

KG
#1366
v. 908



1912phae.proj

PRINCETON UNIVERSITY OBSERVATORY
PRINCETON, N. J.
U. S. A.

Harvard Lunar Plates

Measures and Reductions

Mary Fowler.

Volume XXXII

Plate No.	Date	Page
1591	1912 Jan. 27	1
1598	1912 Jan 31	17

6
10
2

2
3
0

2
23
24

MC1591 Stan Measures. 1913 July 17

1

19444
10.5 1260504
23.6 05
38

23.6835

19.1 17430
9.7 980505
07
17

9.7644

14469
23.5 1429488
24.0 90

24.0178

15342
1077179
76
40

10.5434

19685
1034649
5049
81

19.0667

16810
1553739
40

23.8729

bracket 3

MIC 1591 Stan Measures. 1913 July 19

$\begin{array}{r}
 19449 \\
 05 \quad 1260504 \\
 36 \quad 05 \\
 \quad 38 \\
 \hline
 236835
 \end{array}$

$\begin{array}{r}
 11 \quad 17430 \\
 17 \quad 980505 \\
 \quad 07 \\
 \quad 17 \\
 \hline
 957644
 \end{array}$

$\begin{array}{r}
 3 \quad 14469 \\
 238 \quad 1429488 \\
 40 \quad 90
 \end{array}$

24.0178

$\begin{array}{r}
 15342 \\
 1077179 \\
 \quad 76 \\
 \quad 40 \\
 \hline
 105434
 \end{array}$

$\begin{array}{r}
 19685 \\
 10346 \\
 \quad 5049 \\
 \quad 81 \\
 \hline
 190667
 \end{array}$

$\begin{array}{r}
 16810 \\
 1553739 \\
 \quad 40
 \end{array}$

23.8729

Grade 3

MC1591

1913 July

2.

Moon Measures

d 4

d 2

v.

$\frac{1}{19.5}$ 18732
 209 1547586
 min 95
 30
 $\frac{1}{2}$ 20.3246

possibly on
terminator

2 19.0 18760
 20.5 1510896
 00
 50
20.3655

$\frac{3}{18.0}$ 17801
 20.8 906070
 61
 90
20.8727

$\frac{4}{17.8}$
 21.0

$\frac{5}{17.4}$
 22.0

$\frac{6}{17.4}$
 22.5
 min
 26

19026
 1672534
 30
 00
17.8717

17958
 1163020
 25
 50
17.3672

16913
 1021113
 10
 10
17.3300

MC1591

1913 July

2.

Moon Measures

d 4

d 2

2

1 18732
 195 1547586
 204 91
 30
 203246

possibly on terminator

2 18760
 195 1510896
 204 00
 50
 203655

3 18701
 195 906070
 204 61
 90
 205727

4 178
 210

19026
 1672534
 30
 00

177717

17958
 1163020
 25
 50

173672

16913
 1021113
 10
 10

173300

5 174
 220

6 174
 220
 20

AAC 1591 : moon-measures.

1913 July 19.

$$\begin{array}{r} 2 \\ 17.5 \\ 23.0 \end{array}$$

$$\begin{array}{r} 15880 \\ 1006571 \\ 6271 \\ 70 \\ \hline 17.4192 \end{array}$$

$$\begin{array}{r} 8 \\ 18.0 \\ 23.4 \end{array} \quad \begin{array}{r} 993230 \\ 32 \\ 9178 \end{array}$$

$$\underline{239247}$$

$$\begin{array}{r} 9 \\ 18.1 \\ 24.0 \end{array}$$

$$\begin{array}{r} 167370 \\ 70 \\ 8743 \\ \hline 18.0928 \end{array}$$

17C 1591 4 moon-measures

1913 July 19

3

$$\begin{array}{r} 2 \\ 175 \\ \hline 230 \end{array}$$

$$\begin{array}{r} d \\ 15880 \\ 1006571 \\ 6271 \\ 70 \\ \hline 174192 \end{array}$$

$$\begin{array}{r} 8 \\ 180 \\ \hline 279 \end{array} \quad \begin{array}{r} 993230 \\ 32 \\ \hline 9178 \end{array}$$

$$\underline{239247}$$

$$\begin{array}{r} 9 \\ 181 \\ \hline 240 \end{array}$$

$$\begin{array}{r} 967370 \\ 70 \\ \hline 8743 \\ \hline 180928 \end{array}$$

1
10
2

2
19
9

2
2
2

MC1591

1913 Sept. 15

1

Star - measures.

g

 $\frac{1}{10.5}$
 $\frac{23.7}{23.7}$

d
 16320
 9480
 80 88
 35
23.6847

 $\frac{2}{19.1}$

9.8 15000
 7375
 77 75
 92
9.7618

 $\frac{3}{23.9}$

24.0 8500
 8405 08
 2020
24.0177

16948
~~19325~~
~~13503~~ 00
~~7896~~
 90
 65
.6833

18962
 16570
 80 67
 66
7609

1299293
 9093
 12812
.0180

d
 18178
 13603 00
 00 00
 78
10.5423

1058809
 9199
 9943
19.0653

15090
 13810 09
 11
 96
23.8719

d
 17621
 1216664
 6864
 09
.5449

15910
 1524340
 3840
 08
.0670

18888
 1015250
 5050
 87
.8735

grade 3

MC1591

1913 Sept 15

1

Star - measures

g

x

 $\frac{1}{105}$
 237

d

16320

948088

80

35

2368472

191

98 15000

7375

77

92

976183

239

8580

240

840508

2020

240177

16968

193218

~~1380500~~~~7896~~

92

65

.6833

18962

16570

8067

66

7609

1299293

9093

12812

.0180

d

18178

1360300

00

78

10.5423

1058804

9199

9943

190653

15090

1381009

11

96

23.8719

d

17621

1216664

68

09

.5449

15910

1524340

3840

08

.0670

18888

1015250

5550

87

.8735

MC1591 known measures.

1913 Sept. 15.

2

d	h	m	s	d	h	m	s
1	18	38	0	1	18	30	2
19.5	15	11	0	11	56	0	50
20.4		13	14		50	50	
min		80			05		
2	20.32	68		32	49		
3	18	39	8	16	57	3	
19.0	14	73	2	10	23	0	24
20.5		30	30		22	24	
		10			70		
	20.36	72		36	54		
4	18	43	8	16	52	5	
20.8	87	18	30	15	21	4	20
		30			20		
		42			28		
	20.87	16		86	94		

possibly in terminator

4
17.8
21.0

5
17.4
22.0

6
17.4
22.5
min
26

17400	16649
1624840	788585
5040	0385
00	40
17.8746	8747
15433	16700
908500	12999
92	2011
26	00
17.3663	3690
15390	16715
8695	12385
9990	2090
96	10
173301	3324

MC1591 known measures

1913 Sept 15

2

d		d	
1	18380	1	18302
195	15110	195	1156050
204	1314	204	5050
mm	80	mm	05
in	<u>20.3268</u>	in	<u>3249</u>
4		4	
2	18398	2	16573
190	1473230	190	1023024
25	3030	25	224
	10		70
	<u>20.3672</u>		<u>3654</u>
3		3	
180	17438	180	16525
25	871830	25	1521420
	3030		20
	42		28
	<u>20.8716</u>		<u>8694</u>

possibly in terminator

4
178
210

5
174
220

6
174
225
mm
26

17400	16649
1624840	789585
5040	0385
00	40
<u>17.8746</u>	<u>8747</u>
15433	16700
908500	12999
92	2011
20	00
<u>17.3663</u>	<u>3690</u>
15390	16715
8695	1238590
9990	9090
96	10
<u>173301</u>	<u>3324</u>

2
17
23

8
18
23

9
18
20

MC1591 Moon measures.

1913 Sept 15. 3

$$\begin{array}{r} 2 \\ 17.5 \\ 23.0 \end{array}$$

$$\begin{array}{r} 8 \\ 18.0 \\ 23.9 \end{array}$$

$$\begin{array}{r} 9 \\ 18.1 \\ 24.0 \end{array}$$

$$\begin{array}{r} 888080 \\ 75-80 \\ 8132 \end{array}$$
239254

$$\begin{array}{r} 10064 \\ 931813 \\ 11 \end{array}$$
.9250

$$\begin{array}{r} 14360 \\ 856059 \\ 63 \\ 56 \end{array}$$
17.4203

$$\begin{array}{r} 8063 \\ 5977 \\ 7165 \\ 7 \end{array}$$
18.0901

$$\begin{array}{r} 15741 \\ 11502 \\ 1009 \\ 35 \end{array}$$
.4231

$$\begin{array}{r} 11175 \\ 1028558 \\ 60 \end{array}$$
.0907

VIC 1591 known-measures

1913 Sept 15-3

d
2
175
230

8
18.0
239

9
18.1
24.0

888080
75-80
8132

239254

10064
9318
1113

9250

d
14360
856059
63
56
174203

8043
5987
7165
180901

d
15741
11502
1009
35
4231

11175
1028558
60
0907

M101591

1913 Sept. 22

4

Plate Constants

	1	2	
α	10.5436	19.0662	23.8727
δ	11.3259	19.9622	24.6558
$\alpha - \delta$	-7.823	-8.960	-7.831

μ	23.6840	9.7614	24.0178
δ	22.2343	8.3810	22.6807
$\mu - \delta$	+1.4497	+1.3804	+1.3371

$$\begin{aligned}
 \alpha - \delta &= -8.084 & +2.7x & & +.6y & & +9694 \\
 -7.823 - 19.14 &= -9.737 + 28 &= -9.709 + 14 &= -9.695 &= -1 \\
 -8.960 - 7.89 &= -9.749 + 51 &= -9.699 + 6 &= -9.693 &= +1 \\
 -7.831 - 19.41 &= -9.772 + 64 &= -9.708 + 14 &= -9.694 &= 0 \\
 19.4019 &- 1.810 & & +52 & +13 &= 20.1968
 \end{aligned}$$

$$\begin{aligned}
 \mu - \delta &+ 8.24x & +2y + 2x & & -1.5434 \\
 +1.4497 &+ 8.69 &= +1.5366 &+ 47 + 21 &= +1.5434 &= 0 \\
 +1.3804 &+ 1.571 &= +1.5375 &+ 20 + 38 &= +1.5433 &= -1 \\
 +1.3371 &+ 1.967 &= +1.5338 &+ 48 + 48 &= +1.5434 &= 0 \\
 22.3972 &+ 1.599 & & +45 + 39 & &= 21.0221
 \end{aligned}$$

Tabular	$a = 0.0$	$e = -0.3$	$a - e = +0.3$	$b + a = -2.0$
Observed	-2.7	-2.0	-0.7	-4.2

$$C - 0 \quad \quad \quad +1.0 \quad \quad \quad +2.2$$

1101591

1913 Sept 22

4

Plate Constants

1

2

z	10.5436	19.0662	23.8727
β	11.3259	19.9622	24.6558
$z - \beta$	-7.823	-8.960	-7.831

y	23.6840	9.7614	24.0178
z	22.2343	8.3810	22.6807
$y - z$	+1.4497	+1.3804	+1.3371

$x - \beta$	-8.084	+2.7x	+6y	+9699
-7.823	-1914	= -9737 + 28	= -9709 + 14	= -9695 = -1
-8.960	-789	= -9749 + 51	= -9699 + 6	= -9693 = +1
-7.831	-1941	= -9772 + 64	= -9708 + 14	= -9694 = 0
19.4019	-1810	= +52	+13	= 20.1968

$y - z$	+8.24x	+2y + 2x	-1.5434
+1.4497	+869	= +15366 + 47 + 21	= +1.5434 = 0
+1.3804	+1571	= +15375 + 20 + 38	= +1.5433 = -1
+1.3371	+1967	= +15338 + 48 + 48	= +1.5434 = 0
22.3972	+1599	+45 + 39	= 21.0221

Tabular	$a = 0.0$	$a = -0.3$	$a - c = +0.3$	$b + a = -2.0$
Observed	-2.7	-2.0	-0.7	-4.2

$C - 0$		+1.0	+2.2
---------	--	------	------

NIC 1591. Times etc. 1913 Sept 22. 5
 Expt. stars 1912 Jan 27 $5^h 18^m$ $\sim 5^h 30'$
 Moon $5^h 24^m 19.6^s - 5^h 24^m 19.0^s$
 Clock slow $1^s 25.1^s$

H. Sid T. $5^h 25^m 43.9^s$ $\theta - \alpha = +2^h 35'$
 H. long $4^h 44^m 31.0^s$
 G. Sid T. $10^h 10^m 14.95^s$
 Sid T. in Moon $20^h 21^m 38.05^s$
 Interval $13^h 48^m 36.90^s$
 Reduction $2^h 15.75^s$
 G. in T. $13^h 46^m 21.15^s$

From Naut Alman.
 Moon $14^h 2^m 50^s 50.29^s + 18^h 15' 42.2^s$
 Motion in $1^m = 223.40^s$ 12.678^s
 $-13.6475^s - -30.45^s - 2^h 53.0^s$
 Tabular place $2^h 50^m 19.84^s + 18^h 12^m 49.2^s$

Moon's parallax $58' 18.5^s$
 Semidiam. $15' 54.9^s$

$934 \sim 11.9^s$
 $955 \sim 12.4^s$

$R = 954.9^s$
 Augmentation $+12.4^s$
 Irradiation -0.7^s
 $R = 966.6^s$

$a = 2.7$

$R = 20720^s$
 $(1+a)R = 20714^s$
 $R^2 = 42907^s$

1911 1911	Times etc	1913 Sept 22	5
Exp. Telos 1912 Jan 27	5 ^h 18 ^m	5 ^h 30 ^m	
moon	5 24 18.6	5 24 19.0	
clock slow	1 25.1		
H Sid T	5 ^h 25 ^m 43.9		
H long	4 44 31.05		
G Sid T	10 10 14.95		
Sid T in moon	20 21 38.05		
Interval	13 48 36.90		
Reduction	2 15.75		
G. M. T.	13 46 21.15		

From Nant Alms			
Moon 14 ^h 2 ^m 50 ^s 50 ^s 29	+18° 15' 42"		
Mercury 11 ^h 2 23.90	12 678		
-13.6475	-30.45	-2 53.0	
Tabular place 2 ^h 50 ^m 19.84	+18 12 49.2		

Moon parallax	58' 18.5"
Semidiam	15' 54.9"
R =	954.9
Augmentation	+12.4
Irradiation	-0.7
R =	966.6

4 - 27	R =	207.20
	(1+a) R =	207.14
	R =	4.2907

pt.	hor. L	resid
1	180.0	+10
2	191.2	-34
3	223.0	+69
4	227.5	-46
5	258.9	+59
6	270.0	-29
7	286.9	-69
8	317.0	+77
9	320.7	-33

M 61591

1913 Sept. 24.

6

Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	19.4032	0.0000	-4	0.0000	4.2932	+25
2	19.0000	-0.4032	-4	0.1629	4.2899	-8
3	18.0000	-1.4032	-3	1.9698	4.3024	+117
4	17.8746	-1.5286	-3	2.3375	4.2913	+6
5	17.3676	-2.0356	-1	4.1441	4.3023	+116
6	17.3312	-2.0720	+0	4.2932	4.2932	+25
7	17.4217	-1.9815	+1	3.9260	4.2886	-21
8	18.0000	-1.4032	+3	7.9681	4.3610	+103
9	18.0904	-1.3128	+3	1.7226	4.2896	-11
				$\Sigma =$	4.2907	

	y	$y - y_0$	$(y - y_0)^2$
-1	20.3258	-2.0720	4.2932
2	20.3663	-2.0315	4.1270
3	20.8705	-1.5273	2.3326
4	21.0000	-1.3978	1.9538
5	22.0000	-0.3978	0.1582
6	22.3978	0.0000	0.0000
7	23.0000	+0.6022	0.3626
8	23.9252	+1.5274	2.3329
9	24.0000	+1.6022	2.5670

Approximate Center

$$x = 18.0 \quad y = 20.8705$$

$$23.9252$$

$$44.7957$$

$$\text{mean } y = 22.3978$$

$$y - \text{min} = 20.3258$$

$$R = 2.0720$$

$$x - \text{min} = 17.3312$$

$$\text{mean } x = 19.4032$$

$$\text{Center } \begin{cases} x = 19.4032 \\ y = 22.3978 \end{cases}$$

1912phae

1913 Sept 24.

6

Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)^2$	$O - C$
1	19.40320000	-4	00000	42932	+25	
2	19.0000004032	-4	01629	42899	-8	
3	18.00000014032	-3	19698	43024	-117	
4	17.8746015286	-3	28375	42913	+6	
5	17.3676020356	-1	41441	43023	+116	
-6	17.3312020720	+0	42932	42932	+25	
7	17.4217019815	+1	39260	42886	-21	
8	18.00000014032	+3	29681	43010	+103	
9	18.0904013128	+3	17226	42896	-11	
			$R^2 =$	42907		

	y	$y - y_0$	$(y - y_0)^2$
-1	20.3258020720	42932	
2	20.3663020315	41270	
3	20.8705015273	23326	
4	21.0000013978	19538	
5	22.0000003978	01582	
6	22.3978000000	00000	
7	23.0000006022	03626	
8	23.9252015274	23329	
9	24.0000016022	25670	

Approximate Center

$$x = 18.0 \quad y = 20.8705$$

$$23.9252$$

$$447957$$

$$\text{Mean } y = 22.3978$$

$$y - \text{min} = 20.3215$$

$$R = 2.0720$$

$$x - \text{min} = 17.3312$$

$$\text{Mean } x = 19.4032$$

$$\text{Center} \begin{cases} x = 19.4032 \\ y = 22.3978 \end{cases}$$

Formation of Normal.

	ab	ac	bc
1	-0.08	+ 0.0	- 51.8
2	+0.81	+ 3.2	+ 76.2
3	+2.14	- 16.39	- 179.0
4	+2.14	- 9.2	- 84
5	+0.81	- 23.86	- 46.4
6	-0.00	- 51.8	+ 0.0
7	-1.19	+ 41.6	- 12.6
8	-2.14	- 144.0	+ 155.3
9	-2.10	+ 14.4	- 17.6
	+0.47	-543.3	-144.3

Normal Equations

$$+20.52 + 0.47 = -543$$

$$+ 0.47 + 18.13 = -144$$

$$- 0.47 - 0.01 = + 12$$

$$+ 18.12 = -132$$

$$b = - 7.3$$

$$+20.52 = -543 + 3 = -540$$

$$a = -263$$

Residuals.

	O		C	O - C
1	+ 25	0 + 15 =	+ 15	+ 10
2	- 8	+ 11 + 15 =	+ 26	- 34
3	+ 117	+ 37 + 11 =	+ 48	+ 69
4	+ 6	+ 40 + 10 =	+ 50	- 44
5	+ 116	+ 54 + 3 =	+ 57	+ 59
6	+ 25	+ 54 - 0 =	+ 54	- 29
7	- 21	+ 52 - 4 =	+ 48	- 69
8	+ 103	+ 37 - 11 =	+ 26	+ 77
9	- 11	+ 34 - 12 =	+ 22	- 33

$$+215 - 211$$

$$\text{Average} = 47$$

M.C. 1591

1913 Sept 29.

7

Moon's Center

Conditional Equations

	a	b	c	0	c	0-c
1	0.00	-2.07	=	+25	0 + 25 = +25	0
2	-0.40	-2.03	=	-8	+10 + 25 = +35	-43
3	-1.40	-1.53	=	+117	+35 + 19 = +54	+63
4	-1.53	-1.40	=	+6	+39 + 17 = +56	-50
5	-2.04	-0.40	=	+116	+52 + 5 = +57	+49
6	-2.07	+0.00	=	+25	+52 - 0 = +52	-27
7	-1.98	+0.60	=	-21	+50 - 7 = +43	-63
8	-1.40	+1.53	=	+103	+35 - 19 = +16	+89
9	-1.31	+1.60	=	-11	+33 - 20 = +13	-24

Average = 44

$$1) -5.37 - 7.43 = +256$$

$$2) -6.76 + 3.73 = +96$$

$$+6.76 + 9.35 = -322$$

$$+13.08 = -226$$

$$b = -17.3$$

$$-5.37 = +256 - 128 = +128$$

$$a = -23.8$$

$$4) -3.33 - 7.03 = +140$$

$$5) -8.80 + 3.33 = +212$$

$$+8.80 + 18.60 = -370$$

$$+21.93 = -158$$

$$b = -7.2$$

$$-3.33 = +140 - 51 = +89$$

$$a = -26.8$$

$$\text{Mean } b = -12.2$$

$$a = -25.3$$

M 51191

1913 Sept 29.

7

Munroe Center

Conditional Equations

	a	b	c		c	0-c
1	000	-207	=	+25	0 + 25 = +25	0
2	-040	-203	=	-8	+10 + 25 = +35	-43
3	-140	-153	=	+117	+35 + 19 = +54	+63
4	-153	-140	=	+6	+39 + 17 = +56	-50
5	-204	-040	=	+116	+52 + 5 = +57	+49
6	-207	+000	=	+25	+52 - 0 = +52	-27
7	-148	+060	=	-21	+50 - 7 = +43	-63
8	-140	+153	=	+103	+35 - 19 = +16	+49
9	-131	+160	=	-11	+33 - 20 = +13	-24

Average: 44

$$5) -537 - 743 = +256$$

$$9) -676 + 373 = +96$$

$$+676 + 933 = -322$$

$$+1308 = -226$$

$$b = -17.3$$

$$-537 = +256 - 128 = +128$$

$$a = -23.8$$

$$4) -333 - 703 = +140$$

$$5) -880 + 333 = -547$$

$$+880 + 1860 = -370$$

$$+2193 = -158$$

$$b = -7.2$$

$$-333 = +140 - 51 = +89$$

$$a = -26.8$$

$$\text{Mean } b = -12.2$$

$$a = -25.3$$

Red. and l. app.

$$A + \alpha \quad 0 \quad 30 = 7^{\circ} 30'$$

$$H \quad 21 \quad 42$$

$$A \quad 2 \quad 48$$

$$G \quad 17 \quad 30$$

$$G + \alpha \quad 20 \quad 18 = 309^{\circ} 30'$$

$$l \cos(A + \alpha) \quad 9.7531$$

$$g \quad 0.9110$$

$$\sin \quad 9.9160_m$$

$$\tan S \quad 9.5057$$

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

$$g' \quad 0.6641$$

$$g \quad 91.566_m$$

$$b \quad -0.15$$

$$g \quad -0.14$$

$$h \quad +0.18$$

$$-0.11 \quad \checkmark$$

$$S = +17 \quad 46$$

$$l \cos S \quad 9.9788$$

$$i \quad 0.6885_m$$

$$(i) \quad 0.6673_m$$

$$l \sin S \quad 9.4845$$

$$\cos(A + \alpha) \quad 9.9963$$

$$l \quad 1.2984$$

$$\sin \quad 9.1157$$

$$\sec S \quad 0.0212$$

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

$$h' \quad 0.7792$$

$$h \quad 9.2592$$

$$g' \quad + \quad 4.62$$

$$h' \quad + \quad 6.02$$

$$l \quad - \quad 4.65$$

$$+ \quad 6.00 \quad \checkmark$$

1591

Moon's Mean Position (1912.0)

8

$$\begin{array}{r}
 Y_1 = 194032'' \\
 \text{2nd} \quad -13'' \\
 \hline
 194019''
 \end{array}$$

$$\begin{array}{r}
 Y_0 = 223978'' \\
 \text{2nd} \quad -6'' \\
 \hline
 223972''
 \end{array}$$

From Plate Constants $\gamma = 20.1968''$ $\gamma = 21.0221''$

$$\begin{array}{r}
 S = +2.1968'' \\
 \log S = 0.34179 \\
 \text{const} = 9.97879'' \\
 \text{const} = 8.50724
 \end{array}$$

$$(x-A) = 1.85576''$$

$$x-A = +111.74''$$

$$A = 247.14''$$

$$p_0 = 248.2574''$$

$$p_{\alpha} = -0.11''$$

$$\alpha' = 248.2563''$$

$$m = -0.9779''$$

$$\begin{array}{r}
 \log \tan \delta = 9.5074 \\
 -13'' \\
 \hline
 0.6836'' \\
 m_1 = 72444
 \end{array}$$

$$m_1 = +18''$$

$$m_0 = -0.9797''$$

$$\begin{array}{r}
 \log m_0 = 9.99109'' \\
 \text{const} = 7.33115
 \end{array}$$

$$(x-D) = 2.65994''$$

$$\delta-D = -737.0''$$

$$D = +1753.22''$$

$$\delta = +17^{\circ}45'45.0''$$

$$p_{\delta} = +6.0''$$

$$\delta' = +1745.51.0''$$

1591

Mars Mean Position (1912.0)

8

$$\begin{array}{r}
 Y = 194032 \\
 \text{Zer} \quad -13 \\
 \hline
 194019
 \end{array}$$

$$\begin{array}{r}
 Y = 223978 \\
 \text{Zer} \quad -6 \\
 \hline
 223972
 \end{array}$$

From Plate Constant $X = 20.1968$ $Y = 21.0221$

$$S = +2.1968$$

$$\log S = 0.34179$$

$$\cos S = 9.97879$$

$$\sin S = 8.50724$$

$$(X-A) = 1.85576$$

$$X-A = +1 \quad 11.74$$

$$A = 2 \quad 47 \quad 14$$

$$Y_0 = 2 \quad 48 \quad 25.74$$

$$Red = -0.11$$

$$\alpha' = 2 \quad 48 \quad 25.63$$

$$\eta = -0.9779$$

$$\log \tan \delta = 9.5074$$

$$S = 0.6836$$

$$\eta = 7.2444$$

$$\eta = +1.8$$

$$\eta_0 = -0.9797$$

$$\log \eta_0 = 9.99109$$

$$\sin \eta_0 = 7.33115$$

$$(S-D) = 2.65994$$

$$S-D = -7 \quad 37 \quad 0$$

$$D = +17 \quad 53 \quad 22$$

$$\delta = +17^\circ 45' 45''$$

$$Red = +60$$

$$\delta = +17 \quad 45 \quad 51.0$$

1591 Lunar Parallax,
 $\kappa = 2 \quad 48'' \quad 25.63''$
 $\theta = 5 \quad 25'' \quad 43.9''$
 $G - \alpha = +2 \quad 37 \quad 18.3''$
 $= +39'' \quad 19' \quad 35''$

$$+ \quad 14 \quad 23''$$

$$+ 39 \quad 05 \quad 12''$$

$$\begin{array}{r} 9.95727 \\ 0.00000 \\ 0.11003 \\ \hline 9.06730 \end{array}$$

$$\gamma = 49 \quad 25'' \quad 18''$$

$$17 \quad 45'' \quad 51''$$

$$31 \quad 39 \quad 27''$$

$$\begin{array}{r} 9.82640 \\ 8.22943 \\ 9.72003 \\ 0.11946 \\ \hline 7.89532 \end{array}$$

$$S - S' = +27 \quad 009''$$

$$\delta = +18 \quad 12 \quad 51.9''$$

Transit Altim $S = +18 \quad 12 \quad 49.2''$

$$O - C \quad +2.7''$$

$$\delta' = +17^\circ \quad 45' \quad 51''$$

$$\Pi = 58' \quad 18''$$

$$\begin{array}{r} 9.86913 \\ 8.22943 \\ 9.80191 \\ 0.02232 \\ \hline 7.92279 \end{array}$$

$$\alpha - \alpha' = +28' \quad 46.72''$$

$$+ 1'' \quad 55.11''$$

$$\alpha = 2 \quad 50 \quad 20.74''$$

$$\kappa = 2 \quad 50 \quad 19.84''$$

$$+ 0.90''$$

1591 Lunar Parallax

$$\begin{array}{r}
 \alpha = 2 \quad 48 \quad 25.63 \\
 \delta = 5 \quad 25 \quad 43.9 \\
 G - \alpha - \delta = 37 \quad 18.3 \\
 = +39 \quad 19 \quad 35''
 \end{array}$$

$$= 14 \quad 23$$

$$= 37 \quad 05 \quad 12$$

$$\begin{array}{r}
 9957.27 \\
 000000 \\
 011003 \\
 \hline
 9.06730
 \end{array}$$

$$\gamma = 49 \quad 25 \quad 18$$

$$17 \quad 45 \quad 51$$

$$31 \quad 39 \quad 27$$

$$982640$$

$$822942$$

$$972003$$

$$011946$$

$$789531$$

$$S - S = +27 \quad 009$$

$$S = +18 \quad 12 \quad 51.9$$

$$\text{Hartmann } S = +18 \quad 12 \quad 49.2$$

$$O - C = +27$$

$$S = +17^\circ 45' 51''$$

$$\pi = 58' 18''$$

$$986913$$

$$822942$$

$$980191$$

$$002232$$

$$792278$$

$$\alpha - \alpha' = +28' 46.68$$

$$+ 8' 55.11$$

$$\alpha = 2 \quad 50 \quad 20.74$$

$$\alpha = 2 \quad 50 \quad 19.84$$

$$+090$$

1
6.9
20.
m
5

2
14.
28
m
5-6

3
23.
11.
m
8.6

MC 1598

1913 Sept. 17.

17.

Stars - Measures.

	d	u		v		d	x		v
1	18652		16680		19111		18852		
6.9	12280	84	13054	56	18147	40	9789	82	
20.6	80		55		50		85		
mag	60		88		17		50		
8.6									
	<u>20.6376</u>		<u>.6372</u>		<u>6.9034</u>		<u>9065</u>		
2									
14.7	16330		16984		17298		16878		
28.6	10162	66	13165	60	14960	69	9191	90	
mag	70		67		67		90		
5.9	35		98		00		77		
	<u>28.6167</u>		<u>.6178</u>		<u>14.7667</u>		<u>7687</u>		
3									
23.6	15176		15189		15707		14848		
11.8	10550	56	9798	59	11960	58	8585	90	
mag	50		03		53		90		
8.6	85		88		09		50		
	<u>11.4628</u>		<u>.4614</u>		<u>23.6249</u>		<u>.6261</u>		

Grade 4 or 5

MC 1598

1913 Sept 17

17

Stars - Measurers

	d	u	v	d	x	v
1	18652		16680	19111		18852
69	12280	84	13054	18147	40	9789
206	80		55	50		85
mg	60		88	17		50
56						
	<u>206376</u>		<u>6372</u>	<u>69034</u>		<u>9065</u>
2						
197	16330		16984	17298		16878
246	10162	66	13165	14960	69	9191
mg	70		67	67		90
59	35		98	00		77
	<u>286167</u>		<u>6178</u>	<u>147667</u>		<u>7687</u>
3						
23.6	15176		15189	15707		14848
11.1	10550	56	9798	11960	58	8585
mg	50		03	53		90
86	85		88	09		50
	<u>114628</u>		<u>4614</u>	<u>236249</u>		<u>6261</u>

Grade 4 or 5

110.1598 Moon-measures.

1913-Sept. 17.

18

d
L. scratel16.4 ~~15.906~~

183 19616

1672822

29

15

18.7890

2

16.0 18655

18.6 1255445

50

59

18.6107

14385

725564

67

90

2873

19450

1553035

22

43

6082

15206

919201

00

08

16.3991

15020

16036

6074

15

395115.6
19.0

18880

1587580

78

80

15.6998

18830

1182211

10

30

701615.4
20.0

17758

1160994

09

60

15.3845

18932

1505660

65

40

3875minutes = about 15.382015.5
21.0

16633

1233530

40

40

15.5699

18040

1234350

45

50

570016.0 15876
21.6 941010
08
87
21.647516497
1295580
78
00
6473

1912-1598 known-measures.

1913 Sept. 17.

18

d
Scratch164 ~~15906~~

183 19616

1672822

29

15

182890

2

160 18655

186 12554 45

50

59

186107

3

156

19.0

4

154

20.0

5

15.5

21.0

6

16.0 15876

21.6 9410,0

08

87

216475

14385

725564

67

90

2673

19450

1553035

22

43

6082

15206

919201

00

08

163991

15020

16066

6074

15

3951

18880

1587580

78

80

156998

17758

11609

0994

60

153845min in $\approx$ about 153820

16633

1233530

40

40

155699

18830

1182211

10

30

7016

18932

15056

6560

40

3875

18040

1234350

45

50

5700

16497

1295580

78

00

6473

MC 1598 Moon-measures 1913 Sept 17.

d	y	n	d	x	n
2			16235		16870
16.5	oblique		1079084		1231812
22.0			75		00
			38		78
			<u>16.4546</u>		<u>4564</u>

8		
17.0	19220	15291
22.3	1695050	756463
	50	60
	32	94
	<u>22.2272</u>	<u>2269</u> ✓

max in y = about 22.3000

9		
18.0	19125	14380
22.3	1660010	687381
	80	70
	30✓	90
	<u>22.2529</u>	<u>2494</u>

MC 1598 y moon-measures 1913 Sept 17 19

d	y	d	x	d	x
7		16235		16870	
16.5	ablique	1079084		1231812	
220		75		00	2
		38		78	
		<u>164546</u>		<u>4564</u>	

8		
170	19220	15291
223	1695050	756463
	50	60
	32	94
	<u>22.2772</u>	<u>2269</u>

max in y = about 22.3000

9		
180	19125	14380
223	1660010	687381
	80	70
	30	90
	<u>22.2529</u>	<u>2494</u>

1912 Sept 22				1913 Sept 22					
Cape No. 1022 mag 5.6				Cape No. 1031 mag 5.9					
Cape No. 1040 mag 8.6				Cape No. 1040 mag 8.6					
C	7	05	10.98	7	09	42.51	7	14	55.29
L			11.05			53			36
E			10.95			50			26
mean	7	05	10.99	7	09	42.51	7	14	55.30
Proc			+44.69			+45.00			+44.22
S	7	05	55.68	7	10	27.51	7	15	39.52
D	7	12	11	7	12	11	7	12	11
S-D	-	6	15.32	-	1	43.49	+3		28.52
tan(S-D)			-37.527			-1.03.49			+208.51
log "			2.57434			2.01490			2.31913
mag			9.94987			9.94573			9.95427
z ₀			1.03145			0.46787			0.78064
z ₁	-	1	0.7510	-	2	93.68	+6	0	34.4
z ₂	-		31	-		4	+2		22
z ₃			7.2459			15.0628			24.0366
z ₄			6.9050			14.7677			23.6255
z-3			+3409			+2951			+4111
C	+27°	01'	15.1"	+28°	04'	16.8"	+25°	51'	16.9"
L			14.6			16.7			17.5
E			15.2			17.0			17.4
mean	+27	01	15.0	+28	04	16.8	+25	51	17.3
Proc	-01		08.4	-01		12.5	-01		17.6
S	+27	00	06.6	+28	03	04.3	+25	49	59.7
D	+27	11	23	+27	11	23	+27	11	23
S-D	-11		16.4	+51		41.3	-1	21	23.3
tan(S-D)			-676.4	+31		01.5			-48842
log "			2.83020			3.49157			3.68880
mag			0.16135			0.82272			1.01995
tan S			9.7072			9.7266			9.6850
z ₂			20629			09357			15613
z ₁			8.8235			7.7157			8.2997
z ₀	-1.4		500	+6.6		484	-10.4		700
z ₁	+66		6	+52			+199		
z ₂	206		166	28.6		536	11.5		499
z ₃	20.6		374	28.6		172	11.4		621
z-3	+208			-364			-878		

1912 Sept 22				1913 Sept 22			
Cape W 10 22 mag 5.6				Cape W 10 31 mag 5.9			
C	7	05	10 98	7	09	42 51	7 14 55 29
L			11 05			53	36
E			10 95			50	26
mean	7	05	10 99	7	09	42 51	7 14 55 30
Proc			+ 44 69			+ 45 00	+ 44 22
X	7	05	55 68	7	10	27 51	7 15 39 52
H	7	12	11	7	12	11	7 12 11
A-14	-	6	15 32	-	1	43 49	+ 3 28 52
tan(d-A)			- 37 527			- 10 349	+ 20 851
mag	2	57	43 4	2	01	49 0	2 31 91 3
W 8	9	94	9 87	9	94	5 73	9 95 42 7
50	1	03	14 5	0	46	78 7	0 78 06 4
30	-	1	07 51 0	-	2	93 68	+ 6 03 49
31	-		31	-		4	+ 22
5	7	24	59	-	1	50 62 8	24 03 66
26	6	90	50	1	47	67 7	23 62 55
2-3	+3	40	9	+2	95	1	+ 41 11

C	+27°	01'	15"	+28°	04'	16"	+25°	51'	16"
L			14 6			16 7			17 5
E			15 2			17 0			17 4
mean	+27	01	15 0	+28	04	16 8	+25	51	17 3
Proc	-01	08	4	-01	12	5	-01	17	6
S	+27	00	06 6	+28	03	04 3	+25	49	59 7
12	+27	11	23	+27	11	23	+27	11	23
S+10	-11	16	4	+	51	41 3	-1	21	23 3
tan(d-A)			- 67 6.4			+ 31 01.5			- 48 84 2
mag	2	83	02 0	3	49	15 7	3	68	88 0
mag	0	16	12 5	0	82	27 2	1	01	99 5
tan δ	9	70	72	9	72	66	9	68	50
52	2	06	29	0	93	57	1	56	13
71	8	82	35	7	71	57	8	29	97
mag	-1	45	00	+	6	64 84	-1	0	47 00
71	+		66 6	+		52	+		19 9
71	2	06	16 6	2	86	53 6	1	15	49 9
71	2	06	37 4	2	86	17 2	1	14	62 1
71	+		20 8	-		36 4	-		87 8

12-98

1913 Sept. 22

21

Plate Constants

x	y	R.A.	Decl.
69050	20.6374	7 ^h 05 ^m 56 ^s	+27° 00' 07"
147677	28.6172	10 28	28 03 04
23.6255	11.4621	15 40	25 50 00
31452982	60.7167	7 30 124	21 53 11
1510	20.24	7 10 41	+26 57 44
-18	-22	+1 30	+13 39
290	176	7 12 11	+27 11 23
31	465		
29	819		
87			
89.9			

$$A = 7^h 12^m 11^s$$

$$D = +27^\circ 11' 23''$$

$$\begin{aligned}
 x-3 & -63.24 & +7.5x & -0.7y \\
 -3409 & -1304 & -4713 & +51 & -4662 & -14 & -4676 \\
 -2951 & -1809 & -4760 & +109 & -4651 & -20 & -4671 \\
 -4111 & -724 & -4835 & +175 & -4660 & -8 & -4668 \\
 17.5525 & -1272 & +132 & -14
 \end{aligned}$$

$$\begin{aligned}
 -0.5x & +4699 \\
 -3 & -4679 & = 0 \\
 -7 & -4678 & = +1 \\
 -12 & -4680 & = -1 \\
 -9 & & = 17.9041
 \end{aligned}$$

$$\begin{aligned}
 y-7 & +680x & +4.5y & +.7y-2x & -785 \\
 +208 & +470 & +678 & +93 & +771 & +14 & -1 & +784 & = -1 \\
 -364 & +1004 & +640 & +129 & +769 & +20 & -3 & +786 & = +1 \\
 -878 & +1607 & +729 & +52 & +781 & +8 & -4 & +785 & = 0 \\
 20.1273 & +1194 & +91 & +14 & -4 & = 20.1723
 \end{aligned}$$

$$\begin{aligned}
 \text{Tabulation } a & = -1.0 & e & = -0.4 & a-e & = -0.6 & b+a & = -2.2 \\
 \text{Observed } a & = -7.0 & & -5.2 & & -1.8 & & -3.9
 \end{aligned}$$

$$\begin{aligned}
 (c-0) & +6.0 & +4.8 & +1.2 & +1.7
 \end{aligned}$$

15-98

1913 Sept 22

21

Plate Constants

x	y	R.A.	Decl.
69050	20.6374	7 ^h 05 ^m 56 ^s	+27° 00' 07"
147677	28.6172	10 28	28 03 04
23.6255	11.4621	15 40	25 50 00
1452982	60.7167	7 30 124	21 53 11
1510	20.24	7 10 41	+26 57 44
-18	-22	+1 30	+13 39
290	176	7 12 11	+27 11 23
31	465		
29	819		
87			
89.9			

$A = 7^h 12^m 11^s$
 $\Delta = +27^\circ 11' 23''$

$$\begin{aligned}
 x-3 & -63.24 & - & +7.5x & -0.7y \\
 -3409 & -1304 & = -4713 & +51 & = -4662 & -14 & = -4676 \\
 -2951 & -1809 & = -4760 & +109 & = -4651 & -20 & = -4671 \\
 -4111 & -724 & = -4835 & +175 & = -4660 & -8 & = -4668 \\
 17.5525 & -1272 & & +132 & & -14 &
 \end{aligned}$$

$$\begin{aligned}
 -0.5x & +4699 \\
 -3 & = -4679 & = 0 \\
 -7 & = -4678 & = +1 \\
 -12 & = -4680 & = -1 \\
 -9 & & = 17.9041
 \end{aligned}$$

$$\begin{aligned}
 y-7 & +680x & +4.5y & +.74-22 & -785 \\
 +208 & +470 & = +678 & +93 & = +771 & +14 & = +785 \\
 -364 & +1004 & = +640 & +129 & = +769 & +20 & = +789 \\
 -878 & +1607 & = +729 & +52 & = +781 & +8 & = +789 \\
 20.1273 & +1194 & & +91 & & +14 & = 20.1783
 \end{aligned}$$

$$\begin{aligned}
 \text{Tabulated } a & = -1.0 & z & = -0.4 & a-z & = -0.6 & b+a & = -2.2 \\
 \text{Observed } a & = -7.0 & & -5.2 & & -1.8 & & -3.9
 \end{aligned}$$

$$\begin{aligned}
 (c-0) & +6.0 & +4.8 & +1.2 & +1.7
 \end{aligned}$$

12-98

1913 Sept 22

21

Plate Constants

x	y	R.A.	Decl.
69050	206374	7 ^h 05 ^m 56 ^s	+27° 00' 07"
147677	286172	10 28	28 03 04
236255	114621	15 40	25 50 00
1452982	607167	7 30 124	21 53 11
1510	2024	7 10 41	+26 57 44
-18	-22	+1 30	-13 39
290	176	7 12 11	+27 11 23
31	465		
29	819		
87			
89.9			

$$A = 7^h 12^m 11^s$$

$$D = +27^\circ 11' 23''$$

$$\begin{aligned}
 x-3 & -6329 & +7.52 & -0.74 \\
 -34.09 & -1304 & -47.13 & -51 & -4662 & -14 & -4676 \\
 -2951 & -1809 & -4760 & +109 & -4651 & -20 & -4671 \\
 -4111 & 724 & -4835 & +175 & -4660 & 8 & -4668 \\
 17.5525 & -1272 & +132 & -14
 \end{aligned}$$

$$\begin{aligned}
 -0.5x & +4679 \\
 -3 & -4679 & = 0 \\
 -7 & -4678 & = +1 \\
 -12 & -4680 & = -1 \\
 -9 & & = 179041
 \end{aligned}$$

$$\begin{aligned}
 y-7 & +680x & +4.54 & +74-206 & -745 \\
 +208 & +470 & +678 & +93 & +771 & +14 & -1 & +784 & -1 \\
 -364 & +1004 & +640 & +129 & +769 & +20 & -3 & +796 & +1 \\
 -878 & +1607 & +729 & +52 & +781 & +8 & -4 & +745 & 0 \\
 20.1273 & +1194 & +91 & +14 & -4 & & & 20.1787
 \end{aligned}$$

$$\begin{aligned}
 \text{Tabulation } a & = -1.0 & a & = -0.4 & a-a & = -0.6 & b+a & = -2.2 \\
 \text{Observed } a & = -7.0 & & -5.2 & & -1.8 & & -3.9
 \end{aligned}$$

$$\begin{aligned}
 (C-0) & +60 & +48 & +12 & +17
 \end{aligned}$$

15.98 Times etc 1913 Sept 25 22
 Photo. stars 1912 Jan 31. $10^h 30^m$ - $10^h 42^m$
 " " moon $10 36 02.3^s$ $10 36 02.5^s$
 olive glass $1 28.9^s$

H. Sid T. $10 37 31.3^s$ $\delta - \alpha = +3^m 23^s$
 H. honey $4 44 31.05$
 G. Sid T. $15 22 02.35^s$
 Sid T in moon $20 37 24.28^s$
 Interval $18 44 38.07^s$
 Reductive $3 04.24^s$
 G. m. T. $18 41 33.83^s$

True Naut. Alt. $R \alpha$ $\checkmark$ 1913
 known 19^h $7^h 15^m 39.45^s$ $+27^\circ 19' 36''^{\checkmark}$
 Motion: $1^m = 2.8203^s$ 4418^s
 -18.4362^s -52.00^s $+01 21.5^s$
 Tabular place $7 14 47.45^s$ $+27 20 58.0^s$

age = 12.0 days $\checkmark$
 known parallax $61' 07.8^{\checkmark}$
 semi-diam. $16 40.8^{\checkmark}$
 $934 = 11.3^{\checkmark}$ $R = 1000.8^{\checkmark}$
 $1001 = 13.0$ augmentation = $+13.0$
 Irradiation (A.O.S) = 0.9
 $R = 1012.9^{\checkmark}$
 $R = 2.1713^{\checkmark}$
 $a = -7.0$ $(1+a)R = 2.1698^{\checkmark}$
 $R = 47080^{\checkmark}$

15-98 Times etc 1913 Sept 25 22
 Ep 10 stars 1912 Jan 31. $10^h 30^m$ $-10^h 42^m$
 moon $10^h 36^m 02.35$ $10^h 36^m 02.5$
 double stars 1 28.9

H Sid T. $10^h 37^m 31.3$
 H home $4^h 44^m 31.05$
 G Sid T. $15^h 22^m 02.35$
 Sid T in home $20^h 37^m 24.28$
 Interval $18^h 44^m 38.07$
 Reduction 3 04.24
 G. in T. $18^h 41^m 33.83$

From Hunt Abm R_c 1913
 known 19^h $7^h 15^m 39.45$ $+27^h 19' 36.5$
 Another $1^m : 28203$ 4.418
 -18.9362 -52.00 $+01 21.5$
 Tabular value $7 14 47.45$ $+27 20 58.0$

known parallax $61' 0.78$
 semi-diameter $16' 40.8$
 $939 = 11.3$ $R = 1000.8$
 $1001 = 13.0$ augmentation $+13.0$
 Irradiation (Holt) -0.9
 $R = 1012.9$
 $R = 2.1713$
 $(1+a)R = 2.1698$
 $R^2 = 47080$
 $a = -7.0$

pt.	log L	resid.
1	212.01	+95
2	225.5	+73
3	238.6	-74
4	266.6	+21
5	293.7	-168
6	314.5	+116
7	329.6	-58
8	345.2	+48
9	11.8	-29

1913 Sept 24. 23

MGN-98 Previous Center

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	16.3971	-1.1565	-5	1.3386	4.7242	+1.62
2	16.0000	-1.5536	-4	2.4149	4.7220	+1.40
3	15.7008	-1.8528	-3	3.4340	4.7071	- .9
4	15.3860	-2.1676	-2	4.6985	4.7150	+ .70
5	15.5700	-1.9836	+2	3.9339	4.6934	-1.46
6	16.0000	-1.5536	+4	2.4124	4.7195	+1.15
7	16.4555	-1.0981	+5	1.2047	4.7068	-1.2
8	17.0000	-0.5536	+5	0.3059	4.7092	+1.2
9	18.0000	+0.4464	+5	0.1997	4.7057	-2.9

Comp. R^2 : 4.7080

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
1	18.2882	-1.8402	+2	3.3856
2	18.6094	-1.5190	+4	2.3071
3	19.0000	-1.1284	+1	1.2731
4	20.0000	-0.1284	+0	0.0165
5	21.0000	+0.8716	-1	0.7595
6	21.6474	+1.5190	-1	2.3071
7	22.0000	+1.8716	-2	3.5021
8	22.2270	+2.0986	-2	4.4033
9	22.2512	+2.1228	-2	4.5054

Approximate Center

$$x = 16.04 + 18.6094$$

$$21.6474$$

$$40.2568$$

$$\text{mean } y = 20.1284$$

$$y - \text{max} = 22.3000$$

$$R = 2.1716$$

$$x - \text{min} = 15.3820$$

$$\text{mean } x = 17.5536$$

Center

$$\begin{cases} x = 17.5536 \\ y = 20.1284 \end{cases}$$

MIG 15-98 *Proxima Centauri*

1913 Sept 24.

23

	x	$(x - x_0)$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	16 39 71	-1 15 65	-5	1 33 86	4 72 42	+1 62
2	16 00 00	-1 55 36	-4	2 41 49	4 72 20	+1 40
3	15 70 08	-1 85 28	-3	3 43 40	4 70 71	-9
4	15 38 60	-2 16 76	-0	4 69 85	4 71 50	+70
5	15 57 00	-1 98 36	+2	3 93 39	4 69 34	-1 46
6	16 00 00	-1 55 36	+4	2 41 24	4 71 95	+1 15
7	16 45 55	-1 09 81	+5	1 20 47	4 70 68	-1 2
8	17 00 00	-0 55 36	+5	0 30 59	4 70 92	+1 2
9	18 00 00	+0 44 64	+5	0 19 97	4 70 57	-2 9

Comp Σ 47080

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
1	18 28 82	-1 84 02	-2	3 38 56
2	18 60 94	-1 51 90	-1	2 30 71
3	19 00 00	-1 12 84	+1	1 27 31
4	20 00 00	-0 12 84	+0	0 01 65
5	21 00 00	+0 87 16	-1	0 75 95
6	21 64 74	+1 51 90	-1	2 30 71
7	22 00 00	+1 87 16	-2	3 50 21
8	22 22 70	+2 09 86	-2	4 40 33
9	22 25 12	+2 12 28	-2	4 50 54

Approximate Center

$$x = 16 09 = 18 60 94$$

$$\begin{array}{r} 21 64 74 \\ \hline 40 25 68 \end{array}$$

$$\text{mean } y = 20 12 84$$

$$y - \text{mean} = 22 30 00$$

$$R = 2 17 16$$

$$x - \text{mean} = 15 38 20$$

$$\text{mean } x = 17 55 36$$

$$\text{Center } \begin{cases} x = 17 55 36 \\ y = 20 12 84 \end{cases}$$

Formation of normals.

	ab	an	bn
1	+ 213	- 187.9	- 298.1
2	+ 236	- 217.0	- 212.8
3	+ 209	+ 16.6	+ 10.2
4	+ 0.28	- 151.9	- 9.1
5	- 172	+ 289.1	- 127.0
6	- 236	- 178.2	+ 174.8
7	- 206	+ 13.2	- 22.4
8	- 116	- 6.6	+ 25.2
9	+ 0.95	- 13.0	- 61.5
	+ 0.51	- 4357	- 520.7

15-98

Mounts Center.

24

Conditional Equations

	a	b	0	c	0-c
1	-1.16	-1.84	= +162	+25+42 = +67	+95
2	-1.55	-1.52	= +140	+33+34 = +67	+73
3	-1.85	-1.13	= -9	+39+26 = +65	-74
4	-2.17	-0.13	= +70	+46+3 = +49	+21
5	-1.98	+0.87	= -146	+42-20 = +22	-168
6	-1.55	+1.52	= +115	+33-34 = -1	+116
7	-1.10	+1.87	= -13	+23-43 = -20	+8
8	-0.55	+2.10	= +12	+12-48 = -36	+48
9	+0.45	+2.12	= -29	-10-48 = -58	+29

Average = 70

Normal Equations

$$+19.94 + 0.51 = -436$$

$$+ 0.51 + 22.46 = -521$$

$$- 0.51 - 0.01 = +11$$

$$+ 22.45 = -510$$

$$b = -22.7$$

$$- 0.01 - 0.51 = +12$$

$$+ 19.93 = -424$$

$$a = -21.3$$

1598

Moon's Center

24

Conditional Equations

	a	b	0	c	0-c
1	-1.16	-1.84	= +162	+25 +42 = +67	+95
2	-1.55	-1.52	= +140	+33 +34 = +67	+73
3	-1.85	-1.13	= -9	+39 +26 = +65	-74
4	-2.17	-0.13	= +70	+46 +3 = +49	+21
5	-1.98	+0.87	= -146	+42 -20 = +22	-168
6	-1.55	+1.52	= +115	+33 -34 = -1	+116
7	+1.10	+1.87	= -12	+23 -43 = -20	+8
8	-0.55	+2.10	= +12	+12 -48 = -36	+48
9	+0.45	+2.12	= -29	-10 -48 = -58	+29

Average = 70

Normal Equations

$$+19.94 + 0.51 = -436$$

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$$- 0.01 - 0.51 = +12$$

$$+ 19.93 = -424$$

$$a = -21.3$$

598 Moon's Mean Position (1912.0)

25

$$\begin{array}{r}
 X_0 = 17.5536 \\
 \frac{1}{2}a = \frac{-11}{17.5525} \\
 Y_0 = 20.1284 \\
 \frac{1}{2}b = \frac{-11}{20.1273}
 \end{array}$$

From Plate Constants $X = 17.9041$ $Y = 20.1783$

$$\begin{array}{r}
 z = -0.0959 \\
 \log z = 8.98182 \\
 \log S = 9.95006 \\
 \log \text{const} = 8.50729
 \end{array}$$

$$(x-A) = 0.52452$$

$$d-A = 3.35$$

$$A = 7^{\circ} 12' 11''$$

$$Q_0 = 7^{\circ} 12' 07.65''$$

$$\text{Red} = +1.34$$

$$V' = 7^{\circ} 12' 08.99''$$

$$\eta = -1.8217$$

$$\begin{array}{r}
 \log \tan S = 9.7072 \\
 \log \eta_2 = 7.9636 \\
 \log \eta_1 = 4.7242
 \end{array}$$

$$\begin{array}{r}
 \log \eta_0 = 0.26048 \\
 \log \text{const} = 7.33115
 \end{array}$$

$$(d-D) = 292933$$

$$S-D = -14^{\circ} 09.8'$$

$$D = +27^{\circ} 11' 23''$$

$$S_0 = +26^{\circ} 57' 13.2''$$

$$\text{Red} = +6.3$$

$$S' = +26^{\circ} 57' 19.5''$$

1598 Moons Mean Position (1912.0)

$$\begin{array}{r}
 X_0 = 17.5536 \\
 \frac{1}{2} \Delta = \frac{-1.1}{17.5525} \\
 Y_0 = 20.1284 \\
 \frac{1}{2} \Delta = \frac{-1.1}{20.1273}
 \end{array}$$

From Plate Constant $X = 17.9041$ $Y = 20.1783$

$$\begin{array}{r}
 z = -0.0959 \\
 \log z = 8.98182 \sim \\
 \log S = 9.95006 \\
 \text{const} = 8.50729
 \end{array}$$

$$(x-A) = 0.52452 \sim$$

$$d-A = 3.35$$

$$A = 7^{\circ} 12' 11''$$

$$q_0 = 7^{\circ} 12' 07.65''$$

$$Red = +134$$

$$v' = 7^{\circ} 12' 08.99''$$

$$\eta = -1.8217$$

$$\begin{array}{r}
 \log \tan S = 9.7072 \\
 \log \eta = 7.9636 \\
 \eta_1 = 4.7242
 \end{array}$$

$$\begin{array}{r}
 \log \eta_0 = 0.26048 \sim \\
 \text{const} = 7.53115
 \end{array}$$

$$(d-D) = 292923 \sim$$

$$S-D = -14^{\circ} 09.8'$$

$$D = +27^{\circ} 11' 23''$$

$$S_0 = +26^{\circ} 57' 13.9''$$

$$Red = +63$$

$$S' = +26^{\circ} 57' 19.5''$$

1598

Red. ad l. app.

$$H + \alpha_1 \quad 4 \quad 38 = 69^\circ 30'$$

$$H \quad 21 \quad 26$$

$$\alpha_0 \quad 7 \quad 12$$

$$G \quad 17 \quad 42$$

$$G + \alpha_0 \quad 0 \quad 54 = 13^\circ 30'$$

$$l \cos(G + \alpha) \quad 9.9878$$

$$g \quad 0.9092$$

$$\sin \dots \quad 9.3682$$

$$\tan \dots \quad 9.7062$$

$$\frac{1}{10} \quad 8.8237$$

$$(g') \quad 0.8970$$

$$(g) \quad 88073$$

$$\begin{array}{r} 1 \\ 0 \\ 8 \\ 1 \\ \hline -010 \\ +006 \\ +138 \\ \hline +134 \end{array}$$

$$S = +26^\circ 57'$$

$$l \cos S \quad 9.9501$$

$$i \quad 0.7286$$

$$(i) \quad 0.6787$$

$$l \sin S \quad 9.6563$$

$$\cos(H + \alpha) \quad 9.5443$$

$$h \quad 1.2957$$

$$\sin \dots \quad 9.9716$$

$$\sec \dots \quad 0.0499$$

$$\frac{1}{10} \quad 8.8239$$

$$(h') \quad 0.4963$$

$$(h) \quad 0.1411$$

$$\begin{array}{r} g' \\ h' \\ i \\ \hline +7.89 \\ +3.14 \\ -4.77 \\ \hline +6.26 \end{array}$$

15-98

Red. ad l. apt

$$S = +26^{\circ} 57'$$

$$H+X. \quad 4 \quad 38 = 69^{\circ} 30'$$

$$N \quad 21 \quad 26$$

$$K. \quad 7 \quad 12$$

$$G \quad 17 \quad 42$$

$$G+K. \quad 0 \quad 54 = 13^{\circ} 30'$$

$$L \cos S \quad 99501$$

$$L \quad 07286$$

$$(L) \quad 06787$$

$$L \cos(G+X) \quad 99878$$

$$q \quad 09092$$

$$\sin \quad 93682$$

$$\tan S \quad 97062$$

$$\frac{1}{\tan} \quad 84237$$

$$\log' \quad 08970$$

$$(\log) \quad 88073$$

$$L \sin S \quad 96563$$

$$\cos(H+X) \quad 95443$$

$$L \quad 12957$$

$$\sin \quad 99716$$

$$\cos S \quad 00499$$

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

$$(\sin) \quad 04963$$

$$(\cos) \quad 01911$$

$$\begin{array}{r} f \quad -010 \\ g \quad -006 \\ h \quad +138 \\ \hline \quad +134 \end{array}$$

$$\begin{array}{r} g' \quad +789 \\ h' \quad +319 \\ L \quad -477 \\ \hline \quad +636 \end{array}$$

1598

Lunar Parallax.

$$\begin{array}{rcl}
 \alpha - 7 & 12 & 08.99 \\
 \theta - 10 & 37 & 31.3 \\
 6 - \alpha = -3 & 25 & 22.3 \\
 & + 51 & 20' 35''
 \end{array}$$

$$\begin{array}{rcl}
 + & & 19 \quad 53 \\
 + 51 & 00 & 42
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 9.99999 \\
 0.20123 \\
 \hline
 0.15849
 \end{array}$$

$$\begin{array}{rcl}
 f - & 55 & 13 \quad 50 \\
 & 26 & 57 \quad 20 \\
 & 28 & 16 \quad 30
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.24996 \\
 9.67550 \\
 0.08542 \\
 \hline
 7.83728
 \end{array}$$

$$8 - 8' = + 23 \quad 38.1$$

$$8 = + 27 \quad 20 \quad 57.6$$

$$\text{Parallax } s = + 27 \quad 20 \quad 58.0$$

$$0 - 6 \quad - \quad 0.4$$

$$\delta' = + 26^\circ \quad 57' \quad 19.5$$

$$17 \quad 61' \quad 07.8$$

$$\begin{array}{r}
 9.86913 \\
 8.24996 \\
 9.89260 \\
 0.05148 \\
 \hline
 8.06317
 \end{array}$$

$$\alpha - \nu' = + 39' \quad 45.63$$

$$= + 2^\circ \quad 39.04$$

$$\alpha = 7 \quad 14 \quad 48.03$$

$$\gamma = 7 \quad 14 \quad 47.45$$

$$+ 0.58$$

15-98

Human Parallax

$\alpha = 7^h 12^m 08^s.99$
 $\delta = 10^\circ 37' 21.3''$
 $\mu_{\alpha} = 3.25$
 $\mu_{\delta} = 22.3$
 $\pi = +5.1''$
 $\rho = 20''$
 $\sigma = 35''$

$+ 19.53$
 $+ 5.1$
 00.42

995727
 999999
 020123

 015899

$\delta = 55^\circ 13' 50''$

$26^\circ 57' 20''$

$28^\circ 16' 30''$

982640
 824996
 967550
 008542

 783728

$\delta - \delta' = +23.38.1$

$\delta = 527^\circ 20' 57.8''$

$\mu_{\alpha} = 527^\circ 20' 58.0''$

$\mu_{\delta} =$

$- 0.2$

$\delta' = +26^\circ 57' 19.5''$

$\mu_{\delta'} = 61' 07.8''$

986913

824996

989260

005198

 806317

$\alpha - \alpha' = +39' 45.63$

$= +2'' 39.04$

$\alpha = 7^h 14^m 48.03$

$\mu_{\alpha} = 7^h 14^m 47.45$

$+0.58$

