

KG

11366

v. 890

Volume XV



Harvard Lunar



Plates

no. 1301

1302

1303

Harvard Lunar Plates.

Measures and Reductions

Mary Fowler.

Volume XV

Plate No.	Date	Page
1301	1911 Oct 7	1
1302	" "	13
1303	" "	22.

MC1301 Standard Coords.

1913 Tra 7.

1

1 no. Cape 102 mag. 6.5

2 no. 106 mag. 8.0

C 0h 46m 09.30

0h 46m 46.69

L .31

.68

E .29

.66

mean 0h 46m 09.30

0 46 46.68

Prec + 33.93

+ 33.98

α 0 46 43.23

0 47 20.66

A 0 49 28

0 49 28.

α-A - 2 44.77

- 2 07.34

sin(α-A) - 1 64.77

- 1 27.34

log 2.21688m

2.10497m

cos δ 9.99944

9.99915

z₀ 0.72356m

0.61136m

z₀ -5.2912

-4.0866

z₁ - .44

- .7

z 12.7084

13.9127

x 14.8096

16.0659

x-3 +2.1012

+2.1532

C +2° 50 33.0

+3° 30 59.4

L 33.4

59.2

E 33.9

59.3

mean +2 50 33.4

+3 30 59.3

Prec + 3 35.1

+ 3 35.9

δ +2 54 08.5

+3 34 35.2

D +2 38 57.

+2 38 57.

δ-D +15 11.5

+ 55 38.2

tan(δ-D) + 9 11.5

+ 3 33.8

log 2.95976

3.52356

log 0.29091

0.85471

tan δ = 8.7050

8.7959

z² = 1.4471

1.2227

z₁ 7.2055

7.0720

m₀ +1.9540

+7.1567

m₁ + 1.6

+ 1.2

m 23.9556

29.1579

y 25.1799

30.3705

y-m +1.2243

+1.2126

MC1301 Standard Coords

1915 Mar 7.

1

K no. Cape 102 mag. 6.5

2 no. 106 mag. 8.0

C 0° 46' 09.30

0° 46' 46.69

L .31

.68

E .29

.66

mean 0° 46' 09.30

0 46 46.68

Prec + 33.93

+ 33.98

α 0 46 43.23

0 47 20.66

+ 0 49 28

0 49 28.

1-A - 2 44.77

- 2 07.34

in(X-A) - 164.77

- 127.34

log. 2.21688

2.10497

cbs 9.99944

9.99915

3₀ 0.72356

0.61136

3₀ - 5.2912

- 40866

3₁ - 4

- 7

3 12.7084

13.9127

2 14.8096

16.0659

x-3 + 21.013

+ 2.1532

C + 2 50 33.0

+ 3 30 59.4

1 33.4

59.2

2 33.9

59.3

mean + 2 50 33.4

+ 3 30 59.3

Prec + 3 35.1

+ 3 3 35.9

+ 2 54 08.5

+ 3 34 35.2

+ 2 38 57.

+ 2 38 57.

- 0 + 15 11.5

+ 55 38.2

- (+-D) + 9 11.5

+ 33 38.5

8 2.95976

3.52356

y₀ 0.28091

0.85471

tan δ = 8.7050

8.7959

3² = 1.4471

1.2227

m₁ 7.2055

7.0720

m₀ + 1.9540

+ 7.1567

m₁ + 16

+ 12

y 23.91556

29.1579

y 25.1799

30.3705

y-m + 1.2243

+ 1.2126

NIC 130 A				Stand	Words	1913 Mar. 7.				2
Cycle	no. 121	mag. 7.3				Cycle no. 125	mag. 8.4			
C	0 ^h 52 ^m	31.37				0 ^h 53 ^m	09.00			
L		44					09			
E		39					01			
mean	0 52	31.40				0 53	09.03			
Parallax		+ 33.87					+ 34.02			
δ	0 53	05.27				0 53	43.05			
A	0 49	28				0 49	28			
$\lambda - A$	+ 3	37.27				+ 4	15.05			
$\sin(\lambda - A)$		+ 217.26					+ 255.04			
$\log$		2.33698					2.40661			
$\cos \delta$		9.99989					7.99904			
$\sin \delta$		0.84411					0.91289			
δ_1		+ 6.9841					+ 8.1826			
δ_2		+ 28					+ 30			
δ		24.9869					26.1856			
λ		26.9550					28.3538			
$\lambda - \delta$		+ 1.9681					+ 2.1682			
C	+ 1 ^o 14	39.5				+ 3 45	22.8			
L		40.5					22.9			
E		40.2					23.0			
mean	+ 1 14	40.1				+ 3 45	22.9			
Parallax		+ 33.47					+ 33.45			
δ	+ 1 18	14.8				+ 3 48	57.4			
D	+ 2 38	57				+ 2 38	57			
$\delta - D$	- 1 20	42.2				+ 1 10	00.4			
$\tan(\delta - D)$		- 48.43.0					+ 42.01.0			
$\log$		3.68511					3.62335			
$\log$		1.01626					0.95450			
$\tan \delta$		8.3573					8.8241			
δ^2		16882					18258			
λ		7.0989					7.7033			
μ_0	- 10.38	1.4				+ 9.00	5.4			
μ_1		1.3					5.0			
μ		11.6199					31.0104			
μ		12.7375					32.1090			
$\mu - \mu_0$		+ 1.1176					+ 1.0986			

Mc301		Cen A Stars - Measures		1913 Feb. 25		3
1	α	δ	α	δ	α	δ
14.8	17726	17588	18450	14579		
25.2	15920.4	9380.84	16540.29	6473.81		
mag.	20	80	38	72		
6.5	36	90	50	80		
<u>25.1807</u>		<u>1791</u>	<u>148086</u>	<u>8105</u>		
2	α	δ	α	δ	α	δ
16.0	15998	14968	17005	15441		
30.4	12293.90	8675.78	7660.60	14781.79		
mag.	90	79	60	75		
8.0	00	80	05	50		
<u>30.3708</u>		<u>3702</u>	<u>16.0655</u>	<u>10663</u>		
3	α	δ	α	δ	α	δ
26.9	14415	15700	15331	15631		
12.7	7042.37	13075.70	14871.75	6072		
mag.	42	81	76	76		
7.8	18	06	37	28		
<u>12.7377</u>		<u>7373</u>	<u>269543</u>	<u>9556</u>		
4	α	δ	α	δ	α	δ
28.3	17860	16431	18557	17172		
32.1	16775.75	7540.32	12087.80	13630.33		
mag.	70	38	84	39		
8.4	62	45	48	87		
<u>32.1087</u>		<u>1093</u>	<u>283533</u>	<u>3543</u>		

images not round

MC1301.		Comp Stars - Orions		1913 Feb. 25		3
<u>1</u>	α	N	α	N		
14.8	17726	17588	18450	14579		
25.2	1592024	938084	1654029	647381		
mag.	20	80	3829	7281		
6.5	36	90	50	50		
	<u>25.1807</u>	<u>.1791</u>	<u>14.8086</u>	<u>.8105</u>		
<u>2</u>						
16.0	15998	14968	17005	15441		
30.4	1229390	867578	766060	1478179		
mag.	90	79	6060	7579		
8.0	00	80	05	50		
	<u>30.3708</u>	<u>.3702</u>	<u>16.0655</u>	<u>.0663</u>		
<u>3</u>						
26.9	14415	15700	15331	15631		
12.7	704237	1307570	1487175	6072		
mag.	4237	8170	7675	7667		
7.3	18	06	37	28		
	<u>12.7377</u>	<u>.7373</u>	<u>26.9543</u>	<u>.9556</u>		
<u>4</u>						
28.3	17860	16431	18557	17172		
32.1	1677575	754032	1208780	1363033		
mag.	70	3832	84	39		
8.4	62	45	48	87		
	<u>32.1087</u>	<u>.1093</u>	<u>28.3533</u>	<u>.3543</u>		

images not round

MK1301 Moon-measures.

1913 Feb. 25.

4

$\frac{1}{19.0}$	α	N	α	N
	16980	1851515		
$\frac{19.9}{30}$	733546	11		
		8870		

19.9643.9644

possibly on terminator

$\frac{2}{18.8}$
 $\frac{19.9}{20}$
 min.

16993

1832930

752236

2030
886719.9467.9463 ✓

$\frac{3}{18.0}$
 $\frac{20.1}{10}$

11785

13607

1102010

0102
1285020.0772.0753 ✓

$\frac{4}{17.0}$
 $\frac{20.9}{41}$

18065

1645542

923846

41
766220.8825.8784

$\frac{5}{16.9}$
 $\frac{21.0}$

1455968
 59
 5299

18700
 940810
 18

16.9263.9288

$\frac{6}{16.7}$
 $\frac{22.0}{x}$
 min in

1187575
 73
 5220

17735
 1105056
 51

16.6654.6683

VK1301 Moon-measures

1913 Feb. 25.

4

1/ a N
 19.0 16980 18515.15
 19.9 7335.46 11
 30 46 8870

possibly on terminator.

19.9643 .9644

2
 18.8 16993 18329.30
 19.9 7522.36 20 30
 20 36 8867

19.9467 .9463 ✓

3
 18.0 11785 13607.02
 20.1 11020.10 01 02
 10 12850

20.0772 .0753 ✓

4
 17.0 18065 16455.42
 20.9 9238.46 41
 41 7662

20.8825 .8784

5
 16.9 14559.68 18700
 21.0 5299 9408.10
 18

16.9263 .9288

11875.75 17735
 73 11050.56
 5220 51

16.6654 .6683

6
 16.7
 22.0
 min
 x

20.7
22.0
made
in
76

α
15960
1374340
40

20.7781

γ
1054045
40
8315

.7973

MC1301 Onom - measures

1913 Feb 25

5

$$\begin{array}{r} 7 \\ 16.9 \\ 23.0 \end{array}$$

d

4

N

$$\begin{array}{r} d \\ 13385 \\ 8287 \\ 4132 \end{array}$$

x

N

$$\begin{array}{r} 17770 \\ 8470 \\ 8199 \end{array}$$
16.92539.287

$$\begin{array}{r} 8 \\ 17.0 \\ 23.1 \end{array}$$

$$\begin{array}{r} 1765861 \\ 70 \\ 8936 \end{array}$$

$$\begin{array}{r} 16704 \\ 794855 \\ 56 \end{array}$$
23.12731249

$$\begin{array}{r} 9 \\ 18.0 \\ 23.9 \end{array}$$

$$\begin{array}{r} 1437574 \\ 29 \\ 13659 \end{array}$$

$$\begin{array}{r} 10386 \\ 964058 \\ 55 \end{array}$$
23.92839265

$$\begin{array}{r} 10 \\ 18.7 \\ 24.0+ \\ \text{max} \end{array}$$

$$\begin{array}{r} 1737576 \\ 73 \\ 7969 \end{array}$$

$$\begin{array}{r} 16395 \\ 699090 \\ 8590 \end{array}$$

4

24.0594.0593

$$\begin{array}{r} 11 \\ 19.0 \\ 24.0+ \end{array}$$

$$\begin{array}{r} 1749600 \\ 10 \\ 7955 \end{array}$$

$$\begin{array}{r} 15412 \\ 583023 \\ 18 \end{array}$$
24.0453.0412

MC1301 Orion - measures

1913 Feb 15

5

$$\begin{array}{r} 7 \\ 16.9 \\ 23.0 \end{array}$$

d

y

z

$$\begin{array}{r} d \\ 1338587 \\ 82 \\ 4132 \end{array}$$

x

$$\begin{array}{r} z \\ 17770 \\ 847099 \\ 81 \end{array}$$
16.92539287

$$\begin{array}{r} 8 \\ 17.0 \\ 23.1 \end{array}$$

$$\begin{array}{r} 1765861 \\ 70 \\ 8936 \end{array}$$

$$\begin{array}{r} 16704 \\ 79.4855 \\ 56 \end{array}$$
23.12731249

$$\begin{array}{r} 9 \\ 18.0 \\ 23.9 \end{array}$$

$$\begin{array}{r} 1437574 \\ 79 \\ 13659 \end{array}$$

$$\begin{array}{r} 10386 \\ 964058 \\ 55 \end{array}$$
23.92839265

$$\begin{array}{r} 10 \\ 18.7 \\ 24.0+ \\ \text{max} \end{array}$$

$$\begin{array}{r} 1737576 \\ 73 \\ 7969 \end{array}$$

$$\begin{array}{r} 16395 \\ 699090 \\ 85 \end{array}$$

y

24.0594.0593

$$\begin{array}{r} 11 \\ 19.0 \\ 24.0+ \end{array}$$

$$\begin{array}{r} 1749600 \\ 10 \\ 7955 \end{array}$$

$$\begin{array}{r} 15412 \\ 583023 \\ 18 \end{array}$$
24.0453.0412

1913 mar. 7.

Center of Plate		for plates 1301-1302-1303-1304			Decl.		
x	y	R	a				
12.53	24.02	0 ^h 46	43	+2	54	08	
13.78	29.21	47	21	+3	34	35	
25.43	11.58	53	05	+1	18	15	
26.07	30.94	53	43	+3	48	57	
4 77.81	95.75	200	52	11	35	55	
19.45	23.94	0	50	13	53	59	
-18	-22	-	45	-	15	02	
145	1.94	0 ^h 49 ^m	28 ^s	+2	38	57	
31	465						
145	970						
435	1164						
44.95	776						
	902.10						

$$A = 0^h 49^m 28^s$$

$$D = +2^\circ 38' 57''$$

Preliminary Reduction

$x-3 = -1.9681 - 10.854$	+3x	+1237
+2.1012 = +1.331 - 2606 = -1275 + 44 = -1231 = +6		
+2.1532 = +1.851 - 3143 = -1292 + 48 = -1244 = -7		
+1.9681 = 0 - 1318 = -1318 + 81 = -1237 = 0		
+2.1682 = +2.001 - 3323 = -1322 + 85 = -1237 = 0		
18.7253 = 16.7565 - 2277	+56	= 16.6588 ✓
$y-7 = -1.0986 + 917$	+44	-2708
+1.2243 = +1.257 + 1348 = +2605 + 101 = +2706 = -2		
+1.2126 = +1.140 + 1462 = +2602 + 121 = +2723 = +15		
+1.1176 = +1.90 + 2453 = +2643 + 51 = +2694 = -14		
+1.0986 = 0 + 2580 = +2580 + 128 = +2708 = 0		
22.0021 = 20.9045 + 1704	+88	= 20.8179

1913 Mar 7.

Center of plate
 x y for plates 1301-1302-1303-1304.
Kleeb.

12.53	24.02
13.78	29.21
25.43	11.58
26.07	30.94
4 77.81	95.75
19.45	23.94
-1.8	-0.2
14.5	1.94
31	46.5
-14.5	97.0
43.5	116.4
44.95	776
	902.10

0 ^h 46	43	+2	59	08
47	21	+3	34	35
53	05	+1	18	15
53	43	+3	48	57
20.0	52	11	35	55
0 50	13	+2	53	59
-	45	-	15	02
0 ^h 49	28	+2	38	57

$$A = 0^h 49^m 28^s$$

$$D = +2^\circ 38' 57''$$

Preliminary Reduction

$$x - 3 - 1.9681 - 10.854 + 3x + 1237$$

$$+2.1012 = +1331 - 2606 = -1275 + 44 = -1231 = +6$$

$$+2.1532 = +1851 - 3143 = -1292 + 48 = -1244 = -7$$

$$+1.9681 = 0 - 1318 = -1318 + 81 = -1237 = 0$$

$$+2.1682 = +2001 - 3323 = -1322 + 85 = -1237 = 0$$

$$18.7246 = 16.7565 - 22.77 + 56 = 16.6581$$

$$y - 7 - 1.0986 + 91x + 44 - 2708$$

$$+1.2243 = +1257 + 1348 = +2605 + 101 = +2706 = -2$$

$$+1.2126 = +1140 + 1462 = +2602 + 121 = +2723 = +15$$

$$+1.1176 = +170 + 2453 = +2643 + 51 = +2694 = -14$$

$$+1.0986 = 0 + 2580 = +2580 + 128 = +2708 = 0$$

$$22.0031 = 20.9045 + 1704 + 88 = 20.8149$$

MC1301

Times etc.

1913 Feb. 25.

7.

Exp. to Stars 1911 Oct. 7 21^h 09^m - 21^h 21^m
 moon 21 15 16.1 - 21 15 16.5^v
 clock slow 0 41.6

H. Sid T.	21	15	57.9 ^v	21	14	57.9
H. long	4	44	31.05	4	44	31.05
G. Sid T.	26	00	28.95 ^v	25	59	28.95
Sid T. in moon	13	00	05.64	13	00	03.64
Interval	13	00	25.31 ^v	12	59	25.31
Reduction		2	07.85 ^v		2	07.69
G. m. T.	12	58	17.46 ^v	12	57	17.62

From Naut. Alman. R.A. Decl
 moon 13^h 0^h 46^m 35^s 56^v + 3⁰ 08' 38.0^v
 Motion in 1^m = 2.0310 16.122
 " " - 1.709 2.7063 - 550 - 43.6
 Tabular place: 0 46 30.06 + 3 07 54.4

Moon's parallax 58', 13.2^v
 Semidiameter 15' 53.4

Moon is 3^h 12.8^m before full

Tables a = -4.5 e = -5.5 a - e = +1.0 b + d = +10.0
 Obs a = -3.2 e = -2.7 a - e = -0.5 b + d = +11.5

MC1201

Times etc.

1913 Feb 25.

7

Exp to Stars 1911 Oct 7 $21^h 09^m$ $-21^h 21^m$
 noon 21 15 16.1 -21 15 16.5
 clock slow 0 41.6

H. Sid T. 21 15 57.9
 H long 4 44 31.05
 G. Sid T. 26 00 28.95
 Sid T. in noon 13 00 03.64
 Interval 13 00 25.31
 Reduction 2 07.85
 G. m. T. 12 58 17.46

From Hank. Alm. $0^h 46^m 35.56$ $+3^0 08' 38.0$
 noon 13^h $0^h 46^m 35.56$ $+3^0 08' 38.0$
 when $ul^m = 2.031\phi$ $- 3.47$ 16.122 $- 27.6$
 " $= 1.709$ $- 3.47$ $- 27.6$
 stellar place: $0 46 32.09$ $+3 08 10.4$

moon's parallax $58'$ 13.2
 semidiam. $15'$ 53.4

moon is $3^h 12.8$ before full

NIC1301-1304 Plate constants

1913 Mar 10 8

a	b	c	1301	1302	1303	1304			
+12.71+23.96+1=	+6	-2	-3	-1	+1	0	-14	+4	
+13.91+29.16+1=	-7	+15	+4	-6	-6	-8	+8	-4	
+24.99+11.62+1=	0	-14	-5	+4	+4	+5	0	-7	
+26.19+31.01+1=	0	0	+4	+5	+2	+4	+6	+7	
Mean Equations									
+13.31+26.58+1=	-0.50	+6.50	+0.50	-3.50	-2.50	-4.00	-3.00	0.00	
+25.59+21.32+1=	0.00	-7.00	-0.50	+4.50	+3.00	+4.50	+3.00	0.00	
+18.85+17.79+1=	+3.00	-8.00	-4.00	+1.50	+2.50	+2.50	-7.00	-7.50	
+20.05+30.08+1=	-3.50	+7.50	+4.00	-0.50	-2.00	-2.00	+7.00	+1.50	
-12.28+5.26	=	-0.50	+13.50	+1.00	-8.00	-5.50	-8.50	-6.00	0.00
-1.20-12.29	=	+6.50	-15.50	-8.00	+2.00	+4.50	+4.50	-14.00	-3.00
+1.20-0.52	=	+0.05	-1.32	-0.10	+0.78	+0.54	+0.83	+0.59	0.00
-12.81	=	+6.55	-16.82	-8.10	+2.78	+5.04	+5.33	+13.41	-3.00
b=	-0.51	+1.31	+0.63	-0.22	-0.39	-0.42	+1.05	+0.23	
a=	-0.18	-0.54	+0.19	+0.56	+0.28	+0.51	+0.94	+0.10	

Plate 1301

-0.5	0.0	+3.0	-3.5	+6.5	-7.0	-8.0	+7.5
+2.4	+4.6	+3.4	+3.6	+7.2	+13.8	+10.2	+10.8
+13.6	+10.9	+9.1	+15.3	-34.8	-27.9	-23.3	-39.4
+15.5	+15.5	+15.5	+15.4	-21.1	-21.1	-21.1	-21.1

C for (x-3)

C for (y-4) plate 1301

Plate 1302

+0.5	-0.5	-4.0	+4.0	-3.5	+2.5	+1.5	-0.5
-2.5	-4.9	-3.6	-3.8	-7.5	-14.3	-10.6	-11.2
-16.7	-13.4	-11.2	-18.9	+5.8	+4.7	+3.9	+6.6
-18.7	-18.8	-18.8	-18.7	-5.2	-5.1	-5.2	-5.1

C for (x-3)

C for (y-4)

Plate 1303

-2.5	+3.0	+2.5	-2.0	-4.0	+4.5	+2.5	-2.0
-3.7	-7.2	-5.3	-5.6	-6.8	-13.0	-9.6	-10.2
+10.4	+8.3	+6.9	+11.7	+11.2	+9.0	+7.5	+12.6
+4.2	+4.1	+4.1	+4.1	+0.4	+0.5	+0.4	+0.4

C for (x-3)

C for (y-4)

Plate 1304

-3.0	+3.0	-7.0	+7.0	0.0	0.0	-1.5	+1.5
-12.5	-24.0	-17.7	-18.8	-1.3	-2.6	-1.9	-2.0
-27.9	-22.4	-18.7	-31.6	-6.2	-5.0	-4.2	-7.1
-42.4	-43.4	-43.4	-43.4	-7.5	-7.6	-7.6	-7.6

MG1301-1304 1-tau constant

1913 Mar. 10

8

a	b	c	1301		1302		1303		1304	
+12.71+23.96+12	+6	-2	-3	-1	+1	0	-14	+4		
+13.91+29.16+12	-7	+15	+4	-6	-6	-8	+8	-4		
+24.99+11.62+12	0	-14	-5	+4	+4	+5	0	-7		
+26.19+31.01+12	0	0	+4	+5	+2	+4	+6	+7		

Mean Equation

+13.31+26.58+12	-0.50	+6.50	+0.50	-3.50	-2.50	-4.00	-3.00	0.00
+25.59+21.32+12	0.00	-7.00	-0.50	+4.50	+3.00	+4.50	+3.00	0.00
+18.85+17.79+12	+3.00	-8.00	-4.00	+1.50	+2.50	+2.50	-7.00	-1.50
+20.05+30.08+12	-3.50	+7.50	+4.00	-0.50	-2.00	-2.00	+7.00	+1.50
-12.28+5.26	-0.50	+13.50	+1.00	-8.00	-5.50	-8.50	-6.00	0.00
-1.20-12.29	+6.50	-15.50	-8.00	+2.00	+4.50	+4.50	-14.00	-3.00
+1.20-0.52	+0.05	-1.32	-0.10	+0.78	+0.54	+0.83	+0.59	0.00
-12.81	+6.55	-16.82	-8.10	+2.78	+5.04	+5.33	-13.41	-3.00
b =	-0.51	+1.31	+0.65	-0.22	-0.39	-0.42	+1.05	+0.23
a =	-0.18	-0.54	+0.19	+0.56	+0.28	+0.51	+0.94	+0.10

Plate 1301

-0.5	0.0	+3.0	-3.5	+6.5	-7.0	-8.0	+7.5
+2.9	+4.6	+3.4	+3.6	+7.2	+13.8	+10.2	+10.8
+15.1	+10.9	+9.1	+15.3	-34.8	-27.9	-23.3	-39.4
+15.5	+15.5	+15.5	+15.4	-21.1	-21.1	-21.1	-21.1

c for (x-3)

c for (y-7) plate 1301

Plate 1302

+0.5	-0.5	-4.0	+4.0	-3.5	+4.5	+1.5	-0.5
-2.5	-4.9	-3.6	-3.8	-7.5	-14.3	-10.6	-11.2
-16.7	-13.4	-11.2	-18.9	+5.8	+4.7	+3.9	+6.6
-18.7	-18.8	-18.8	-18.7	-5.2	-5.1	-5.2	-5.1

c for (x-3)

c for (y-7)

Plate 1303

-2.5	+3.0	+2.5	-2.0	-4.0	+4.5	+2.5	-2.0
-3.7	-7.2	-5.3	-5.6	-6.8	-13.0	-9.6	-10.2
+10.4	+8.3	+6.9	+11.7	+11.2	+9.0	+7.5	+12.6
+4.2	+4.1	+4.1	+4.1	+0.4	+0.5	+0.4	+0.4

c for (x-3)

c for (y-7)

Plate 1304

-3.0	+3.0	-7.0	+7.0	0.0	0.0	-1.5	+1.5
-12.5	-24.0	-17.7	-18.8	-1.3	-2.6	-1.9	-2.0
-27.9	-22.4	-18.7	-31.6	-6.2	-5.0	-4.2	-7.1
-42.4	-43.4	-43.4	-43.4	-7.5	-7.6	-7.6	-7.6

MC1301-1304.

1913 Mar 11

9

Residuals

Plate 1301

	C	O	O-C		C	O	O-C
- 2 - 12 + 15 = +1	+6	+5	- 7 + 31 - 21 = +3	-2	-5		
- 3 - 15 + 15 = -3	-7	-4	- 8 + 38 - 21 = +9	+15	+6		
- 4 - 6 + 15 = +5	0	-5	- 13 + 15 - 21 = -19	-14	+5		
- 5 - 16 + 15 = -6	0	+6	- 14 + 40 - 21 = +5	0	-5		

Plate 1302

+ 2 + 15 - 19 = -2	-3	-1	+ 7 - 5 - 5 = -3	-1	+2		
+ 3 + 18 - 19 = +2	+4	+2	+ 8 - 6 - 5 = -3	-6	-3		
+ 5 + 7 - 19 = -7	-5	+2	+ 14 - 3 - 5 = +6	+4	-2		
+ 5 + 20 - 19 = +6	+4	-2	+ 15 - 7 - 5 = +3	+5	+2		

Plate 1303

+ 4 - 9 + 4 = -1	+1	+2	+ 6 - 19 + 0 = -4	0	+4		
+ 4 - 11 + 4 = -3	-6	-3	+ 7 - 12 + 0 = -5	-8	-3		
+ 7 - 3 + 4 = +8	+4	-4	+ 13 - 4 + 0 = +9	+5	-4		
+ 7 - 12 + 4 = -1	+2	+3	+ 13 - 13 + 0 = 0	+4	+4		

Plate 1304

+ 12 + 25 - 43 = -6	-14	-8	+ 1 + 6 - 8 = -1	+4	+5		
+ 13 + 31 - 43 = +1	+8	+7	+ 1 + 7 - 8 = 0	-4	-4		
+ 23 + 12 - 43 = -8	0	+8	+ 3 + 3 - 8 = -2	-7	-5		
+ 25 + 33 - 43 = +15	+6	-9	+ 3 + 7 - 8 = +2	+7	+5		

MC 1301-1304.

1913. May 11

9

Residuals

Plate 1301

C

O

O-C

C

O

O-C

-	2	-	12	+	15	=	+1	+6	+5	-	7	+	31	-	21	=	+3	-2	-5
-	3	-	15	+	15	=	-3	-7	-4	-	8	+	38	-	21	=	+9	+15	+6
-	4	-	6	+	15	=	+5	0	-5	-	13	+	15	-	21	=	-19	-14	+5
-	5	-	16	+	15	=	-6	0	+6	-	14	+	40	-	21	=	+5	0	-5

Plate 1302

+	2	+	15	-	19	=	-2	-3	-1	+	7	-	5	-	5	=	-3	-1	+2
+	3	+	18	-	19	=	+2	+4	+2	+	8	-	6	-	5	=	-3	-6	-3
+	5	+	7	-	19	=	-7	-5	+2	+	14	-	3	-	5	=	+6	+4	-2
+	5	+	20	-	19	=	+6	+4	-2	+	15	-	7	-	5	=	+3	+5	+2

Plate 1303

+	4	-	9	+	4	=	-1	+1	+2	+	6	-	19	+	0	=	-4	0	+4
+	4	-	11	+	4	=	-3	-6	-3	+	7	-	12	+	0	=	-5	-8	-3
+	7	-	3	+	4	=	+8	+4	-4	+	13	-	4	+	0	=	+9	+5	-4
+	7	-	12	+	4	=	-1	+2	+3	+	13	-	13	+	0	=	0	+4	+1

Plate 1304

+	12	+	25	-	43	=	-6	-14	-8	+	1	+	6	-	8	=	-1	+4	+5
+	13	+	31	-	43	=	+1	+8	+7	+	1	+	7	-	8	=	0	-4	-4
+	23	+	12	-	43	=	-8	0	+8	+	3	+	3	-	8	=	-2	-7	-5
+	25	+	33	-	43	=	+15	+6	-9	+	3	+	7	-	8	=	+2	+7	+5

Correction for phase

$$\begin{cases} X = -22' = -0.37 \\ Y = -2^{\circ} 36' = -2.6 \end{cases}$$

	x	y	x ₂	y ₄		
1	+0.28	-2.04	-0.10	+5.30	+5.20	+80
2	0.00	-2.06	0.00	+5.35	+5.35	+84
3	-0.72	-1.93	+0.27	+5.01	+5.28	+82
4	-1.72	-1.12	+0.64	+2.91	+3.55	+37
5	-1.80	-1.00	+0.67	+2.60	+3.27	+32
6	-2.06	0.00	+0.76	0.00	+0.76	+2
7	-1.80	+1.00	+0.67	-2.60		

MC 1301

Proton's Center

1913 Mar 11.

10

	x	$x - X_0$	Δx	$(x - X_0)^2$		$O - C$	COR. (mean)
1	19.0000	+0.2767	+20	0.0776	4.2339	+31	+80
2	18.7233	0.0000	+21	0.0000	4.2296	-12	+84
3	18.0000	-0.7233	+19	0.5204	4.2333	+25	+82
4	17.0000	-4.7233	+11	2.9660	4.2262	-46	+37
5	16.9276	-1.7957	+10	3.2209	4.2269	-39	+30
6	16.6668	-2.0565	+0	4.2292	4.2292	-16	+2
7	16.9270	-1.7963	+10	3.2303	4.2247	-61	
8	17.0000	-1.7233	+11	2.9736	4.2354	+46	
9	18.0000	-0.7233	+19	0.5259	4.2304	-4	
10	18.7233	0.0000	+21	0.0000	4.2300	-8	
11	19.0000	+0.2767	+20	0.0754	4.2390	+82	
12	20.9777	+2.0544	+0	4.2253	4.2308	-2	

	y	$y - Y_0$	Δy	$(y - Y_0)^2$	
1	19.9644	-2.0385	-2	4.1563	
2	19.9465	-2.0564	-2	4.2296	
3	20.0762	-1.9267	-2	3.7129	
4	20.8804	-1.1225	-1	1.2602	
5	21.0000	-1.0029	-1	1.0060	
6	22.0000	-0.0029	-0	0.0000	
7	23.0000	+0.9971	+1	0.9949	
8	23.1261	+1.1232	+1	0.2618	
9	23.9274	+1.9245	+2	3.7045	
10	24.0594	+2.0565	+2	4.2300	
11	24.0432	+2.0403	+2	4.1636	

Approximate Center.

$x = 19.0 \quad y = 19.9644$

$y = 24.0432$

440076

mean $y = 22.0038$

mean $y_0 = 22.0029$

$y - \text{max} = 24.0594$

$R = 2.0565$

$x - \text{min} = 16.6668$

$X_0 = 18.7233$

$x = 18.0 \quad y = 20.0762$

239274

440036

mean $y = 22.0018$

$x = 17.0 \quad y = 20.8804$

231261

440065

mean $y = 22.0032$

Assume $\begin{cases} X_0 = 18.7233 \\ Y_0 = 22.0029 \end{cases}$

MC 1301

Proton's Center

1913 Mar. 11.

10

	x	$x - X_0$	Δx	$(x - X_0)^2$		$0 - C$
1	19.0000	+0.2767	+20	0.0776	4.2339	+31.80
2	18.7233	0.0000	+21	0.0000	4.2296	-12.44
3	18.0000	-0.7233	+19	0.5244	4.2333	+25.42
4	17.0000	-1.7233	+11	2.9660	4.2262	-4.63
5	16.9276	-1.7957	+10	3.2209	4.2269	-39.32
6	16.6668	-2.0565	+0	4.2292	4.2292	-16.12
7	16.9270	-1.7963	+10	3.2303	4.2247	-6.1
8	17.0000	-1.7233	+11	2.9736	4.2354	+4.6
9	18.0000	-0.7233	-19	0.5259	4.2304	-4
10	18.7233	0.0000	-21	0.0000	4.2300	-8
11	19.0000	+0.2767	-20	0.0754	4.2390	+8.2
12	20.7777	+2.0564		4.2253		
					4.2308	-2

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	19.9644	-2.0385	-2	4.1563
2	19.9465	-2.0564	-2	4.2296
3	20.0762	-1.9267	-2	3.7129
4	20.8804	-1.1225	-1	1.2602
5	21.0000	-1.0029	-1	1.0060
6	22.0000	-0.0029	-0	0.0000
7	23.0000	+0.9971	+1	0.9944
8	23.1261	+1.1232	+1	0.2618
9	23.9274	+1.9245	+2	3.7045
10	24.0594	+2.0565	+2	4.2300
11	24.0432	+2.0403	+2	4.1636
12	21.0000	-0.0029		

Approximate Center.

$$x = 19.0 \quad y = 19.9644$$

$$y = \frac{24.0432}{440076}$$

$$\text{mean } y = 22.0038$$

$$\text{mean } y_0 = 22.0029$$

$$y - \text{max} = 24.0594$$

$$R = 2.0565$$

$$x - \text{min} = 16.6668$$

$$X_0 = 18.7233$$

$$x = 18.0 \quad y = 20.0762$$

$$\frac{23.9274}{440036}$$

$$\text{mean } y = 22.0018$$

$$x = 17.0 \quad y = 20.8804$$

$$\frac{23.1261}{440065}$$

$$\text{mean } y = 22.0032$$

$$\text{Assume } \begin{cases} X_0 = 18.7233 \\ Y_0 = 22.0029 \end{cases}$$

Formation of Normals correction for phase

No	at	an	bn	an	bn	cn
1	-0.57 +	8.7 -	63.2 +	22.4 -	163.0 +	80
2	-0.00 -	0.0 +	29.7	0.0 -	173.0	84
3	+1.39 -	18.0 -	98.2 -	59.0 -	158.0	82
4	+1.93 +	79.0 +	51.5 -	63.6 -	41.4	37
5	+1.80 +	70.2 +	39.0 -	57.6 -	32.0	32
6	-0.00 +	33.0 -	0.0 -	9.1 -	0.0	2
7	-1.80 +	109.9 -	61.0			
8	-1.93 -	79.0 +	51.5			
9	-1.38 +	29 -	7.7			
10	+4.00 -	0.0 -	16.5			
11	+0.57 +	230 +	167.0			
	0.00 +	229.7 +	137.1 -	161.9 -	567.4 +	317
		-161.9	-567.4			
		+67.8	-430.3			

$$[aa] = +17.82$$

$$[bb] = +27.72$$

$$[cc] = -9.98$$

$$[re] = 0.0$$

$$cn = -2$$

$$+317$$

$$+315$$

Corrected Residuals

o	c	o-c
1 +111	+11+32+65 = +108	+3
2 +72	0+32 = +97	-25
3 +109	-29+30 = +1	+43
4 -9	-69+17 = -52	-22
5 -7	-73+16 = -57	-15
6 -14	-83-0 = -83	+4
7 -61	-73-16 = -89	-37
8 +46	-69-17 = -86	+67
9 -4	-29-30 = -59	-10
10 -8	-0-32 = -32	-41
11 +82	+11-32 = -21	+38

$$+155 - 150$$

$$\text{Average} = 28$$

MC1301

1913 Mar 12. 11

Gauss's Centre - Conditional Equations

	a	b	c	0		c	0=c	
1	+0.28	-2.04	+1	=+31	+7	-1.0+23	=+20	+11
2	0.00	-2.06	+1	=-12	0	-1.0+23	=+13	-25
3	-0.72	-1.93	+1	=+25	-19	-1.0+23	=-6	+31
4	-1.72	-1.12	+1	=-46	-45	-1.0+23	=-28	-18
5	-1.80	-1.00	+1	=-39	-47	-1.0+23	=-29	-10
6	-2.06	+0.00	+1	=-16	-54	0+23	=-31	+15
7	-1.80	+1.00	+1	=-61	-47	5+23	=-19	-42
8	-1.72	+1.12	+1	=+46	-45	6+23	=-16	+62
9	-0.72	+1.92	+1	=-4	-19	10+23	=+14	-18
10	0.00	+2.06	+1	=-8	0	10+23	=+33	-41
11	+0.28	+2.04	+1	=+82	+7	10+23	=+40	+42

+161-154

Average 0=c = 29

Normal Equations

$$\begin{aligned}
 +17.82a + 0.00b - 9.98c &= +230 + 68 \\
 0.00a + 27.72b + 0.00c &= +137 - 430 \\
 -9.98a + 0.00b + 11.00c &= -2 + 315
 \end{aligned}$$

$$\begin{aligned}
 0.00a + 0.00b - 0.00c &= 0 \\
 +9.98a + 0.00b - 5.59c &= +129 + 38
 \end{aligned}$$

$$0.00a + 27.72b + 0.00c = +137 - 430$$

$$0.00a + 5.41b = +127 + 353$$

$$-9.98a = -2 - 258 = -260$$

$$= +315 - 718 = -403$$

$$a = +26$$

$$+40$$

$$\frac{\Delta y}{\Delta x} = 0$$

$$\frac{\Delta x}{\Delta y} = +1.15$$

1974

MC1301

1913 Mar 12.

11

Normal Equations - Conditional Equations

	a	b	c	0		c	0-c
1	+0.28	-2.04	+1	= +31	+7	-10+23 = +20	+11
2	0.00	-2.06	+1	= -12	0	-10+23 = +13	-25
3	-0.72	-1.93	+1	= +25	-19	-10+23 = -6	+31
4	-1.72	-1.12	+1	= -46	-45	-6+23 = -28	-18
5	-1.80	-1.00	+1	= -39	-47	-5+23 = -29	-10
6	-2.06	+0.00	+1	= -16	-54	0+23 = -31	+15
7	-1.80	+1.00	+1	= -61	-47	-5+23 = -19	-42
8	-1.72	+1.12	+1	= +46	-45	-6+23 = -16	+62
9	-0.72	+1.92	+1	= -4	-19	-10+23 = +14	-18
10	0.00	+2.06	+1	= -8	0	0+23 = +33	-41
11	+0.28	+2.04	+1	= +82	+7	+10+23 = +40	+42

+161 - 154

Average (0-c) = 29

Normal Equations

$$\begin{array}{rcl}
 +17.82a & + & 0.00b - 9.98c = +230 + 68 \\
 0.00a & + & 27.72b + 0.00c = +137 - 430 \\
 -9.98a & + & 0.00b + 11.00c = -2 + 315
 \end{array}$$

$$\begin{array}{rcl}
 0.00a & - & 0.00b - 0.00c = 0 \\
 +9.98a & + & 0.00b - 5.59c = +129 + 38
 \end{array}$$

$$\begin{array}{rcl}
 0.00a & + & 27.72b + 0.00c = +137 - 430 \\
 0.00a & + & 5.41b = +127 + 353
 \end{array}$$

$$\begin{array}{rcl}
 -9.98a & = & -2 - 258 = -260 \\
 -2 + 3 + 5 & = & 718 = -403
 \end{array}$$

$$\begin{array}{rcl}
 a & = & +26 \\
 & & +40
 \end{array}$$

MC 1301.

Lunar Parallel

1913 May 14

$$\begin{array}{rcl}
 \alpha' & = & 0 \quad 48 \quad 49.27 \\
 \delta & = & 21 \quad 15 \quad 57.9 \\
 \theta - \alpha' & = & -3 \quad 32 \quad 51.2 \\
 & = & -53 \quad 12 \quad 48
 \end{array}$$

$$\delta' = +2 \quad 30 \quad 03.5$$

$$\pi = 58' 13.2''$$

$$\frac{1}{2}(\alpha - \alpha')$$

$$(\theta - \delta') - \frac{1}{2}(\alpha - \alpha') =$$

$$\log \tan \phi' = 9.95727$$

$$\begin{array}{l}
 \cos i(\alpha - \alpha') : \\
 - \dots (\theta - \delta') - \frac{1}{2}(\alpha - \alpha') :
 \end{array}$$

$$\tan \gamma =$$

 γ δ'

$$\gamma - \delta' =$$

$$\log \sin \phi' = 9.82640$$

$$\begin{array}{l}
 \sin \pi = 8.22878 \\
 \dots (\gamma - \delta') \\
 - \dots \gamma
 \end{array}$$

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

$$\delta - \delta' =$$

$$\delta =$$

 α

$$3108$$

$$\text{Ann Eph. } \delta = +3 \quad 08 \quad 10.4 \quad \alpha \quad 0 \quad 46 \quad 32.09$$

$$O - C =$$

$$O - C$$

MC 1301

1913 Mar. 13.

12

Moon's mean position (1911.0)

$$X_0 = 18.7233$$

$$Y_0 = 22.0029$$

$$\Delta\alpha = +20$$

$$\Delta\delta = -28$$

$$18.7253$$

$$22.0021$$

Journ Preliminary Reduction $X = 16.6588^\vee$ $Y = 20.8129$

Plate Constants

$$a_x = -3$$

$$-9$$

$$b_y = -11$$

$$+27$$

$$c = +16$$

$$-21$$

$$X = 16.6580$$

$$20.8126$$

$$\xi = -1.3410^\vee$$

$$\eta = -1.1884^\vee$$

$$\log \xi = 0.12743^\vee$$

$$\log \tan \delta = 8.6572$$

$$\cos \delta = 9.99959^\vee$$

$$\xi^2 = 0.2553$$

$$\text{const} = 8.50724^\vee$$

$$\eta_1 = 59.659$$

$$(d-A) = 162060^\vee$$

$$\eta_1 = +1$$

$$d-A = -41.74^\vee$$

$$\eta_0 = -1.1885^\vee$$

$$A = 04928^\vee$$

$$\log \eta_0 = 0.07500^\vee$$

$$X_0 = 04846.26^\vee$$

$$\text{const} = 7.33115^\vee$$

$$(S-D) = 2.74385^\vee$$

$$\text{Red. aff.} +3.01$$

$$S-D = -9.144^\vee$$

$$\alpha_1 = 04849.27^\vee$$

$$D = +238.57^\vee$$

$$\delta_0 = +229.426^\vee$$

$$\text{Red.} +20.9^\vee$$

$$\delta_1 = +230.035^\vee$$

MC 1301

Lunar Parallax

1913 May 14

$$\begin{aligned}
 \alpha' &= 0 \quad 48 \quad 49.27 \\
 \theta &= 21 \quad 14 \quad 57.9 \\
 \theta - \alpha' &= -3 \quad 33 \quad 51.4 \\
 &= -53 \quad 27 \quad 51
 \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = -17 \quad 20$$

$$(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = -53 \quad 10 \quad 31$$

$$\begin{aligned}
 \log \tan \phi' &= 9.95727 \\
 \cos \frac{1}{2}(\alpha - \alpha') &= 9.99999 \\
 \therefore \frac{1}{2}(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') &= 9.79769
 \end{aligned}$$

$$\tan \gamma = 0.17957$$

$$\gamma = +56 \quad 31 \quad 17.9$$

$$\delta = +2 \quad 30 \quad 03.5$$

$$\gamma - \delta = +54 \quad 01 \quad 13.5$$

$$\begin{aligned}
 \log \sec \phi' &= 9.82640 \\
 \sin \pi &= 8.22878 \\
 \therefore \gamma - \delta &= 9.90807 \\
 \therefore \gamma &= 9.92125
 \end{aligned}$$

$$\log \sin (\delta - \delta') = 8.04204$$

$$\delta - \delta' = +37 \quad 52.4$$

$$\delta - \delta' = +3 \quad 07 \quad 55.9 \quad \alpha \quad 0 \quad 46 \quad 30.63$$

$$\text{App. Sph. } \delta = +3 \quad 07 \quad 54.4 \quad \alpha \quad 0 \quad 46 \quad 30.09$$

$$\therefore \delta - \delta' = +1.5 \quad 0 - c \quad + 0.57$$

$$\delta' = +2 \quad 30 \quad 03.5$$

$$\pi = 58' \quad 13.2$$

$$\log \sec \phi' = 9.86913$$

$$\sin \pi = 8.22878$$

$$\therefore \sin (\theta - \alpha') = 9.90498$$

$$\therefore \cos \delta = 9.99935$$

$$\log \sin (\alpha - \alpha') = 8.00353$$

$$\alpha - \alpha' = -34' \quad 39.6$$

$$\therefore \alpha = -2 \quad 18.64$$

1913 Mar. 13.

12

MC 1301

Moon's mean position (1911.0)

$$X_0 = 18.7233$$

$$Y_0 = 22.0029$$

$$+A = +20$$

$$+B = -2.8$$

$$18.7253$$

$$22.0021$$

From Preliminary Reduction $X = 16.6588$ $Y = 20.8179$

Plate Constants

$$a_x = -3$$

$$-9$$

$$b_y = -11$$

$$+27$$

$$c = +16$$

$$-21$$

$$X = 16.6590$$

$$20.8176$$

$$\xi = -1.3410$$

$$\log \xi = 0.12743$$

$$\log \delta = 9.99959$$

$$\text{const} = 9.50774$$

$$(X-A) = 1.62060$$

$$X-A = -41.79$$

$$A = 04928$$

$$X_0 = 04846.26$$

$$\text{Red w-off} = +3.01$$

$$X_1 = 04849.27$$

$$\eta = -1.1884$$

$$\log \tan \delta = 8.6572$$

$$\delta = 0.2553$$

$$\eta_1 = 59.659$$

$$\eta_1 = +1$$

$$\eta_0 = -1.1885$$

$$\log \eta_0 = 0.07509$$

$$\text{const} = 7.33115$$

$$(S-D) = 2.74385$$

$$S-D = -914.4$$

$$D = +23857$$

$$\delta_0 = +22942.6$$

$$\text{Red} = +20.9$$

$$\delta_1 = +23003.5$$

MC1302

7913 Feb. 27.

13

Comp. Star Measures.

u

x

	d		N
1/14.0	18718		16916
24.8	1066065		1498081
mg	58		83
6.5	20		22

d	N
6538	1226665
6320	66
2217	12061

24.8059.806413.9782.9782

E			
15.3	11995		9072
30.0	0493		905040
mg	65		5040
8.0			

29.9968.9975

17509	15630
978281	1333940
86	36
09	31

15.2274.2292

I			
26.1	15789		15303
124	1200204		909192
mg	0204		9292
7.3	86		10

12.3785.3785

18535	16880
999190	15401
9690	0500
25	79

16.1466.1478

4			
27.5	15599		18778
31.7	800103		1632632
mg	00		3032
8.4	41		80

31.7542.7551

15770	17086
10910	1192226
0810	27
64	86

27.5142.5161

MC1302

1912 Jan 27

13

	d	n
14.0	18718	16916
14.8	1066065	1498081
mg	58	83
2.5	20	22

24.80598064

15.3	1199593	9072
50.0	04	905040
mg	65	5040
6.0		

29.99689975

5	15789	15303
26.1	1200204	909192
12.4	02	92
mg	86	10
7.3		

12.37853785

4	15599	18778
7.5	800103	1632632
1.7	00	30
mg	41	80
8.9		

31.75427551

d	n
6538	1726665
6320	66
2217	2061

13.97829782

17509	15630
978281	1333940
86	36
09	31

15.22742292

118535	16880
999190	15491
9690	0500
25	79

16.14661478

15770	17086
10910	1192226
0810	2726
69	86

27.51425161

ML 1302

1913 Feb. 27.

14

Moon - measures.

$\frac{1}{2}$	α	γ	δ	ϵ	ζ	η
19.0	16369	18415				
20.4	13584	11198				
min	69	00				
in	80	30				
γ						

possibly on
terminator20.2798.2772

$\frac{2}{3}$		
18.0	15439	18379
20.6	10484	13330
	80	31
	79	10
	47	81

20.4962.4944

$\frac{3}{4}$
17.4
21.0

15443	17780
8948	14281
35	55
30	72
40	70

$\frac{4}{5}$		
17.0	15790	15597
21.6	9727	11646
	06	09
	00	00
	02	

<u>17.3497</u>	<u>.3508</u>
16345	Remeasure (4)

reject.

21.6086.6025

$\frac{5}{6}$
16.9
22.0

17710	15210
16559	73504
57	49
51	95
15	

16.8845.8851

1161302

1913 Feb. 27.

14

Moon - (measured).

L	d	N
19.0	16369	18415
20.4	13584	11198
mm	69	00
in	80	30
y		

possibly a
terminator20.27982772

18.0	15439	18379
20.6	10484	13330
	79	10
	47	81

20.49624944

3
17.4
21.0

15443	17780
8948	14281
35	65
40	70

17.34973508

16345 remeasure (+)

reject.

17.0	15790	15597
21.6	9727	11646
	06	15
	02	00

21.60866025

5
16.9
22.0

17710	16210
16359	7350
57	49
15	95

16.88458851

$\frac{12}{20.9}$
 $\frac{22.3}{\text{max}}$
 in
 26

14224
 13952
 5651
20.9729

985140
 5040
 9588
9741

NIC 1302

-d

N

6
16.8
22.3
min
in
N

7
16.9
23.0

8
17.0 11028
23.1 10051
40 55

9045
985-00
8076

9
17.7
24.0

23.0979.0934

10
18.0 17277
24.2 15465
70 80
79

16444
8266
8070
59

24.1805.1816

11
19.0 16223
24.4 1223036
max 25
in 22

15505
9476
8079
12

12
24.3993

.3969

1913 Feb 27.

15

2 N
17679 16214
16249 7635
44 51 3934
91 10

16.8567.8575

13306
12960
60 60

10000
0597
9669

16.9654.9668

very oblique

17235
14251
66 60
41

18930
11870
80 65
35

17.7022.7061

NIC 1302

d⁴

N

6
16.8
22.3

min
w
w

2
16.9
23.0

8

17.0 11028
23.1 1005155
40

9045
98500
8076

23.09790934

2
17.7
24.0

10

18.0 17277
24.2 1546580
70
79

16444
8266
8070
59

24.1805.1816

11
19.0 16223
24.4 1223036
max 25
22

15505
9476
8079
12

4
0 24.3993

3969

1913 Feb 27.

15

d

N

17679
16249.51
44
91

16214
763534
39
10

16.8567.8575

13306
1296060
60

1000097
0597
9669

16.9654.9668

very oblique

17235
14251
6660
41

18930
1187065
80
35

17.7022.7061

MC 1302

1913 mar. 8.

16

Preliminary Reduction

	1	2	3	4
x	139782	152283	261472	275152
3	127084	139127	249869	261856
x-3	+12698	+13156	+11603	+13296
y	248062	299972	123785	317546
4	239556	291579	116199	310104
y-4	+8506	+8393	+7586	+7442

$$\begin{array}{rcll}
 x-3 & -1.1603 & -874 & +x \\
 +1.2698 & = +1095 & -2158 & = -1063 + 14 = -1049 = -3 \\
 +1.3156 & = +1553 & -2610 & = -1057 + 15 = -1042 = +4 \\
 +1.1603 & = & 0 & -1077 = -1077 + 26 = -1051 = -5 \\
 +1.3296 & = +1693 & -2763 & = -1070 + 28 = -1042 = +4 \\
 18.9188 & = & -1943 & +19 = 17.6784
 \end{array}$$

$$\begin{array}{rcll}
 y-4 & +782 & +24 & -9646 \\
 +8506 & +1089 & = +9595 & +50 = +9645 = -1 \\
 +8393 & +1187 & = +9580 & +60 = +9640 = -6 \\
 +7586 & +2039 & = +9625 & +25 = +9650 = +4 \\
 +7442 & +2146 & = +9588 & +63 = +9651 = +5 \\
 22.3376 & +1476 & +45 & = 21.5258
 \end{array}$$

$$\begin{array}{llll}
 \text{Tables } a = -3.2 & e = -4.5 & a - e = +1.3 & b + a = +6.8 \\
 \text{Obs } a = -0.8 & e = -2.2 & a - e = +1.4 & b + a = +10.2
 \end{array}$$

MC 1302

1913 mar 8.

16

Preliminary Reduction

	1	2	3	4
x	13.9782	15.2283	26.1472	27.5152
z	12.7084	13.9127	24.9869	26.1856
$x-z$	+1.2698	+1.3156	+1.1603	+1.3296
y	24.8062	29.9972	12.3785	31.7546
η	23.9556	29.1579	11.6199	31.0104
$y-\eta$	+8506	+8393	+7586	+7442

$$\begin{array}{rclcl}
 x-z & -1.1603 & -874 & +x & +1046 \\
 +1.2698 & = +1095 & -2158 & = -1063 & +14 = -1049 = -3 \\
 +1.3156 & = +1553 & -2610 & = -1057 & +15 = -1042 = +4 \\
 +1.1603 & = 0 & -1077 & = -1077 & +20 = -1057 = -5 \\
 +1.3296 & = +1693 & -2763 & = -1070 & +28 = -1042 = +4 \\
 18.9178 & = & -1943 & +19 & = 17.6697
 \end{array}$$

$$\begin{array}{rclcl}
 y-\eta & +782 & +24 & -9646 & \\
 +8506 & +1089 = +9595 & +50 & +9645 & = -1 \\
 +8393 & +1187 = +9580 & +60 & +9640 & = -6 \\
 +7586 & +2039 = +9625 & +25 & +9650 & = +4 \\
 +7442 & +2146 = +9588 & +63 & +9651 & = +5 \\
 22.3383 & +1476 & +45 & & = 21.5258
 \end{array}$$

1913 Mar 11 17

MC1302

Times etc.

Exp. to stars 1911 Oct. 7 $21^h 29^m$ = $21^h 41^m$
 Moon clock slow. $21 \quad 35 \quad 27.0 - 21 \quad 35 \quad 27.3$
 $0 \quad 41.6$

N. Sid T.	21	36	08.75	21	35	08.75
N. long	4	44	31.05	4	44	31.05
S. Sid T.	26	20	39.80	26	19	39.80
Sid T. in Moon	13	00	03.64	13	00	03.64
Interval	13	20	36.16	13	19	36.16
Reduction		2	11.16		2	11.00
G. M. T.	13	18	25.00	13	17	25.16

From Naut Alm.

R. 9

Moon 13^h $0 \quad 46 \quad 35.56$ + $3 \quad 08 \quad 38.0$

Motion in $1^m = 2.0315$ $1.6.122$ $+8.4167 \quad 17.4193$ $+ \quad 35.39$ + $4 \quad 40.8$

Tabular place

 $0.47 \quad 10.95$ + $3 \quad 13 \quad 18.8$

Moon's parallax

 $58' \quad 13.7''$

semidiam.

 $15' \quad 53.5''$ Moon is $2^h 52.7^m$ before full.

1911phae.proj

1913 Mar. 11. 17

MC1302.

Times etc.

Exp. to stars 1911 Oct. 7 $21^h 29^m$ - $21^h 41^m$
 Moon $21 35 27.0 - 21 35 27.3$
 Clock slow $0 41.6$

N Sid T. $21 36 08.75$
 H. long $4 41 31.05$
 B. Sid T. $26 17 39.80$
 Sid T. in room $13 00 03.64$
 Interval $13 17 36.16$
 Reduction $2 11.16$
 G. M. T. $13 18 25.00$

From Naut. Alm.

R. G.

Moon 13^h $0 46 35.56 + 3 08 38.0$
 Motion $1^m - 2.0318$ 16.122
 $18.4167 + 37.41 + 4 56.9$
 Tabular place $0 47 12.97 + 3 13 34.9$

Moon's parallax $58' 13.7$
 Semidiam. $15' 53.5$

Moon is $2^h 52.7$ before full.

Corrections for phase $\begin{cases} X & -15' \sim -0^{\circ}.25 \\ Y & -2^{\circ}16' = -2^{\circ}.27 \end{cases}$

	x	y	$X-x$	$Y-y$	$(X-x+Y-y)$	$295^{\circ}(X-x+Y-y)$
1	+0.08	-2.06	-0.02	+4.68	+4.66	+64
2	-0.92	-1.84	+0.23	+4.18	+4.41	+57 $\frac{1}{2}$
3	-1.57	-1.34	+0.39	+3.04	+3.43	+35
5	-2.03	-0.34	+0.51	+0.77	+1.28	+5
6	-2.06	0.00	+0.51	0.00	+0.51	+1
4	-1.92	-0.73	+0.48	+1.66	+2.14	+14

1913 Mar. 13

18

MC1302

Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$0 - C$	cor for plate
1	19.0000	+0.0831	+15	0.0072	4.2512	+75	+64
2	18.0000	-0.9169	+14	0.8382	4.2355	-82	+572
3	17.3502	-1.5667	+16	2.4514	4.2430	-7	+35
4	17.0000	-1.9169	+13	3.6695	4.2067	-370	+14
5	16.8848	-2.0321	+2	4.1286	4.2430	-9	+5
-6	16.8571	-2.0598	-0	4.2428	4.2428	-9	+1
7	16.9661	-1.9508	-5	3.8076	4.2455	+18	
8	17.0000	-1.9169	-6	3.6768	4.2504	+67	
9	17.7042	-1.2127	-12	1.4736	4.2355	-82	
10	18.0000	-0.9169	-14	0.8433	4.2395	-42	
11	19.0000	+0.0831	+15	0.0067	4.2507	+70	
Mean					4.2437	-1	

	y	$y - y_0$	Δy	$(y - y_0)^2$
-1	20.2785	-2.0598	-3	4.2440
2	20.4953	-1.8430	-2	3.3973
3	21.0000	-1.3383	-2	1.7916
4	21.6056	-0.7327	-2	0.5372
5	22.0000	-0.3383	0	0.1144
6	22.3383	0.0000	0	0.0000
7	23.0000	+0.6617	+1	0.4379
8	23.0956	+0.7573	+1	0.5736
9	24.0000	+1.6617	+2	2.7619
10	24.1810	+1.8427	+2	3.3962
+11	24.3981	+2.0598	+3	4.2440

Approximate Center

$$x = 19.0 \quad y = 20.2785$$

$$24.3981$$

$$44.6766$$

$$\text{Mean } y = 22.3383$$

$$y = \text{min} = 20.2785$$

$$R = 20.598$$

$$x = \text{min} = 16.8571$$

$$x_0 = 18.9169$$

$$x_0 = 18.0 \quad y = 20.4953$$

$$y = 24.1810$$

$$44.6763$$

$$\text{Mean } y = 22.3382$$

$$x = 17.0 \quad y = 21.6056$$

$$23.0956$$

$$44.3042$$

$$\text{Mean } y = 22.3506$$

$$\text{Assume } \begin{cases} x_0 = 18.9169 \\ y_0 = 22.3383 \end{cases}$$

1913 Mar. 13.

18

MC1302

Moon's Center

x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1 19.0000	+0.0831	+15	0.0072	4.2512	+75
2 18.0000	-0.9169	+14	0.8382	4.2355	-82
3 17.3502	-1.5667	+10	2.4514	4.2430	-7
~~4 17.0000~~	~~-1.9169~~	~~+13~~	~~3.6695~~	~~4.2062~~	
5 16.8848	-2.0321	+2	4.1286	4.2428	-9
-6 16.8571	-2.0598	-0	4.2428	4.2428	-9
7 16.9661	-1.9508	-5	3.8076	4.2455	+18
8 17.0000	-1.9169	-6	3.6768	4.2504	+67
9 17.7042	-1.2127	-12	1.4736	4.2355	-82
10 18.0000	-0.9169	-14	0.8433	4.2395	-42
11 19.0000	+0.0831	-15	0.0067	4.2507	+70
Mean				4.2437	-1

y	$y - y_0$	Δy	$(y - y_0)^2$
-1 20.2785	-2.0598	-3	4.2440
2 20.4953	-1.8430	-2	3.3973
3 21.0000	-1.3383	-2	1.7916
4 21.6056	-0.7327	-2	0.5372
5 22.0000	-0.3383	0	0.1142
6 22.3383	0.0000	0	0.0000
7 23.0000	+0.6617	+1	0.4375
8 23.0956	+0.7573	+1	0.5736
9 24.0000	+1.6617	+2	2.7619
10 24.1810	+1.8427	+2	3.3962
11 24.3981	+2.0598	+3	4.2440

Approximate Center.

$$x = 19.0 \quad y = 20.2785$$

$$\quad \quad \quad 24.3981$$

$$\quad \quad \quad 44.6766$$

$$\text{Mean } y = 22.3383$$

$$y_{\text{min}} = 20.2785$$

$$R = 20.598$$

$$x_{\text{min}} = 16.8571$$

$$y_0 = 18.9169$$

$$x_0 = 18.0 \quad y = 20.4953$$

$$\quad \quad \quad y = 24.1810$$

$$\quad \quad \quad 44.6763$$

$$\text{Mean } y = 22.3382$$

$$x = 17.0 \quad y = 21.6056$$

$$\quad \quad \quad 23.0956$$

$$\quad \quad \quad 44.7002$$

$$\text{Mean } y = 22.3506$$

$$\text{Assume } \begin{cases} x_0 = 18.9169 \\ y_0 = 22.3382 \end{cases}$$

Formation of normals.

No				Cor. for phase			cn
	ab	an	bn	an	bn	cn	
1	- 0.16 +	6.0	- 154.5 +	51	- 131.9		+ 64
2	+ 1.69 +	75.5	+ 150.8 -	52.7	- 106.0		- 57
3	+ 2.10 +	11.0	+ 9.4 -	55.0	- 46.9		+ 35
5	+ 0.69 +	18.2	+ 31 -	10.2	- 1.7		+ 5
6	- 0.00 +	18.5	- 0.0 -	2.0	- 0.0		+ 1
7	- 1.29 -	35.2	+ 11.9				
8	- 1.46 -	128.5	+ 51.0				
9	- 2.01 +	99.2	+ 136.0				
10	- 1.69 +	38.6	- 77.2				
11	+ 0.16 +	5.6	+ 144.0				
	- 1.97	+ 108.9	+ 2.5	- 11.48	- 286.5		+ 162
		<u>- 114.8</u>	<u>- 286.5</u>				
		5.9	- 284.0				

$$[aa] = +21.48$$

$$[bt] = +21.50$$

$$[ac] = -12.42$$

$$[bc] = +1.40$$

$$[cn] = -1$$

	C			O		
1	+ 3	+ 29	+ 58	+ 90	+ 139	+ 49
2	- 29	+ 27		+ 56	- 25	- 81
3	- 50	+ 19		+ 27	+ 28	+ 1
4	- 64	+ 5		- 1	- 4	- 3
5	- 65	+ 0		- 7	- 8	- 1
6	- 62	+ 9		- 13	+ 18	+ 31
7	- 61	- 11		- 14	- 67	+ 81
8	- 38	- 23		- 3	- 82	- 79
9	- 29	- 26		+ 3	- 42	- 45
10	+ 23	- 29		+ 22	+ 70	+ 48
11	+ 3					
					+ 21.0	
					- 209	

Average = 42

$$4 - 61 + 10 + 58 = +7 \quad - 356 \quad - 363$$

MG 1302

1913 Mar 13.

19

Moon's Center

Conditional Equations

	a	b	c	0		c	0-c
1	+0.08	-2.06	+1	= +75.5	+ 1+22	= +23	+52
2	-0.92	-1.84	+1	= -82.7	- 16+22	= + 6	-88
3	-1.57	-1.34	+1	= -75.5	- 28+22	= - 6	- 1
5	-2.03	-0.34	+1	= -9.5	- 36+22	= -14	+5
6	-2.06	+0.00	+1	= -9.5	- 37+22	= -15	+6
7	-1.95	+0.66	+1	= +18	- 35+22	= -13	+31
8	-1.92	+0.76	+1	= +67	- 34+22	= -12	+79
9	-1.21	+1.66	+1	= -82	- 22+22	= 0	-82
10	-0.92	+1.84	+1	= -42	- 16+22	= + 6	-48
11	+0.08	+2.06	+1	= +70	+ 1+22	= +23	+47

+220-219

Normal Equations

corrected
for phase
Average(0-c) = 44

$$\begin{aligned}
 +21.48 - 1.97 - 12.42 &= +109 - 6 & \frac{\Delta x}{\Delta y} &= +1.19 \\
 -1.97 + 21.50 + 1.40 &= +2-284 \\
 -12.42 + 1.40 + 10.00 &= -1+161
 \end{aligned}$$

$$\begin{aligned}
 +1.97 - 0.18 - 1.14 &= +10 - 1 \\
 +12.42 - 1.14 - 720 &= +63 - 3
 \end{aligned}$$

$$\begin{aligned}
 +21.32 + 0.26 &= +12-285 & \frac{\Delta x}{\Delta y} &= -0.3 \\
 +0.26 + 2.80 &= +2+158
 \end{aligned}$$

$$\begin{aligned}
 -0.26 - 0.00 &= 0 + 4 & & +58 \\
 +2.80 &= +2+162 & & c = +22
 \end{aligned}$$

$$\begin{aligned}
 -0.02 - 0.26 &= 6 - 15 \\
 +21.30 &= +6-300 & & b = -14
 \end{aligned}$$

$$\begin{aligned}
 -17.50 + 1.97 + 14.08 &= 1+227 \\
 +190.90 - 21.50 - 1536.0 &= +15-2470
 \end{aligned}$$

$$\begin{aligned}
 +3.98 &+ 1.66 = +108 + 221 \\
 +188.93 &- 152.20 = +17-2754
 \end{aligned}$$

$$\begin{aligned}
 +2.06 &- 1.66 = 0 - 30 & & +32 \\
 +6.04 &= +128 + 191 & & a = +18
 \end{aligned}$$

MG 1302

1913 Mar 13.

19

Moon's Center.

Conditional Equations.

	a	b	c	0		c	0 - c
1	+ 0.08	- 2.06	+ 1	= + 75	+ 1 + 22	= + 23	+ 52
2	- 0.92	- 1.84	+ 1	= - 82	- 16 + 22	= + 6	- 88
3	- 1.57	- 1.34	+ 1	= - 7	- 28 + 22	= - 6	+ 1
4	- 2.03	- 0.34	+ 1	= - 9	- 30 + 22	= - 14	+ 5
5	- 2.06	+ 0.00	+ 1	= - 9	- 37 + 22	= - 15	+ 6
7	- 1.95	+ 0.66	+ 1	= + 18	- 35 + 22	= - 13	+ 31
8	- 1.92	+ 0.76	+ 1	= + 67	- 34 + 22	= - 12	+ 79
9	- 1.21	+ 1.66	+ 1	= - 82	- 22 + 22	= 0	- 82
10	- 0.92	+ 1.84	+ 1	= - 42	- 16 + 22	= + 6	- 48
11	+ 0.08	+ 2.06	+ 1	= + 70	+ 1 + 22	= + 23	+ 47
							+ 220 - 219

Average (0 - c) = 44

Normal Equations.

$$\begin{aligned}
 + 21.48 - 1.97 - 12.42 &= + 109 - 6 \\
 - 1.97 + 21.50 + 1.40 &= + 2 - 284 \\
 - 12.42 + 1.40 + 10.00 &= - 1 + 161
 \end{aligned}$$

$$\begin{aligned}
 + 1.97 - 0.18 - 1.14 &= + 10 - 1 \\
 + 12.42 - 1.14 - 7.20 &= + 63 - 3
 \end{aligned}$$

$$+ 21.32 + 0.26 = + 12 - 285$$

$$+ 0.26 + 2.80 = + 62 - 158$$

$$- 0.26 - 0.00 = - 0 + 4$$

$$+ 2.80 = + 62 + 162$$

$$- 0.02 - 0.26 = - 6 - 15$$

$$+ 21.30 = + 6 - 300$$

$$- 17.50 + 1.97 + 14.08 = - 1 + 227$$

$$+ 190.90 - 21.50 - 153.60 = + 15 - 2470$$

$$+ 3.98 + 1.66 = + 108 + 221$$

$$+ 188.93 - 152.20 = + 17 - 2754$$

$$+ 2.06 - 1.66 = + 0 - 30$$

$$+ 6.04 = + 108 + 191$$

MC 1302

1913 Mar 13

20

Moons Mean Position (1911.0)

$$\begin{aligned}
 X_0 &= 1891.69^\circ & Y_0 &= 22.3383^\circ \\
 \Delta\alpha &= +16 & \Delta\delta &= -7 \\
 X &= 1891.85^\circ & Y &= 22.3376^\circ
 \end{aligned}$$

From preliminary Reduction $X = 17.6704^\circ$ $Y_0 = 21.5251^\circ$

Plate Constants

$\Delta\alpha =$	+3	+10
$b\eta =$	+14	-5
$c =$	-19	-5
	<u>17.6702</u>	<u>21.5251</u>

$$\begin{aligned}
 z &= -0.3298^\circ \\
 \log z &= 9.51825 \\
 \cos \delta &= 9.99955 \\
 \cos t &= 8.50724
 \end{aligned}$$

$$(x-A) = 1.01146$$

$$(x-A) = -10.27$$

$$A = 0^h 49^m 28.5^s$$

$$X_0 = 0^h 49^m 17.73^s$$

$$\text{Red} = +3.01$$

$$Y' = 0.49 20.74$$

$$\eta = -0.4749^\circ$$

$$\begin{aligned}
 \log \tan \delta &= 8.6372 \\
 \log \eta &= 9.0383 \\
 \eta_1 &= 4.7289 \\
 \eta_0 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \log \eta_0 &= 9.67660 \\
 \log \eta &= 7.33115
 \end{aligned}$$

$$(x-D) = 23.4545$$

$$\begin{aligned}
 \delta - D &= -3^h 41.5^m \\
 D &= +2^h 38^m 57^s
 \end{aligned}$$

$$\delta = +2^h 35^m 15.5^s$$

$$\text{Red} = +20.9$$

$$\delta' = +2^h 35^m 36.4^s$$

MC1302

1913 Mar 13.

20

moons mean Position (1911.0)

$$\begin{array}{rcl}
 X_0 & = & 18.9169 \\
 Y_0 & = & 22.3383 \\
 a & = & +16 \\
 b & = & -9 \\
 \hline
 X_0 & = & 18.9185 \\
 Y_0 & = & 22.3373
 \end{array}$$

From preliminary Reductions $X = 17.6764$ $Y = 21.5258$
 Plate Constants

$$\begin{array}{rcl}
 ax & = & +3 \\
 by & = & +14 \\
 c & = & -19 \\
 \hline
 & = & 17.6792
 \end{array}
 \qquad
 \begin{array}{rcl}
 & = & +10 \\
 & = & -5 \\
 & = & -5 \\
 \hline
 & = & 21.5258
 \end{array}$$

$$\begin{aligned}
 z & = -0.3298 \\
 \log z & = 9.51825 \\
 \log S & = 9.99955 \\
 \log \cos \delta & = 8.50724
 \end{aligned}$$

$$(X-A) = 1.01246$$

$$(X-A) = -10.27$$

$$A = 0^h 49^m 28^s$$

$$X = 0 49 17.73$$

$$\text{Red} = +3.01$$

$$X' = 0 49 20.74$$

$$\eta = -0.4749$$

$$\begin{aligned}
 \log \tan \delta & = 8.6372 \\
 \log S & = 9.0383 \\
 \eta_1 & = 4.7289 \\
 \eta_2 & = 0
 \end{aligned}$$

$$\begin{aligned}
 \log \eta_0 & = 9.67546 \\
 \log \cos \delta & = 7.33115
 \end{aligned}$$

$$(X-D) = 2.34545$$

$$\begin{array}{rcl}
 S-D & = & 3 41.5 \\
 D & = & +2 38 57
 \end{array}$$

$$\delta = +2 35 15.5$$

$$\text{Red} = +20.9$$

$$\delta' = +2 35 36.4$$

11C1302

1913, May 14.

21

Linear Parallax.

$$\begin{aligned} \alpha' &= 0 \quad 49 \quad 20.74'' \\ \delta &= 21 \quad 35 \quad 08.75'' \\ \delta - \alpha' &= -3 \quad 14 \quad 12'' \\ &= -48 \quad 33 \quad 00'' \end{aligned}$$

$$\delta' = +2 \quad 35 \quad 36.4''$$

$$\pi = 58 \quad 13.7''$$

$$\frac{1}{2}(\alpha - \alpha') = - \quad 16 \quad 10.$$

$$\delta - \delta' - \frac{1}{2}(\alpha - \alpha') = -48^\circ \quad 16' \quad 50''$$

$$\begin{aligned} \log \cos \phi' &= 9.86913 \\ \dots \sin \pi &= 8.22884 \\ \dots \sin(\delta - \alpha') &= 9.87479 \\ - \dots \cos \delta &= 9.99931 \end{aligned}$$

$$\therefore \sin(\alpha - \alpha') = 7.97345$$

$$\alpha - \alpha' = -32' \quad 20.4''$$

$$= -2^m \quad 09.35$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \dots \cos(\alpha - \alpha') &= 0.00000 \\ - \dots \cos(\delta - \alpha') - (\alpha - \alpha') &= 9.82314 \end{aligned}$$

$$\log \tan \gamma = 0.13413$$

$$\gamma = +53^\circ \quad 42' \quad 37.0''$$

$$\delta' = +2 \quad 35 \quad 36.4''$$

$$\gamma - \delta' = +51 \quad 07 \quad 00.6''$$

$$\begin{aligned} \log \sin \phi' &= 9.82640 \\ \dots \sin \pi &= 8.22884 \\ \dots \sin(\gamma - \delta') &= 9.89122 \\ - \dots \sin \gamma &= 9.90636 \end{aligned}$$

$$\therefore \sin(\delta - \delta') = 8.09070$$

$$\delta - \delta' = +37 \quad 42.2''$$

$$\delta = +3 \quad 13 \quad 18.6'' \quad \alpha \quad 0 \quad 47 \quad 11.39''$$

$$\text{Ann Eph } \delta = +3 \quad 13 \quad 18.8'' \quad \alpha \quad 0 \quad 47 \quad 10.95''$$

$$O - C = 0.20 - C \quad + 0.44$$

MC 1302

1913, May 14.

21

Lunar Parallax.

$$\begin{aligned} \alpha' &= 0 \quad 49 \quad 20.74 \\ G &= 21 \quad 36 \quad 08.75 \\ G - \alpha' &= -3^h \quad 13^m \quad 12^s \\ &= -48^\circ \quad 18' \quad 00'' \end{aligned}$$

$$\delta' = +2 \quad 35 \quad 36.4$$

$$IT = 58 \quad 13.7$$

$$\frac{1}{2}(\alpha - \alpha') = - \quad 16 \quad 6$$

$$G - \delta' - \frac{1}{2}(\alpha - \alpha') = -47^\circ \quad 01' \quad 54''$$

$$\begin{aligned} \log \tan \phi' &= 9.95727 \\ \sin(\alpha - \alpha') &= 0.00000 \\ \cos(\alpha - \alpha') - (\alpha - \alpha') &= 9.83352 \end{aligned}$$

$$\log \tan \gamma = 0.12375$$

$$\gamma = +53^\circ \quad 03' \quad 12.7$$

$$\delta' = +2 \quad 35 \quad 36.4$$

$$\gamma - \delta' = +50 \quad 27 \quad 41.3$$

$$\begin{aligned} \log \sin \phi' &= 9.82640 \\ \sin IT &= 8.22884 \\ \sin(\gamma - \delta') &= 9.88717 \\ \sin \gamma &= 9.90266 \end{aligned}$$

$$\sin(\delta - \delta') = 8.03975$$

$$\delta - \delta' = +37 \quad 40.4$$

$$\delta = +3 \quad 13 \quad 16.8 \quad \alpha \quad 0 \quad 47 \quad 11.88$$

$$\text{Am Eph } \delta = +3 \quad 13 \quad 34.9 \quad \alpha \quad 0 \quad 47 \quad 12.97$$

$$O - C \quad -18.10 - C \quad -1.09$$

MC1303

1913 Feb 28.

Comp. Stars - measures - Rescan reversed 22

u

x

ℓ	d	n	d	n
12.5	17517	15456	18210	17448
24.6	1198590	1100404	1361819	1202325
mag	90	00	21	32
6.5	20	67	14	57

24.5531.554212.5407.5425

ℓ	d	n	d	n
13.7	17784	15131	16376	16020
29.7	1027270	1265051	1399090	840000
mag	70	52	90	01
8.0	80	40	68	30

29.7510.751813.7616.7628

ℓ	d	n	d	n
24.7	18080	16640	17490	16820
12.2	1619801	852122	1526254	904551
mag	01	20	58	48
7.3	77	40	90	22
	12.1879	.1881	24.7768	.7774

ℓ	d	n	d	n
26.0	15760	18266	1038180	9706
31.6	1002826	1399501	80	930102
mag	28	99	9992	11
8.4	50	67		

31.5727.573226.0388.0401

M41303

1913 Feb 28.

Comp. Stars - measures - Russian reversed.

22

L	d	n	d	n
12.5	17517	15456	18210	17448
24.6	1198590	1100404	1361819	1202825
mag	90	00	21	32
6.5	20	67	14	57
	<u>24.5531</u>	<u>.5542</u>	<u>12.5407</u>	<u>.5425</u>
3				
13.7	17784	15131	16376	16020
29.7	1027270	1265051	1399090	840000
mag	70	52	90	01
8.0	80	40	68	30
	<u>29.7510</u>	<u>.7518</u>	<u>13.7616</u>	<u>.7628</u>
3				
20.7	18080	16640	17990	16820
12.2	1619801	852122	1522254	904551
mag	01	20	90	48
2.8	77	40		22
	<u>12.1879</u>	<u>.1881</u>	<u>24.7768</u>	<u>.7774</u>
4				
26.0	15760	18266	1038180	9706
31.6	1002826	1399501	80	930102
mag	28	99	9992	11
8.4	50	67		
	<u>31.5727</u>	<u>.5732</u>	<u>26.0388</u>	<u>0401</u>

ML 1303

1913 Feb. 28.

23

Moon Measures.

Resonance reversed

	α	μ	N
18.2	16550		14537
20.6	10445	49	1063027
	46		26
min	60		36

possibly on
phase limb.

20.6119	6091
15573	14521
18.0 9290	10795
20.6 9295	9195
75	30

20.6282 6270

17.1	11791	9860
21.0	9094	929200
	11231	0800

17.0561	0560
Remeasure (4) Mar 13	
11253	8451
10865	51
6970	

17.0	9078	9407
21.1	869682	0811
	86	9040

21.0390 0369

5. Remeasure (5) Mar 13	
16.4 15801	
22.0 897020	
	80
	95

0386	
18149	14154
11330	10942
3035	4050
59	50

16.3176

16.3176 3208

16.3	18789	18140
22.7	1078182	16107
min	76	1211
in	75	40
π		

16.2002 2030

AL1303

1913 Feb. 28.

23

Moon measures.

Reson reversed

	d	N
18.2	16560	14537
20.6	1044549	1063027
min	46	26
	60	36

possibly on
phase limb.

20.6119 6091

2	15573	14521
18.0	929095	1079595
20.6	92	91
	75	30

20.6282 6270

3
17.1
21.0

1179194 9860
9094 929200
11231 08

17.0561 0560
Remeasured 4/ Mar. 13
11253 8451
1086570 51
6970

4	9078	9407
17.0	869682	0811
21.1	86	9040

21.0390 0369

5	Remeasured (5) Mar. 13
16.4	15801
22.0	897070
	80
	95

0386

18149 14154
11330 10942
3035 4050
59 50

16.3176

16.3176

3208

6
16.3
22.7
min
in
2

18789 18140
1078182 16107
76 1211
75 40

16.2002

2030

12
20.3
22.5
MAY
in
N

18426
11610
15-20
23

20,319.1

18023
1482000
1000
20

3212

M61303

1913 Feb 28.

24.

Moon Measures - Residuals

7

13.3

d

N

d

N

23.5

16787

16310

17740

18175

12110

11020

11359

14530

06

20

59

25

97

10

40

90

23.4683.471116.3616.3651

8

Remeasure (8) Mar 13

16.7

15350

16448

15960

24.0

12300

13398

8995

05

05

06

40

40

77

16.695516.6955.6974

9

17.0

16784

14904

24.4

13809

7850

11

85

85

06

24.2977.2985

10

18.0

15750

14950

Remeasure (10) Mar 13

24.6

8556

12125

15137

63

21

7937

54

62

24

35

24.7197.7171.7202

11

18.2

14740

13968

24.7

7401

11296

05

01

38

81

24.7334.7325

MCI 308

1913 Feb. 28.

24.

Known - Measures - Residuals reversed

7	d	N	d	N
18.3	16787	16310	17740	18175
23.5	12110	11020	11359	14530
	06	2024	59	2531
	97	10	40	90

8	23.4683	4711	16.3616	3651
16.7	15350		16448	15950
24.0	12300		13398	8995
	0100		0501	06
	40		40	77
	16.6955		16.6955	.6974

9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

10	24.2977	2985	Remeasured (10) Mar 13
18.0	15750	14950	15137
24.6	8556	12625	7937
	63	21	2442
	59	62	35

11	24.7197	7171	7202
18.2	14740	13968	
24.7	7401	11296	
max	0509	01	
	38	81	
	24.7334	7325	

1913 Mar. 10.

25

MC1303

Preliminary Reduction

Star	1	2	3	4
x	12.5416	13.7622	24.7771	26.0394
z	12.7084	13.9127	24.9869	26.1856
$x-z$	-1.668	-1.505	-2.098	-1.462

y	24.5536	29.7514	12.1880	31.5730
z	23.9556	29.1579	11.6179	31.0104
$y-z$	+5980	+5935	+5681	+5626

$x-z$	-339	+2x	+2454
-1.668-810	= -2478	+25	= -2453
-1.505-982	= -2487	+27	= -2460
-2.098-404	= -2500	+50	= -2450
-1.462-1042	= -2504	+52	= -2452
Mean 18.2663 - 748	+37		= 18.4406

$y-z$	+26x	+y	-6331
+5980 + 326	= +6306	+25	= +6331
+5935 + 358	= +6293	+30	= +6323
+5681 + 643	= +6324	+12	= +6336
+5626 + 677	= +6303	+32	= +6335
Mean 22.6717 + 475	+23		= 22.0884

Tables	$a = -2.5$	$z = -3.9$	$a-z = +1.4$	$b+a = +6.2$
Obs	$a = -1.7$	$z = -1.4$	$a-z = -0.3$	$b+d = +7.1$

1913 Mar. 10.

25

1101303

Preliminary Reduction

1	2	3	4
x 12.5416	13.7622	24.7771	26.0394
z 12.7084	13.9127	24.9869	26.1856
$z - x$ -1668	-1505	-2098	-1462

y 24.5536	29.7514	12.1880	31.5730
y 23.9556	29.1579	11.6199	31.0104
$y + 5980$	+ 5935	+ 5681	+ 5626

$z - x$ -334	+2x	+2454
-1668-810 = -2478	+25 = -2453	= +1
-1505-982 = -2487	+27 = -2460	= -6
-2098-404 = -2502	+50 = -2450	= +4
-1462-1042 = -2504	+52 = -2452	= +2
$z - y$ 18.2663 - 748 =	+32	= 18.4406

$y - x$ +26x	+y	-6331
+5980 + 326 = +6306	+25 = +6331	= 0
+5935 + 358 = +6293	+30 = +6323	= -8
+5681 + 643 = +6324	+12 = +6336	= +5
+5626 + 677 = +6303	+32 = +6335	= +4
$z - y$ 22.6717 + 475	+23	= 22.0884

ML 1303

1913 Mar 11.

26

Times Etc.

Exp. to stars 1911 Oct 7. $21^h 45^m$ - 21 57
 " " moon 21 51 07.9 - 21 51 08.2
 clock slow 0 41.6

H Sid T.	21	51	49.65	21	50	49.65
H Long	4	44	31.05	4	44	31.05
G Sid T.	26	36	20.70	26	35	20.70
Sid T. in noon	13	00	03.64	13	00	03.64
Interval	13	36	17.06	13	35	17.06
Reduction		2	13.73		2	13.56
G to T.	13	34	03.33	13	33	03.50

From Am. Eph.	R. A.	Decl.
Moon 13^h	$0^h 46^m 35.56$	$+3^\circ 08' 38''$
Motion $1^m = 2.0319$		16.122
" " 34.0555 33.058	$+ 1$	$+ 8$
Tabular place	$0 47 42.73$	$+3 17 31.0$

Moon's parallax 58 14.3
 " semidiameter 15 53.6 ✓

Moon is $2^h 37.0$ before full

HL 1303

1913 Mar. 11.

26.

Times Etc.

Exp. to stars	1911 Oct 7.	21 ^h 45 ^m	-21	57	
" moon		21 51	07.9	-21 51	08.2
clock slow		0	41.6		

H Sid T.	21	51	49.65
H Long	4	44	31.05
G Sid T.	26	36	20.70
Sid T m. now	13	00	03.64
Tabular	13	36	17.06
Reduction		2	13.73
G. N. Y.	13	34	03.33

From Am. Eph.	R. C.	Heal.
Moon 13 ^h	0 ^h 46 ^m 35.56	+3° 08' 38.0
Motion 1 ^m = 2.0327		16.121
" " 34.0555	+ 1 09.22	+ 9 09.0
Tabular place.	0 47 44.78	+3 17 47.0

Moon's parallax	58	14.3
" semidiameter	15	53.6

Moon is 2^h 37.0 before full

MC 1303

1913 Mar 13.

27

Moon's Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - c$
1	18.2629	0.0000	+12	0.0000	4.2502	+40
2	18.0000	-0.2629	+12	0.0684	4.2484	+22
3	17.0560	-1.2069	+10	1.4542	4.2498	+36
4	17.0000	-1.2629	+10	1.5924	4.2624	+162
5	16.3192	-1.9437	+4	3.7764	4.2279	-183
-6	16.2016	-2.0613	-0	4.2489	4.2489	+27
7	16.3634	-1.8995	-5	3.6100	4.2468	+16
8	16.6964	-1.5665	-8	2.4564	4.2210	-252
9	17.0000	-1.2629	-10	1.5974	4.2429	-33
10	18.0000	-0.2629	-12	0.0698	4.2596	+134
11	18.2629	0.0000	-12	0.0000	4.2498	+36
					4.2462	-5

85

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
-1	20.6105	-2.0613	-3	4.2502
2	20.6276	-2.0442	-3	4.1800
3	21.0000	-1.6718	-2	2.7956
4	21.0380	-1.6338	-2	2.6700
5	22.0000	-0.6718	-1	0.4515
6	22.6718	0.0000	+0	0.0000
7	23.4697	+0.7979	+1	0.6368
8	24.0000	+1.3282	+2	1.7646
9	24.2981	+1.6263	+2	2.6455
10	24.7184	+2.0466	+3	4.1898
+11	24.7330	+2.0612	+3	4.2498

Approximate Center

$$x = 18.00 \quad y = 20.6276$$

$$24.7184$$

$$45.3460$$

$$\text{Mean } y = 22.6730$$

$$x = 17.0 \quad y = 21.0380$$

$$24.2981$$

$$45.3361$$

$$\text{Mean } y = 22.6680$$

$$\text{Mean } y = 22.6718$$

$$y = \text{min} = 20.6105$$

$$R = 2.0613$$

$$x = \text{min} = 16.2016$$

$$x_0 = 18.2629$$

$$\text{Assume } \begin{cases} x_0 = 18.2629 \\ y_0 = 22.6718 \end{cases}$$

MC 1303

1913 Mar 13.

27

Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)^2$	$0 -$
1	18.2629	0.0000	+12	0.0000	4.2502	+40
2	18.0000	-0.2629	+12	0.0684	4.2484	+22
3	17.0560	-1.2069	+10	1.4542	4.2498	+36
4	17.0000	-1.2629	+10	1.5924	4.2624	+162
5	16.3192	-1.9437	+4	3.7764	4.2279	-183
-6	16.2016	-2.0613	-0	4.2489	4.2489	+27
7	16.3634	-1.8995	-5	3.6100	4.2468	+16
8	16.6964	-1.5665	-8	2.4564	4.2210	-252
9	17.0000	-1.2629	-10	1.5974	4.2429	-33
10	18.0000	-0.2629	-12	0.0698	4.2596	+134
11	18.2629	0.0000	-12	0.0000	4.2998	+36
					4.2462	-5

85

	y	$(y - y_0)$	Δy	$(y - y_0)^2$
-1	20.6105	-2.0613	-3	4.2502
2	20.6276	-2.0442	-3	4.1800
3	21.0000	-1.6718	-2	2.7956
4	21.0380	-1.6338	-2	2.6700
5	22.0000	-0.6718	-1	0.4515
6	22.6718	0.0000	+0	0.0000
7	23.4697	+0.7979	+1	0.6368
8	24.0000	+1.3282	+2	1.7646
9	24.2981	+1.6263	+2	2.6455
10	24.7184	+2.0466	+3	4.1898
+11	24.7330	+2.0612	+3	4.2498

Approximate Center.

$$x = 18.00 \quad y = 20.6276$$

$$24.7184$$

$$45.3460$$

$$\text{Mean } y = 22.6730$$

$$x = 17.0 \quad y = 21.0380$$

$$24.2981$$

$$45.3361$$

$$\text{Mean } y = 22.6680$$

$$\text{Mean } y = 22.6718$$

$$y = \text{min} = 20.6105$$

$$R = 2.0613$$

$$x - \text{min} = 16.2016$$

$$x_0 = 18.2629$$

$$\text{Assume } \begin{cases} x_0 = 18.2629 \\ y_0 = 22.6718 \end{cases}$$

Formation of Normals

	ab		an		bn
1	-0.00	+	0.0	-	82.5
2	+0.53	-	5.7	-	44.9
3	+2.02	-	43.6	-	60.0
4	+2.06	-	204.0	-	264.3
5	+1.30	+	355.0	+	122.8
6	-0.00	-	55.6	+	0.0
7	-1.52	-	11.4	+	4.8
8	-2.09	+	395.8	-	33.5
9	-2.06	+	41.5	-	53.7
10	-0.53	-	34.8	+	275.0
11	+0.00	+	6.0	+	74.2
	-0.29	+	437.2	-	62.1

$$[aa] = +18.87 \quad [bb] = +27.83$$

$$[ac] = -11.72 \quad [bc] = -0.20$$

MK 1303

19.3 Mar 17

Conditional Equations.

	a	b	c	0		c	0-c
1	0.00	-2.06	+1	= +40		0 + 2 + 72 = +74	-34
2	-0.26	-2.04	+1	= +22	-	18 + 2 + 72 = +56	-34
3	-1.21	-1.67	+1	= +36	-	83 + 2 + 72 = -9	+45
4	-1.26	-1.63	+1	= +162	-	87 + 2 + 72 = -13	+175
5	-1.94	-0.67	+1	= -183	-	134 + 1 + 72 = -61	-122
6	-2.06	+0.00	+1	= +27	-	142 - 0 + 72 = -70	+97
7	-1.96	+0.86	+1	= +6	-	131 - 1 + 72 = -60	+66
8	-1.57	+1.33	+1	= -252	-	108 - 1 + 72 = -37	-215
9	-1.26	+1.63	+1	= -33	-	87 - 2 + 72 = -17	-16
10	-0.26	+2.05	+1	= +134	-	18 - 2 + 72 = +52	+82
11	0.00	+2.06	+1	= +36		0 - 2 + 72 = +70	-34

Normal Equations

$$\begin{aligned}
 +1887 - 0.29 - 11.72 &= +437 \\
 -0.29 + 27.83 - 0.20 &= -62 \\
 -11.72 - 0.20 + 11.00 &= -5
 \end{aligned}$$

$$\begin{aligned}
 +0.29 - 0.00 - 0.18 &= +7 \\
 +11.72 - 0.18 - 7.30 &= +272
 \end{aligned}$$

$$\begin{aligned}
 +27.83 - 0.38 &= -55 \\
 -0.38 + 3.70 &= +267
 \end{aligned}$$

$$\begin{aligned}
 +0.38 - 0.01 &= -1 \\
 +3.69 &= +266
 \end{aligned}$$

$$\begin{aligned}
 -0.04 + 0.38 &= +27 \\
 +27.79 &= -28
 \end{aligned}$$

$$\begin{aligned}
 +17.00 + 0.29 - 15.97 &= +7 \\
 -1540.20 - 27.83 + 1445.57 &= -657
 \end{aligned}$$

$$\begin{aligned}
 +35.87 &= -27.69 = +444 \\
 -1540.49 &= +445.37 = -662
 \end{aligned}$$

$$\begin{aligned}
 -729.60 &= +27.69 = -13 \\
 +6.27 &= +431
 \end{aligned}$$

$$+465 - 455$$

$$\text{Average } (0-c) = 84$$

$$\frac{\Delta x}{\Delta z} = +1.28$$

$$\frac{\Delta y}{\Delta z} = +0.03$$

$$c = +72$$

$$b = -1 +$$

$$a = +69 -$$

MK 1303

19.3 Mar. 17

Conditional Equations

	a	b	c	0		c	0-c
1	0.00	-2.06	+1	= +40		0 + 2 + 72 = +74	-34
2	-0.26	-2.04	+1	= +22	-	18 + 2 + 72 = +56	-34
3	-1.21	-1.67	+1	= +36	-	83 + 2 + 72 = -9	+43
4	-1.26	-1.63	+1	= +162	-	87 + 2 + 72 = -13	+175
5	-1.94	-0.67	+1	= -183	-	134 + 1 + 72 = -61	-122
6	-2.06	+0.00	+1	= +27	-	142 - 0 + 72 = -70	+97
7	-1.90	+0.80	+1	= +6	-	131 - 1 + 72 = -60	+66
8	-1.57	+1.33	+1	= -252	-	108 - 1 + 72 = -37	-215
9	-1.26	+1.63	+1	= -33	-	87 - 2 + 72 = -17	-16
10	-0.26	+2.05	+1	= +134	-	18 - 2 + 72 = +52	+82
11	0.00	+2.06	+1	= +36		0 - 2 + 72 = +70	-34

Normal Equations

$$\begin{aligned}
 +18.87 - 0.29 - 11.72 &= +437 \\
 -0.29 + 27.83 - 0.20 &= -62 \\
 -11.72 - 0.20 + 11.00 &= -5
 \end{aligned}$$

$$\begin{aligned}
 +0.29 - 0.00 - 0.18 &= +7 \\
 +11.72 + 0.18 - 7.30 &= +272
 \end{aligned}$$

$$\begin{aligned}
 +27.83 - 0.38 &= -55 \\
 -0.38 + 3.70 &= +267
 \end{aligned}$$

$$\begin{aligned}
 +0.38 - 0.01 &= -1 \\
 +3.69 &= +266
 \end{aligned}$$

$$\begin{aligned}
 -0.04 + 0.38 &= +27 \\
 +27.79 &= -28
 \end{aligned}$$

$$\begin{aligned}
 +17.00 + 0.29 - 15.97 &= +7 \\
 -1540.20 - 27.83 + 1445.57 &= -657
 \end{aligned}$$

$$\begin{aligned}
 +35.87 & & -27.69 &= +444 \\
 -1540.49 & & +445.37 &= -662
 \end{aligned}$$

$$\begin{aligned}
 -729.60 & & -27.69 &= -13 \\
 +6.27 & & &= +431
 \end{aligned}$$

$$\begin{aligned}
 +465 - 455 \\
 \text{Average } 0 - c &= 84
 \end{aligned}$$

$$\begin{aligned}
 5 + 95.36 \\
 9.0
 \end{aligned}$$

30

$$c = +72$$

$$b = -11$$

$$a = +69$$

1913 Apr 17

MC 1303 - Moon's Center.

$$X_0 = 18.2629$$

$$+34$$

$$X = 18.2663$$

$$Y_0 = 22.6718$$

$$-1$$

$$Y = 22.6717$$

from Prelim Reductions

$$X = 18.4406$$

$$Y = 22.0884$$

Plate constants

$$a_x = +5$$

$$+9$$

$$b_y = -9$$

$$-9$$

$$c = +4$$

$$0$$

$$\bar{z} = +0.4406$$

$$\bar{z} = +0.0884$$

$$\log \bar{z} = 9.64404$$

$$\log \delta = 9.99953$$

$$\log \omega = 8.50724$$

$$\log \tan \delta = 8.6372$$

$$\log \gamma = 9.2881$$

$$\log \eta = 4.9787$$

$$\log \mu = 0$$

$$(\alpha - A) = 1.13727$$

$$\alpha - A = +1.372$$

$$\log \eta_0 = 8.94645$$

$$\log \mu_0 = 7.33115$$

$$A = 0^h 49^m 28^s$$

$$\alpha_0 = 0^h 49^m 41.72^s$$

$$(V - D) = 16.1530$$

$$S - D = +41.2$$

$$D = +238.57$$

Estimate cor for phase $+0.2$

$$\text{Red. app.} +3.01$$

$$E_0 = +239' 38.2''$$

$$\alpha' 0 49 44.75$$

Estimated phase -3

$$\text{Red.} +20.9$$

$$S' = +239 58.8$$

1913 Apr 17

MC 1303 - Moon's Center.

$$X_0 = 18.2629$$

$$+ 34$$

$$X = 18.2663$$

$$Y_0 = 22.6718$$

$$- 1$$

$$Y = 22.6717$$

from Prelim Reductions

$$X = 18.4406$$

$$Y = 22.0884$$

Plate Constants

$$a_x = + 5$$

$$+ 9$$

$$b_y = - 9$$

$$- 9$$

$$c = + 4$$

$$0$$

$$\bar{z} = +0.4406$$

$$\bar{z} = +0.0884$$

$$\log \bar{z} = 9.64404$$

$$\log \delta = 9.99953$$

$$\log \mu = 8.50724$$

$$\log \tan \delta = 8.6372$$

$$\log \mu = 9.2881$$

$$\log \eta_1 = 4.9787$$

$$\log \eta_2 = 0$$

$$(\alpha - A) = 1.13727$$

$$\alpha - A = +13.72$$

$$\log \eta_0 = 8.94645$$

$$\log \eta_1 = 7.33115$$

$$A = 0^h 49^m 28^s$$

$$(\delta - D) = 1.61530$$

$$\alpha = 0^h 49^m 41.72^s$$

$$\delta - D = + 41.2$$

$$D = + 238.57$$

$$\delta = + 239' 38.2''$$

MC 1303

Lunar Parallax

$$\begin{aligned}
 \alpha' &= 0 \quad 49 \quad 44.75 \\
 \theta &= 21 \quad 50 \quad 49.65 \\
 \alpha - \alpha' &= -2 \quad 58 \quad 55.10 \\
 &= -44^\circ 43' 46.5
 \end{aligned}$$

$$\delta' = +2 \quad 39 \quad 58.8$$

$$\mu = 58' 14.3$$

$$\frac{1}{2}(\alpha - \alpha') = -15 \quad 11$$

$$\alpha - \frac{1}{2}(\alpha - \alpha') = 44 \quad 28 \quad 35$$

$$\begin{aligned}
 \log \tan \phi' &= 9.95727 \\
 \log \sin(\alpha - \alpha') &= 0.00000 \\
 \log(\alpha - \frac{1}{2}(\alpha - \alpha')) &= 9.85342
 \end{aligned}$$

$$\log \tan \gamma = 0.10385$$

$$\gamma = +51^\circ 47 \quad 09.2$$

$$\delta' = +2 \quad 39 \quad 58.8$$

$$\delta - \delta' = +49 \quad 07 \quad 10.4$$

$$\begin{aligned}
 \log \sin \phi' &= 9.82640 \\
 \log \sin \mu &= 8.22892 \\
 \log(\delta - \delta') &= 9.87857 \\
 \log \gamma &= 9.89526
 \end{aligned}$$

$$\log \sin(\delta - \delta') = 8.03863$$

$$\delta - \delta' = +37 \quad 34.6$$

$$\delta = +3 \quad 17 \quad 33.4$$

$$\text{Am Eph } \delta = +3 \quad 17 \quad 31.0$$

$$O - C = +2.4$$

$$\begin{aligned}
 \log \sec \phi' &= 9.86913 \\
 \log \sin \mu &= 8.22892 \\
 \log \sin(\alpha - \alpha') &= 9.84742 \\
 \log \cos \delta &= 9.99928
 \end{aligned}$$

$$\log \sin(\alpha - \alpha') = 7.94619$$

$$\alpha - \alpha' = -30 \quad 22.3$$

$$= -2^\circ 01.49$$

$$\alpha = 0 \quad 47 \quad 43.26$$

$$\alpha = 0 \quad 47 \quad 42.73$$

$$O - C = +0.53$$

