

KG
11366
w945

LXVII

3215

3376

Harvard Lunar Plates

Measures and Reductions

Mary Fowler

Volume LXVIII

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24
2
2
2

Apr. 19, 1913
3215

Star Measures

1914 Apr 13

α	δ	α	δ	α	δ	α	δ
1	1012119	12795	16790	15712			
58	10	1197172	1462510	786580			
20.9	9308	71-72	7908	7176			
			94	20			
	<u>20.9191</u>	<u>.9178</u>	<u>57.7824</u>	<u>.7844</u>			
3	14629	15568	15520	15681			
24.6	10400	9810	1177172	9429			
10.4	9098	0101	80	1322			
	35	83	22	87			
	<u>10.4235</u>	<u>.4227</u>	<u>14.6253</u>	<u>.6264</u>			
defect in plate very near star 2.							
3	19640	14771	14243	14878			
27.5	1670501	771198	991202	921209			
233	00	99	00	1509			
	45	81	60	81			
	<u>23.2939</u>	<u>.2925</u>	<u>27.5654</u>	<u>.5668</u>			

grade 4

Apr. 19, 1913
3215Star measures
4

1919 Apr 13

1	1212119	12795	16790	15712
58	109	1197172	1462510	786180
29	9308	71	1908	7176
			99	20
	<u>209191</u>	<u>9178</u>	<u>57824</u>	<u>7844</u>

3	14629	15568	15520	15281
46	10400	9810	1177172	942922
109	9098	0101	80	13
	35	83	22	87
	<u>10.4235</u>	<u>4227</u>	<u>19.6253</u>	<u>6269</u>

defect as relatively near star 2.

3	19640	14771	14248	14878
275	1670501	77198	991202	921209
233	00	99	00	1509
	45	81	60	81
	<u>23.2939</u>	<u>2925</u>	<u>27.5654</u>	<u>5668</u>

Grade 4

3
1
19.
10

2
18
16

3
17
17

4
17
17
~
~
~

5
1
1

3215 moon measure

$\frac{1}{d}$	$\frac{1}{N}$	$\frac{1}{d \times N}$
18612	17945	
19.0 13849	1270196	
15.5 5444	976	
32	65	
<u>15.4773</u>	<u>.4743</u>	

possibly on
termination

$$\frac{2}{18.1}$$

$$16.0$$

$$1352209$$

$$0022$$

$$13300$$

$$11871$$

$$1165059$$

$$8070$$

$$\frac{3}{17.4}$$

$$17.0$$

$$180213$$

$$17183$$

$$1146151$$

$$6051$$

$$01$$

$$17.4263$$

$$0206$$

$$16929$$

$$12635$$

$$3635$$

$$35$$

$$.4293$$

$$\frac{4}{17.3}$$

$$17.5$$

$$mi$$

$$\frac{1}{2}$$

$$17253$$

$$1081919$$

$$10$$

$$71$$

$$17.3551$$

$$17959$$

$$1441095$$

$$90$$

$$51$$

$$.3545$$

$$\frac{5}{17.4}$$

$$18.0$$

$$16132$$

$$1013150$$

$$39$$

$$40$$

$$17.4003$$

$$18981$$

$$1498180$$

$$8280$$

$$00$$

$$4008$$

$$\frac{6}{17.9}$$

$$19.0$$

renewance direct

$$19537$$

$$18840$$

$$4935$$

$$51$$

$$17.9303$$

$$16081$$

$$1516269$$

$$65$$

$$99$$

$$17.9082$$

$$1436183$$

$$6983$$

$$13709$$

$$.9338$$

3215 known unknown

$$\begin{array}{r}
 \text{d} \quad \text{N} \\
 \hline
 1 \quad 18612 \quad 17945 \\
 190 \quad 13849 \quad 1270196 \\
 155 \quad 5444 \quad 9796 \\
 \quad 32 \quad 65 \\
 \hline
 154773 \quad 4743
 \end{array}$$

d N

normal eye
termination

$$\begin{array}{r}
 1352209 \quad 11871 \\
 \quad 0022 \quad 1165059 \\
 13300 \quad 8070
 \end{array}$$

$$180213$$

$$0206$$

$$\begin{array}{r}
 17183 \\
 1146151 \\
 \quad 60 \\
 \quad 01 \\
 174263
 \end{array}$$

$$\begin{array}{r}
 18929 \\
 12635 \\
 \quad 3635 \\
 \quad 35 \\
 4295
 \end{array}$$

$$\begin{array}{r}
 17253 \\
 1081919 \\
 \quad 10 \\
 \quad 71 \\
 173851
 \end{array}$$

$$\begin{array}{r}
 17939 \\
 1941095 \\
 \quad 90 \\
 \quad 51 \\
 3545
 \end{array}$$

$$\begin{array}{r}
 16132 \\
 1013150 \\
 \quad 39 \\
 \quad 40 \\
 174003
 \end{array}$$

$$\begin{array}{r}
 18981 \\
 1498180 \\
 \quad 5280 \\
 \quad 00 \\
 4008
 \end{array}$$

$$\begin{array}{r}
 16081 \\
 1514269 \\
 \quad 65 \\
 \quad 99 \\
 179082
 \end{array}$$

$$\begin{array}{r}
 1936183 \\
 \quad 6983 \\
 13709 \\
 9338
 \end{array}$$

known unknown

$$\begin{array}{r}
 19537 \\
 18890 \\
 \quad 4935 \\
 \quad 51 \\
 179308
 \end{array}$$

$\frac{8}{19}$
 $\frac{19}{19}$

3215 *lunar measures*

<u>7</u>	16000	2039.1
19.0	9842	16538.50
19.5	39	50
	21	09
	<u>19.6176</u>	<u>.6148</u>

<u>8</u>	15972	14432
19.5	926138	11170.52
19.6	5056	69
mov	00	50
in	<u>19.6740</u>	<u>.6726</u>

<u>9</u>	15955	15459
20.0	9852	11539.40
19.5	58	49
	71	78
	<u>19.6111</u>	<u>.6076</u>

Indistinct image of moon

3215

Lycoris lucasii

d

in

d

w

7	10000	20391
190	9892	16538
195	39	50
	21	09
	<u>196176</u>	<u>6148</u>

8	15972	14432
195	926138	11170
190	5056	69
195	00	50
	<u>196740</u>	<u>6726</u>

9	15955	15459
200	9832	11539
195	58	40
	71	78
	<u>196111</u>	<u>6076</u>

Indistinct image of moon

3215 Trines etc.
 1913 Apr. 19, 14^h 45^m ✓
 14 51 14.3 ✓ 14 57 ✓
 clock fast 1 07.0 ✓

K Sid T. 14 50 07.5 ✓ 0-2-+1^h 36^m
 H. Hong 4 44 31.0 ✓
 G Sid T. 19 34 38.5 ✓
 Sid T. U. Moon 1 47 55.1 ✓
 Interval 17 46 43.4 ✓
 Reduction 2 54.7 ✓
 G M. T. 17 43 48.6 ✓

From Nant Queen R. A. ✓ Week.
 Moon 18^h ✓ 13^h 14^h 16.29 ✓ -9 35 38.3 ✓
 Motion in 2.2032 ✓ 16.726 ✓
 " " -16.889 ✓ - 35.67 ✓ + 4 30.8 ✓
 Tabular place 13 13 40.62 ✓ -9 31 07.5 ✓

Moon in age 13 days
~~Parallax~~ 60' 05' 52" ✓
 Pericynthion 16 23.9 ✓
 R 983.9 ✓
 Augmentation + 9.8 ✓
 Irradiation (4) - 0.8 ✓
 R 992.9 ✓
 R 2.1284 ✓
 (1+a)/R 2.1280 ✓
 R² 4.5284 ✓

934 = 8.8 ✓
 984 = 9.8 ✓

a = -1.7

3215 Times etc
 Sept. 1913 Apr. 19, 14^h 45^m - 14^h 57^m
 Moon 14 51 14.3 - 14 51 147
 Clock fast 1 07.0

H Sid T. 14 50 07.5 0-2-11 36^m
 H Hong 4 44 31.05
 G Sid T. 19 34 38.55
 Sid T. (u) Moon 1 47 55.13
 Interval 17 46 43.42
 Reduction 2 54.76
 G. M. T. 17 43 48.66

From Hunt Allen R. A. Wheel
 Moon 18^h 13^h 14^h 16^h 29 -9 35 38.3
 Moon 18^h 2.2032 16.726
 " " -16.889^m - 35.67 + 4 30.8
 Tabular plan 13 13 40.62 -9 31 07.5

Moon age 13 days.
~~Parallax~~ 60' 05" 52
 Pericynthion 16 23.9
 R 983.9
 Augment factor + 9.8
 Irradiation (4) - 0.8
 R 992.9
 R 2.1284
 1174/R 2.1280
 R² 4.5284

934 = 8.8
 984 = 9.8

a = -17

3215	Plate Constant			Recl.		
x	y	R	A	x	y	z
5.7839	20.9184	13	05	12	-9	51
24.6258	10.4231		15	09	-11	12
27.5661	23.2932		16	39	-9	32
3 5798	5464		36	60	129	95
19.33	1831	13	12	20	-10	12
-18	-22			40	+	28
1.33	3.69	13	11	40	-9	43
31	466					50
41 ^s	1722	Center of Plate			A = 13° 11' 40"	
	= 28° 42"				D = -9° 43' 50"	

2-3	-45.74	+1.876	-12	+144
+802	-956	-1.54	+10	-144
+290	-476	-1.86	+44	-142
+873	-1064	-1.91	+500	-141
19.4829	-803	+35	-2	= 19.4203

4-7	+52.8x	+4.54	-297
-103	+305	+202	+94
-1050	+1300	+250	+47
-1263	+1955	+198	+105
17.5459	+1029	+179	= 17.6270

Tables a: -0.5 z: -5.1 a-e: +4.6 b+a: -4.5
Obs a: -1.7 z: -4.5 a-e: +2.8 b+a: -7.1

3215

Plate Constant

Decl.

	γ	R	A	
5.7834	20.9184	13.05	12	-9 51 56
29.6258	10.4231	10	09	-11 12 56
27.5661	43.2932	16	39	-9 32 40
3 5798	5464	36	60	29 45 152
19.33	1831	13	12	20 -10 12 31
-18	22	-	40	+ 28 42
133	369	13	11	40 -9 43 50
31	466			
41 ⁵	1722			
	= 28 42"			

Center of Plate } $A = 13^{\circ} 11' 40''$
 $D = -9^{\circ} 43' 50''$

2-3	-45.74	+1.826	-12	+144
+802	-956	-154	+10	-144 = -1
+290	-476	-186	+44	-142 = 0
+873	-1064	-191	+50	-141 = 0
19.4829	-803	+35	-2	= 19.4203

$\gamma - \gamma$	+52.82	+4.54	-297
-103	+305	+202	+94 = +296 = -1
-1050	+1300	+250	+47 = +297 = 0
-1263	+1955	+192	+105 = +297 = 0
17.5459	+1029	+179	= 17.6270

Tables $a = -0.5$ $a = -5.1$ $a - c = +4.6$ $b + a = -4.5$
 Obs $a = -1.7$ $a = -4.5$ $a - c = +2.8$ $b + a = -7.1$

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Standard Coordinate Comparison stars

6

Cape No. 1783 mag 6.2

Cape No. 1805 mag 7.1

Cape No. 1808 mag 7.0

C	13	04	31.14	13	14	28.06	13	15	58.00
L			13			05			99
S			18			00			95
mean	13	04	31.15	13	14	28.04	13	15	57.98
Proc	+		40.77	+		41.04	+		40.89
X	13	05	11.92	13	15	09.08	13	16	38.87
A	13	11	40	13	11	40	13	11	40
B-A	-	6	28.08	+	3	29.08	+	4	58.87
tan(B-A)			-388.03			+209.07			+298.85
log ₁₀			2.58886			2.32029			2.47546
-cos _δ			9.99353			9.99162			9.99395
-30			108963			081915			097665
30			-12.2922			+6.5940			+9.4765
31			-			28			23
32			5.7032			29.5968			27.4788
33			5.7834			24.6258			27.5661
34-3			+802			+290			+873
C	-9°	47'	45.30	-11°	08'	48.7	-9°	28'	33.5
L			45.3			48.7			33.8
S			45.5			49.6			33.3
mean	-9	47	45.4	-11	08	49.0	-9	28	33.5
Proc	-4		10.5	-4		06.8	-4		06.3
S	-9	51	55.9	-11	12	55.8	-9	32	39.8
D	-9	43	50	-9	43	50	-9	43	50
B-D	-	8	05.9	-1	29	05.8	+	11	10.2
tan(B-D)			-485.9			-5347.0			+670.2
log ₁₀			2.68655			5.72811			2.82620
-70			0.01770			1.05926			0.15735
tan _δ			9.2403			9.2973			9.2257
-32			2.1793			1.6383			1.9533
31			84730			7.9890			82324
30			-1.0416			-11.4621			+1.4366
31			-29.7			98			171
32			20.9287			10.5281			23.4195
33			20.9184			10.4231			23.2932
34-2			-103			-1050			-1263

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Standard Coordinate Comparison Plan

6

Cape W 1783 mag 6.2

Cape W 1805 mag 7.1

Cape W 1808 mag 7.0

C	13	04	31.14	13	14	28.06	13	15	58.00
L			13			05			.99
E			18			00			95
mean	13	04	31.15	13	14	28.04	13	15	57.98
Price	+		4077	+		41.04	+		4089
X	13	05	1192	13	15	0408	13	16	3887
A	13	11	40	13	11	40	13	11	40
d-A	-	.6	2808	+	3	2908	+	4	5887
L(d-A)			-38803			+20907			+29885
log			258886~			232029			247546
cos			999353			999162			999395
sin			108963~			081915			097665
tan			-122922			+65940			+94765
sec			-			28			23
cot			57032			295968			27.4788
csc			5.7834			246258			27.5661
2-c			+802			+290			+873
C	-9	47	45.30	-11	08	48.7	-9	28	33.5
L			45.3			48.7			33.8
E			45.5			49.6			33.3
mean	-9	47	45.4	-11	08	49.0	-9	28	33.5
Price	-4		10.5	-4		068	-4		063
S	-9	51	559	-11	12	558	-9	32	398
D	-9	43	50	-9	43	50	-9	43	50
S-D	-	.8	059	-1	29	058	+	11	102
L(S-D)			-4859			-53470			+6702
log			2.68655~			3.72811~			2.82620
tan			001770~			105926~			015735
sec			92403~			92973~			92257~
csc			21793			16383			19533
tan			84730~			79890~			82324~
sec			-1.0416			-1.14621			+1.4366
tan			-			98			171
tan			209287			-10.5281			-24195
tan			20.9184			10.4281			232932
4-2			-103			-1050			-1265

	p	$p-c$			θ	Corr from Hayn	O	$O-c$	
1	166.9	146.2	+ 1.5	- 1.7	+3.5	-0.4	-27	-56	-19
2	136.8	116.1	+ 2.3	- 0.9	+3.5	+0.2	+18	+24	+6
3	104.8	84.1	+ 2.6	+ 0.2	+2.7	+0.5	+46	-61	-107
4	90.0	69.3	+ 2.4	+ 0.8	+1.9	0.0	0	+4	+4
5	77.7	57.0	+ 2.2	+ 1.1	+1.4	0.0	0	+131	+131
6	47.0	26.3	+ 1.2	+ 1.9	-0.4	+0.4	-37	-80	-117
7	13.1	352.4	- 0.4	+ 2.1	-2.2	+0.2	+18	-61	-79
8	0.0	339.3	- 0.9	+ 2.0	-2.6	-0.2	-18	+18	+36
9	346.0	325.3	- 1.5	+ 1.7	-2.9	-0.8	-74	+17	+91

$$\lambda = +2.6$$

$$\beta = +2.1$$

$$c = 20.7$$

	p	$p-c$	$\lambda \sin(h-u)$	$\beta \cos(p-c)$	θ	Corr from Hayn	O	$O-c$	
1	193.1	172.4	+0.4	-2.1	+2.8	-1.6	-147	-56	+91
2	223.2	202.5	-1.0	-2.0	+1.3	+0.1	+9	+24	+15
3	255.2	234.5	-2.1	-1.2	-0.6	-0.7	-64	-61	+3
4	270.0	249.3	-2.4	-0.7	-1.4	+0.3	+28	+4	-24
5	282.3	261.6	-2.6	-0.3	-2.0	+1.2	+110	+131	+21
6	313.0	292.3	-2.4	+0.8	-2.9	+0.2	+18	-80	-98
7	346.9	326.2	-1.4	+1.7	-2.8	-0.6	-55	-61	-6
8	0.0	339.3	-0.9	+2.0	-2.6	-0.2	-18	+18	+36
9	14.0	353.8	-0.4	+2.1	-2.2	+0.6	+55	+17	-38

Old

 $O-c$

Hayn

New $O-c$

1	-59	-147	+88
2	+1	+9	-8
3	-96	-64	-32
4	-34	+28	-62
5	+93	+110	-17
6	-110	+18	-128
7	-74	-55	-19
8	+13	-18	+31
9	+21	+55	-34

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Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	19.0000	-0.4820	-8	0.2331	4.5225	-59
2	18.0210	-1.4610	-6	2.1362	4.5285	+1
3	17.4278	-2.0542	-2	4.2205	4.5188	-96
4	17.3548	-2.1272	0	4.5250	4.5250	-34
5	17.4006	-2.0814	+2	4.3314	4.5377	+93
6	17.9320	-1.5500	+6	2.4013	4.5174	-110
7	19.0000	-0.4820	+8	0.2316	4.5210	-74
8	19.4820	0.0000	+8	0.0000	4.5297	+13
9	20.0000	+0.5180	+8	0.2692	4.5305	+21

Comp K^2 : 4.5284

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	15.4758	-2.0702	-9	4.2894
2	16.0000	-1.5460	-7	2.3923
3	17.0000	-0.5460	-2	0.2983
4	17.5460	0.0000	0	0.0000
5	18.0000	+0.4540	+2	0.2063
6	19.0000	+1.4540	+7	2.1161
7	19.6162	+2.0702	+9	4.2894
8	19.6733	+2.1273	+10	4.5297
9	19.6094	+2.0634	+9	4.2613

Approx. Center $X = 19.0$

$$y = 15.4758$$

$$19.6162$$

$$35.0920$$

$$y_0 = 17.5460$$

$$y - \max = 19.6733$$

$$K = 2.1273$$

$$x - \min = 17.3548$$

$$x_0 = 19.4821$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 19.4820 \\ y_0 = 17.5460 \end{array} \right.$$

3215

known Center

7

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	19.0000	-0.4820	-8	0.2331	4.5225	-59
2	18.0210	-1.4610	-6	2.1362	4.5285	+1
3	17.4278	-2.0542	-2	4.2205	4.5188	-96
4	17.3548	-2.1272	0	4.5250	4.5250	-34
5	17.4006	-2.0814	+2	4.3314	4.5377	+93
6	17.9320	-1.5500	+6	2.4013	4.5174	-110
7	19.0000	-0.4820	+8	0.2316	4.5210	-74
8	19.4820	0.0000	+8	0.0000	4.5297	+13
9	20.0000	+0.5180	+8	0.2692	4.5305	+21

Comp $R^2 = 4.5284$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	15.4758	-2.0702	-9	4.2894
2	16.0000	-1.5460	-7	2.3923
3	17.0000	-0.5460	-2	0.2983
4	17.5460	0.0000	0	0.0000
5	18.0000	+0.4540	+2	0.2063
6	19.0000	+1.4540	+7	2.1161
7	19.6162	+2.0702	+9	4.2894
8	19.6733	+2.1273	+10	4.5297
9	19.6094	+2.0634	+9	4.2613

Approx Center $x = 19.0$ $y = 15.4758$ 19.6162

35.0920

 $y_0 = 17.5460$ $y_{\text{max}} = 19.6733$ $r = 2.1273$ $x_{\text{min}} = 17.3548$ $x = 19.4821$

Center $\left\{ \begin{array}{l} x_0 = 19.4820 \\ y_0 = 17.5460 \end{array} \right.$

Formation of Normals

	ab	an	bn		
1	+ 0.99	+ 28.3	+ 122.0	- 42.2	- 182.2
2	+ 2.26	- 1.5	- 1.6	+ 11.7	+ 12.4
3	+ 1.12	+ 196.8	+ 52.7	+ 65.7	+ 17.6
4	- 0.00	+ 72.5	- 0.0	+ 132.0	- 0.0
5	- 0.94	- 193.5	+ 41.9	+ 35.3	- 7.7
6	- 2.24	+ 170.5	- 109.5	+ 198.3	- 185.6
7	- 0.99	+ 35.5	- 103.2	+ 9.1	- 39.3
8	+ 0.00	+ 0.0	+ 27.7	+ 0.0	+ 66.0
9	+ 1.07	+ 10.9	+ 43.3	- 17.7	- 70.0
	+ 1.27	+ 319.5	- 26.7	+ 392.2	- 388.8

Residuals with Haynie Corrections

	O	C	O - C
1	+ 88	- 11 + 18 = + 7	+ 81
2	- 8	- 33 + 13 = - 20	+ 12
3	- 32	- 47 + 5 = - 42	+ 10
4	- 62	- 48 - 0 = - 48	- 14
5	- 17	- 47 - 4 = - 51	+ 34
6	- 128	- 35 - 13 = - 48	- 80
7	- 19	- 11 - 18 = - 29	+ 10
8	+ 31	+ 0 - 19 = - 19	+ 50
9	- 34	+ 12 - 18 = - 6	- 28
			+ 197 - 122
			Average = 35

3215 Inverse Center

Conditional Equations

	a	b	0		c	0-c
1	-0.48	-2.07	= -59	-	8 + 5 = -3	-56
2	-1.46	-1.55	= +1	-	26 + 3 = -23	+24
3	-2.05	-0.55	= -96	-	36 + 1 = -35	-61
4	-2.13	+0.00	= -34	-	38 - 0 = -38	+4
5	-2.08	+0.45	= +93	-	37 - 1 = -38	+131
6	-1.55	+1.45	= -110	-	27 - 3 = -20	-80
7	-0.48	+2.07	= -74	-	8 - 5 = -13	-61
8	+0.00	+2.13	= +13	+	0 - 5 = -5	+18
9	+0.52	+2.06	= +21	+	9 - 5 = +4	+17

+194 - 258

Average = 50

Normal Equations

$$+18.35 + 1.27 = +320 (+392)$$

$$+ 1.27 + 22.38 = -27 (-389)$$

$$- 1.27 - 0.09 = -22 (-27)$$

$$+ 22.29 = -49 (-416) \quad b = -2.2 (-8.7)$$

$$+18.35 = +320 + 3 = +323$$

$$= (+392 + 24 = +416)$$

$$a = +17.6 (+22.7)$$

Arc measured = 181°

Average (0-c) = -7

$$\frac{pc}{n} = 0.34$$

$$- \frac{7}{.34} = -0.21 \quad \Delta n = -0.2$$

3215 Inverse Center

Conditional Equations

	a	b	0	c	0-c
1	-048	-207	= -59	-8 + 4 = -3	-56
2	-146	-155	= +1	-26 + 3 = -23	+24
3	-205	-055	= -96	-36 + 1 = -35	-61
4	-213	+000	= -34	-38 - 0 = -38	+4
5	-208	+045	= +93	-37 - 1 = -38	+131
6	-155	+145	= -10	-27 - 3 = -30	-80
7	-048	+207	= -74	-8 - 5 = -13	-61
8	+000	+213	= +13	+0 - 5 = -5	+18
9	+052	+206	= +21	+9 - 5 = +4	+17

+194 = 258

Average = 50

Normal Equations

$$+18.35 + 1.27 = +320$$

$$+ 1.27 + 22.38 = -27$$

$$- 1.27 - 0.09 = -22$$

$$+ 22.29 = -49$$

$$b = -2.2$$

$$+18.35 = +320 + 3 = +323$$

$$a = +17.6$$

Arc measure = 181°

Average (0-c) = -7

$$\frac{pc}{m} = 0.34$$

$$- \frac{7}{.34} = -0.21 \Delta n = -0.2$$

3215 Moon's Mean Position (1913.0)

$$X_0 = 19.4820 \quad Y_0 = 17.5460$$

$$\frac{1}{2}a = +9 \quad \frac{1}{2}b = -1$$

$$19.4829 \quad 17.5459$$

$$\text{Harpn} (19.4831) \quad (17.5456)$$

$$\text{From Plate Constant } X = 19.4203 \quad Y = 17.6270$$

$$(19.4205) \quad (17.6267)$$

$$\xi = +1.4203 \quad (\xi = +1.4205) \quad \eta = -4.3730 \quad (\eta = -4.3733)$$

$$\log \xi = 0.15238 \quad (0.15244) \quad \log \tan \delta = 9.2062$$

$$\cos \delta = 9.9929 \quad \xi^2 = 0.3048$$

$$\sin \delta = 8.50729 \quad \eta = 7.0539$$

$$(x-k) = 165219 \quad (165225)$$

$$x-A = +44.89 \quad (4490)$$

$$A = 13 \quad 11 \quad 40$$

$$X_0 = 13 \quad 12 \quad 24.89 \quad (2490)$$

$$\text{Red} = +2.00$$

$$X' = 13 \quad 12 \quad 26.89 \quad (2690)$$

$$\log \eta_0 = 0.64074 \quad (6407)$$

$$\eta_0 = 7.33115$$

$$(d-D) = 3.30959 \quad (3.30963)$$

$$S-D = -33 \quad 59.8 \quad (00.0)$$

$$D = 9 \quad 43 \quad 50$$

$$S_0 = 10 \quad 17 \quad 49.8 \quad (50.0)$$

$$\text{Red} = -15.8$$

$$S' = +10^\circ \quad 18' \quad 05.6'' \quad (05.8)$$

3215 Invar's mean Position (1913.0)

$$X = 19.4820$$

$$Y = 17.5460$$

$$+ 9$$

$$- 1$$

$$19.4829$$

$$17.5459$$

From Plate Constant $X = 19.4203$ $Y = 17.6270$

$$z = +1.4203$$

$$\eta = -4.3730$$

$$\log z = 0.15238$$

$$+ 9.99295$$

$$+ 8.50729$$

$$(z-k) 1.65219$$

$$\alpha - A + 44.89$$

$$A 13 11 40$$

$$\alpha_0 13 12 24.89$$

$$\text{Red} = +2.00$$

$$\alpha' = 13^h 12^m 26.89^s$$

$$\log \tan S = 9.2062$$

$$+ 0.3048$$

$$+ 7.0539$$

$$\eta_1 6.5644$$

$$\eta_1 - 4$$

$$\eta_0 - 4.3726$$

$$\log \eta_0 0.64074$$

$$+ 7.33115$$

$$(d-D) = 3.30959$$

$$S-D - 33.59.8$$

$$D - 9.43.50$$

$$S_0 - 10.17.49.8$$

$$\text{Red} = -1.58$$

$$S' = -10^\circ 18' 05.6''$$

3215 Red ad locum app.

$$S = -10^{\circ} 17' 50''$$

$$H + \alpha \quad 5^{\circ} 05' = 76^{\circ} 15'$$

$$H \quad 15 \quad 53$$

$$\alpha \quad 13 \quad 12.4$$

$$G \quad 19 \quad 58$$

$$G + \alpha \quad 9 \quad 10 = 137^{\circ} 30'$$

$$l \cos(G + \alpha) \quad 9.8676 \text{ m}$$

$$q \quad 1.0366$$

$$\sin \quad 9.8297$$

$$\tan S \quad 9.2593 \text{ m}$$

$$\frac{1}{15} \quad 8.8239$$

$$(g') \quad 0.9042 \text{ m}$$

$$(g) \quad 8.9495 \text{ m}$$

$$f \quad +0.83$$

$$g \quad +0.09 \text{ m}$$

$$h \quad +1.26$$

$$+2.00 \text{ m}$$

$$l \cos S = 9.9980$$

$$" \quad l \quad 0.8504 \text{ m}$$

$$(L) \quad 0.8434 \text{ m}$$

$$l \sin S \quad 9.2523 \text{ m}$$

$$" \quad \cos(H + \alpha) \quad 9.3760$$

$$h \quad 1.2834$$

$$\sin \quad 9.9874$$

$$\sec S \quad 0.0070$$

$$\frac{1}{15} \quad 8.8239$$

$$(h') \quad 9.9117 \text{ m}$$

$$(h) \quad 0.1017$$

$$g' \quad -80.2$$

$$h' \quad -0.82$$

$$i \quad -6.97 \text{ m}$$

$$-15.81$$

3215 Red ad locum alt.

$$S = -10^{\circ} 17' 50''$$

$$H + \alpha \quad 5 \quad 05 = 76^{\circ} 15'$$

$$H \quad 15 \quad 53$$

$$\alpha \quad 13 \quad 124$$

$$G \quad 19 \quad 58$$

$$G + \alpha \quad 9 \quad 10 = 137^{\circ} 30'$$

$$l \cos(G + \alpha) \quad 98676 \text{ m}$$

$$q \quad 10366$$

$$\sin \quad 98297$$

$$\tan \quad 92593 \text{ m}$$

$$\frac{1}{\sin} \quad 88237$$

$$(q') \quad 09042 \text{ m}$$

$$(q) \quad 89495 \text{ m}$$

$$\begin{array}{r} f \quad 1083 \\ s \quad 00.09 \\ h \quad +126 \\ \hline +200 \end{array}$$

$$l \cos S = 99930$$

$$l \quad 08504$$

$$(l) \quad 08434 \text{ m}$$

$$l \sin S \quad 92523 \text{ m}$$

$$\cos(H + \alpha) \quad 93760$$

$$h \quad 12834$$

$$\sin \quad 99874$$

$$\sec S \quad 00070$$

$$\frac{1}{\sin} \quad 88239$$

$$(h') \quad 99117 \text{ m}$$

$$(h) \quad 01017$$

$$s' \quad -80.2$$

$$h' \quad -0.82$$

$$l \quad -697$$

$$-15.81$$

$$\begin{array}{r}
 3215 \\
 \alpha' = 13^h 12^m 26.89^s \quad (22.95) \\
 \theta = 14 \quad 50 \quad 07.5 \\
 \delta - \alpha = +1^h 37^m 40.6 \\
 = + \quad 24^h 25^m 09.0
 \end{array}$$

$$+ \quad \quad \quad 9 \quad 19$$

$$+ \quad 24 \quad 15 \quad 50$$

$$9.95727$$

$$0.00000$$

$$0.04017$$

$$9.99744$$

$$\gamma = 44^\circ 49' 53''$$

$$-10 \quad 18 \quad 06$$

$$55 \quad 07 \quad 59$$

$$9.82640$$

$$8.24252$$

$$9.91407$$

$$0.15180$$

$$8.13479$$

$$\delta - \delta' = +46 \quad 53.4$$

$$\delta = -9 \quad 31 \quad 12.2$$

$$\alpha = 13 \quad 13 \quad 41.43$$

$$\text{Nautical } \delta = -9 \quad 31 \quad 07.5$$

$$\alpha = 13 \quad 13 \quad 40.62$$

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

$$+0.81$$

$$\text{with Hays's Correction } (-4.9)$$

$$(+0.82)$$

$$\delta' = -10^\circ 18' 05.6 \quad (22.95)$$

$$IT = 60' 05.52''$$

$$9.86913$$

$$8.24252$$

$$9.61638$$

$$0.00602$$

$$7.73405$$

$$\alpha - \alpha' = +18' 38.10$$

$$= +1^m 14.54$$

3215 Lunar Parallax

$$s' = -10^{\circ} 18' 05.6''$$

$$\begin{array}{rcl} \alpha' & = & 13^{\circ} 12' 26.89'' \\ \theta & = & 14^{\circ} 50' 07.5'' \\ \alpha - \alpha' & + & 1^{\circ} 37' 40.6'' \\ & + & 24^{\circ} 25' 09'' \end{array}$$

$$17 = 60' 05.52''$$

$$+ \quad \quad \quad 9 \quad 19$$

$$+ \quad 24 \quad 15 \quad 50$$

$$995727$$

$$000000$$

$$004017$$

$$999744$$

$$9.86913$$

$$8.24252$$

$$9.61638$$

$$000602$$

$$773405$$

$$\alpha - \alpha' = +18' 35.10''$$

$$+ \quad 1' 14.54''$$

$$\gamma = 44^{\circ} 49' 53''$$

$$-10^{\circ} 18' 06''$$

$$55^{\circ} 07' 59''$$

$$982640$$

$$824252$$

$$991407$$

$$015180$$

$$813479$$

$$\alpha - \delta = \quad \quad \quad +46 \quad 53.4$$

$$\delta = -9 \quad 31 \quad 122 \quad \alpha = 13 \quad 13 \quad 41.43$$

$$\text{Nautical } s = -9 \quad 31 \quad 07.5 \quad \alpha = 13 \quad 13 \quad 40.62$$

$$0 - \epsilon = \quad \quad \quad -47 \quad \quad \quad +0.81$$

1913 May 12

3376

Star measures

1914 Apr. 14

12

	α	δ	μ
1	19431	19017	
10.5	10944	17519	20
22.8	45	22	
	44	22	
	<u>22.8496</u>	<u>8502</u>	

	α	δ	μ
	18924	19868	
	13810	14971	74
	01	75	
	31	70	
	<u>10.4876</u>	<u>4896</u>	

	α	δ	μ
2	18411	17255	
25.3	11350	14321	20
17.7	48	22	
	09	75	
	<u>17.7064</u>	<u>7060</u>	

	α	δ	μ
	18429	18920	
	10809	16551	50
	04	49	
	31	38	
	<u>25.2376</u>	<u>2374</u>	

	α	δ	μ
3	18383	17611	
25.6	14119	11890	92
20.5	11	95	
	00	32	
	<u>30.4276</u>	<u>4268</u>	

	α	δ	μ
	17039	17351	
	12929	11489	97
	19	89	
	49	09	
	<u>25.5878</u>	<u>5910</u>	

Grade 3.

measures
 $3 \times (\alpha)$
 17550
 1344742
 46
 60
25.3891

Additional stars between (1 and 2)

	α	δ	μ
18.7	15829	15345	
14.4	12541	8656	57
	30	58	
	40	69	
	<u>14.3296</u>	<u>3294</u>	
23.8	19762	18609	
34.8	11252	17129	30
	54	24	
	58	19	
	<u>34.8507</u>	<u>8517</u>	

	α	δ	μ
	12597	12597	
	9890	10033	
	11661	9091	81
		8784	
	<u>15.0934</u>	<u>0947</u>	
	18730	19491	
	16839	11391	86
	3039	19	
	21	00	
	<u>23.8108</u>	<u>8106</u>	

1913 May 12

3376

Star measures

1914 Apr 14

12

	α	δ
1	19431	19017
10.5	10944.50	17515.20
228	45	22
	44	22
	<u>22.8496</u>	<u>8502</u>

	α	δ
	18924	19868
	13810.01	14971.74
	01	75
	31	70
	<u>10.4876</u>	<u>4896</u>

	α	δ
2	18411	17255
25.3	11350.39	14321.20
177	48	22
	09	75
	<u>17.7064</u>	<u>7060</u>

	α	δ
	18429	18920
	10809.08	16551.50
	04	49
	31	38
	<u>25.2376</u>	<u>2374</u>

	α	δ
3	18383	17611
25.6	14119.12	11890.92
205	11	91
	00	32
	<u>30.4276</u>	<u>4268</u>

	α	δ
	17039	17351
	12929.16	11489.97
	19	89
	49	09
	<u>25.5878</u>	<u>5910</u>

Grade 3.

mean
 $3 \times (26)$
 17550
 1344742
 46
 60
21.3891

Additional stars between (1) and (2)

	α	δ
157	15829	15345
194	12541.41	8656.57
	30	58
	40	69
	<u>14.3296</u>	<u>3294</u>
238	14762	18609
248	11252.50	17129.30
	54	24
	58	19
	<u>34.8507</u>	<u>8517</u>

	α	δ
	12597	10033
	9890	90918.1
	11661	8784
	<u>15.0939</u>	<u>0947</u>
	18730	19491
	16839.39	11391.86
	30	17
	21	00
	<u>23.8108</u>	<u>8106</u>

3376

moon measures

d

4

N

d

N

1 15939
19.0 13431
103 2931

19544
1206720
60
62

53
20.2513

62
2508

2 scratch

15978
1007679
82

19510
1544039
33

91
20.5907

19
5923

16083

15360

1182120
20

963929
32

90
18.5734

68
5731

16045

15482

867272
66

1288989
90

61
18.2613

90
2595

12179

1075048

1192920
20

39
10504

17.9744

9718

4

17.9
22.0
in
in
N

min in x
may be a trifle
smaller.

5 scratch

18.8 13886
22.6 833126
32

15581
1116961
69

03
22.5564

08
5571

1
1253130

16055
1563932
38

12131

180400

.0419

14960

17209

6940
5549

1519091
92

68
18.1982

15
2019

6
18.3
23.8

3376 moon measures

$$\begin{array}{r}
 \text{a} \quad 4 \quad \text{''} \quad \text{d} \quad \text{''} \quad \text{''} \\
 \begin{array}{r}
 1 \quad 15939 \\
 190 \quad 13431 \\
 203 \quad 291 \\
 \quad 53 \\
 \hline
 20.2513
 \end{array}
 \quad
 \begin{array}{r}
 19544 \\
 1206720 \\
 \quad 60 \\
 \quad 62 \\
 \hline
 2508
 \end{array}
 \end{array}$$

2 scratch

$$\begin{array}{r}
 18.1 \quad 15978 \\
 20.6 \quad 1007679 \\
 \quad 82 \\
 \quad 91 \\
 \hline
 20.5907
 \end{array}
 \quad
 \begin{array}{r}
 19510 \\
 1544039 \\
 \quad 33 \\
 \quad 19 \\
 \hline
 5923
 \end{array}$$

3183
210

$$\begin{array}{r}
 16083 \\
 1182120 \\
 \quad 20 \\
 \quad 90 \\
 \hline
 18.5734
 \end{array}
 \quad
 \begin{array}{r}
 11360 \\
 963929 \\
 \quad 32 \\
 \quad 68 \\
 \hline
 5731
 \end{array}$$

$$\begin{array}{r}
 16045 \\
 867272 \\
 \quad 66 \\
 \quad 61 \\
 \hline
 18.2613
 \end{array}
 \quad
 \begin{array}{r}
 15482 \\
 1288989 \\
 \quad 90 \\
 \quad 90 \\
 \hline
 2595
 \end{array}$$

4179
220
un
un
2

min in x
may be a triple
smaller.

$$\begin{array}{r}
 12179 \\
 1192920 \\
 \quad 20 \\
 \hline
 17.9744
 \end{array}
 \quad
 \begin{array}{r}
 1075048 \\
 39 \\
 10504 \\
 \hline
 9718
 \end{array}$$

5 scratch

$$\begin{array}{r}
 18.1 \quad 13886 \\
 22.6 \quad 833126 \\
 \quad 32 \\
 \quad 03 \\
 \hline
 22.5564
 \end{array}
 \quad
 \begin{array}{r}
 15581 \\
 1116961 \\
 \quad 69 \\
 \quad 08 \\
 \hline
 5571
 \end{array}$$

$$\begin{array}{r}
 1 \\
 1253130 \\
 \quad 3030 \\
 12131 \\
 \hline
 18.0400
 \end{array}
 \quad
 \begin{array}{r}
 16055 \\
 1563932 \\
 \quad 38 \\
 \hline
 0419
 \end{array}$$

618.3
238

$$\begin{array}{r}
 14960 \\
 69405549 \\
 \quad 68 \\
 \hline
 18.1982
 \end{array}
 \quad
 \begin{array}{r}
 17209 \\
 1519091 \\
 \quad 92 \\
 \quad 15 \\
 \hline
 2019
 \end{array}$$

3376 Moon - measures.

14

	d	4	n	x	n
7	19393		15600		
19.0	10820		14200	99	
23.8	0521		00		
	00		19		
	<u>23.8584</u>		<u>8597</u>		

8	18635	17043
20.0	1708899	860001
24.2	90	96
max	49	57
in	<u>24.1545</u>	<u>.1544</u>
y		

9	Scratch			
20.4	19379	19109	19705	19540
24.1	1806060	1045958	1344549	1578882
	51	58	50	89
	84	31	10	17
	<u>24.1324</u>	<u>.1330</u>	<u>20.3740</u>	<u>.3745</u>

0.171 5.000
 0.500 0.500
 0.1 0.0
0.24 0.500

0.500 0.500
 0.500 0.500
 0.1 0.0
 0.2 0.0
0.24 0.500

0.500 0.500 0.500 0.500
 0.500 0.500 0.500 0.500
 0.1 0.0 0.1 0.0
0.24 0.500 0.500 0.500

3376 *lunar measures*

14

	d	q	n	a	x	n
<u>7</u>	19393		15600			
190	10820		14200		99	
238	0521		00			
	00		19			
	<u>238584</u>		<u>8597</u>			

<u>8</u>	18635	17043
200	1708899	860001
242	90	96
max	49	57
w	<u>24.1545</u>	<u>.1544</u>
r		

q	$Scratch$			
20.4	19379	19109	19705	19540
24.1	1806060	1045958	1344549	1578882
	51	58	50	89
	84	31	10	17
	<u>24.1324</u>	<u>.1330</u>	<u>20.3740</u>	<u>.3745</u>

3376 Times etc.
 Exh to stars 1913 May 12, $12^h 06^m$ - $12^h 18^m$
 " " Moon $12 11 41.7$ - $12 11 42.0$
 clock fast $1 35.0$

H. L. T. $12 10 06.85$ $0 - \alpha = +2^h 51^m$
 H. L. T. $4 44 31.05$
 G. S. T. $16 54 37.90$
 S. L. T. in Moon $3 18 35.92$
 Interval $13 36 01.98$
 Reduction $2 13.69$
 G. M. T. $13 33 48.29$

From Kant Obs. R. A. Decl.
 Moon 13^h $9^h 17^m 38.97$ $+19^\circ 39' 01.5$
 Motion in $1^m = 2.3200$ 12.747
 " " 33.8048 $+1 18.43$ $- 7 10.9$
 Tabular place $9 18 57.40$ $+19 31 50.6$

lunar age 7 days
 parallax $59' 04.45$
 semidiameter $16 07.4$
 R 967.4
 Augmentation $+12.4$
 Irradiation (3) $- 0.7$
 R 979.1
 R 2098.8
 $a = +0.6$ $(1+a) R$ 2098.9
 R^2 4405.4

3376 Taurus etc

Opt. stem 1913 May 12, $12^h 06^m - 12^h 18^m$
 Moon $12 11 41.7 - 12 11 42.0$
 Clock fast $1 35.0$

H. dist. Taurus $12 10 06.85$ $0 - x = +2^h 51^m$
 H. long $4 44 31.05$
 G.S.M.T. $16 54 37.90$
 Dist. in Moon $3 18 35.92$
 Interval $13 36 01.98$
 Reduction $2 13.69$
 G.M.T. $13 33 48.29$

From Kant Obs. R.A. Decl.
 Moon $13^h 17^m 38.97$ $+19^{\circ} 39' 01.5$
 Motion in $= 2.3200$ 12.747
 " 33.8048 $+1 18.43$ $- 7 10.9$
 Tabular place $9 18 57.40$ $+19 31 50.6$

lunar age 7 days.

parallax 59.0445
 semidiam 16.074
 R 9674
 Augmentation $+12.4$
 Irradiation (3) -0.7
 R 979.1
 R 2.0988
 a $+0.6$ (1+a) R 2.0989
 R² 44054

3376

2

104886

252375

255897

3 6132

2044

-18

244

31

755

Plate constants

4

228499

177062

304272

7098

23.66

-22

1.66

4662

774"

9 11 34

19 40

19 52

49 126

9 17 02

-1 15

9 15 47

A = 9 15 47

D = +19 04 09

R.A.

Decl.

+19 10 24

+18 30 58

+20 09 48

49 130

+19 17 03

-12 54

+19 04 09

Preliminary Red.

x - 3

-454

-659

+1680

-1028

= +652

= -7

+1314

-645

= +669

= +10

+2209

-1568

= +641

= -18

+1463

-797

= +666

= +7

+2037

-1369

= +668

= +9

20.0745

y - 4

+45x

-34

-641

+2220

+472

= +692

-69

= +623

= -18

+17

+679

= +696

-43

= +653

= +12

-325

+1071

= +746

-105

= +641

= 0

-452

+1136

= +684

-53

= +631

= -10

-406

+1152

= +746

-91

= +655

= +14

22.0557

Tables a = -0.4

e = -0.4

a - e = 0.0

b + a = -2.3

Obs a = +0.6

e = +2.8

a - e = -2.2

b + d = -0.5

$$\left. \begin{array}{l} b = +44.0 \\ d = -44.5 \end{array} \right\}$$

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Plate constants

R.A.

Decl.

10.4886	228499	9 11 34	+19 10 24
25.2375	177062	19 40	+18 30 58
25.5897	304272	19 52	+20 09 48
3 6132	7098	49 126	49 130
2044	23.66	9 17 02	+19 17 03
-18	-22	-1 15	- 12 54
244	1.66	9 15 47	+19 04 09
31	4.66		
75	774		

$$\begin{cases} A = 9^h 15^m 47^s \\ D = +19 \quad 04 \quad 09 \end{cases}$$

Preliminary Red.

x - z	-454	-659
+1680	-1028	+652
+1314	-645	+669
+2209	-1568	+641
+1463	-797	+666
+2037	-1369	+668

y - z	+452	-34	-641
+220	+472	+692	-69
+17	+679	+696	-43
-325	+1071	+746	-105
-452	+1136	+684	-53
-406	+1152	+746	-91

Tables a: -0.4 c: -0.4 a - c: 0.0 b + a: -2.3
 Obs a: +0.6 c: +2.8 a - c: -2.2 b + c: -0.5

$$\begin{cases} b = +44.0 \\ c = -44.5 \end{cases}$$

Cape W. 1281 m 6.6

$$\begin{array}{r} 9 \quad 13 \quad 24.05 \\ \quad \quad \quad 03 \\ \quad \quad \quad .04 \end{array}$$

$$\begin{array}{r} 9 \quad 13 \quad 24.04 \\ \quad \quad + 43.61 \end{array}$$

$$9 \quad 14 \quad 07.65$$

$$9 \quad 15 \quad 47$$

$$- \quad 1 \quad 39.35$$

$$- \quad \quad 99.35$$

$$1.99717m$$

$$997802$$

$$0.48243m$$

$$- 3.0369$$

$$- \quad \quad 5$$

$$14.9626$$

$$15.0940$$

$$+ 1314$$

$$+ 18 \quad 07 \quad 45.4$$

$$456$$

$$45.4$$

$$+ 18 \quad 07 \quad 45.5$$

$$- \quad 3 \quad 16.8$$

$$+ 18 \quad 04 \quad 28.7$$

$$+ 19 \quad 04 \quad 09$$

$$- \quad 59 \quad 40.3$$

$$- \quad 3580.7$$

$$3.55396m$$

$$0.88511m$$

$$4.5137$$

$$0.9649$$

$$7.5320$$

$$- 7.6756$$

$$+ \quad \quad 34$$

$$14.3278$$

$$14.3295$$

$$+ \quad 17$$

Cape W. 1290 m 7.8

$$9 \quad 18 \quad 08.77$$

$$76$$

$$67 \checkmark$$

$$9 \quad 18 \quad 08.73 \checkmark$$

$$+ 4406 \checkmark$$

$$9 \quad 18 \quad 52.79 \checkmark$$

$$9 \quad 15 \quad 47$$

$$+ 3 \quad 05.79 \checkmark$$

$$+ 185.78 \checkmark$$

$$2.26900 \checkmark$$

$$997091 \checkmark$$

$$0.74715 \checkmark$$

$$+ 5.5870$$

$$+ \quad \quad 28$$

$$23.5898$$

$$23.8107$$

$$+ 2209$$

$$+ 20 \quad 47 \quad 29.6$$

$$29.2$$

$$29.8 \checkmark$$

$$+ 20 \quad 47 \quad 29.5 \checkmark$$

$$- \quad 3 \quad 18.2 \checkmark$$

$$+ 20 \quad 44 \quad 11.3 \checkmark$$

$$+ 19 \quad 04 \quad 09$$

$$+ 1 \quad 40 \quad 02.3 \checkmark$$

$$+ 6004.0 \checkmark$$

$$3.77844 \checkmark$$

$$1.10959 \checkmark$$

$$9.5782 \checkmark$$

$$14943 \checkmark$$

$$8.1259 \checkmark$$

$$+ 12.8703 \checkmark$$

$$+ \quad \quad 134 \checkmark$$

$$34.8837 \checkmark$$

$$34.8512$$

$$- 325$$

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Standard Coordinates Comp. Stars

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Cape No. 1275 mag 6.9				Cape No. 1292 mag 7.1				Cape No. 1293 mag 6.6			
α	9 ^h	10 ^m	50 ^s 36	α	9 ^h	18 ^m	55 ^s 88	α	9 ^h	19 ^m	07 ^s 0
δ			35	δ			88	δ			69
ϵ			33	ϵ			80	ϵ			66
mean	9	10	50.35	mean	9	18	55.85	mean	9	19	07.68
prec		+	43.83	prec		+	43.70	prec		+	43.96
μ	9	11	34.15	μ	9	19	39.55	μ	9	19	51.64
λ	9	15	47	λ	9	15	47	λ	9	15	47
$\alpha - \lambda$		-	4	$\alpha - \lambda$		+	3	$\alpha - \lambda$		+	4
$\sin(\delta - \lambda)$			-252.81	$\sin(\delta - \lambda)$			+232.54	$\sin(\delta - \lambda)$			+244.63
$\log \mu$			2.40280	$\log \mu$			2.36650	$\log \mu$			2.38851
$\cos \delta$			9.97522	$\cos \delta$			9.97691	$\cos \delta$			9.97253
$\sin \delta$			0.88526	$\sin \delta$			0.85065	$\sin \delta$			0.86828
δ_0			-7.6782	δ_0			+7.0900	δ_0			+7.3838
δ_1			-	δ_1			+12	δ_1			+22
δ_2			10.3206	δ_2			25.0912	δ_2			25.3860
α			10.4886	α			25.2375	α			25.5897
$\alpha - \delta_3$			+1680	$\alpha - \delta_3$			+1463	$\alpha - \delta_3$			+2037
α			+19° 13' 37.3	α			+18° 34' 17.8	α			+20° 13' 09.1
δ			380	δ			17.9	δ			69.5
ϵ			370	ϵ			16.5	ϵ			68.1
mean	+19	13	37.4	mean	+18	34	17.4	mean	+20	13	08.9
prec		-	3	prec		-	3	prec		-	3
μ	+19	10	24.4	μ	+18	30	58.3	μ	+20	09	48.1
λ	+19	04	09	λ	+19	04	09	λ	+19	04	09
$\delta - \lambda$		+	6	$\delta - \lambda$		-	33	$\delta - \lambda$		+	1
$\tan(\delta - \lambda)$			+375.4	$\tan(\delta - \lambda)$			-1990.8	$\tan(\delta - \lambda)$			+3939.6
$\log \mu$			2.57449	$\log \mu$			3.29903	$\log \mu$			3.59546
$\cos \delta$			9.90564	$\cos \delta$			0.63018	$\cos \delta$			0.92661
$\sin \delta$			9.5412	$\sin \delta$			9.5249	$\sin \delta$			9.5649
δ_2			17705	δ_2			17013	δ_2			17366
δ_1			83651	δ_1			8.2796	δ_1			8.3549
μ_0			+0.8047	μ_0			-4.2676	μ_0			+8.4452
μ_1			+232	μ_1			+190	μ_1			+226
μ_2			228279	μ_2			17.7514	μ_2			30.4678
μ_3			228499	μ_3			17.7062	μ_3			30.4272
$\mu - \mu_4$			+220	$\mu - \mu_4$			-452	$\mu - \mu_4$			-406

Standard Coordinates Comp. Cam														
3376 Cape W. 1275 mg 69				Cape W. 1292 mg 71				Cape W. 1293 mg 66						
C	9 ⁿ	10 ^m	50 ^s 36	C	9 ⁿ	18 ^m	55 ^s 88	C	9 ⁿ	19 ^m	07 ^s 70			
L			35	L			88	L			69			
z			33	z			80	z			66			
h _{mean}	9	10	50.35	h _{mean}	9	18	55.85	h _{mean}	9	19	07.68			
Prece		+	43.83	Prece		+	43.70	Prece		+	43.96			
x	9	11	34.18	x	9	19	39.55	x	9	19	51.64			
A	9	15	47	A	9	15	47	A	9	15	47			
x-A		-	4.12.82	x-A		+	3.52.55	x-A		+	4.04.64			
sin(x-A)			-252.81	sin(x-A)		+	232.54	sin(x-A)		+	244.63			
log			2.40280	log			2.36650	log			2.38851			
cos			9.97522	cos			9.97691	cos			9.97253			
tan			0.88526	tan			0.85065	tan			0.86828			
3 ₁			-7.6782	3 ₁			+7.0900	3 ₁			+7.3838			
3 ₂			-12	3 ₂			-12	3 ₂			-22			
3 ₃			10.3206	3 ₃			25.0912	3 ₃			25.3860			
2			10.4886	2			25.2375	2			25.5897			
2-3			+1.680	2-3			+1.463	2-3			+2.037			
C	+	19°	13'	37.3	C	+	18°	34'	17.8	C	+	20°	13'	09.1
L				38.0	L				17.9	L				69.5
z				37.0	z				16.5	z				68.1
h _{mean}	+	19	13	37.4	h _{mean}	+	18	34	17.4	h _{mean}	+	20	13	08.9
Prece		-	3	13.0	Prece		-	3	19.1	Prece		-	3	20.8
S	+	19	10	24.4	S	+	18	30	58.3	S	+	20	09	48.1
D	+	19	04	09	D	+	19	04	09	D	+	19	04	09
S-D		+	6	15.4	S-D		-	33	10.7	S-D		+	05	39.1
tan(S-D)			+	375.4	tan(S-D)			-	1990.8	tan(S-D)			+	3939.6
log				2.57449	log				3.29903	log				3.59546
tan				9.90564	tan				0.63018	tan				0.92661
tan				9.5412	tan				9.5249	tan				9.5649
3 ₁				17705	3 ₁				17013	3 ₁				17366
3 ₂				83651	3 ₂				82796	3 ₂				83549
3 ₃				+0.8047	3 ₃				-4.2676	3 ₃				+8.4452
2				+23.2	2				+19.0	2				+22.6
2-3				228279	2-3				177514	2-3				304678
2				228499	2				177062	2				304272
2-3				+220	2-3				-452	2-3				-408

Residuals.

		C	O	O - C
6	- 23 + 13 =	- 4	- 7	- 3
+ 9	- 15 + 13 =	+ 9	+ 10	+ 1
+ 14	- 36 + 13 =	- 9	- 18	- 9
+ 15	- 18 + 13 =	+ 10	+ 7	- 3
+ 15	- 31 + 13 =	- 3	+ 9	+ 12

+ 5	- 4 - 6 =	- 5	- 18	- 13
+ 7	- 2 - 6 =	- 1	+ 12	+ 11
+ 11	- 4 - 6 =	+ 1	0	- 1
+ 12	- 4 - 6 =	+ 2	- 10	- 12
+ 12	- 4 - 6 =	- 12	+ 14	+ 12

		C	O	O - C
- 2	- 25 + 31 =	+ 4	+ 3	- 1
- 3	- 16 + 31 =	+ 12	+ 12	0
- 5	- 38 + 31 =	- 12	- 21	- 9
- 6	- 19 + 31 =	+ 6	+ 5	- 1
- 6	- 33 + 31 =	- 8	0	+ 8

- 16	+ 32 - 3 =	+ 13	- 4	- 17
- 23	+ 20 - 3 =	- 6	+ 11	+ 17
- 36	+ 48 - 3 =	+ 9	+ 17	+ 8
- 38	+ 25 - 3 =	- 16	- 34	- 18
- 38	+ 42 - 3 =	+ 1	+ 9	+ 8

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Plate Constants

Conditional Equations

	ξ	η	$x-3$	$y-4$	$x-5$	$y-2$
1	+ 10.32	+ 22.83	+ 1	- 7	+ 3	- 4
2	+ 14.96	+ 14.33	+ 1	+ 10	+ 12	+ 11
3	+ 23.59	+ 34.88	+ 1	- 18	0	+ 17
4	+ 25.09	+ 17.75	+ 1	+ 7	+ 10	- 34
5	+ 25.39	+ 30.47	+ 1	+ 9	0	+ 9

Mean Equations

1+2	+ 12.64	+ 18.59	+ 1	+ 1.50	- 3.00	+ 7.50	+ 3.50
3+5	+ 25.02	+ 27.70	+ 1	- 0.69	+ 1.33	- 5.33	- 2.67
2,4	+ 20.02	+ 16.04	+ 1	+ 8.50	+ 1.00	+ 9.50	- 11.50
1,3,5	+ 19.77	+ 29.39	+ 1	- 5.33	- 1.33	- 6.00	+ 7.33
-	12.38	- 9.11	= +	2.17	- 4.33	+ 12.83	+ 6.17
+	0.25	- 13.35	= +	13.83	+ 2.33	+ 14.50	- 18.53
-	0.25	- 0.18	= +	0.04	- 0.09	+ 0.26	+ 0.12
-	13.53		= +	13.87	+ 2.24	+ 14.76	- 18.71
+			= -	1.02	- 0.17	- 1.09	+ 1.38
a =			= +	0.58	+ 0.47	- 0.23	- 1.52

+ 1.5	- 0.7	+ 8.5	- 5.3	- 3.0	+ 1.3	+ 1.0	- 1.3
- 7.3	- 14.5	- 11.6	- 11.4	- 6.0	- 11.8	- 9.5	- 9.3
+ 18.9	+ 28.2	+ 16.3	+ 30.0	+ 3.1	+ 4.6	+ 2.6	+ 4.9
+ 13.1	+ 13.0	+ 13.2	+ 13.3	- 5.9	- 5.9	- 5.9	- 5.7

+ 7.5	- 5.3	+ 8.5	- 6.0	+ 3.5	- 2.7	- 11.5	+ 7.3
+ 20.3	+ 30.2	+ 17.5	+ 31.9	- 25.7	- 38.3	- 22.2	- 40.6
+ 2.9	+ 5.8	+ 4.7	+ 4.6	+ 19.1	+ 37.9	+ 30.3	+ 30.0
+ 30.7	+ 30.7	+ 30.7	+ 30.5	- 3.1	- 3.1	- 3.4	- 3.3

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Rate Constants

Conditional Equations

	x	y	$x - 3$	$y - 4$	$x - 5$	$y - 7$
1	+ 1032	+ 2283	+ 1	- 7	- 1	- 4
2	+ 1496	+ 1433	+ 1	+ 10	+ 12	+ 11
3	+ 2359	+ 3488	+ 1	- 18	0	+ 17
4	+ 2509	+ 1775	+ 1	+ 7	- 10	- 24
5	+ 2539	+ 3047	+ 1	+ 9	+ 14	+ 7

Mean Equations

1.2	+ 12.64	+ 18.59	+ 1	+ 1.50	- 3.00	+ 7.50	+ 3.50
3.5	+ 25.02	+ 27.70	+ 1	- 0.69	+ 1.33	- 5.33	- 2.67
2.4	+ 20.02	+ 16.04	+ 1	+ 8.50	+ 1.00	- 8.50	- 11.50
13.5	+ 19.77	+ 29.39	+ 1	- 5.33	- 1.33	- 6.00	+ 7.33
	- 12.38	- 9.11	+ 1	+ 2.17	- 4.33	+ 12.83	+ 6.17
	+ 0.25	- 13.35	+ 1	+ 13.83	+ 2.33	+ 14.50	- 12.83
	- 0.25	- 0.18	+ 1	+ 0.04	- 0.09	+ 0.26	+ 0.12
		- 13.53	+ 1	+ 13.87	+ 2.24	+ 14.76	- 12.71
			+ 1	- 1.02	- 0.17	- 1.09	+ 1.38
			+ 1	+ 0.58	+ 0.47	- 0.23	- 1.52

+ 11.5	- 0.7	+ 8.57	- 5.3	- 3.0	+ 1.3	+ 1.0	- 1.3
- 7.3	- 14.5	- 11.6	- 11.4	- 6.0	- 11.8	- 9.5	- 7.2
+ 18.9	+ 28.2	+ 16.3	+ 36.0	+ 3.1	+ 4.6	+ 2.6	+ 4.0
+ 13.1	+ 13.0	+ 13.2	+ 13.3	- 5.9	- 5.9	- 5.9	- 5.9

1.5	- 1.3	+ 8.57	- 6.0	- 2.1	- 2.7	- 1.1	+ 7.3
0.3	- 30.2	+ 17.1	+ 31.9	- 6.7	+ 38.3	- 22.2	- 40.6
2.9	- 5.8	+ 4.7	+ 4.6	+ 19.1	- 37.9	+ 30.3	+ 30.0
0.7	+ 30.7	+ 30.7	+ 30.7	- 3.1	- 3.1	- 3.4	- 3.3

	P	$P-C$		
1	129.2	132.7	- 1.5	+ 3.2
2	134.3	117.7	- 2.2	+ 2.2
3	120.2	103.6	- 2.4	+ 1.1
4	91.5	74.9	- 2.4	- 1.2
5	76.2	59.6	- 2.2	- 2.4
6	63.2	46.6	- 1.8	- 3.2
7	30.8	14.2	- 0.6	- 4.6
8	2.0	345.4	+ 0.6	- 4.6
9	351.7	335.1	+ 1.1	- 4.3

$B \cos(p-c)$	D	Hayn
+ 4.0	- 3.1	+ 1.6
+ 3.6	- 2.1	+ 0.6
+ 3.0	- 1.0	0.0
+ 1.3	+ 1.4	+ 1.6
+ 0.2	+ 2.6	- 1.6
- 0.7	+ 3.5	+ 0.1
- 2.8	+ 5.0	+ 0.6
- 3.9	+ 5.0	+ 0.5
- 4.1	+ 4.8	- 0.2

$$\lambda = -2.52$$

$$\beta = -4.72 + 0.6 = -4.1$$

$$C = 16.6$$

	P	$P-C$	$\lambda \sin(p-c)$	$B \cos(p-c)$	D	Corr from Hayn	O	$O-C$	
1	210.7	194.1	+ 0.6	+ 4.6	-3.7	+1.6 ^v	+147	+71	-76
2	225.7	209.1	+ 1.2	+ 4.1	-2.6	+0.6 ^v	+55	-66	-121
3	239.8	223.2	+ 1.7	+ 3.4	-1.4	0.0	0	+10	+10
4	268.5	251.9	+ 2.4	+ 1.5	+1.2	+1.6 ^v	+147	+52	-95
5	283.8	267.2	+ 2.5	+ 0.3	+2.5	-1.6 ^v	-147	-194	-47
6	296.8	280.2	+ 2.5	- 0.8	+3.6	+0.1 ^v	-9	-6	-15
7	329.2	312.6	+ 1.9	- 3.2	+5.4	+0.8 ^v	+74	+1	-73
8	358.0	341.4	+ 0.8	- 4.5	+5.6	+0.5 ^v	+46	+48	+2
9	43	351.7	+ 0.4	- 4.7	+5.4	-0.1 ^v	-9	-10	-1

	Old $O-C$	Corr Hayn	New $(O-C)$
1	+ 36	+ 147	- 111
2	- 100	+ 55	- 155
3	- 22	0	- 22
4	+ 30	+ 147	- 117
5	- 209	- 147	- 62
6	- 13	- 9	- 22
7	+ 14	+ 74	- 60
8	+ 75	+ 46	+ 29
9	+ 18	- 9	+ 27

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Miron's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	19.0000	-1.0740	-5	1.1546	4.4090	+36
2	18.5732	-1.5008	-4	2.2536	4.3954	-100
3	18.2609	-1.8136	-3	3.2902	4.4032	-22
4	17.9751	-2.0989	-0	4.4054	4.4084	+30
5	18.0410	-2.0330	+1	4.1327	4.3845	-209
6	18.2000	-1.8740	+2	3.5111	4.4041	-13
7	19.0000	-1.0740	+5	1.1524	4.4068	+14
8	20.0000	0.0740	+5	0.0054	4.4129	+75
9	20.3742	0.3002	+5	0.0904	4.4072	+18

$$\text{Comp } R^2 = 4.4054$$

	y	$y - y_0$	$(y - y_0)^2$
1	20.2510	-1.8040	3.2544
2	20.5915	-1.4635	2.1418
3	21.0000	-1.0550	1.1130
4	22.0000	0.0550	0.0030
5	22.5568	0.5018	0.2518
6	23.0000	0.9450	0.8930
7	23.8590	1.8040	3.2544
8	24.1544	2.0994	4.4075
9	24.1327	2.0777	4.3168

Approx Center

$$x = 19.0 \quad y = 20.2510$$

$$23.8590$$

$$44.1100$$

$$y_0 = 22.0550$$

$$y_{\text{max}} = 24.1544$$

$$R = 2.0994$$

$$x_{\text{min}} = 17.9750$$

$$x_0 = 20.0744$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 20.0744 \\ y_0 = 22.0550 \end{array} \right.$$

1913phae.proj.1949

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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1913phae.proj.1949

1913phae.proj.1949

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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1913phae.proj.1949

1913phae.proj.1949

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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1913phae.proj.1949

3376

Mars Center

19

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	19.0000	-1.0740	-5	1.1546	4.4090	+36
2	18.5732	-1.5008	-4	2.2536	4.3954	-100
3	18.2609	-1.8136	-3	3.2902	4.4032	-22
4	17.9751	-2.0989	-2	4.4054	4.4084	+30
5	18.0410	-2.0330	+1	4.1327	4.3845	-209
6	18.2000	-1.8740	+2	3.5111	4.4041	-13
7	19.0000	-1.0740	+5	1.1524	4.4068	+14
8	20.0000	0.0740	+5	0.0054	4.4129	+75
9	20.3742	+0.3002	+5	0.0904	4.4072	+18

Comp. R^2 4.4059

	y	$y - y_0$	$(y - y_0)^2$
1	20.2510	-1.8040	3.2544
2	20.5915	-1.4635	2.1418
3	21.0000	-1.0550	1.1130
4	22.0000	0.0550	0.0030
5	22.5568	+0.5018	0.2518
6	23.0000	+0.9450	0.8930
7	23.8590	+1.8040	3.2544
8	24.1544	+2.0994	4.4075
9	24.1327	+2.0777	4.3168

Approx Center

$$x = 19.0 \quad y = 20.2510$$

$$23.8590$$

$$44.1100$$

$$y_0 = 22.0550$$

$$y_{\text{max}} = 24.1544$$

$$R = 20994$$

$$x_{\text{min}} = 17.9750$$

$$x_0 = 20.0744$$

Center } $x_0 = 20.0740$

Formation of Normals

	at	an	bn	an	bn
1	+ 1.92	- 38.5 [✓]	- 64.8 [✓]	+ 118.8 [✓]	+ 200.0 [✓]
2	+ 2.19	+ 150.0 [✓]	+ 146.0 [✓]	+ 232.3 [✓]	+ 226.0 [✓]
3	+ 1.92	+ 39.8 [✓]	+ 23.3 [✓]	+ 39.8 [✓]	+ 23.3 [✓]
4	+ 0.12	- 63.0 [✓]	- 1.8 [✓]	+ 246.0 [✓]	+ 7.0 [✓]
5	- 0.25	+ 106.0 [✓]	- 26.2 [✓]	+ 125.8 [✓]	- 31.0 [✓]
6	- 1.78	+ 24.3 [✓]	- 12.4 [✓]	+ 41.1 [✓]	- 20.9 [✓]
7	- 1.92	- 15.0 [✓]	+ 25.2 [✓]	+ 64.3 [✓]	- 108.2 [✓]
8	- 0.15	- 5.2 [✓]	+ 157.5 [✓]	- 2.0 [✓]	+ 61.0 [✓]
9	+ 0.62	+ 5.4 [✓]	+ 37.5 [✓]	+ 8.1 [✓]	+ 56.2 [✓]
	+ 2.67	+ 203.8 [✓]	+ 284.3 [✓]	+ 874.2 [✓]	+ 413.6 [✓]
	- 1.77	giving (5) full wt.			
	1190				

Residuals with Haydn's Corrections

	⊙	C	O-C
1	-111	-45-32:-77	-34
2	-15.5	-63-26:-89	-66
3	-22	-76-19:-95	+73
4	-187	-89-1:-90	-27
5	-62	-86+9:-77	+15
6	-22	-79+17:-62	+40
7	-60	-45+32:-13	-47
8	+29	-3+37:+34	-5
9	+27	+13+37:+50	-23
			+128 = 202
			Average = 37

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Moon's Center Conditional Equations

20

	a	b	c		c	O-C
1	-1.07	-1.80	+3.6	-11-24	= -35	+71
2	-1.50	-1.46	-1.00	-15-19	= -34	-66
3	-1.81	-1.06	-2.2	-18-14	= -32	+10
4	-2.10	-0.06	+3.0	-21-12	= -22	+52
5	-2.03	+0.50	-2.09	-10+3	= -7	-97 -194
6	-1.87	+0.95	-1.3	-19+12	= -7	-6
7	-1.07	+1.80	+1.4	-11+24	= +13	+1
8	-0.07	+2.10	+7.5	-1+28	= +27	+48
9	+0.30	+2.08	+1.8	+0+28	= +28	-10
				+182-179		
				Average = 42		

Normal Equation.

Normal Equations

$$\begin{aligned}
 +16.90 + 2.67 &= +204 \\
 +2.67 + 19.45 &= +284 \\
 -2.67 - 0.42 &= -32 \\
 +19.03 &= +252
 \end{aligned}$$

$$b = +13.25$$

$$+16.90 = +204 - 35 = +169$$

$$a = +10.0$$

With Hayns correction giving 5 full wt.

$$\begin{aligned}
 +20.00 + 1.90 &= +874 \\
 +1.90 + 19.64 &= +414
 \end{aligned}$$

$$\begin{aligned}
 -1.90 - 0.18 &= -83 \\
 +19.46 &= +331
 \end{aligned}$$

$$b = +17.1 (+17.1)$$

$$\begin{aligned}
 +20.00 &= +874 - 29 = +845 \\
 &= +874 - 32 = +842
 \end{aligned}$$

$$\begin{aligned}
 a &= +42.3 \\
 a &= +42.0
 \end{aligned}$$

Arch measured: 15.7° Average $O-C = +0.4$

$$\frac{pc}{m} = 0.19$$

$$+ \frac{0.4}{19} = +0.02 + \Delta n = 0.0$$

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Moon's Center
Conditional Equations

20

	a	b	0	c	0-c
1	-1.07	-1.80	+36	-11-24 = -35	+71
2	-1.50	-1.46	-100	-15-19 = -34	-66
3	-1.81	-1.06	-22	-18-14 = -32	+10
4	-2.10	-0.06	+30	-21-1 = -22	+52
5	-2.03	+0.50	-209	-10+3 = -7	-97
6	-1.87	+0.95	-13	-19+12 = -7	-6
7	-1.07	+1.80	+14	-11+24 = +13	+1
8	-0.07	+2.10	+75	-1+28 = +27	+48
9	+0.30	+2.08	+18	+0+28 = +28	-10
					+182-179

Average = 42

Normal Equations

$$\begin{aligned}
 +16.90 + 2.67 &= +204 \\
 +2.67 + 19.45 &= +284 \\
 -2.67 - 0.42 &= -32 \\
 +19.03 &= +252
 \end{aligned}$$

$$b = +13.2$$

$$+16.90 = +204 - 35 = +169$$

$$a = +100$$

Archmeasured = 15.7° Average $(0-c) = +0.4$

$$\frac{p.c.}{n} = 0.19$$

$$+ \frac{0.4}{19} = +0.021 \quad \Delta n = 0.0$$

3376 Moon Mean Position (1913.0)

21

$$\begin{array}{rcl}
 X_0 = 20.0740 & Y_0 = 22.0550 \\
 \frac{1}{2} \text{ sec} = + 5 & \frac{1}{2} \text{ sec} = + 7 \\
 \hline
 20.0745 & 22.0557 \\
 \text{Hayn (20.0761)} & (22.0559)
 \end{array}$$

$$\begin{array}{rcl}
 \text{From Plate Constants } 20.0745 \\
 b_y = - 970 \\
 a_x = - 12 \\
 c = - 672 \\
 \hline
 19.9091 \\
 (19.9107)
 \end{array}$$

$$\begin{array}{rcl}
 22.0557 \\
 d_x = + 893 \\
 d_y = - 62 \\
 b = - 635 \\
 \hline
 22.0753 \\
 (22.0755)
 \end{array}$$

$$\begin{array}{rcl}
 \bar{x} = +1.9091 & (1.9107) & \eta = +0.0753 & (0.0755) \\
 \log \bar{x} = 0.28083 & (28117) & \log \tan S = 9.5390 \\
 \text{" cos } 9.97547 & & 0.5617 \\
 8.50724 & & 7.0534 \\
 & & 7.1541
 \end{array}$$

$$\text{" (d-A) } 1.79812 \quad (1.79846)$$

$$\begin{array}{rcl}
 \alpha - A & + 1.0282 & (0287) \quad \eta_1 = + 14 \\
 A & 9.1547 & \eta_0 = +0.0739 & (+0.0741) \\
 \alpha_0 & 9.164982 & (49.57)
 \end{array}$$

$$\begin{array}{rcl}
 \log \eta_0 = 8.86864 & (8.86982) \\
 7.33115
 \end{array}$$

$$\text{Red} = +1.17 \quad \text{"(d-D)} = 1.53749 \quad (1.53867)$$

$$\begin{array}{rcl}
 \alpha' = 9.165099 & S-D = + 34.5 & (34.6) \\
 51.04 & D = +19.0409
 \end{array}$$

$$S_0 = +19.04435 \quad (43.6)$$

$$\text{Red} = + 24$$

$$d' = +19.04459 \quad (46.0)$$

3376 Moon Mean Position (1913 0)

21

$$\begin{array}{r}
 X_0 = 20.0740 \quad Y_0 = 22.0550 \\
 \hline
 20.0745 \quad 22.0557
 \end{array}$$

$$\begin{array}{r}
 \text{From Plate Constants} \quad 20.0745 \\
 \left. \begin{array}{l}
 \log = -970 \\
 \text{arc} = -12 \\
 c = -672
 \end{array} \right\} \\
 19.9091
 \end{array}
 \quad
 \begin{array}{r}
 22.0557 \\
 \log = +893 \\
 \text{arc} = -62 \\
 c = -635 \\
 \hline
 22.0753
 \end{array}$$

$$\begin{array}{l}
 z = +1.9091 \\
 \log z = 0.28083 \\
 \log S = 9.97547 \\
 8.50724
 \end{array}$$

$$(A-A) = 1.79812$$

$$A - A = +1.0282$$

$$A = 9.1547$$

$$A_0 = 9.164982$$

$$\text{Red} = +1.17$$

$$A = 9.165099$$

$$\eta = +0.0753$$

$$\begin{array}{l}
 \log \tan S = 9.5390 \\
 0.5617 \\
 7.0534 \\
 7.1541
 \end{array}$$

$$\eta_1 = +14$$

$$z_0 = +0.0739$$

$$\begin{array}{l}
 \log \eta_0 = 8.86864 \\
 7.33115
 \end{array}$$

$$(D-D) = 1.53749$$

$$S-D = +34.5$$

$$D = +19.0409$$

$$S_0 = +19.04435$$

$$\text{Red} = +24$$

$$D = +19.04459$$

3376

Red. all locum app.

$$\begin{array}{rcl}
 H + \alpha & 23^h & 40^m : 355^\circ \\
 H & 14 & 23 \\
 \alpha & 9 & 17 \\
 G & 20 & 28 \\
 G + \alpha & 5 & 45 = 86^\circ 15'
 \end{array}$$

$$\begin{array}{rcl}
 l \cos(G + \alpha) & 8.8156 \\
 g & 1.0528 \\
 \sin & 9.9991 \\
 \tan & 9.5390 \\
 & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 g' & 9.8684 \\
 g & 9.4148
 \end{array}$$

$$\begin{array}{rcl}
 l & +1.03 \\
 g & +0.26 \\
 h & -0.12 \\
 \hline
 & +1.17
 \end{array}$$

$$S = +19^\circ 05'$$

$$\begin{array}{rcl}
 l \cos S & 9.9755 \\
 i & 0.7030m \\
 (i) & 0.6785m
 \end{array}$$

$$\begin{array}{rcl}
 l \sin S & 9.5144 \\
 \cos(H + \alpha) & 9.9983 \\
 h & 1.2975 \\
 \sin & 8.9403m \\
 + \cos & 0.0245 \\
 & 9.8239
 \end{array}$$

$$\begin{array}{rcl}
 h' & 0.8102 \\
 h & 9.0863m
 \end{array}$$

$$\begin{array}{rcl}
 g' & +0.74 \\
 h' & +6.46 \\
 i & -4.77 \\
 \hline
 & +2.43
 \end{array}$$

3576. Red all known app

$$\begin{array}{rcl}
 H + \alpha & 23^{\circ} & 40^{\circ} : 355^{\circ} \\
 H & 14 & 23 \\
 \alpha & 9 & 17 \\
 G & 20 & 28 \\
 G + \alpha & 5 & 45 = 86^{\circ} 15'
 \end{array}$$

$$\begin{array}{rcl}
 \log(G + \alpha) & 8.8156 \\
 g & 1.0528 \\
 \log & 9.9991 \\
 \log & 9.5390 \\
 & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 g' & 9.8684 \\
 g & 9.4148
 \end{array}$$

$$\begin{array}{rcl}
 f & +1.03 \\
 g & +0.26 \\
 h & -0.12 \\
 \hline
 & +1.17
 \end{array}$$

$$S = +19^{\circ} 05'$$

$$\begin{array}{rcl}
 \log S & 9.9755 \\
 & 0.7030 \\
 (L) & 0.6785
 \end{array}$$

$$\begin{array}{rcl}
 \log S & 9.5144 \\
 \cos(H + \alpha) & 9.9983 \\
 h & 1.2975 \\
 \log & 8.9403 \\
 \log S & 0.0245 \\
 & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 h' & 0.8102 \\
 h & 9.0863
 \end{array}$$

$$\begin{array}{rcl}
 g' & +0.74 \\
 g & +6.46 \\
 \hline
 & -4.77 \\
 & +2.43
 \end{array}$$

G.

$$\begin{array}{rcl}
 3376 & \text{Lunar Parallax} & \\
 \alpha' = 9^{\circ} 16' 50.99'' (51.04) & \delta' = +19^{\circ} 04' 45.9'' (46.0) & \\
 0 - 12 & 10 & 06.85 \\
 G - \alpha' = +2 & 53 & 15.86 \\
 = + & 43^{\circ} & 18' 58''
 \end{array}$$

$$\begin{array}{rcl}
 + & 1 & 15.54 \\
 + & 43 & 03.04
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.13624 \\
 \hline
 0.09351
 \end{array}$$

$$\begin{array}{rcl}
 \gamma = 51^{\circ} 07' 16'' \\
 19 & 04 & 46 \\
 32 & 02 & 30
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.23510 \\
 9.72471 \\
 0.10875 \\
 \hline
 7.89496
 \end{array}$$

$$S - S' = +26 \quad 59.5$$

$$S = +19 \quad 31 \quad 45.4$$

$$\text{Lunar } S = +19 \quad 31 \quad 50.6$$

$$O - C = -5.2$$

$$\text{with Hay's correction} = -5.1$$

$$\Pi = 59.04.45$$

$$\begin{array}{r}
 9.86913 \\
 8.23510 \\
 9.83634 \\
 \hline
 0.02573 \\
 7.96630
 \end{array}$$

$$\begin{array}{rcl}
 \alpha - \alpha' = +31' 48.68'' \\
 = +2'' 07.25''
 \end{array}$$

$$\begin{array}{rcl}
 \alpha = 9 & 18 & 58.24 \\
 \alpha = 9 & 18 & 57.40
 \end{array}$$

$$\begin{array}{r}
 +0.84 \\
 (+0.89)
 \end{array}$$

3376

9' 16' 50.99" ✓

0 - 12 10 06.85" ✓

G - α' + 2 53 15.86" ✓

+ 43 18' 58" ✓

+ 1 15 54" ✓

43 03 04" ✓

9.95727

000000

013624

0.09351 ✓

γ 51° 07' 16" ✓

19 04 46" ✓

32 02 30" ✓

9.82640

823510 ✓

972471 ✓

010875 ✓

789496 ✓

S - S' + 26 59.5" ✓

S = +19 31 45.4" ✓

Humboldt S = +19 31 50.6" ✓

0 - α - 5.2" ✓

human Parallax

S = +19° 04' 45.9" ✓

π = 5.90445" ✓

9.86913

823510 ✓

983634 ✓

002573 ✓

796630 ✓

α - α' + 31 48.68" ✓

+ 2 07.25" ✓

α = 9 18 58.24" ✓

α = 9 18 57.40" ✓

+ 0.84" ✓

$$l = \lambda - \alpha$$

$$b = \left\{ 10.50^\circ \text{ in } (20 - \lambda) - \beta \right.$$

$$\sin c = - \sin i \cos (\alpha - \delta')$$

$$\sin c = - \sin i' \frac{\cos (\alpha - \delta')}{\sin l}$$

$$\begin{array}{rcl} \lambda & 15^h 26^m 17^s & = 231^\circ 31' \\ \delta' & & 3 \quad 5'' \\ \alpha - \delta' & & 228 \quad 26 \end{array}$$

$$l \quad 22^\circ 30'$$

$$C = +14^\circ 50' + 14.83$$

$$14.75$$

$$\sin c = + \sin i \cos (\alpha - \delta')$$

$$-0.12 \quad -1''.4$$

$$+0.12 \quad +1.4$$

$$21 \quad 0.24 \quad 3''.3$$

$$0.012 \quad 0''.16$$

$$l = \lambda' - c$$

$$= \lambda + \underbrace{\mu}_{\text{Tabl}} + \underbrace{Ab}_{\text{Tabl}} - c$$

Ab not used

$$\frac{1}{\cos B} = 0.12$$

$$l = \lambda - c + Ab$$

$$b = B - \beta$$

$$B = 1^{\circ} 32' \sin(\delta - \lambda)$$

$$A = 0.023 \cos(\delta - \lambda)$$

Jan. Cen. meridian

$$\lambda = 235^{\circ} 14' \quad c = 239^{\circ} 54' \quad \delta = 309^{\circ} 44'$$

$$\beta = -5^{\circ} 0'$$

$$\delta - \lambda = 74^{\circ} 30'$$

$$\lambda - c = -4^{\circ} 40' \quad Ab = +2'$$

$$B = +1^{\circ} 29'$$

$$b = +6^{\circ} 29' = +6^{\circ}.48$$

$$A = +.006$$

$$l = -4^{\circ} 38' = -4^{\circ}.63$$

$$\beta = 5^{\circ} \sin(\delta - \delta)$$

$$A = 0.023 \cos(\delta - \lambda)$$

$$b = B + \beta = 6^{\circ}.6 \sin(\delta - \lambda) \quad A = 0^{\circ}.15 \cos(\delta - \lambda) / \sin(\delta - \lambda)$$

