4
5
6
7
8
9

4296

Moon's Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	18.00000	-0.4984	0.2484	3.4816	-26
2	17.3420	-1.1564	1.3372	3.4796	-46
3	17.0000	-1.4984	2.2452	3.4855	+13
4	16.8804	-1.6180	2.6179	3.4876	+34
5	16.6326	-1.8658	3.4812	3.4857	+15
6	16.9630	-1.5354	2.3574	3.4967	+125
7	18.0000	-0.4984	0.2484	3.4816	-26
8	18.4984	0.0000	0.0000	3.4816	-26
9	19.0000	+0.5016	0.2516	3.4700	-142

$$R^2 = 3.4842$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	
1	18.1346	-1.7980	-1	3.2332	195
2	18.4690	-1.4636	-1	2.1424	218
3	18.8190	-1.1136	-1	1.2403	233
4	19.0000	-0.9326	0	0.8697	240
5	20.0000	+0.0674	0	0.0045	273.270
6	21.0000	+1.0674	0	1.1393	305
7	21.7306	+1.7980	+1	3.2332	345
8	21.7984	+1.8658	+1	3.4816	360
9	21.7265	+1.7939	+1	3.2184	16

Range 181

Approx Center of Moon

$$x = 18.0 \quad y = 18.1346$$

$$21.7306$$

$$39.8652$$

$$y_0 = 19.9326$$

$$y - \text{mid} = 21.7984$$

$$R = 1.8658$$

$$x - \text{min} = 16.6326$$

$$x_0 = 18.4984$$

$$\text{Center } \begin{cases} x_0 = 18.4984 \\ y_0 = 19.9326 \end{cases}$$

4296

Approx Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	180000	-04984	02484	34816	-26
2	173420	-11564	13372	34796	-46
3	170000	-14984	22452	34855	+13
4	168804	-16180	26179	34876	+34
5	166326	-18658	34812	34857	+15
6	169630	-15354	23574	34967	+125
7	180000	-04984	02484	34816	-26
8	184984	00000	00000	34816	-26
9	190000	05016	02516	34700	-142

$$R^2 = 34842$$

	y	$y - y_0$	Δy	$(y - y_0)^2$	
1	181346	-17980	-1	32332	195
2	184690	-14636	-1	21424	212
3	188190	-11136	-1	12403	233
4	190000	-9326	0	08697	241
5	200000	+00674	0	00045	273
6	210000	+10674	0	11393	308
7	217306	+17980	+1	32332	345
8	217984	+18658	+1	34816	360
9	217265	+17939	+1	32184	16

Range 181

Approx Center of moon

$$x = 180 \quad y = 181346$$

$$217306$$

$$398652$$

$$y = 199326$$

$$y - \text{mid} = 217984$$

$$R = 18658$$

$$x - \text{mid} = 166326$$

$$x = 184984$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 184984 \\ y_0 = 199326 \end{array} \right.$$

Formation of normals

1	+ 0.90	+ 13.0	+ 46.8
2	+ 1.69	+ 53.4	+ 67.2
3	+ 1.67	- 19.5	- 14.4
4	+ 1.51	- 55.0	- 31.6
5	- 0.13	- 28.1	+ 1.1
6	- 1.65	- 192.5	+ 133.8
7	- 0.90	+ 13.0	- 46.8
8	+ 0.00	- 0.0	- 48.6
9	+ 0.90	- 71.0	- 254.0
	+ 4.00	- 286.7	- 146.5

$\checkmark$ -a	$\checkmark$ -b	+15 + ΔC
- 5	+ 5	+ 15 $\checkmark$
- 13	+ 4	+ 6 $\checkmark$
- 17	+ 3	+ 1 $\checkmark$
- 18	+ 3	+ 0 $\checkmark$
- 20	- 0	- 5 $\checkmark$
- 17	- 3	- 5 $\checkmark$
- 5	- 5	+ 5 $\checkmark$
+ 0	- 6	+ 9 $\checkmark$
+ 5	- 5	+ 0+15 $\checkmark$

4296

Moon's Center - Conditional Equations.

	a	b	0	c	o - c Corr
1	-0.50	-1.80	-46	+11 + 6 = +17	-43 - 28"
2	-1.16	-1.46	-46	+25 + 5 = +30	-76 - 70"
3	-1.50	-1.11	+13	+32 + 3 = +35	-22 - 21"
4	-1.62	-0.93	+34	+35 + 3 = +38	-4 - 4"
5	-1.87	+0.07	+15	+40 - 0 = +40	-25 - 30"
6	-1.54	+1.07	+125	+33 - 3 = +30	+95 + 90"
7	-0.50	+1.80	-26	+11 - 6 = +5	-31 - 26"
8	+0.00	+1.87	-26	-0 - 6 = -6	-20 - 11"
9	+0.50	+1.79	-142	-11 - 6 = -17	-125 - 170"

+95 = 346

Average 49

Normal Equations.

$$\begin{aligned}
 +12.79 + 4.00 &= -287 & -8.19 \\
 +4.00 + 18.56 &= -146 & +1.30 \\
 -4.00 - 1.25 &= +90 & +2.56 \\
 &+17.31 = -56 & +3.86 \\
 +12.79 &= -287 + 13 = -274 & a = -21.4 - 0.71
 \end{aligned}$$

Arc measured: 180°

Average (o - c) = -28

$$\frac{p_0}{n} = 33$$

$$-\frac{28}{33} = -0.85 \quad \Delta n = -0.9$$

$$-2RC + 0.75 + 15$$

$$\text{Corr} = -0.2$$

$$\Delta b = +0.16 + 3 \quad \Delta \delta = +0.1$$

$$\Delta R = -0.7$$

$$\Delta a = -0.54 - 11 \quad \Delta \alpha = -0.02$$

4296

Moon's Center - Conditional Equations

	a	b	0	c	$0 - c$
1	-0.50	-1.80	-26	+11 + 6 = +17	-43
2	-1.16	-1.46	-46	+25 + 5 = +30	-76
3	-1.50	-1.11	+13	+32 + 3 = +35	-22
4	-1.62	-0.93	+34	+35 + 3 = +38	-4
5	-1.87	+0.07	+15	+40 - 0 = +40	-25
6	-1.54	+1.07	+125	+33 - 3 = +30	+95
7	-0.50	+1.80	-26	+11 - 6 = +5	-31
8	+0.00	+1.87	-26	- 0 - 6 = -6	-20
9	+0.50	+1.79	-142	-11 - 6 = -17	-125

+95 = 346

Average 149

Normal Equations

$$+12.79 + 4.00 = -287$$

$$+ 4.00 + 18.56 = -146$$

$$- 4.00 - 12.5 = + 90$$

$$+ 17.31 = - 56$$

$$b = - 3.2$$

$$+12.79 = -287 + 13 = -274$$

$$a = -21.4$$

Core measured: 180° Average $(0 - c) = -38$

$$\frac{m}{n} = 33$$

$$- \frac{26}{33} = -0.85 \quad \Delta n = 0.9$$

4296 Moon's Mean Position (1930)

$$X_0 = 18.4984$$

$$Y_0 = 19.9326$$

$$\Delta X = -11$$

$$\Delta Y = -2$$

$$18.4973$$

$$19.9324$$

From plate constants $X = 18.3607$ $Y = 20.2458$

$$z = +0.3607$$

$$\log z = 9.55715$$

$$\log s = 9.97442$$

$$8.50724$$

$$1.07249$$

$$\eta = -1.7542$$

$$\log \tan \delta = 9.5287$$

$$32 = 9.1143$$

$$7.0534$$

$$5.6964$$

$$X - A = + 1.182$$

$$A = 2 \ 28 \ 39$$

$$X_0 = 2 \ 28 \ 50.82$$

$$\eta_0 = -1.7542$$

$$\log = 0.24408m$$

$$7.33115$$

$$Red = + 4.16$$

$$2.91293m$$

$$X' = 2 \ 28 \ 54.98$$

$$S - D = -13 \ 38.3$$

$$D = +18 \ 32 \ 43$$

$$S_0 = +18 \ 19 \ 04.7$$

$$Red = + 26.1$$

$$S' = +18 \ 19 \ 30.8$$

4296 Moon's Mean Position (1930)

$$X_0 = 18.4984$$

$$Y_0 = 19.9326$$

$$\Delta X = -11$$

$$\Delta Y = -2$$

$$18.4973$$

$$19.9324$$

From plate constants $X = 18.3607$ $Y = 20.2458$

$$S = 0.3607$$

$$\eta = -1.7542$$

$$\log S = 9.55715$$

$$\log \tan S = 9.5287$$

$$\log 3 = 9.97942$$

$$3 = 9.1143$$

$$8.50721$$

$$7.0534$$

$$1.07249$$

$$5.6964$$

$$X - A = + 1.182$$

$$\eta = -1.7542$$

$$A = 2.2839$$

$$\log = 0.24408$$

$$X_0 = 2.2850.82$$

$$7.33115$$

$$Red = + 4.16$$

$$2.91293$$

$$X' = 2.285498$$

$$S - D = -13.383$$

$$D = +18.3243$$

$$S = +18.19047$$

$$Red = + 26.1$$

$$S' = +18.19308$$

4296

Red. ad. locum aph.

$$S = +18^{\circ} 19'$$

$$\begin{array}{rcl} H + \alpha & 4^h & 58.8 = 74^{\circ} 42' \\ H & 2 & 30.0 \\ \alpha & 2^h & 28.8 \\ G & 22 & 13.4 \\ G + \alpha & 0 & 42.2 = 10^{\circ} 33' \end{array}$$

$$\begin{array}{rcl} \log(G + \alpha) & & 9.9926 \\ \log S & & 1.2952 \\ \log \sin \alpha & & 9.2627 \\ \log \tan S & & 9.5199 \\ & & 8.8239 \end{array}$$

$$\begin{array}{rcl} g' & & 1.2908 \\ g & & 8.9047 \end{array}$$

$$\begin{array}{rcl} f & + & 2.74 \\ g & + & 0.08 \\ h & + & 1.34 \\ & + & 4.16 \end{array}$$

$$\begin{array}{rcl} \log \sin S & & 9.9774 \\ \log \cos(H + \alpha) & & 0.7170 \\ (L) & & 0.6944 \end{array}$$

$$\begin{array}{rcl} \log \sin S & & 9.4973 \\ \log \cos(H + \alpha) & & 9.4214 \\ \log h & & 1.2965 \\ \log \sin \alpha & & 9.9843 \\ \log \sec S & & 0.0226 \\ & & 8.8239 \end{array}$$

$$\begin{array}{rcl} h' & & 0.2152 \\ h & & 0.1273 \end{array}$$

$$\begin{array}{rcl} g' & + & 19.53 \\ h' & + & 1.64 \\ i & + & 49.5 \\ & & 26.12 \end{array}$$

4296

Red. ecl. elements.

$$S = +18^{\circ} 19'$$

$$\begin{array}{rcl} H + \alpha & 4^{\circ} & 58.8 - 74^{\circ} 42' \\ H & 2 & 300 \\ \alpha & 2^{\circ} & 28.8 \\ G & 22 & 134 \\ G + \lambda & 0 & 42.2 - 10^{\circ} 33' \end{array}$$

$$\begin{array}{rcl} \cos(G + \alpha) & 99926 \\ g & 12982 \\ \sin & 92627 \\ \tan g & 91199 \\ & 88239 \end{array}$$

$$\begin{array}{rcl} g' & 12908 \\ g & 89047 \end{array}$$

$$\begin{array}{rcl} f & +274 \\ g & -0.08 \\ h & +134 \\ \hline & +4.16 \end{array}$$

$$\begin{array}{rcl} \log \sin S & 99774 \\ \log \cos S & 07170 \\ (2) & 06944 \end{array}$$

$$\begin{array}{rcl} \sin S & 94973 \\ \cos(H + \alpha) & 94214 \\ h & 12965 \\ \sin & 99843 \\ \cos S & 00226 \\ & 88239 \end{array}$$

$$\begin{array}{rcl} h' & 02152 \\ h & 01273 \end{array}$$

$$\begin{array}{rcl} g & +19.53 \\ h' & +164 \\ i & -59.1 \\ \hline & 26.12 \end{array}$$

4296

Lunar Parallax

$$\alpha' = 2^h 28^m 54.98$$

$$\theta = 2 \quad 18 \quad 451$$

$$\delta - \alpha' = -10 \quad 9.9$$

$$= -2^\circ 32' 28''$$

$$- \quad 57$$

$$- \quad 2 \quad 31 \quad 31$$

$$995727$$

$$0.00000$$

$$000042$$

$$995769$$

$$\delta = 42^\circ 12' 50$$

$$18 \quad 19 \quad 31$$

$$23 \quad 53 \quad 19$$

$$9.82640$$

$$820426$$

$$960741$$

$$017269$$

$$781076$$

$$\delta - \delta' = 22 \quad 14.1$$

$$\delta = +18 \quad 41 \quad 44.9 \quad \alpha = 2 \quad 28 \quad 47.36$$

$$\text{Nant Allen } \delta = +18 \quad 41 \quad 41.1 \quad \alpha = 2 \quad 28 \quad 46.48$$

$$O - C \quad + 3.8$$

$$\text{Cur. of Plate} \quad + 0.3$$

$$\text{2nd Ord. Ref.} \quad 0.0$$

$$\text{Inv} \quad + 0.1$$

$$+ 0.88$$

$$\text{Cur} \quad - 0.01$$

$$\text{Inv} \quad - 0.02$$

$$\alpha \quad 2 \quad 28 \quad 47.34$$

$$\delta = +18 \quad 41 \quad 45.0 \quad O - C \quad + 0.86$$

$$O - C = + 3.9$$

4296

Lunar Parallax.

$$\alpha' : 2^h 28^m 54^s 9$$

$$\delta : 2 \quad 18 \quad 451$$

$$\delta - \alpha : -10 \quad 9.9$$

$$-2^0 32' 28''$$

$$-57$$

$$-2 \quad 31 \quad 31$$

$$995727$$

$$000000$$

$$000042$$

$$995769$$

$$\delta : 42^0 12' 50$$

$$18 \quad 19 \quad 31$$

$$23 \quad 53 \quad 19$$

$$982640$$

$$820426$$

$$960741$$

$$017269$$

$$7.81076$$

$$\delta - \delta' : 22 \quad 14.1$$

$$\delta : +18 \quad 41 \quad 44.9 \quad \alpha : 2 \quad 28 \quad 47.366$$

$$\text{Nautical Almanac } \delta : +18 \quad 41 \quad 41.1 \quad \alpha : 2 \quad 28 \quad 46.485$$

$$O - C \quad +3.8$$

$$\text{Cur. of Plate} \quad +0.3$$

$$\text{2nd Ord. Rep.} \quad 0.0$$

$$\text{3rd} \quad +0.1$$

$$+0.88$$

$$\text{Cur.} \quad -0.01$$

$$\text{2nd} \quad -0.02$$

$$\alpha \quad 2 \quad 28 \quad 47.34$$

$$\delta : +18 \quad 41 \quad 45.0 \quad O - C \quad +0.86$$

$$O - C = +3.9$$

