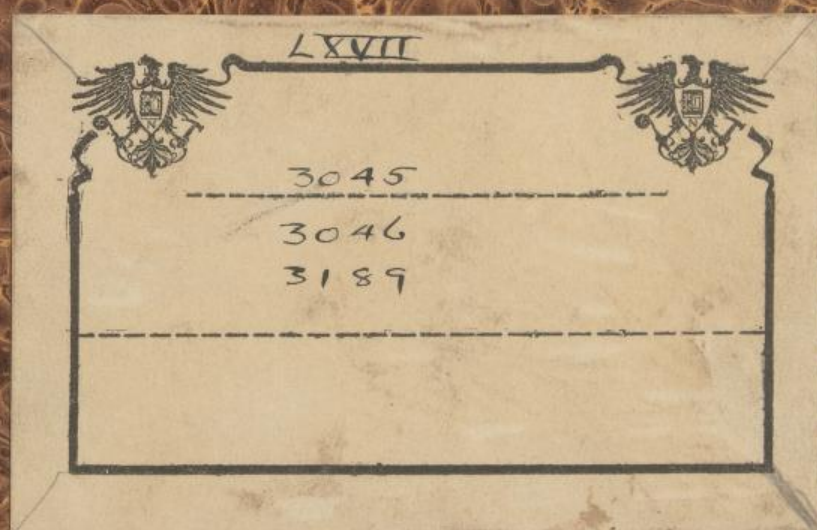


KG
11366
v. 944



Harvard Lunar Plates.

Measures and Reductions.

Mary Fowler

Plate No.	Date	Page
3045	1913 March 22	1
3046	1913 March 22	12
3189	1913 Apr 17	21

1913 Mar 22

3045

Stars - Measures.

1914 Apr. 6

d	N	d	N	d	N	d	N
1 1/2	16761	20425	16415	13746			
7.6	9620	17569	12641	749290			
20.7	2219	6566	4840	89			
	61	15	00	20			
	<u>20.7141</u>	<u>7143</u>	<u>7.6234</u>	<u>.6240</u>			
2	19890	18759	16202	19923			
23.2	14633	14007	8318	17780			
31.5	2029	9999	20	7580			
	75	51	95	10			
	<u>31.5255</u>	<u>.5247</u>	<u>232119</u>	<u>.2142</u>			
3	18541	19229	15997	20129			
27.8	11639	16092	14099	12009			
87	3840	0301	00	0416			
	20	05	95	06			
	<u>28.6887</u>	<u>.6879</u>	<u>27.8109</u>	<u>.8101</u>			

Grade 3

1913 Mar 22

3045

Stars - measures

d

y

z

d

N

1 1

16761

20425

16415

13746

76

9620

17569

1264140

749290

207

2219

6566

4840

89

61

15

00

20

20.71417.1437.62346240

2

19890

18759

16202

19923

232

14633

14007

831821

1778050

31.5

2029

9999

20

7550

75

51

95

10

31.5255524723.21192142

3

18541

19229

11997

20129

278

1163940

1609209

1440910

1200916

87

38

0301

00

0416

20

05

95

06

28.6887687927.81098101

Grade 3.

3045 leeson measure

2.

<u>1</u> scratch	<u>4</u>	<u>2</u>	<u>2</u>
19.0 15435	14085	8169	8038
16.4 1307581	6437	7171	7035
6077	4249	2158	3231
39	79	19.1012	1005
<u>16.2363</u>	<u>.2363</u>		

<u>2</u>	988580	8781
20.1	78	802328
15.9	9143	1528
min		
<u>4</u>	<u>15.9262</u>	<u>.9241</u>

<u>3</u>	8945	959895
21.0	818069	0195
16.1	70	8847
	<u>16.0772</u>	<u>.0751</u>

<u>4</u>
22.1
17.0

842821	10329
20	962001
7700	0401

<u>22.0723</u>	<u>0723</u>
14012	16400
.763025	1276057
21	51
95	90
<u>22.3623</u>	<u>.3640</u>

<u>5</u>
22.4
18.0
max
in
70

<u>6</u>
22.1
19.0

13892	15538
546777	1394030
80	4030
85	28
<u>22.1588</u>	<u>.1600</u>

3045. lesson learner

d

v

d

v

1 scratch

194 15435 14085

164 1307581 6437

6077 4245

39 79

1623632363

8169

7171

7158

191012

8038

7031

3231

10015

2 988580

201 78

159 9143

v

159262

8781

802328

1528

9241

3 8945

210 818069

161 70

959895

0195

8847

1607720751

4

221

170

842821

20

7700

10329

962001

0401

2207230723

5

224

180

may

v

v

14012

763025

21

95

223623

16400

1276057

51

90

3640

6

221

190

13892

546777

80

85

221588

15538

1394030

40

28

1600

3045

a. y

Moon measures

3

n

a x

n

2 scratch

21.7 19263
 193 1292221
 27
 88
21.6337

15479
 1181610
 20
 71
16339

19461
 16520
 1225-
 80
21.7061

15663
 861528
 20
 66
17044

8 14126
 21.0 1326955-
 20.1 5955-
20.0865

1013820
 29
 9279
0850

+4

9 scratch

207 17448
 202 1562905
 1104
 40
20.1834

16900
 873122
 2622
 91
1833

18096
 14748
 5047
 86
20.6655

17772
 1111111
 0211
 70
6663

3045

Known Unknowns

3

a

n

a

n

2 scratch

217 19263
 793 1292221

27

88

21.6337

15479
 1181610

20

71

6339

19461

1652025-

12

80

21.7061

15663

861528

20

66

7044

8 14126

210 1326955-

21 59

20.0865

1013820

29

9279

0850

9 scratch

207 17448

202 1562905-

1104

40

20.1834

16900

873122

26

91

1833

18096

14748

5047

86

20.6655

17772

1111111

02

70

6663

3.045	Times etc							
Eph. to stars	1913 Mar 22	11 ^h	21 ^m		- 11 ^h	33 ^m		
.. .. .		11	26	53.4 ^v	- 11	26	53.9 ^v	
Block fact			0	59.8 ^v				
H. Sid T.		11	25	53.85 ^v	G - d - -	1 ^h	15 ^m	
.. .. .		9	44	31.05 ^v				
G. Sid T.		16	10	24.90 ^v				
Sid T. G. - Wom		3	57	31.62 ^v				
Interval		16	12	53.28 ^v				
Reduction			2	39.38 ^v				
G. M. T.		16	10	13.90 ^v				

.. .. .				R. A.		Block		
.. .. .	16 ^m	12	40 ^m	15.45 ^v	- 50	09'	19.6 ^v	
.. .. .	1 ^h = 2.2002 ^v							
.. .. .	10.232 ^v			+ 22.51 ^v		- 3	01.1 ^v	
Tabular place		12	40	37.96 ^v	- 5	12	20.7 ^v	

.. .. . age 15 days

934 = 10.9 ^v	Parallax	60'	41.34 ^v
994 = 11.3 ^v		16'	33.7 ^v
	R		993.7 ^v
	Augmentation		+ 11.3 ^v
	Irradiation (3)		- 0.7 ^v
	R		1004.3 ^v
	R		2.1528 ^v
	(1 + a/R		2.1531 ^v
	R ²		4.6358 ^v

$$\alpha = -1.4$$

3045

Taurus etc

Spiral arm 1913 Mar 32.

11"	21"	-11"	33"
11	26	534	-11 26 539
	0	598	

H. Sect

11 25 5385" G-2 -1" 15"

H. Sect

4 44 31.01

G. Sect

16 1.0 24.90

Sect T. G. Wom

23 57 31.62

Tentative

16 12 5328

Radiation

2 3938

G. W. i

16 10 1390

Bromant Allen

R. H.

Heat

Unon 16"

12 40 1545 -5° 09' 19.6

Unon 16" 22002

17.709

10232

-2251

-3 011

Tubular phase

12 40 3796 -5 12 207

Census cage 15 days.

Parallax 60' 41.34

Semi-major 16' 33.7

R 9937

Augmentation +11.3

Imaginary (R) -0.7

R 100.4.3

R 215.28

R 215.31

R 4.6358

934 10.0

194 11.3

a = 71.4

1 + 0.1 R

R²

3045

Pleete Constants

5

α	δ	R.A.	Decl.
7.6237	20.7142	12 35 01	-5 37 21
23.2130	31.5251	43 05	-4 12 21
27.8105	8.6883	45 36	-7 09 31
3 58.65	60.93	123 42	16 58 73
19.55	20.31	12 41 14	-5 39 44
-1.8	-22	-	+13 10
1.55	169	12 40 26	-5 26 34
31	466		
48	790		
	= 13' 10"		

Center of
plate } $A = 12^h 40^m 26^s$
 $D = -5^{\circ} 26' 34''$

$$\begin{array}{rcl}
 2-3 & -84.34 & -1.42 \\
 +140 & -1746 & -11 = -1617 \\
 +1073 & -2658 & -32 = -1617 \\
 -845 & -2732 & -39 = -1616 \\
 20.2129 & -1524 & -28 = 202194
 \end{array}$$

$$\begin{array}{rcl}
 4-m & +83.32 & +2.44 \\
 +1127 & +635 & +1762 +50 = +1812 \\
 -199 & +1934 & +1735 +76 = +1811 \\
 -526 & +2317 & +1791 +21 = +1812 \\
 18.0800 & +1684 & +43 = 180715
 \end{array}$$

$$\begin{array}{llll}
 \text{Tables } a = 0.0 & e = -3.9 & a - e = +3.9 & b + a = +2.5 \\
 \text{Obs } a = +1.4 & e = -2.4 & a - e = +3.8 & b + a = +1.0
 \end{array}$$

3045

Pleisto Constants

5

Σ	γ	R_A	μ_{each}
7.6237	20.7142	12 35 01	-5 37 21
23.2130	31.5251	43 05	-4 12 21
27.8105	8.6883	45 36	-7 09 31
3 58.65	60.93	123 42	116 58 72
19.55	20.31	12 41 14	-5 39 44
-1.8	-2.2	- 48	+ 13 10
1.55	1.69	12 40 26	-5 26 34
31	46.6		
48"	79.0"		

= 13' 10"

Center of } A = 12° 40' 26"
 planet } D = -5° 26' 34"

2-3	-5434	-1.4x	+1617
+140	-1746	-1606	-115
+1073	-2658	-1585	-32
-845	-7732	-1577	-37
202129	-1524	-28	
			= 202194

4-2	+83.3x	+2.44	-1812
+1127	+6357	+1762	+50
-1997	+1934	+1735	+76
-526	+2317	+1791	+21
180800	+1684	+43	
			= 180715

Tables $a = 0.0$ $c = -3.9$ $a - c = +3.9$ $b + a = +2.5$
 Obs $a = +1.4$ $c = -2.4$ $a - c = +3.8$ $b + a = +1.0$

3045 Standard Coordinates - Comparison stars

Cape W. 1717mg6.9 Cape W. 1732mg8.0 Cape W. 1741mg6.9

C	12 ^h	34 ^m	21 ^s .14	12	42	24.98	12	44	55.82
L			15 ^m			99			88
L			14 ^m			25.00			75
Mean	12	34	21.14 ^v	12	42	24.99	12	44	55.82
Prece		+	40.22 ^v			+40.18		+	40.16
X	12	35	01.36 ^v	12	43	05.17	12	45	35.98
A	12	40	26 ^v	12	40	26	12	40	26
$\alpha - A$	-	5	24.64 ^v	+	2	39.17	+	5	09.98
Sin($\alpha - A$)		-	324.61 ^v		+	159.17		+	309.95
log μ	2.51136 ^m			2.20186			2.49129		
"cos	9.99791 ^v			9.99883			9.99660		
" Σ	1.01651 ^m			0.70793			0.99513		
" Σ	-10.3874 ^v			+5.1042			+9.8885 ^v		
" Σ	-		29 ^v	+		15	-		65
" Σ		7.6097 ^v		23.1057			27.8950		
" Σ		7.6237 ^v		23.2130			27.8105 ^v		
" $\Sigma - \Sigma$		+140 ^v		+1073			-845		
C	-5 ^h	33'	02.9	-4	08	04.7	-7	05	15.7
L			02.9 ^v			04.1			16.0
L			03.3 ^v			05.6			15.2
Mean	-5	33	03.0 ^v	-4	08	04.8	-7	05	15.6
Prece	-	4	17.8 ^v	-	4	16.1	-	4	15.3
δ	-5	37	20.8 ^v	-4	12	20.9	-7	09	30.9
D	-5	26	34 ^v	-5	26	34	-5	26	34
$\delta - D$	-10	46.8 ^v		+1	14	13.1	-1	42	56.9
Tan($\delta - D$)		-646.8 ^v			+4453.8			-6178.8	
log μ	2.81077 ^m			3.64873			3.79091 ^m		
" γ_0	0.14192 ^m			0.97988			1.12206 ^m		
"tan δ	8.9932 ^m			8.8665 ^m			9.0990 ^m		
" Σ	20330 ^v			14159			19903		
" Σ	80796 ^m			73358 ^m			81427 ^m		
" γ_0	-1.3865 ^v			+9.5472			-13.2452		
" γ_1	-	120 ^v		-	22		-	139	
" γ	20.6015 ^v			31.5450			8.7409		
" γ	20.7142 ^v			31.5251			8.6883		
" $\gamma - \gamma$		+1127 ^v		-199			-526		

3045 Standard Coordinates - Comparison Stars

Cape W. 1717 mag 6.9 Cape W. 1732 mag 8.0 Cape W. 1741 mag 6.9

C	12	34	21.14	12	42	24.98	12	44	55.82
L			15			99			88
L			14			25.00			75
Mean	12	34	21.14	12	42	24.99	12	44	55.82
Proc			+40.22			+40.18			+40.16
X	12	35	01.36	12	43	05.17	12	45	35.98
A	12	40	26	12	40	26	12	40	26
x.4	-	5	24.64	+	2	39.17	+	5	09.98
Sol. A1		-	324.61		+	159.17		+	309.95
log.	2.51	13.6		2.20	18.6		2.49	12.9	
"ans	999	791		999	883		999	660	
3.	101	651		070	793		099	513	
3.	-	10.38	74	+	5.10	92	+	9.88	85
3.	-		29	+		15	+		65
3		760	97	23	105	7	27	895	0
2		762	37	23	213	0	27	810	5
2.7		+	140	+	107	3	-	84	5
C	-5	33	02.9	-4	08	04.7	-7	05	15.7
L			02.9			04.1			16.0
L			03.3			05.6			15.2
Mean	-5	33	03.0	-4	08	04.8	-7	05	15.6
Proc	-	4	17.8	-	4	16.1	-	4	15.3
S	-5	37	20.8	-4	12	20.9	-7	09	30.9
D	-5	26	34	-5	26	34	-5	26	34
S.D	-10	46.8		+1	14	13.1	-1	42	56.9
(S.D)		-64.68			+	44.538		-61.788	
log.	2.81	07.7		3.64	87.3		3.79	09.1	
70	0.14	19.2		0.97	98.8		1.12	20.6	
rand	8.99	32		8.86	65		9.09	90	
3	203	30		141	59		199	03	
31	807	96		733	58		814	27	
40	-138	65		+	9.54	72	-	13	29.52
41	-	120		-		22	-		139
4	206	01.5		31	54.50		8.74	40.9	
4	207	14.2		31	52.51		8.68	83	
4.21	+	112.7		-	199		-	52.6	

	p	$p-c$			θ	Corr.	Haym	Δ	$O-C$
	149.2	127.7	+2.5	-0.6	+3.4	+0.5	+4.6	+13	-33
	180.0	158.5	+1.2	-0.9	+2.4	+1.2	+11.0	+10.9	-1
3	201.5	180.0	+0.0	-1.0	+1.3	+0.6	+5.5	+2.5	-3.0
4	240.0	218.5	-2.0	-0.8	-0.9	+0.2	+1.8	-10.1	-11.9
5	267.9	246.4	-2.9	-0.4	-2.2	-0.1	-9	-5.7	-4.6
6	295.2	273.7	-3.2	+0.1	-3.0	-0.5	-4.6	-9	+3.7
7	316.4	294.9	-2.9	+0.4	-3.0	+0.1	+9	+5.6	+4.7
8	338.5	317.0	-2.2	+0.7	-2.6	+1.1	+10.1	+8.8	-1.3
9	347.8	326.3	-1.8	+0.8	-2.3	-0.6	-5.5	-4.0	+1.5

+99-211

$$\chi = +3.20$$

$$\beta = +1.00$$

$$c = 21.5$$

	p	$p-c$	$\Delta_{\text{new}}(p-c)$	$\beta_{\text{cor}}(p-c)$	θ	Corr	Δ	$O-C$	
[1	210.8	189.3	-0.5	-1.0	+0.8	+0.6	+5.5	+13]	-4.2
2	180.0	158.5	+1.2	-0.9	+2.4	+1.1	+10.1	+10.9	+8
3	158.5	137.0	+2.2	-0.7	+3.2	-0.3	-2.8	+2.5	+5.3
4	120.0	98.5	+3.2	-0.1	+3.6	-0.4	-3.7	-10.1	-6.4
5	90.0	68.5	+3.0	+0.4	+3.0	-0.2	-1.8	-5.7	-3.9
6	64.8	43.3	+2.2	+0.7	+1.8	-0.2	-1.8	-9	+9
7	43.6	22.1	+1.2	+0.9	+0.6	+0.3	+2.8	+5.6	+2.8
8	21.5	0.0	+0.0	+1.0	-0.7	0.0	0	+8.8	+8.8
9	12.2	-350.7	-0.5	+1.0	-1.2	-0.4	-3.7	-4.0	-3

	Old $O-C$	Haym	New ($O-C$)
2	+10.8	+10.1	+7
3	+10.8	-2.8	+13.6
4	+8.2	-3.7	+11.9
5	+15.5	-1.8	+17.3
6	+18.3	-1.8	+20.1
7	+20.4	+2.8	+17.6
8	+16.7	0	+16.7
9	+6	-3.7	+4.3

3045

Lissac's Center.

7

	x	$y - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 \cdot (y - Y_0)^2$	$O - C$
1	19.1008	-1.1072	+5	1.2247	4.6261	reject
2	20.2080	0.0000	+5	0.0000	4.6466	+108
3	21.0000	+0.7920	+5	0.6280	4.6460	+102
4	22.0723	+1.8643	+3	3.4767	4.6440	+82
5	22.3632	+2.1552	+0	4.6449	4.6513	+155
6	22.1594	+1.9514	-2	3.8072	4.6541	+183
7	21.7052	+1.4972	-4	2.2404	4.6562	+204
8	21.0000	+0.7920	-5	0.6265	4.6525	+167
9	20.6659	+0.4579	-5	0.2092	4.6364	+6

Comp $R^2 = 4.6358$

	x	$y - y_0$	Δy	$(y - y_0)^2$
1	16.2363	-1.8437	-6	3.4014
2	15.9252	-2.1548	-8	4.6466
3	16.0762	-2.0038	-7	4.0180
4	17.0000	-1.0800	-4	1.1673
5	18.0000	-0.0800	-0	0.0064
6	19.0000	+0.9200	+3	0.8469
7	19.6338	+1.5538	+5	2.4158
8	20.0858	+2.0058	+7	4.0260
9	20.1834	+2.1034	+7	4.4272

Approx. Center

$$\bar{x} = 21.0 \quad y = 16.0762$$

$$20.0818$$

$$3.61620$$

$$y_0 = 18.0810$$

$$y_{\text{min}} = 15.9252$$

$$12 = 2.1558$$

$$x_{\text{max}} = 22.3632$$

$$x_0 = 20.2074$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 20.2080 \\ y_0 = 18.0800 \end{array} \right.$$

3045

Lunar Center

7

	x	y	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$	$(y - y_0)^2$	$O - C$
1	19.1008	-1.1072	+5	12247	4.6261				
2	20.2080	0.0000	+5	00000	4.6466	+108			
3	21.0000	+0.7920	+5	06280	4.6460	+102			
4	22.0723	+1.8643	+3	34767	4.6440	+82			
5	22.3632	+2.1552	+0	4.6449	4.6513	+155			
6	22.1594	+1.9514	-2	3.8072	4.6541	+183			
7	21.7052	+1.4972	-4	22404	4.6562	+204			
8	21.0000	+0.7920	-5	06265	4.6525	+167			
9	20.6659	+0.4579	-5	02092	4.6364	+6			

Comp $R^2 = 4.6358$

	x	y	$x - x_0$	Δy	$(y - y_0)^2$
1	16.2363	-1.8437	-6	3.4014	
2	15.9252	-2.1548	-8	9.6466	
3	16.0762	-2.0038	-7	4.0180	
4	17.0000	-1.0800	-9	1.1673	
5	18.0000	-0.0800	-0	0.0064	
6	19.0000	+0.9200	+3	0.8469	
7	29.6338	+1.5538	+5	2.4118	
8	20.0858	+2.0058	+7	4.0260	
9	20.1834	+2.1034	+7	4.4272	

Aphelion Center

$$x = 21.0 \quad y = 16.0762$$

$$20.0858$$

$$3.61620$$

$$y_0 = 18.0810$$

$$y - y_0 = 15.9252$$

$$r^2 = 2.1558$$

$$x - x_0 = 22.3632$$

$$x_0 = 20.2074$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 20.2080 \\ y_0 = 18.0800 \end{array} \right.$$

Bruntation of comets

	ab	an	bn
1			
2	-0.00	+ 0.0	- 232.0 + 0.0 - 15.0
3	-1.58	+ 80.8	- 204.0 + 107.2 - 272.0
4	-2.01	+ 152.5	- 88.5 + 221.5 - 128.5
5	-0.17	+ 335.0	- 12.4 + 374.0 - 13.8
6	+1.80	+ 307.0	+ 168.2 + 392.0 + 185.0
7	+2.33	+ 306.5	+ 316.0 + 264.0 + 272.8
8	+1.58	+ 302.0	+ 334.0 + 13.20 + 334.0
9	+0.97	+ 2.8	+ 12.6 + 19.8 + 90.4
	<u>+12.92</u>	<u>+1536.6</u>	<u>+293.9 +1510.5 +452.9</u>

Residuals with Haig's Correction

	O	C	O - C
2	+7	+ 0 - 18 = -18	+25
3	+136	+ 75 - 16 = +59	+77
4	+119	+ 177 - 9 = +168	-49
5	+173	+ 205 - 1 = +204	-31
6	+201	+ 185 + 8 = +193	+8
7	+176	+ 142 + 13 = +155	+21
8	+167	+ 75 + 16 = +91	+76
9	+43	+ 44 + 17 = +61	-18
			<u>+207 - 98</u>
			Average = 38

3045 Wilson's Center
Conditional Equations

8

[1	-1.11	-1.84	= -	9.7]	[-109	-1	= -110	+13]
2	0.00	-2.15	= +108		+0	-1	= -1	+109
3	+0.79	-2.00	= +102		+78	-1	= +77	+25
4	+1.86	-1.08	= +82		+183	-0	= +183	-101
5	+2.16	-0.08	= +115		+212	-0	= +212	-57
6	+1.95	+0.92	= +183		+192	+0	= +192	-9
7	+1.50	+1.55	= +204		+147	+1	= +148	+56
8	+0.79	+2.00	= +167		+78	+1	= +79	+88
9	+0.46	+2.10	= +6		+45	+1	= +46	-40
					+278 - 207			

Normal Equations

Average 61

$$+15.63 + 2.92 = +15.37 \quad (+1510)$$

$$+2.92 + 21.55 = +294 \quad (+453)$$

$$-2.92 - 0.54 = -285 \quad (-282)$$

$$+21.01 = +9 \quad (+171) \quad b = +0.43 \quad (+82)$$

$$+15.63 = +15.37 - 1 = +15.36$$

$$(+1510 - 24 = +1486)$$

$$a = +98.4 \quad (+95.1)$$

Arc measured = 199° included 1st point

excluding (1) = 168 Average (1) = +9

$$\frac{m}{n} = 0.25$$

$$+ \frac{9}{25} = +0.36 \quad \Delta n = +0.4$$

2045- Luovon's Center
conditional equations

8

$$\begin{array}{r|l}
 \begin{array}{l}
 [1 \quad -1.11 \quad -1.84 \quad - \quad 9.7] \\
 2 \quad -0.00 \quad -2.15 = +1.08 \\
 3 \quad +0.79 \quad -2.00 = +1.02 \\
 4 \quad +1.86 \quad -1.08 = +1.82 \\
 5 \quad +2.16 \quad -0.08 = +1.15 \\
 6 \quad +1.95 \quad +0.92 = +1.83 \\
 7 \quad +1.50 \quad +1.15 = +2.04 \\
 8 \quad +0.79 \quad +2.00 = +1.67 \\
 9 \quad +0.46 \quad +2.10 = +1.6
 \end{array} &
 \begin{array}{l}
 [-109-1 \quad -110 \quad +13] \\
 + \quad 0 = 1 = -1 \quad +1.09 \\
 + \quad 78 = 1 = +77 \quad +25 \\
 + \quad 183 = 0 = +183 \quad -101 \\
 + \quad 212 = 0 = +212 \quad -57 \\
 + \quad 172 = 0 = +172 \quad -9 \\
 + \quad 147 = 1 = +148 \quad +56 \\
 + \quad 78 = 1 = +79 \quad +88 \\
 + \quad 45 = 1 = +46 \quad -40
 \end{array}
 \end{array}$$

$$+278 - 207$$

Normal Equations

Average 61

$$+15.63 + 2.92 = +1.537$$

$$+2.92 + 21.55 = +2.94$$

$$-2.92 - 0.54 = -2.85$$

$$+21.01 = +9$$

$$b = +0.4$$

$$+15.63 = +1.537 - 1 = +1.536$$

$$a = +98.4$$

One measured - 199° included 1st point

including (1)

1.68

$$\text{Average } (1) = +9$$

$$\frac{m}{m} \quad 0.25$$

$$+ \frac{9}{25} = +0.36 \quad a = +0.4$$

2045 Moon's Mean Position (1913.0)

$$X_0 = 20.2080^\circ \quad Y_0 = 18.0800^\circ$$

$$+ 49 \quad - 0$$

$$20.2129^\circ \quad 18.0800^\circ$$

$$\text{Hayn } 20.2128^\circ \quad (18.0804)$$

$$\text{Jovian plate constants } X_p = 20.2194^\circ \quad Y = 18.0715^\circ$$

$$(20.2193)$$

$$(18.0719)$$

$$Z = +2.2194^\circ \quad (2.2193)$$

$$\eta = -3.9285^\circ \quad (-3.9281)$$

$$\log \xi = 0.34624^\circ \quad (0.34622) \quad \log \tan S = 9.0093^\circ$$

$$\log \cos S = 9.99765^\circ$$

$$8.50724$$

$$\xi = 0.6925^\circ$$

$$7.0534^\circ$$

$$\eta_1 = 6.7552^\circ$$

$$(W-A) = 1.84135^\circ \quad (84133)$$

$$X-A = +1.0940^\circ \quad (09.40)$$

$$\eta_1 = -6^\circ$$

$$\eta_0 = -3.9279^\circ \quad (-3.9275)$$

$$A = 12.40.26^\circ$$

$$X_0 = 12^\circ 41' 35.40''$$

$$\log \eta_0 = 0.59416^\circ \quad (59412)$$

$$7.33115^\circ$$

$$\text{Red} = 1.51^\circ$$

$$(A-D) = 3.26301^\circ \quad (26297)$$

$$\alpha' = 12.41.37.21^\circ$$

$$S-D = -30' 32.4'' \quad (32.2)$$

$$D = -5.26.34^\circ$$

$$S_0 = -5.57.06.4^\circ \quad (06.2)$$

$$\text{Red} = -1.36^\circ$$

$$S' = -5.57.20.0^\circ \quad (19.8)$$

2045 Brooks Mean Position (1913.0)

$$\begin{array}{r}
 X_0 = 20.2080 \\
 a = +49 \\
 \hline
 20.2129
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 1.80800 \\
 b = 0 \\
 \hline
 1.80800
 \end{array}$$

Journ plate constant $X_0 = 20.2194$ $Y = 1.80715$

$$z = +2.2194$$

$$\eta = -3.9285$$

$$\log z = 0.34624$$

$$\log s = 5.99765$$

$$8.50724$$

$$(z - A) = 1.84135$$

$$X - A = +1.0940$$

$$A = 12.40.26$$

$$X_0 = 12^h 41^m 35.40^s$$

$$Red = 1.51$$

$$\alpha = 12.41.37.21$$

$$\log \tan \delta = 9.0093m$$

$$\delta = 0.6925$$

$$7.0534$$

$$\eta_1 = 6.7552$$

$$\eta_2 = -6$$

$$\eta_0 = -3.9279$$

$$\log \eta_0 = 0.59416$$

$$7.33115$$

$$(d - D) = 3.26301$$

$$S - D = -30' 32.4''$$

$$D = -5.26.34$$

$$S_0 = -5.57.06.4$$

$$Red = -1.36$$

$$S = -5.57.20.0$$

3045

Red ad locum app

10

$$H + \alpha \quad 6 \quad 33 = 98^\circ 15'$$

$$A \quad 17 \quad 51$$

$$\alpha_0 \quad 12 \quad 42$$

$$C \quad 19 \quad 30$$

$$G + \alpha \quad 8 \quad 12 = 123^\circ$$

$$l \cos(G + \alpha) \quad 9.7361m$$

$$g \quad 1.0239$$

$$\sin \dots \quad 9.9236$$

$$\tan S \quad 9.0180m$$

$$T_1 \quad 8.8239$$

$$(g') \quad 0.7600m$$

$$(g) \quad 8.7894m$$

$$l \quad +0.62$$

$$S \quad -0.06$$

$$h \quad +1.25$$

$$+1.81 \quad \checkmark$$

$$S_0 - 5^\circ 57'$$

$$l \cos S \quad 9.9976$$

$$i \quad 0.9107m$$

$$(i) \quad 0.9083m$$

$$l \sin S \quad 9.0156m$$

$$\cos(H + \alpha) \quad 9.1568m$$

$$h \quad 1.2737$$

$$\sin \dots \quad 9.9955$$

$$\sec S \quad 0.0024$$

$$T_1 \quad 8.8239$$

$$(h') \quad 9.4461$$

$$(h) \quad 0.0955$$

$$S' \quad -5.75$$

$$h' \quad +0.28$$

$$l \quad -8.10$$

$$-1.357 \quad \checkmark$$

3045

Red. ad locum - hfs

10

 $\delta - 5^{\circ} 57'$

$$H + \alpha \quad 6 \quad 33 = 98^{\circ} 15'$$

$$N \quad 17 \quad 51$$

$$a_0 \quad 12 \quad 42$$

$$G \quad 19 \quad 30$$

$$G + \alpha \quad 8 \quad 12 = 123^{\circ}$$

$$l \cos(G + \alpha) \quad 97361m$$

$$q \quad 10239$$

$$\sin \quad 99236$$

$$\tan \delta \quad 90180m$$

$$r_1 \quad 88239$$

$$(g') \quad 07600m$$

$$(g) \quad 87894m$$

$$h \quad +062$$

$$\delta \quad -006$$

$$a \quad +125$$

$$+181$$

$$l \cos \delta \quad 99976$$

$$i \quad 09107m$$

$$(i) \quad 09083m$$

$$l \sin \delta \quad 90156m$$

$$\cos(H + \alpha) \quad 91568m$$

$$h \quad 12737$$

$$\sin \quad 99955$$

$$\sec \delta \quad 00024$$

$$r_2 \quad 88239$$

$$(h') \quad 94461$$

$$(h) \quad 00955$$

$$\delta' \quad -5.75$$

$$h' \quad +0.28$$

$$i \quad -8.10$$

$$-13.57$$

3045

Lunar Parallax.

$$\begin{array}{r}
 \delta = 12^{\circ} 41' 37.21'' \\
 \delta = 11 \quad 25 \quad 53.85'' \\
 \delta - \alpha = -1 \quad 15 \quad 43.36'' \\
 = -18^{\circ} 55' 50'' \\
 - \quad \quad \quad 7 \quad 19' \\
 - \quad 18 \quad 48 \quad 31''
 \end{array}$$

$$\begin{array}{r}
 9.95727'' \\
 0.00000'' \\
 0.02383'' \\
 \hline
 9.98110''
 \end{array}$$

$$\begin{array}{r}
 \delta = 43 \quad 45 \quad 14'' \\
 \quad \quad \quad 5 \quad 57 \quad 20'' \\
 \quad \quad \quad 49 \quad 42 \quad 34''
 \end{array}$$

$$\begin{array}{r}
 9.82640'' \\
 8.24681'' \\
 9.88240'' \\
 0.16017'' \\
 \hline
 8.11578''
 \end{array}$$

$$\delta - \delta' = +44 \quad 529''$$

$$\delta = -5 \quad 12 \quad 27.1'' (26.9) \quad \alpha = 12 \quad 40 \quad 38.71''$$

$$\text{Naut. Alm. } \delta = -5 \quad 12 \quad 20.7'' \quad \alpha = 12 \quad 40 \quad 37.96''$$

$$O - C \quad \quad \quad - 6.4'' \quad \quad \quad + 0.75''$$

$$\text{With Hayns Correction } (-6.2'') \quad \quad \quad + 0.75''$$

$$\delta' = -5^{\circ} 57' 20.0'' (198)$$

$$\overline{\delta} = 60' 41.34''$$

$$\begin{array}{r}
 9.86913'' \\
 8.24681'' \\
 9.51111'' \\
 0.00179'' \\
 \hline
 7.62884''
 \end{array}$$

$$\alpha - \alpha' = -14' 37.54''$$

$$= -58.50''$$

3045

Lunar Parallax

11

$$\begin{array}{r}
 \lambda' \quad 12'' \quad 41'' \quad 37.21 \\
 \mu \quad 11'' \quad 25'' \quad 53.85 \\
 \theta - \alpha \quad -1'' \quad 15'' \quad 43.36 \\
 \quad \quad \quad -18'' \quad 55'' \quad 50'' \\
 \quad \quad \quad - \quad \quad \quad 7 \quad 19 \\
 \quad \quad \quad - \quad 18 \quad 48 \quad 31
 \end{array}$$

$$\begin{array}{r}
 995727 \\
 000000 \\
 002383 \\
 \hline
 998110
 \end{array}$$

$$\mu = 43 \quad 45 \quad 14$$

$$5 \quad 57 \quad 20$$

$$49 \quad 42 \quad 34$$

$$\begin{array}{r}
 982640 \\
 824681 \\
 988240 \\
 016017 \\
 \hline
 811578
 \end{array}$$

$$\delta - \delta' = +44 \quad 52.9$$

$$\delta' = -5'' \quad 12'' \quad 27.1$$

$$\text{Nautical} \quad \delta = -5'' \quad 12'' \quad 20.7$$

$$\alpha - \alpha' = -6.4$$

$$\delta = -5'' \quad 57'' \quad 20.0$$

$$\mu = 60' \quad 41'' \quad 34$$

$$\begin{array}{r}
 986913 \\
 824681 \\
 951111 \\
 000179 \\
 \hline
 762884
 \end{array}$$

$$\alpha - \alpha' = -14' \quad 37.54$$

$$= -58^{\circ} 50'$$

$$\alpha = 12 \quad 40 \quad 38.71$$

$$\alpha = 12 \quad 40 \quad 37.96$$

$$+0.75$$

1913 Mar. 22
3046

Stars measured

4

N

<u>1</u>	18141	18796
6.9	13108	13821
21.5	0009	2924
	49	02
	<u>11.5039</u>	<u>5026</u>

<u>2</u>	17755	18715
22.4	13754	12519
32.4	60	11
	59	21
	<u>323802</u>	<u>3794</u>

<u>3</u>	16319	18440
27.1	10662	14080
71	72	76
	20	39
	<u>9.5652</u>	<u>5636</u>

1914 Apr. 7.

12

d

n

N

<u>1</u>	8080	19838
	16661	11252
	5259	5955
	79	35
	<u>68577</u>	<u>8581</u>
<u>1</u>	7060	19431
	1109602	1540600
	00	00
	60	40
	<u>22.4039</u>	<u>4033</u>
<u>1</u>	093443	13109
	39	1210095
	9929	0095
	<u>27.1010</u>	<u>1006</u>

Grade 3

1913 Apr. 22

3046

Stars measured

4

N

1	18141	18796
69	13108	13821
215	0009	2924
	49	02
215	5039	5026

2	17755	18715
224	13754	12519
329	60	11
	59	21
329	3802	3794

3	16319	18440
371	10662	14080
71	72	76
	20	39
71	95652	5636

1914 Apr. 7

12

d

N

18080	19838
16661	11252
5259	5955
79	35
68577	8581

17060	19431
1109602	1540600
00	00
60	40
22.4039	4033

1093443	13109
39	1210095
9729	00
27.1010	1006

Grade 3

1
19
16

2
2
1

13
6
6

1
1
1

1
1
1

21
17

5
2
1

7
1
1

3046

moon measures

13

$$\begin{array}{r}
 1 \\
 19.0 \\
 16.5 \\
 \hline
 16164 \\
 10833 \\
 41 \\
 74 \\
 \hline
 16.5332
 \end{array}$$

$$\begin{array}{r}
 19549 \\
 14851 \\
 4157 \\
 50 \\
 \hline
 5300
 \end{array}$$

$$\begin{array}{r}
 2 \\
 20.0 \\
 16.3 \\
 \hline
 15074 \\
 12779 \\
 2989 \\
 84 \\
 \hline
 16.2293
 \end{array}$$

$$\begin{array}{r}
 15243 \\
 754949 \\
 4849 \\
 50 \\
 \hline
 2301
 \end{array}$$

$$\begin{array}{r}
 3 \\
 21.0 \\
 16.5 \\
 \hline
 14980 \\
 1073945 \\
 41 \\
 86 \\
 \hline
 16.4240
 \end{array}$$

$$\begin{array}{r}
 15329 \\
 957872 \\
 6972 \\
 42 \\
 \hline
 4236
 \end{array}$$

$$\begin{array}{r}
 4 \\
 21.7 \\
 17.0 \\
 \hline
 15
 \end{array}$$

$$\begin{array}{r}
 15452 \\
 1297068 \\
 74 \\
 58 \\
 \hline
 217517
 \end{array}$$

$$\begin{array}{r}
 17068 \\
 953239 \\
 35 \\
 75 \\
 \hline
 7535
 \end{array}$$

$$\begin{array}{r}
 5 \\
 22.2 \\
 18.0 \\
 \hline
 15
 \end{array}$$

$$\begin{array}{r}
 15060 \\
 7250 \\
 4752 \\
 63 \\
 \hline
 22.2187
 \end{array}$$

$$\begin{array}{r}
 15790 \\
 1361009 \\
 109 \\
 99 \\
 \hline
 2182
 \end{array}$$

$$\begin{array}{r}
 6 \\
 22.3 \\
 18.5 \\
 \hline
 15
 \end{array}$$

$$\begin{array}{r}
 13865 \\
 643130 \\
 40 \\
 72 \\
 \hline
 22.2564
 \end{array}$$

$$\begin{array}{r}
 16820 \\
 1426163 \\
 50 \\
 35 \\
 \hline
 2566
 \end{array}$$

3046

lunar measures

13

$$\begin{array}{r}
 1 \\
 16164 \\
 190 \\
 10833 \\
 165 \\
 41 \\
 74 \\
 \hline
 165332
 \end{array}$$

$$\begin{array}{r}
 19549 \\
 14851 \\
 4157 \\
 50 \\
 \hline
 5300
 \end{array}$$

$$\begin{array}{r}
 2 \\
 15074 \\
 20.0 \\
 12779 \\
 163 \\
 79 \\
 84 \\
 \hline
 162293
 \end{array}$$

$$\begin{array}{r}
 15243 \\
 754949 \\
 4649 \\
 50 \\
 \hline
 2301
 \end{array}$$

$$\begin{array}{r}
 3 \\
 14980 \\
 210 \\
 1073945 \\
 165 \\
 41 \\
 86 \\
 \hline
 164240
 \end{array}$$

$$\begin{array}{r}
 15329 \\
 957872 \\
 69 \\
 42 \\
 \hline
 4236
 \end{array}$$

$$\begin{array}{r}
 4 \\
 217 \\
 170 \\
 \hline
 5 \\
 222 \\
 180
 \end{array}$$

$$\begin{array}{r}
 15452 \\
 1297068 \\
 74 \\
 58 \\
 \hline
 217517
 \end{array}$$

$$\begin{array}{r}
 17068 \\
 953239 \\
 35 \\
 78 \\
 \hline
 7535
 \end{array}$$

$$\begin{array}{r}
 15060 \\
 7250 \\
 4752 \\
 63 \\
 \hline
 222187
 \end{array}$$

$$\begin{array}{r}
 15790 \\
 1361009 \\
 109 \\
 99 \\
 \hline
 2182
 \end{array}$$

$$\begin{array}{r}
 13865 \\
 643130 \\
 40 \\
 72 \\
 \hline
 222564
 \end{array}$$

$$\begin{array}{r}
 16820 \\
 1426163 \\
 50 \\
 35 \\
 \hline
 2566
 \end{array}$$

$$\begin{array}{r}
 6 \\
 223 \\
 185 \\
 \hline
 34
 \end{array}$$

3046 moon-measures.

14

2
22.1
19.0

8
21.5
20.0

9 18041
21.0 14619
20.4 1519
60
20.3443

18339
11729
3941
49
3390

19495
11125
30
82
22.1643

18969
14238
3540
78
21.5264

16875
15240
3030
90
1644

17857
12581
7970
60
5282

3046 known decreases
d 4

2
221
190

8
615
200

19495
1112529
30
82
22.1643

18969
14238
3540
78
21.5264

16875
1524030
30
90
1644

17857
1258170
79
60
5282

2 18061 18339
21.0 14619 1172941
20.4 1519 39
60 49
20.3443 3390

2046

Times etc

15

Expt stars 1913 Mar 22 11^h 35^m ✓ - 11^h 47^m ✓
 ... Moon 11 40 43.9^s - 11 40 44.3^s ✓
 clock fast 0 59.8^s ✓

A. Sid T. 11 39 44.3 ✓ 6 - 2 - - 1^h 01^m ✓
~~Sid T. Moon~~ 4 44 31.05 ✓
 Sid T. 16 24 15.35 ✓
 Sid T. Moon 23 57 31.62 ✓
 Interval 16 26 43.73 ✓
 Reduction 2 41.65 ✓
 A. Sid T. 16 24 02.08 ✓

from hand Alu R. A. Decl.
 Moon 16^h 12^h 40^m 15.45^s - 5° 09' 19.6^s ✓
 Motion in ... = 2 20 03^s 17.699^s ✓
 ... 24.0347^s + 52.88^s - 7 05.4^s ✓
 Tabular place 12 41 08.33^s - 5 16 25.0^s ✓

Moon age 15 days
 ... parallel 60' 41.04^s ✓
 ... Zenith diam 16 33.6^s ✓
 9342 10.2^s R 993.6^s ✓
 9936 = Augmentation + 11.6^s ✓
 + irradiation (3) - 0.7^s ✓
 R 1004.5^s ✓
 R 2.1533^s ✓
 a = +3.3 (1+a) R 2.1540^s ✓
 R² 46397^s ✓

2046 Times etc.

Exp. to star	1913 Mar 22	11 ^h 35 ^m	- 11 ^h 47 ^m
Moon		11 40 43.9	- 11 40 44.3
clock fast		0 598	
H. Lig. T.		11 39 44.3	0 - x - - 1 ^m 01 ^m
~~S. T. T. T. T. T.~~		4 44 31.05	
A. Sid. T.		16 24 15.35	
Sid. T. in time		23 57 31.62	
Interval		16 26 43.73	
Reduction		2 41.65	
A. M. T.		16 24 02.08	

from hand Alu.	R. A.	Decl.
moon 16"	12 ^h 40 ^m	15 ^h 45 ^m - 5 ^h 09 ^m 19 ^s 6
Correction : 2 2003		17 699
24.0347	+	5288 - 7 054
Tabular place	12 41 08.33	- 5 16 25.0

moon age 11 days	60' 41".04
parallax	16 33.6
semidiameter	993.6
R	+ 11.6
Augmentation	- 0.7
+ radiation (3)	1004.5
R	215.33
R	215.40
(1+a) R	463.97
R ²	

9342.102
 $993.6 =$
 $a = +33$

3046

Plate Constants

	1	2	3
x	68579	224036	271008
y	76097	231057	278950
z	-7518	-7021	-7942
u	215032	323798	95644
v	206015	315450	87409
w	+9017	+8348	+8235

$$\begin{array}{rcll}
 2-3 & -41.12 & -332 & +8425 \\
 -7518 - & 884 & -23 = -8402 & -8425 = 0 \\
 -7021 - & 1330 & -74 = -8352 & -8426 = -1 \\
 -7942 - & 393 & -89 = -8335 & -8424 = +1 \\
 20.1017 - & 756 & -7 & = 20.8679 \\
 \\
 4-m & +40.72 & +334 & -9368 \\
 +9017 + & 279 & +71 = +9296 & +9367 = -1 \\
 +8348 + & 912 & +107 = +9260 & +9367 = -1 \\
 +8235 + & 1103 & +32 = +9338 & +9370 = +2 \\
 18.3826 + & 818 & +6 & = 17.5282
 \end{array}$$

$$\begin{array}{l}
 \text{Tables } a = 0.0 \quad e = -3.7 \quad a - e = +3.7 \quad b + a = +1.9 \\
 \text{Obs } a = +3.3 \quad e = -3.3 \quad a - e = +6.6 \quad b + a = +0.4
 \end{array}$$

3046

Plate Constant

	1	2	3
x	6.8579	22.4036	27.1008
y	7.6097	23.1057	27.8950
$2-3$	-7518	-7021	-7442
y	21.5032	32.3798	9.5644
$3-1$	206015	315450	8.7409
$4-2$	+9017	+8348	+8235

$$\begin{array}{rclcl}
 2-5 & -4112 & & -332 & +8425 \\
 -7518 - & 889 & = -6402 & -23 = -8425 & = 0 \\
 -7021 - & 1330 & = -8352 & -74 = -8426 & = -1 \\
 -7942 - & 1393 & = -8335 & -89 = -8424 & = +1 \\
 201017 - & 756 & & -7 & = 208679
 \end{array}$$

$$\begin{array}{rclcl}
 4-1 & +4072 & & +334 & -9368 \\
 +9017 + & 279 & = +9296 & +71 = +9367 & = -1 \\
 -8348 + & 912 & = +9260 & +107 = +9367 & = -1 \\
 -8235 + & 1103 & = +9338 & +32 = +9370 & = +2 \\
 183826 + & 818 & & +6 & = 175282
 \end{array}$$

$$\begin{array}{l}
 \text{Tables } a = 0.0 \quad a = -3.7 \quad a = -3.7 \quad b + a = +1.9 \\
 \text{Obs } a = +3.3 \quad a = -3.3 \quad a = -3.3 \quad b + a = +0.4
 \end{array}$$

	p	p-c			10	Corr.	Hayn	Q	O-C	
	149.7	128.2	+2.5	-0.6	+3.4	+1.1	+101	-3	-104	3
	177.3	155.8	+1.3	-0.9	+2.5	+1.2	+110	+86	-24	1
	204.5	183.0	-0.2	-1.0	+1.1	+1.1	+101	+71	-30	2
4	230.0	208.5	-1.5	-0.9	-0.3	-0.1	-9	0	+9	3
5	259.8	238.3	-2.7	-0.5	-1.9	-1.1	-101	-72	-21	4
6	270.0	248.5	-3.0	-0.4	-2.3	-0.1	+9	+37	+28	5
7	286.6	265.1	-3.2	-0.1	-2.8	-0.5	-46	-39	+7	6
8	318.7	297.2	-2.9	+0.5	-3.1	+0.2	+18	+99	+81	7
9	335.5	314.0	-2.2	+0.7	-2.6	+1.1	+101	+70	-31	8

$$\lambda = +3.20$$

$$\beta = +1.00$$

$$c = 21.5$$

	p	p-c	1 sin(p-c)	3 cos(p-c)	10	Corr.	Hayn	
1	210.3	188.8	-0.5	-1.0	+0.8	+0.5	+46	2
2	182.7	161.2	+1.0	-0.9	+2.2	+0.1	+9	3
3	155.5	134.0	+2.3	-0.7	+3.3	+0.2	+18	4
4	130.0	108.5	+3.0	-0.3	+3.6	0.0	0	5
5	100.2	78.7	+3.1	+0.2	+3.2	-0.2	-18	6
6	90.0	68.5	+3.0	+0.4	+2.9	-0.2	-18	7
7	73.4	51.9	+2.5	+0.6	+2.2	-0.3	-28	8
8	41.3	19.8	+1.1	+0.9	+0.5	+0.2	+18	9
9	24.5	3.0	+0.2	+1.0	-0.5	+0.4	+37	

	old (O-C)	Hayn	new (O-C)
1	+41	+46	-5
2	+109	+9	+100
3	+60	+18	+42
4	-34	0	-34
5	-176	-18	-158
6	-21	-18	-3
7	-99	-28	-71
8	+49	+18	+31
9	+31	+37	-6

3046 Inverse Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$o - c$
1	19.0000	-1.1030	+3	1.2139	4.6438	+ 41
2	20.0000	-0.1030	+4	0.0105	4.6502	+ 105
3	21.0000	+0.8970	+4	0.8053	4.6457	+ 60
4	21.7526	+1.6496	+3	2.7222	4.6363	- 34
5	22.2184	+2.1154	+1	4.4753	4.6221	- 176
6	22.2565	+2.1535	0	4.6376	4.6376	- 21
7	22.1644	+2.0614	-1	4.2489	4.6298	- 99
8	21.5273	+1.4243	-3	2.0278	4.6446	+ 49
9	21.0000	+0.8970	-4	0.8039	4.6428	+ 31

$$\text{Comp } R^2 = 4.6397$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.5316	-1.8514	-6	3.4299
2	16.2297	-2.1533	-7	4.6397
3	16.4238	-1.9592	-7	3.8404
4	17.0000	-1.3830	-5	1.9141
5	18.0000	-0.3830	-1	0.1468
6	18.3830	0.0000	0	0.0000
7	19.0000	+0.6170	+2	0.3809
8	20.0000	+1.6170	+6	2.6168
9	20.3416	+1.9586	+7	3.8389

Approx Center

$$x = 21.0 \quad y = 16.4238$$

$$20.3416$$

$$367654$$

$$y_0 = 18.3827$$

$$y_{\text{min}} = 16.2297$$

$$R = 21.530$$

$$x_{\text{max}} = 22.2565$$

$$x_0 = 20.1035$$

$$\text{Center } \begin{cases} x_0 = 20.1030 \\ y_0 = 18.3830 \end{cases}$$

3046 Moon's Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	19 0000	-1.1030	+3	12139	46438	+41
2	20 0000	-0.1030	+4	00105	46502	+105
3	21 0000	+0.8970	+4	08053	46457	+60
4	21 7526	+1.6496	+3	27222	46363	-34
5	22 2184	+2.1154	+1	44753	46221	-176
6	22 2565	+2.1535	0	46376	46376	-21
7	22 1644	+2.0614	-1	42489	46298	-99
8	21 5273	+1.4243	-3	20278	46446	+49
9	21 0000	+0.8970	-4	08039	46428	+31

Comp $R^2 = 46397$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	16 5316	-1.8514	-6	34299
2	16 2297	-2.1533	-7	46397
3	16 4238	-1.9592	-7	38404
4	17 0000	-1.3830	-5	19141
5	18 0000	-0.3830	-1	01468
6	18 3830	0.0000	0	00000
7	19 0000	+0.6170	+2	03809
8	20 0000	+1.6170	+6	26168
9	20 3416	+1.9586	+7	38389

Approx Center

$$\begin{aligned}
 x &= 21.0 & y &= 16.4238 \\
 & & & 20.3416 \\
 & & & \hline
 & & & 36.7654 \\
 Y_0 &= 18.3827 \\
 y_{\text{min}} &= 16.2297 \\
 R &= 21.530 \\
 x_{\text{max}} &= 22.2565 \\
 X &= 20.1035
 \end{aligned}$$

$$\begin{aligned}
 \text{Center } \sum X_0 &= 20.1030 \\
 \sum Y_0 &= 18.3830
 \end{aligned}$$

Formation of H₂ molecules

	ab	ac	bc	with Hayn	Corr.
1	+2.03	-45.0	-75.9	+5.5	+79.2
2	+0.22	-10.5	-226.0	-10.0	-21.5
3	-1.76	+54.0	-117.5	+37.8	-82.4
4	-2.28	-56.1	+46.9	-56.1	+46.9
5	-0.81	-373.0	+66.9	-335.0	+60.0
6	+0.00	-45.2	-0.0	-6.3	-0.0
7	+1.28	-204.0	-61.4	-146.3	-44.0
8	+2.30	+69.6	+79.5	+44.0	+50.2
9	+1.76	+27.9	+60.8	-5.4	-11.8
	+2.74	-582.3	-226.7	-471.8	+6.6

Residuals with Hayn Correction

	O	C	O - C
1	-5	+25 - 6 = +19	-24
2	+100	+2 - 7 = -5	+105
3	+42	-21 - 7 = -28	+70
4	-34	-38 - 5 = -43	+9
5	-158	-49 - 1 = -50	-108
6	-3	-50 + 0 = -50	+47
7	-71	-47 + 2 = -45	-26
8	+31	-33 + 6 = -27	+58
9	-6	-21 + 7 = -14	+8

+297 - 158
Average = 51 -

5046

Munroe's Center

18

Conditional Equations

	a	b	c		c	0 - c
1	-1.10	-1.85	= +4.1	+ 30 + 14 =	+ 44	- 3
2	-0.10	-2.15	= +10.5	+ 3 + 16 =	+ 19	+ 86
3	+0.90	-1.96	= +6.0	- 25 + 14 =	- 11	+ 71
4	+1.65	-1.38	= -3.4	- 44 + 10 =	- 34	0
5	+2.12	-0.38	= -17.6	- 57 + 3 =	- 54	-122
6	+2.15	+0.00	= -2.1	- 58 - 0 =	- 58	+ 37
7	+2.06	+0.62	= -9.9	- 55 - 5 =	- 60	- 39
8	+1.42	+1.62	= +4.9	- 38 - 12 =	- 50	+ 99
9	+0.90	+1.96	= +3.1	- 25 - 14 =	- 39	+ 70

+363 = 164

Average = 59

Normal Equations

$$\begin{aligned}
 +20.95 + 2.74 &= -582 \quad (-472) \\
 + 2.74 + 20.81 &= -227 \quad (+7)
 \end{aligned}$$

$$\begin{aligned}
 - 2.74 - 0.36 &= +76 \quad (+62) \\
 + 20.45 &= -151 \quad (+69)
 \end{aligned}$$

$$k = -7.4 \quad (+3.4)$$

$$\begin{aligned}
 +20.95 &= -582 + 20.81 \cdot 562 \\
 &= (-472 - 9 = -481)
 \end{aligned}$$

$$a = -26.8 \quad (-23.1)$$

Arc measured = 186°

Average (0-c) = +11

$$\frac{pc}{m} = 0.38$$

$$+ \frac{11}{.38} = +0.29$$

$$\Delta n = +0.3$$

5046

Known Center

18

Conditional Equations

	a	b	c				0-c
1	-1.10	-1.85	+4.1	+30	+14	+44	-3
2	-0.10	-2.15	+10.5	+3	+16	+19	+86
3	+0.90	-1.96	+6.0	-25	+14	-11	+71
4	+1.65	-1.38	-3.4	-44	+10	-34	0
5	+2.12	-0.38	-1.76	-57	+3	-54	-122
6	+2.15	+0.00	-2.1	-58	0	-58	+37
7	+2.06	+0.62	-9.9	-55	5	-60	-39
8	+1.42	+1.62	+4.9	-38	+12	-50	+99
9	+0.90	+1.96	+3.1	-25	+14	-39	+70

$$+363 = -164$$

$$\text{Average} = 59$$

Normal Equations

$$+20.95 + 2.74 = -582$$

$$+ 2.74 + 20.41 = -227$$

$$- 2.74 - 0.36 = +76$$

$$+ 20.45 = -151$$

$$b = -7.4$$

$$+20.95 = -582 + 20 + 562$$

$$a = -26.8$$

$$\text{Angle measured} = 186^\circ \quad \text{Average } (0-c) = +11$$

$$\frac{pc}{m} = 0.38$$

$$+ \frac{11}{34} = +0.29$$

$$\Delta = +0.3$$

Red, ad locum app.

$$S = -6 \quad 01$$

$$H + \alpha \quad L \quad 33^\circ = 98^\circ 15'$$

H	17	51
α	12	42
α	19	30
$G + \alpha$	8	12 = 123°

$$l \cos S \quad 9.9976$$

$$i \quad 0.9107$$

$$(i) \quad 0.9083$$

$$l \cos(G + \alpha) \quad 9.7361$$

$$g \quad 1.0239$$

$$\sin \dots \quad 9.9236$$

$$\tan S \quad 9.0232$$

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

$$l \sin S \quad 9.0208$$

$$\cos(H + \alpha) \quad 9.1568$$

$$h \quad 1.2737$$

$$\sin \dots \quad 9.9955$$

$$\sec S \quad 0.0024$$

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

$$g' \quad 0.7600$$

$$g \quad 8.7946$$

$$h' \quad 9.4513$$

$$h \quad 0.0955$$

$$b \quad +0.62$$

$$g \quad -0.06$$

$$n \quad +1.25$$

$$+1.81$$

$$g' \quad -5.76$$

$$h' \quad +0.28$$

$$i \quad -8.10$$

$$-13.58$$

30 46

Moon's Mean Position (1913.0)

19

$$X_0 = 20.1030 \checkmark$$

$$Y_0 = 18.3830 \checkmark$$

$$2a = -13 \checkmark$$

$$2b = 4 \checkmark$$

$$20.1017 \checkmark$$

$$18.3826 \checkmark$$

$$\text{Hayn} (20.1018)$$

$$(18.3832)$$

$$\text{From Plate Constants } X = 20.8679 \checkmark \quad Y = 17.5282 \checkmark$$

$$(20.8680)$$

$$(17.5288)$$

$$\xi = +2.8679 \checkmark \quad (+2.8680) \quad \eta = -4.4778 \checkmark \quad (-4.4772)$$

$$\log \xi = 0.45757 \checkmark \quad (0.45758) \quad \log \tan \delta = 9.0216 \checkmark$$

$$\dots 9.99760$$

$$0.9151 \checkmark$$

$$\dots 8.50724$$

$$7.0534$$

$$6.9901$$

$$\dots (\alpha - A) \quad 1.95273 \checkmark \quad (1.95274)$$

$$\alpha - A \quad + \quad 1 \quad 29.69 \checkmark \quad (29.69)$$

$$\eta_1 = -10 \checkmark$$

$$A \quad 12 \quad 40 \quad 26 \checkmark$$

$$\eta_0 = -44708 \checkmark \quad (-44702)$$

$$X_0 = 12 \quad 41 \quad 55.69 \checkmark$$

$$\log \xi_0 = 0.65038 \checkmark \quad (0.65033)$$

$$7.33115$$

$$\text{Red} = \quad + 1.81 \checkmark$$

$$\dots (\delta - D) \quad 3.31923 \checkmark \quad (3.31918)$$

$$\alpha' = 12 \quad 41 \quad 57.50 \checkmark$$

$$\delta - D = -34 \quad 45.6 \checkmark$$

$$(45.4)$$

$$D = -5 \quad 26 \quad 34 \checkmark$$

$$S_0 = -6 \quad 01 \quad 19.6 \checkmark \quad (19.4)$$

$$\text{Red} = \quad -13.6 \checkmark$$

$$\delta = -6 \quad 01 \quad 33.2 \checkmark$$

$$(33.0)$$

3046

Luvon's Mean Position (1913:0)

17

$$X_0 = 20.1030$$

$$Y_0 = 18.3830$$

$$\Delta\alpha = -13$$

$$\Delta\delta = -4$$

$$20.1017$$

$$18.3826$$

From Plate Constants $X = 20.8679$ $Y = 17.5282$

$$Z = +2.8679$$

$$\eta = -4.4778$$

$$\log Z = 0.45757$$

$$\log S = 9.99760$$

$$\log \dots = 8.50724$$

$$(\alpha - \delta) = 1.95273$$

$$\alpha - \delta = +1.2969$$

$$A = 12.40.26$$

$$X_0 = 12.41.55.69$$

$$Red = +1.81$$

$$\alpha = 12.41.57.50$$

$$\log \tan S = 9.0216$$

$$0.9551$$

$$7.0539$$

$$6.9901$$

$$\eta_1 = -10$$

$$\eta_0 = -4.4708$$

$$\log \eta_0 = 0.65038$$

$$7.33115$$

$$(\delta - \eta) = 3.31923$$

$$\delta - \eta = -34.45.6$$

$$D = -5.26.34$$

$$S_0 = -6.01.19.6$$

$$Red = -13.6$$

$$\delta = -6.01.33.2$$

3046

Lunar Parallax

$$\begin{array}{r} \alpha' = 12^h 41^m 57.50^s \\ \delta = 11^\circ 39' 44.3'' \\ \delta - \alpha = -1^\circ 02' 13.2'' \\ = -1^\circ 5' 33' 18'' \end{array}$$

$$- \quad \quad \quad 6 \quad 03''$$

$$- 15 \quad 27 \quad 15''$$

$$\begin{array}{r} 9.95727 \\ 0.00000 \\ 0.01599 \\ \hline 9.97326 \end{array}$$

$$\delta = 43 \quad 14 \quad 14''$$

$$- 6 \quad \quad \quad 1 \quad 33''$$

$$49 \quad 15 \quad 47''$$

$$\begin{array}{r} 9.82640 \\ 8.24677 \\ 9.87951 \\ 0.16430 \\ \hline 8.11698 \end{array}$$

$$\delta - \delta' = +45 \quad 00.3''$$

$$\delta = -5 \quad 16 \quad 32.9'' (327) \quad \alpha = 12 \quad 41 \quad 09.14''$$

$$\text{Ant. Acc. } \delta = -5 \quad 16 \quad 25.0''$$

$$\alpha = 12 \quad 41 \quad 08.33''$$

O-C

$$- 7.9''$$

$$+ 0.81''$$

with Haug's correction (- 7.7)

$$(+ 0.81'')$$

$$\delta' = -6^\circ 01' 33.2'' (33.0) \quad 20$$

$$\pi = 60' 41.04''$$

$$9.86913''$$

$$8.24677''$$

$$9.42840''$$

$$0.00184''$$

$$\hline 7.54614''$$

$$\delta - \delta' = -12' 05.38''$$

$$- 48.536''$$

Lunar Parallax

$$\begin{array}{r}
 3046 \\
 \alpha = 12^\circ 41' 57.50'' \\
 \delta = 11^\circ 39' 44.3'' \\
 G - \alpha = -1^\circ 02' 13.2'' \\
 \therefore \quad \quad -15^\circ 33' 18''
 \end{array}$$

$$- \quad \quad \quad 6 \quad 0.3$$

$$-15 \quad 27 \quad 15$$

$$\begin{array}{r}
 995727 \\
 000000 \\
 001599 \\
 \hline
 997326
 \end{array}$$

$$\delta = 43 \quad 14 \quad 14$$

$$- \quad 6 \quad 1 \quad 33$$

$$49 \quad 15 \quad 47$$

$$\begin{array}{r}
 982640 \\
 824677 \\
 987951 \\
 016430 \\
 \hline
 811698
 \end{array}$$

$$\delta - \delta = +45 \quad 00.3$$

$$\delta = -5 \quad 16 \quad 32.9$$

$$\text{Lunar Parallax } \delta = -5 \quad 16 \quad 25.0$$

$$G - \delta = -7.9$$

$$\delta' = -6^\circ 01' 33.2''$$

$$\pi = 60' 41.04''$$

$$9.86913$$

$$824677$$

$$942840$$

$$000184$$

$$754614$$

$$\alpha - \alpha' = -12^\circ 05' 38''$$

$$-48.36$$

$$\alpha = 12 \quad 41 \quad 09.14$$

$$\alpha = 12 \quad 41 \quad 08.33$$

$$+0.81$$

14
2
17
3
17
6
23

1913 Apr. 17
3189

Star Measures

1914 Apr. 8.

21

α	δ	α	δ	α	δ	α	δ
1	16591	17741	17479	19420			
14.7	14560	977875	1465149	1223439			
20.2	50	70	4049	3539			
	00	56	89	21			
	30.2040	2021	14.7165	7185			
2	15829	18717	16259	17850			
17.7	14599	994141	1476769	932520			
9.2	9099	4041	68	2520			
	27	21	63	59			
	9.1233	1220	17.8508	8535			
3	15620	17449	15220	17481			
30.5	7454	1561214	1061004	1208980			
17.8	62	12	99	81			
	19	60	10	78			
	29.8160	8162	30.5389	5397			

Grade 3.

Additional Stars

6.6	19859	17719	18469	18481
23.6	1395254	1363030	1429599	1214350
	58	29	00	51
	56	14	79	86
	23.5902	5916	6.6325	6336

913 Apr 17
3189

Star measures

1914 Apr 8

21

d		v		d		v	
1	16591	17741		17479	19420		
147	14560 ₅₀	977875		1465149	1223939		
302	50	70		4049	3539		
	00	56		89	21		
	<u>30.2040</u>	<u>2021</u>		<u>14.7165</u>	<u>7185</u>		
2	15829	18717		16259	17850		
177	14599	994141		1476769	932520		
92	9099	40		68	2520		
	27	21		63	59		
	<u>9.1233</u>	<u>1220</u>		<u>17.8508</u>	<u>8535</u>		
3	15620	17449		15220	17481		
505	7454 ₆₂	1561214		1061009	1208980		
178	62	12		99	81		
	19	60		10	78		
	<u>17.8160</u>	<u>8162</u>		<u>30.5389</u>	<u>5397</u>		

Grade 3.

3189 Moon - Measures

22

	cl	y	v	d	n
1	scratch				
18.4	10150	14939	15152	20111	
16.1	9155 ⁶²	48 ⁵³	9038 ³⁰	16256 ¹⁰	
	48	13929	21	48	
			59	11	
	<u>16.0995</u>	<u>.1018</u>	<u>18.3874</u>	<u>.3860</u>	

2	19831	19700		
18.0	16320	13189		
16.4	18 ⁰⁹	80 ⁹⁷		
	32	11		
	<u>16.3515</u>	<u>.3482</u>		

3	19983	15580
17.5	14440 ³⁵	11109 ³⁰
17.0	30	21
	79	91
	<u>17.4454</u>	<u>.4465</u>

4	20003	15439
17.2	11850	13599 ⁹⁵
18.0	39 ⁴⁸	90
min	11	39
in		<u>.1844</u>
x	<u>17.1837</u>	

5	18941	16169
17.5	13111 ⁹⁹	11991 ⁸¹
18.0	00	78
	49	60
	<u>17.4157</u>	<u>.4182</u>

6	19165	19591
18.0	12005 ⁹⁵	11758 ⁶²
19.7	03	70
	80	09
	<u>19.7175</u>	<u>.7167</u>

3189 moon measures

22

$\begin{array}{c} \text{d} \\ \text{4} \end{array}$
 $\begin{array}{c} \text{N} \\ \text{N} \end{array}$
 $\begin{array}{c} \text{d} \\ \text{N} \end{array}$

Scratch

$$\begin{array}{r}
 184 \quad 10150 \\
 161 \quad 9155 \\
 \quad \quad 4862 \\
 \hline
 160995
 \end{array}$$

$$\begin{array}{r}
 14939 \\
 \quad \quad 453 \\
 \hline
 13929
 \end{array}$$

$$\begin{array}{r}
 15152 \\
 903830 \\
 \quad \quad 21 \\
 \quad \quad 59 \\
 \hline
 183874
 \end{array}$$

$$\begin{array}{r}
 20111 \\
 1625610 \\
 \quad \quad 48 \\
 \quad \quad 11 \\
 \hline
 3860
 \end{array}$$

$$\begin{array}{r}
 2 \quad 19831 \\
 180 \quad 16320 \\
 164 \quad 1809 \\
 \quad \quad 32 \\
 \hline
 163515
 \end{array}$$

$$\begin{array}{r}
 19700 \\
 13189 \\
 \quad \quad 8097 \\
 \quad \quad 11 \\
 \hline
 3482
 \end{array}$$

$$\begin{array}{r}
 3 \\
 175 \\
 170
 \end{array}$$

$$\begin{array}{r}
 19983 \\
 1444035 \\
 \quad \quad 30 \\
 \quad \quad 79 \\
 \hline
 174454
 \end{array}$$

$$\begin{array}{r}
 15580 \\
 1110930 \\
 \quad \quad 21 \\
 \quad \quad 91 \\
 \hline
 4465
 \end{array}$$

$$\begin{array}{r}
 4 \\
 172 \\
 180 \\
 170
 \end{array}$$

$$\begin{array}{r}
 20003 \\
 11850 \\
 \quad \quad 3948 \\
 \quad \quad 11 \\
 \hline
 171837
 \end{array}$$

$$\begin{array}{r}
 15439 \\
 1359995 \\
 \quad \quad 90 \\
 \quad \quad 39 \\
 \hline
 1844
 \end{array}$$

$$\begin{array}{r}
 5 \\
 175 \\
 180
 \end{array}$$

$$\begin{array}{r}
 18941 \\
 1311199 \\
 \quad \quad 00 \\
 \quad \quad 49 \\
 \hline
 174157
 \end{array}$$

$$\begin{array}{r}
 16169 \\
 1199181 \\
 \quad \quad 78 \\
 \quad \quad 60 \\
 \hline
 4182
 \end{array}$$

$$\begin{array}{r}
 6 \\
 180 \quad 19165 \\
 197 \quad 12005 \\
 \quad \quad 0395 \\
 \quad \quad 80 \\
 \hline
 197175
 \end{array}$$

$$\begin{array}{r}
 19591 \\
 1175862 \\
 \quad \quad 70 \\
 \quad \quad 09 \\
 \hline
 7167
 \end{array}$$

3189 Moon Measures.

d

4

u

d 70

u

$\frac{7}{18771}$
 19.0 1725877
 20.2 6765
 85
20.1506

$\frac{1}{5131}$
 6621
 112
 39
1477

$\frac{8}{17758}$
 193 1593430
 202 33
 max 70
20.1828

$\frac{1}{6150}$
 79558
 59
 88
1787

$\frac{9}{14590}$
 20.0 1386162
 20.1 60

$\frac{1}{2834}$
 21
 12111

20.07290717

not very clear image of Moon.

3189	Times etc.					24
Exp. tables	1913 Apr. 17	11 ^h 55 ^m			- 12 ^h 07 ^m	
.. Moon		12 01	07.9	-	12 01 08.3	
Clock fast		1	05.9			
H. Sid. T.		12 00	02.2		$\Theta - \alpha = +0^{\circ} 36' 25''$	
Whony		4 44	31.05			
G. Sid. T.		16 44	33.25			
Sid. T. in Moon		1 40	02.02			
Interval		15 04	31.23			
Reduction		2	28.18			
G. M. T.		15 02	03.05			

Journ. hant. Alen		K. A		bleed	
Moon 15 ^m	1 1	23 32.11	+ 5	15	49.5
Motion in 1 ^m = 2.1738				17 446	
.. 2.0508		+ 4.46		-	35.8
Tabular place	1 1	23 36.57	+ 5	15	43.7

Moon's age 11 days

134 = 12.4	parallax	60'	21.12
488 = 13.9	semidiameter	16	28.2
	R		988.2
	Augmentation		+ 13.9
	Irradiation (3)		- 0.7
	R		1001.4
	R		2.1466
$\alpha - + 0.2$	(1 + a) R		
	R ²		4.6079

3189

Taurus etc.

24

Exp. time 1913 Apr 17 $11^h 55^m - 12^h 07^m$
 Moon $12^h 01^m 07.9 - 12^h 01^m 08.3$
 Clock time $1^h 05.9$

H. West $12^h 00^m 02.2 \quad \Theta - \lambda = +0^h 36^m 21^s$
 Henry $4^h 44^m 31.05$
 G. West $16^h 44^m 33.25$
 Star in Moon $1^h 40^m 02.02$
 Interval $15^m 04^s 31.23$
 Reduction $2^m 28.18$
 G. W. T. $15^m 02^s 03.05$

Ironpoint Obs.

K A

Block

Moon $11^h 11^m 23^s 32.11 + 5^m 15^s 49.5^s$
 Motion in $1^m = 2.1738$ 17.446
 $2.0598 + 4.46 - 35.8$
 Tabular place $11^h 23^m 36.57 + 5^m 15^s 13.7$

Moon's age 11 days.

parallax $60' 21.12$
 semidiam $16' 28.2$

 934 ± 12.4 958 ± 13.9

Augmentation

Irradiation (3)

R

R

 $a = +0.2$ $(1+a)R$ R^2

9882

+139

-07

10014

21466

46079

$$\begin{array}{r} 6.6320 \\ 23.5909 \end{array}$$

$$+ 6.63 + 23.59 + 1 =$$

$$\begin{array}{r} 4 - 2 \\ + 3 \\ + 6 \\ - 8 \end{array}$$

$$\begin{array}{r} 26-3-14.44 \\ + 312-390 \\ + 416-435 \\ + 119-131 \\ + 241-257 \\ 19.3306-260 \end{array} \quad \begin{array}{r} - 28-3 \\ - 19-7 \\ - 17-9 \\ - 16-15 \\ - 10 \end{array} \quad \begin{array}{r} + 29 \\ - 31 \\ - 26 \\ - 26 \\ - 31 \\ - 10 \end{array} \quad \begin{array}{r} = -2 \\ = +3 \\ = +3 \\ = -2 \\ = 19.3065 \end{array}$$

$$\begin{array}{r} 4-7+17.82 \\ + 165+118 \\ + 22+262 \\ - 9+318 \\ - 254+543 \\ 18.0314+344 \end{array} \quad \begin{array}{r} + 1.29 \\ + 283+28 \\ + 284+36 \\ + 309+11 \\ + 289+21 \\ + 21 \end{array} \quad \begin{array}{r} - 315 \\ - 4 \\ + 5 \\ + 5 \\ - 5 \end{array} \quad \begin{array}{r} = 18.0364 \end{array}$$

3189

Plate Constants

25

x	y	R.A.	Decl.
14.7175	30.2030	11 ^h 20 ^m 42 ^s	+6 13 05
17.8522	9.1226	22 21	3 29 15
30.5393	17.8161	28 56	4 36 54
6311	57.14	70 119	113 78 74
21.04	19.05	11 24 00	+4 46 25
-18	-22	- 1 34	+ 22 55
304	295	11 22 26	+5 09 20
31	466 $\frac{1}{2}$		
94 ^s	1375 ^s		

Center of Plate $\left\{ \begin{array}{l} A = 11^h 22^m 26^s \\ D = +5^{\circ} 09' 20'' \end{array} \right.$

$$\begin{array}{rclcl}
 x-3 & -14.44 & -22 & +22 & \\
 +416 & -435 & -19-3 & -22 & = 0 \\
 +114 & -131 & -17-4 & -21 & = +1 \\
 +241 & -257 & -16-6 & -22 & = 0 \\
 19.3306 & -260 & -4 & & = 19.3064 \checkmark
 \end{array}$$

$$\begin{array}{rclcl}
 y-m & +18.32 & +1.24 & +14 & -329 \\
 +22 & +269 & +291 & +36 & = +327 +3 +330 = +1 \\
 -9 & +327 & +318 & +11 & = +329 +1 +330 = +1 \\
 -254 & +559 & +305 & +21 & = +326 +2 +328 = -1 \\
 18.0314 & +354 & +27 & +2 & = 18.0362 \checkmark
 \end{array}$$

Tables $a: +0.7$ $e: -1.5$ $a-e: +2.2$ $b+d: -0.8$
~~Obs. $a: +0.2$ $e: +1.3$ $a-e: +1.5$ $b+d: -3.9$~~
 Obs $a: +0.5$ $e: -1.2$ $a-e: +1.7$ $b+d: -3.4$

3189

Plate Constant

25

2	4	K.A	Decl.
14.71 75	30.20 30	11 20 42	+6 13 05
17.85 22	9.12 26	22 21	3 29 15
30.53 93	17.81 61	28 56	4 36 54
<u>16311</u>	<u>5714</u>	<u>70 119</u>	<u>113 78 74</u>
21.04	19.05	11 24 00	+4 46 25
18	22	- 1 34	+ 22 55
304	295	11 22 26	+5 09 20
31	4662		
94	1375		

Center of
Plate $\left\{ \begin{array}{l} A = 11^h 22^m 26^s \\ B = +5^{\circ} 09' 20'' \end{array} \right.$

$$\begin{array}{rclcl}
 x-3 & -1444 & -22 & +22 & \\
 +416 & -435 & -19-3 & -22 & = 0 \\
 +114 & -131 & -17-4 & -21 & = +1 \\
 +241 & -257 & -16-6 & -22 & = 0 \\
 193306 & -260 & -4 & & = 193064
 \end{array}$$

$$\begin{array}{rclcl}
 y-2 & +1832 & +124 & +14 & -329 \\
 +22 & +2692 & +291 & +36 & = +327+3+330 = +1 \\
 -9 & +327 & +318 & +11 & = +329+1+330 = +1 \\
 -254 & +559 & +305 & +21 & = +326+2+328 = -1 \\
 180319 & +354 & +28 & +2 & = 180362
 \end{array}$$

Tables a: +0.7 e: -1.5 a-e: +2.2 b+d: -0.8
 b: a: +0.2 e: -1.3 a-e: +1.5 b+a: -3.9

Cape No. 15-38 mag 8.4

11" 15" 49^s 77

81

80

11 15 49.79

+40.25

Q 11 16 30.04

A 11 22 26

- 5 55.96

- 355.92

255135m

999810

105669m

- 11.3945

- 37

6.6018

6.6320

+ 312

+ 5 25 43.6

443

438

+ 5 25 43.9

- 4 15.9

S + 5 21 28.0

D + 5 09 20

+ 12 08.0

+ 728.0

2.86213

0.19328

8.9721

21134

8.1389

+ 1.5606

+ 138

23.5744

23.590.9

+ 165

Standard and Coordinate Comparison Star												26
3189 Cape W. 1552mg8.2				Cape W. 1555mg6.3				Cape W. 1572mg9.2				
C	11 ^h	20 ^m	01 ^s 71 ^v	11 ^h	21 ^m	41 ^s 52 ^v	11 ^h	28 ^m	16 ^s 27 ^v			
L			87			51			30			
E			71			64			19			
mean	11	20	01.76	11	21	41.56	11	28	16.25			
Pre		+	40.27 ^v		+	39.48		+	40.13 ^v			
X	11	20	42.03	11	22	21.04	11	28	56.38			
A	11	22	26	11	22	26	11	22	26			
A-A	-	1	43.97	-		04.96		+	6 30.38			
ln(A-A)	-		103.97	-		04.96			+390.33			
log			201.691 ^m			0.69548 ^m			2.59143			
cos			9.99744			9.99920			9.99859			
3.			0.52159 ^m			9.20192 ^m			1.09726			
3.			-3.3235			-0.1592			+12.5100			
3.			- 6			0			+ 52			
3			14.6759			17.8408			30.5152			
3			14.7175			17.8522			30.5393			
3-3			+ 416			+114			+241			
C	+6 ^o	17'	21.2 ^v	+3 ^o	33'	29.1 ^v	+4 ^o	41'	11.5 ^v			
L			21.2			30.3			11.8			
E			21.4			28.8			11.8			
mean +6		17	21.3	+3	33	29.4	+4	41	11.7			
Pre	-	4	16.7	-	4	14.5	-	4	18.2			
S	+6	13	04.6	+3	29	14.9	+4	36	53.5			
D	+5	09	20	+5	09	20	+5	09	20			
S-D	+1	03	44.6	-1	40	05.1	-	32	2.65 ^v			
ln(S-D)			+3825.0			-6006.8			-1946.6 ^v			
log			3.58263			3.77865 ^m			3.28928 ^m			
70			0.91378			1.10980 ^m			0.62043 ^m			
tan5			9.0372			8.7848			8.9069 ^v			
5 ²			10432			84038			21945 ^v			
71			7.1338			4.2420			8.1548			
70			+8.1994			-12.8765			-4.1728 ^v			
71			+ 14			0			+ 143 ^v			
7			30.2008			9.1235			17.8415 ^v			
7			30.2030			9.1226			17.8161 ^v			
7-7			+ 22			- 9			- 254			

Standard and Coordinate Comparison Star.												26
Cape W. 1552mg82. Capulus. 1555mg83. Cape W. 1572mg92												
C	11	20	01.71	11	21	41.52	11	28	16.27			
L			87			51			30			
E			71			64			19			
Mean	11	20	01.76	11	21	41.56	11	28	16.25			
Proc		+	40.27		+	39.48		+	40.13			
X	11	20	42.03	11	22	21.04	11	28	56.38			
A	11	22	26	11	22	26	11	22	26			
x-A	-	1	43.97	-		04.96		+	6	30.38		
w(A-A)	-		103.97	-		04.96			+390.33			
log			201.691~			0.69548~			259.143			
cos			999.744			999.920			999.859			
"3"			0521.59~			9201.92~			1097.26			
			-332.35			-0.1592			+1251.00			
			7			0			+32			
			14.6759			17.8408			30.5152			
			14.7175			17.8522			30.5393			
			+416			+114			+241			
C	+6°	17'	21.2	+3°	33'	29.1	+4°	41'	11.5			
L			21.2			30.3			11.8			
E			21.4			28.8			11.8			
Mean	+6	17	21.3	+3	33	29.4	+4	41	11.7			
Proc	-	4	16.7	-4		14.5	-4		18.2			
S	+6	13	04.6	+3	29	14.9	+4	36	53.5			
D	+5	09	20	+5	09	20	+5	09	20			
x-D	+1	03	44.6	-1	40	05.1	-	32	26.5			
W(A-D)			+382.50			-6006.8			-1946.6			
log			3.58263			3.77865~			3.28928~			
q ₀			0913.78			1109.80~			0.62043~			
tan			9.0372			8.7848			8.9069			
"2"			1043.2			8403.8			2194.5			
q ₁			7133.8			+4242.0			8154.8			
q ₀			+8.1994			-12.8765			-4.1728			
q ₁			+14			0			+143			
q ₂			30.2008			9.1235			17.8415			
q ₃			30.2030			9.1226			17.8161			
q ₄			+22			-9			-254			

	p	$p-c$			θ	Corr. Hayn	O
1	154.0	132.4	-0.3	+1.0	-1.0	-0.2	-18 +120
2	141.6	120.0	-0.4	+0.8	-0.9	+0.7	+64 -86
3	118.8	97.2	-0.4	+0.2	-0.3	-0.6	-55 +77
4	90.9	69.3	-0.4	-0.5	+0.4	-0.1	-9 +8
5	63.2	41.6	-0.3	-1.1	+1.1	+0.1	+9 -76
6	38.9	16.8	-0.1	-1.5	+1.7	+0.8	+74 +53
7	8.9	347.3	+0.1	-1.5	+1.9	-0.2	-18 -120
8	0.0	338.4	+0.2	-1.4	+1.9	+0.6	+55 +121
9	341.8	320.2	+0.3	-1.2	+1.8	-0.8	-74 +69

$$\lambda = -0.43$$

$$\beta = -1.52$$

$$C = 21.6$$

	p	$p-c$	$\lambda \sin(p-c)$	$\beta \cos(p-c)$	θ	Corr. Hayn	O	$O-c$
1	206.0	184.4	+0.0	+1.5	-1.2	-0.1	-9 +120	+129
2	218.4	196.8	+0.1	+1.4	-1.0	-0.4	-37 -86	-49
3	241.2	219.6	+0.3	+1.2	-0.6	+0.1	+9 +77	+68
4	270.0	248.4	+0.4	+0.6	+0.1	+0.4	+37 +8	-29
5	296.8	275.2	+0.4	-0.1	+0.8	-0.9	-83 -76	+7
6	321.6	300.0	+0.4	-0.8	+1.5	+0.4	+37 +53	+16
7	351.1	329.5	+0.2	-1.3	+1.8	-2.0	-124 -120	+64
8	0.0	338.4	+0.2	-1.4	+1.9	+0.7	+64 +121	+57
9	18.2	356.6	+0.0	-1.5	+1.8	0.0	0 +69	+69

Old ($O-c$)	Hayn	new ($O-c$)
+230	-9	+239
+13	-37	+50
+147	+9	+138
+24	+37	-8
-111	-83	-28
-24	+37	-61
-229	-124	-45
+8	+64	-56
-44	0	-44

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Incoos Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - 6$
1	18.3867	-0.9443	0.8917	4.6309	+ 230
2	18.0000	-1.3310	1.7716	4.6092	+ 13
3	17.4460	-1.8850	3.5532	4.6226	+ 147
4	17.1840	-2.1470	4.6096	4.6108	+ 29
5	17.4170	-1.9140	3.6634	4.5968	- 111
6	18.0000	-1.3310	1.7716	4.6055	- 29
7	19.0000	0.3310	0.1096	4.5850	- 229
8	19.3310	0.0000	0.0000	4.6087	+ 8
9	20.0000	+0.6690	0.4476	4.6035	- 44

Comp $R^2 = 4.6079$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.0006	-1.9334	-3	3.7392
2	16.3498	-1.6842	-3	2.8376
3	17.0000	-1.0340	-2	1.0694
4	18.0000	-0.0340	-0	0.0012
5	19.0000	+0.9660	+1	0.9334
6	19.7171	+1.6831	+3	2.8339
7	20.1492	+2.1152	+3	4.4754
8	20.1808	+2.1468	+3	4.6087
9	20.0723	+2.0383	+3	4.1559

Approx Center

$$x = 18.0 \quad y = 16.3498$$

$$19.7171$$

$$36.0669$$

$$y_0 = 18.0334$$

$$y_{\text{max}} = 20.1808$$

$$R = 2.1474$$

$$x_{\text{min}} = 17.1840$$

$$x_0 = 19.3314$$

$$\text{Center} \begin{cases} y_0 = 19.3310 \\ x_0 = 18.0340 \end{cases}$$

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Innovis Center

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	x	y	$x - x_0$	$(x - x_0)(y - y_0)$	$y - y_0$
1	18.3867	-0.9443	0.8917	4.6309	+2.30
2	18.0000	-1.3310	1.7716	4.6092	+1.3
3	17.4460	-1.8850	3.5532	4.6226	+1.47
4	17.1840	-2.1470	4.6096	4.6108	+2.9
5	17.4170	-1.9140	3.6634	4.5968	-1.11
6	18.0000	-1.3310	1.7716	4.6055	-2.9
7	19.0000	-0.3310	0.1096	4.5850	-2.29
8	19.3310	0.0000	0.0000	4.6087	+8
9	20.0000	+0.6690	0.4476	4.6035	-4.4

Comp R^2 4.6079

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.0006	-1.9334	-3	3.7392
2	16.3498	-1.6842	-3	2.8376
3	17.0000	-1.0340	-2	1.0694
4	18.0000	-0.0340	-0	0.0012
5	19.0000	+0.9660	+1	0.9334
6	19.7171	+1.6831	+3	2.8339
7	20.1492	+2.1152	+3	4.4754
8	20.1808	+2.1468	+3	4.6087
9	20.0723	+2.0383	+3	4.1559

Approx Center

$$x = 18.0 \quad y = 16.3498$$

$$19.7171$$

$$36.0669$$

$$y_0 = 18.0334$$

$$y_{\text{max}} = 20.1808$$

$$R = 2.1474$$

$$x_{\text{min}} = 17.1840$$

$$x_0 = 19.3314$$

$$\text{Center} \begin{cases} x_0 = 19.3310 \\ y_0 = 18.0340 \end{cases}$$

Formation of comets

	wb	an	bn	an
1	+ 1.81	- 216.2	- 444.0	- 224.5 - 461.0
2	+ 2.23	- 17.3	- 21.8	- 66.5 - 84.0
3	+ 1.95	- 277.8	- 151.5	- 260.8 - 142.0
4	+ 0.06	- 62.4	- 0.9	+ 17.2 + 0.2
5	- 1.85	+ 212.0	- 107.6	+ 53.5 - 27.2
6	- 2.23	+ 31.9	- 40.4	+ 81.2 - 102.8
7	- 0.70	+ 75.5	- 485.0	+ 14.7 - 95.5
8	+ 0.00	+ 0.0	+ 17.2	- 0.0 - 120.0
9	+ 1.37	- 29.5	- 89.8	- 29.4 - 89.9
	+ 2.64	- 283.8	- 1323.8	- 414.6 - 1122.2

Residuals from Hays' correction

	O	L	O - L
1	+ 239	+ 17 + 84 = + 101	+ 138
2	+ 50	+ 24 + 73 = + 97	- 47
3	+ 138	+ 34 + 45 = + 79	+ 59
4	- 8	+ 38 + 1 = + 39	- 47
5	- 28	+ 34 + 42 = + 76	- 20
6	- 61	+ 24 - 73 = - 49	- 12
7	- 45	+ 6 - 92 = - 86	+ 41
8	- 56	- 0 - 94 = - 94	+ 38
9	- 44	- 12 - 89 = - 101	+ 57
			+ 353 - 126
			Average = 51

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Moons Cauter

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Conditional Equations

	a	b	c		c	0-c
1	-0.94	-1.93	= +230	+ 8 + 102	= +110	+120
2	-1.33	-1.68	= +13	+11 + 88	= +99	-86
3	-1.89	-1.03	= +147	+16 + 54	= +70	+77
4	-2.15	-0.03	= +29	+19 + 2	= +21	+8
5	-1.91	+0.97	= -111	+16 - 51	= -35	-76
6	-1.33	+1.68	= -24	+11 - 88	= -77	+53
7	-0.33	+2.12	= -229	+3 - 112	= -109	-120
8	+0.00	+2.15	= +8	-0 - 113	= -113	+121
9	+0.67	+2.04	= -44	-6 - 107	= -113	+69
						+448 - 282

Average = 81

Normal Equations

$$+16.82 + 2.64 = -284 \quad \text{Harm} \quad (-415)$$

$$+ 2.64 + 24.65 = -1324 \quad (-1122)$$

$$- 2.64 - 0.41 = +45 \quad (+65)$$

$$+ 24.24 = -1279 \quad (-1057)$$

$$b = -52.7 \quad (-43.0)$$

$$+16.82 = -284 + 139 = -145$$

$$= (-415 + 115 = -300)$$

$$a = -8.6 \quad (-17.8)$$

$$\text{Arc measured} = 172 \quad \text{Average}(0-c) = +18.4$$

$$\frac{pc}{m} = 0.29$$

$$\frac{+18.4}{27} = +0.68 \quad \Delta n = +0.8$$

3189

Known Center
Conventional Equations

28

	L	b	O		L	O-L
1	-094	-193	+230	+ 8	+102	+110
2	-133	-168	+13	+11	+88	+99
3	-189	-103	+147	+16	+59	+70
4	-215	-003	+29	+19	+2	+21
5	-191	+097	-111	+16	-11	-35
6	-133	+168	-24	+11	-188	-77
7	-033	+212	-229	+3	-112	-109
8	+000	+215	+8	-0	-113	-113
9	+067	+204	-44	-6	-107	-113

+448 - 282

Average = 81

Normal Equations

$$+16.82 + 264 = -284$$

$$- 264 + 2465 = -1324$$

$$- 264 - 041 = -45$$

$$+ 24.24 = -1279$$

$$b = -52.7$$

$$+16.82 = -284 + 139 = -145$$

$$a = 86$$

$$\text{Ans. measured} = 172 \quad \text{Average } (O-L) = +184$$

$$\frac{p \sigma}{m} = 0.29$$

$$\frac{+184}{27} = +0.68 \quad \Delta = -0.8$$

3189 Red ad locum abh.

$$S = +4^{\circ} 38'$$

$$\begin{array}{rcl}
 H + \alpha & 3^{\circ} & 24^{\circ} = 51^{\circ} \\
 H & 16 & 01^{\circ} \\
 \alpha & 11 & 23^{\circ} \\
 a & 19 & 56^{\circ} \\
 G + \alpha & 7 & 19 = 109^{\circ} 45'
 \end{array}$$

$$\begin{array}{rcl}
 l \cos S & 9.9986 \\
 l & 0.8586^{\circ} \\
 \textcircled{L} & 0.8572^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 l \cos(G + \alpha) & 9.5288^{\circ} \\
 g & 1.0381^{\circ} \\
 \sin & 9.9737^{\circ} \\
 \tan S & 8.9087^{\circ} \\
 h & 8.8239^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 g' & 0.5669^{\circ} \\
 g & 8.7444^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 h & +0.81^{\circ} \\
 g & +0.06 \\
 h & +1.00 \\
 \hline
 & +1.87^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 l \sin S & 8.9073 \\
 \cos(H + \alpha) & 9.7989 \\
 h & 1.2822^{\circ} \\
 \sin & 9.8905^{\circ} \\
 \sec S & 0.0014^{\circ} \\
 h & 8.8239^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 h' & 9.9884 \\
 h & 9.9980
 \end{array}$$

$$\begin{array}{rcl}
 g' & -3.69 \\
 h' & +0.97 \\
 l & -7.20 \\
 \hline
 & -9.92^{\circ}
 \end{array}$$

3189 moon's mean Position (1913.0)

29

$$\begin{array}{r}
 x_0 = 19.3310^\circ \quad y_0 = 18.0340^\circ \\
 \begin{array}{r}
 -4^\circ \\
 \hline
 19.3306^\circ
 \end{array}
 \quad
 \begin{array}{r}
 -26^\circ \\
 \hline
 18.0314^\circ
 \end{array} \\
 \text{Hayn (19.3301)} \quad (18.0318)
 \end{array}$$

$$\begin{array}{l}
 \text{From plate constants } X = 19.3064^\circ \quad Y = 18.0362^\circ \\
 \quad \quad \quad (19.3059) \quad (18.0364) \\
 \bar{z} = +1.3064^\circ \quad (+1.3059) \quad \eta = -3.9638^\circ \quad (-3.9634)
 \end{array}$$

$$\begin{array}{l}
 \log \bar{z} = 0.11608^\circ \quad (11591) \quad \log \tan \delta = 8.9119^\circ \\
 \log S \quad 9.99857^\circ \quad \log \bar{z} \quad 0.2322^\circ \\
 \quad \quad 8.50724^\circ \quad \quad \quad 7.0539^\circ
 \end{array}$$

$$(x-A) = 1.61027^\circ \quad (1.61010) \quad 6.1975^\circ$$

$$\begin{array}{l}
 x-A \quad + \quad 40.76^\circ \quad (40.75) \quad \eta_1 = +1^\circ \\
 \eta_0 = -3.9639^\circ \quad (-3.9635)
 \end{array}$$

$$A \quad 11 \quad 22 \quad 26^\circ$$

$$\begin{array}{l}
 x_0 \quad 11 \quad 23 \quad 06.76^\circ \quad (06.75) \quad \log \eta_0 = 0.59812^\circ \quad (5989) \\
 \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 7.23115^\circ
 \end{array}$$

$$\text{Red} = +1.67^\circ \quad (3.26697)^\circ \quad (3.26693)^\circ$$

$$\begin{array}{l}
 x' = 11 \quad 23 \quad 08.63^\circ \quad (08.62) \quad (d-D) = -30 \quad 49.1^\circ \quad (49.0)^\circ \\
 D = +5 \quad 09 \quad 20^\circ
 \end{array}$$

$$\begin{array}{l}
 S_0 = +4 \quad 38 \quad 30.9^\circ \quad (31.0)^\circ \\
 \text{Red} = -9.9^\circ
 \end{array}$$

$$\begin{array}{l}
 d' = +4 \quad 38 \quad 21.0^\circ \quad (21.1)^\circ
 \end{array}$$

3189 Unknown Mean Position (1913.0)

29

$$\begin{array}{r}
 X = 19.3310 \quad Y = 18.0340 \\
 \hline
 - 4 - 26 \\
 \hline
 19.3306 \quad 18.0314
 \end{array}$$

True Position at $X = 19.3064 \quad Y = 18.0362$

$$\Delta = +1.3064$$

$$\eta = -3.9638$$

$$\begin{array}{l}
 \log \Delta = 0.11608 \\
 \log \eta = 9.99257 \\
 8.10724
 \end{array}$$

$$\begin{array}{l}
 \log \tan \delta = 8.91119 \\
 0.2322 \\
 7.0534
 \end{array}$$

$$(W-A) = 1.61027$$

$$6.1975$$

$$\alpha - \alpha' = +40.76$$

$$\gamma_1 = +1$$

$$\gamma_2 = -3.9639$$

$$\Delta \quad 11 \quad 22 \quad 26$$

$$\alpha' \quad 11 \quad 23 \quad 06.76$$

$$\begin{array}{l}
 \log \gamma_2 = 0.59812 \\
 7.23115 \\
 3.26697
 \end{array}$$

$$\text{Red.} = +1.87$$

$$(\alpha - \alpha') = -30.491$$

$$\alpha' = 11 \quad 23 \quad 08.63$$

$$\delta = +5 \quad 09 \quad 20$$

$$\delta = +4 \quad 38 \quad 30.9$$

$$\text{Red.} = -9.9$$

$$\delta' = +4 \quad 38 \quad 21.0$$

3189

Lunar Parallax

 $\alpha' = 11^h$ $23^m 08^s 63^v$ (08.62) $\delta' = +4^\circ 38' 21'' 0$ (21.1) $\delta = 12$ $00 02 2^v$

$$+ 36 53.6^v$$

$$+ 9^0 13' 24''^v$$
 $\pi 60' 21'' 12^v$

$$+ 3 36$$

$$+ 9 09 48$$

$$9.95727^v$$

$$0.00000$$

$$0.00558^v$$

$$\underline{9.96285^v}$$

$$\delta - 42^\circ 33' 09''^v$$

$$4 38 21^v$$

$$37 54 48^v$$

$$9.82640^v$$

$$9.24439^v$$

$$9.78850^v$$

$$0.16988^v$$

$$\underline{8.02917^v}$$

$$\delta - \delta' = +36 460^v$$

$$\delta = +5 15 07.0^v (07.1) \alpha = 11 23 37.38$$

(37.37)

$$\text{Hartmann } \delta = +5 15 13.7^v$$

$$\alpha = 11 23 36.57^v$$
 $\alpha - \alpha'$ $- 6.7^v$

$$\text{With Hays Corrections } (-6.6)$$
 $+ 0.81^v$

$$(+ 0.80)$$

3189 Lunar Parallax

$$\alpha = 11^{\circ} 23' 08.63$$

$$\delta = 12^{\circ} 00' 06.2$$

$$+ 36 53.6$$

$$= 9^{\circ} 13' 24''$$

$$- 3 26$$

$$+ 9 09 48$$

$$995727$$

$$000000$$

$$000558$$

$$\hline 1.96285$$

$$\delta = 42^{\circ} 33' 07''$$

$$9 35 21$$

$$37 54 48$$

$$982640$$

$$+ 29439$$

$$978850$$

$$016988$$

$$\hline 1.02947$$

$$S-S = +36 46 0$$

$$\delta = 5 15 07.0$$

$$\text{Hantken } S = +5 15 13.7$$

$$0-0 = 6.7$$

$$S = 4^{\circ} 32' 21'' 0$$

$$IT 60 21 12$$

$$986913$$

$$824439$$

$$920489$$

$$000183$$

$$\hline 732024$$

$$\alpha - \alpha' = +7 11 19$$

$$+ 28 75$$

$$\alpha = 11 23 37.38$$

$$\alpha = 11 23 36.57$$

$$+ 0.81$$

