

KG

1/366

99E11
v.905



Volume XXIX

Plates

1520

1521

1524



Harvard Lunar Plates

Measures and Reductions

Mary Fowler

Volume XXIX

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MC1520

Stars - Measurers. 1913 June 28 1

	a	v	d	n
L	19076	16535	19446	16368
9.3	1266269	12926	12588	1322220
21.5	60	2827	5987	30
mg	62	21	52	60
7.0	<u>21.6403</u>	<u>6397</u>	<u>93138</u>	<u>13141</u>
2				
25.9	18170	18750	14450	1012320
13.5	1350006	1311010	1391114	7320
mg	68	10	18	9610
7.5	60	40		
	<u>13.4363</u>	<u>4365</u>	<u>25.9464</u>	<u>9488</u>
3				
26.2	16677	19000	16410	17643
30.4	1265861	1294652	825059	1577586
mg	61	52	50	7986
8.7	92	95	96	37
	<u>30.3947</u>	<u>3953</u>	<u>26.1854</u>	<u>1862</u>

brade 1

MC1570

Stars - measurements

1913 June 28 1

	α	δ	α	δ	α	δ
1	19076	16535	19446	16368		
1.3	1266269	12926	12558	1322220		
21.5	60	2827	8987	30		
mag	62	21	52	60		
7.0	<u>41.6403</u>	<u>6397</u>	<u>93138</u>	<u>3141</u>		
2						
25.9	18170	18750	19450	1017320		
13.5	1380006	1311010	1391114	7320		
mag	00	10	18	9610		
7.5	60	40				
	<u>13.4363</u>	<u>4365</u>	<u>259464</u>	<u>9488</u>		
3						
26.2	16677	19000	16410	17643		
30.4	1265861	1294652	825059	15775		
mag	61	52	50	7986		
8.7	92	95	46	37		
	<u>30.3947</u>	<u>3953</u>	<u>261854</u>	<u>1862</u>		

bracket 1

KIC 1520-

4 mean measures

1913 June 28

2

1 1315-59
19.6 51
19.9 12563

12819
12249
55-57

min.

19.9410

.9435

19.0 11586
20.7 1089084
90

1185068
58-57
11175-

20.0698

.0683

3
17.9
21.0

18296
1699805
1005
82

17.8710

16458
771512
06
40

.8731

4
17.6
22.0

17241
1292019
2019
29

17.5685

16454
1075042
47
46

.5704

min in x - about

17.5670

5
17.8
23.0

16190
1383322
3022
75

17.7639

15496
784350
32
90

.7649

6
18.0 14557
23.4 1052215
10
50
23.4038

19152 14557
13125450522
4940 1015
42 50
3993

1912 1520-

4 moon measurements

1913 June 28

2

1315259

12819

1224957

12563

55-57

19.9410

9435

11586

1185068

1089089

5857

90

11175

20.0698

0683

3

7.9

21.0

18296

1699805

10

82

17.4710

16458

771512

06

40

8731

4

17.6

23.0

17241

1292019

2019

29

17.5685

16459

1075042

47

46

5704

min in x - about 17.5670

5

17.8

23.0

16190

1383322

30

75

17.7639

15496

784350

32

90

7649

6

18.0

23.4

14557

19152

14557

10522

1312543

0522

10

4940

1015

50

42

50

23.4038

3993

MC 1520 moon - measures 1913 June 28/3
 a 4 n d n

7
 18.7
 24.0

19770
 16650 70
 70
 40

18600
 11663 46
~~50~~ 35
 70

18.6902

.6930

8
 19.0
 24.2

18530
 17169 60
 67
 25

24.7364

16150
 7510 01
 66
 45
1360

MC 1520 Moon Measures 1913 June 28/3

7
18.7
24.0

19770
16650.70
70
40

18600
11663.46
50.35
70
6930

8
19.0
24.2

18530
17169.60
67
25
241364

16150
7510.01
66
45
1360

18.6702

NIC 1520 - *Trinus etc* 1913 June 30. 4
 Eph. stan 1912 Jan 1. 2^h 59^m - 3^h 11^m
 " " noon 3 05 03.4 = 3 05 04.0
 clock slow 01 07.8 ✓

H. Sid T. 3 06 11.5^m
 H. honey 4 44 31.05^m
 G. Sid T. 7 50 42.55^m
 Sid T in noon. 18 39 07.54^m
 Interval 15 11 35.01^m
 Reduction 2 09.68^m
 G. in T. 13 09 25.33^m

From Naut. Alm. *R.A.* *Decl.*
 Moon 15^h 4^h 13^m 24.79 + 24 19 47.8
 Motion in 1^m 2.628 ✓ 9.126
 9.0945 + 23.90 + 1 23.0
 Tabular place 4 13 48.69 + 24 21 10.8
 Moon's parallax 60' 32.8
 - semidiam. 16 31.3

From Naut Alm. *R.A.* *Decl.*
 Moon 13^h 4^h 08^m 10.57 + 24^h 01' 12.1
 Motion in 1^m 2.6099 ✓ 9.442 ✓
 - 9.4222 ✓ + 24.59 ✓ + 1 29.0 ✓
 Tabular place 4 08 35.16 ✓ + 24 07 41.1 ✓

Moon's parallax 60' 29.1 ✓
 - semidiam. 16 30.4 ✓

934 = 14.5
 990 = 16.4

- 990.4
 augmentation + 16.4
 Irradiation (grade 1) - 0.3
 $R = 1006.5$
 $R = 2157.5$
 $(1+a)R = 2157.6$
 $R^2 = 4655.2$

$a = +0.4$

1912phae.0001
 1912 Jan 1 2' 59" - 3' 11" 4
 Moon 3 05 03 45 3 05 04 0
 Clock slow 01 07 8

H Sid T 3 06 11 5
 H Honey 4 49 31 05
 G Sid T 7 50 42 55
 Sid T in Moon 14 39 07 54
 Interval 15 11 35 01
 Radiation 2 09 68
 G in T 13 09 25 33

From Transit Alms R G Decl
 Moon 15^h 4^m 13^s 24^s 79 + 24 19 47 8
 Moon 1^m 26 28 9.126
 90945 + 2390
 Tabular place 4 13 48 69 + 24 21 10 8
 Moon's parallax 60' 32 8
 Semidiameter 16 31 3

From Transit Alms R G Decl
 Moon 13^h 4^m 08^s 10^s 57 + 24 01 12 1
 Moon 1^m 26 09 9442
 94222 + 24 59 + 1 29 0
 Tabular place 4 08 35 16 + 24 03 41 1

Moon's parallax 60' 29 1
 Semidiameter 16 30 4

934 = 145
 990 = 164

9904
 augmentation + 164
 radiation (grad 1) = 0.3
 $R = 10065$
 $R = 21575$
 $(1+a)R = 21576$
 $R^2 = 46552$

a = +0.4

2
L
E
an
Pr
o
K
Si
we
u
20
m
P
S
t
h

MC1520 Standard Cords. 1913 July 1. 5

Cape No 597 mag 7.0				Cape No. 619 mag 7.5				Cape No 620 mag 8.7.			
L	4	02	52.44	4	12	17.14	4	12	24.87		
L			465			22			90		
L			41			08			83		
mean	4	02	52.44	4	12	17.15	4	12	24.87		
Prec			+42.99			+42.82			+43.47		
A	4	03	35.43	4	12	59.97	4	13	08.34		
A	4	08	37	4	08	37	4	08	37		
K-A			-5.01.57			+4.22.97			+4.31.34		
sin(k-A)			-301.55			+262.95			+271.32		
log			2.47936m			2.41988			2.43348		
"cos			9.96194			9.96532			9.95802		
"Σ ₀			0.94854m			0.89244			0.89874		
Σ ₀			-8.8826			+7.8062			+7.9202		
Σ ₁			-17			+26			+26		
Σ ₂			9.1157			25.8088			25.9228		
Σ ₃			9.3140			25.9476			26.1858		
Σ ₄ -Σ ₅			+1983			+1388			+2630		
L	+23	36	19.2	+22	33	42.2	+24	45	31.2		
L			19.4			42.9			31.55		
L			19.2			41.9			31.3		
mean	+23	36	19.3	+22	33	42.3	+24	45	31.4		
Prec			+1.57.3			+1.48.6			+1.46.5		
S	+23	38	16.6	+22	35	30.9	+24	47	19.9		
D	+23	41	47	+23	41	47	+23	41	47		
S-D			-3.30.4	-1	06	16.1	+1	08	32.9		
tan(S-D)			-210.4			-3976.6			+3933.4		
log			2.32305m			5.59952m			3.59476		
"Σ ₀			9.65420m			0.93067m			0.92591		
tan S			9.6412			9.6192			9.6645		
Σ ₂			18971			19849			17975		
"Σ ₁			85917			84575			85154		
Σ ₀			-0.4510			-8.5246			+8.4316		
Σ ₁			+391			+287			+328		
Σ ₂			21.5881			13.5041			30.4644		
Σ ₃			21.6400			13.4364			30.3950		
Σ ₄ -Σ ₅			+5.19			-677			-694		

MC 1520

Standard Curve

1913 July 1

5

Cape No 597 mag 7.0				Cape No 619 mag 7.5				Cape No 620 mag 8.7			
C	4	02	52.44	4	12	17.14		4	12	24.87	
L			46.5			22				90	
E			41			08				83	
Mean	4	02	52.44	4	12	17.15		4	12	24.87	
Prac			+42.99			+42.82				+43.47	
A	4	03	35.43	4	12	59.97		4	13	08.34	
A	4	08	37	4	08	37		4	08	37	
A-4		-5	01.57		+4	22.97			+4	31.34	
W(L-A)			-301.55		+262.95				+271.32		
log			2479.36		2419.88				2433.48		
W			996.194		996.532				995.802		
S ₀			0.94854		0.89244				0.89874		
T ₀			-8.8826		+7.8062				+7.9202		
S ₁			-17		+26				+26		
S			9.1157		25.8088				25.9228		
2			9.3140		25.9476				26.1858		
2-3			+1.983		+1.388				+2.630		
L	+23	36	19.2	+22	33	42.2		+24	45	31.2	
L			19.4			42.9				31.5	
L			19.2			41.9				31.2	
Mean	+23	36	19.3	+22	33	42.3		+24	45	31.4	
Prac			+1.573			+1.486				+1.485	
S	+23	38	16.6	+22	35	30.9		+24	47	19.9	
B	+23	41	47	+23	41	47		+23	41	47	
S-B		-3	30.4	-1	06	16.1		+1	05	32.9	
W(L-B)			-21.04		-39.76.6				+39.33.4		
log			2.32305		3.59952				3.59476		
W ₀			965420		093067				092591		
W ₁			9.6412		9.6192				9.6645		
W ₂			19.971		17.849				17.975		
W ₃			85.917		84.575				85.154		
W ₄			-0.4510		-8.5296				+8.4712		
W ₅			+39.1		+3.247				+3.228		
W ₆			21.5881		13.5041				30.9644		
W ₇			21.6400		13.4364				30.3950		
W ₈			+5.19		-6.77				-6.94		

1913 July 8

6

Center of Plate

x	y	$R.A.$	Decl.
9.3140	21.6400	4 03 35	+23 38 17
25.9476	13.4364	4 13 00	+22 35 31
26.1858	30.3950	4 13 08	+24 47 20
3 61.45	65.47	29 43	121 08
20.48	21.82	4 09 54	+23 40 23
-1.8	-22	-1 17	+ 1 24
2.48	1.8	4 08 37	+23 41 47
31	46.5		
248	84		
744			
76.88			

$$A = 4^h 08^m 37^s$$

$$D = +23^\circ 41' 47''$$

Plate Constant.

$x-3$	-73.24	-42	-39.5
+1983	-1584	+399	+396
+1388	-984	+404	+394
+2630	-2225	+405	+395
19.7275	-1618	-8	-19.5224
	+71.92	-1189	
+519	+670	+1189	= 0
-677	+1866	+1189	= 0
-694	+1883	+1189	= 0
22.1029	+1418		-22.1256

Tables	$b+a = +0.5$	$a = +0.6$	$e = +0.6$	$a-e = 0.0$
Observed	$b+a = +1.3$	$a = +0.4$	$e = 0$	$a-e = +0.4$
$c = 0$	-0.8			-0.4

Center of Plate

1915 July 8

6

R.A.

Decl

93140	216400	4	03	35	+23	38	17
259476	134364	4	13	00	+22	35	31
<u>261858</u>	<u>207950</u>	4	13	00	+24	47	20
316145	6547		29	43		121	08
2048	2182	4	09	54	+23	40	23
-18			-1	17		+1	24
248	18	4	08	37	+23	41	47
31	465						
248	24						
<u>794</u>							
7688							

$$A = 4^h 08^m 37^s$$

$$D = +23^{\circ} 41' 47''$$

-7324	-42	-395
3-1584	3-+396	+1
+1388	+404	+394
-2630	+905	+395
147245	-1618	-8
+7192	-1189	-19.5224
+519	+670	+1189
-677	+1866	+1189
-694	+1883	+1189
221027	+1418	-22.1252

Tables	b+d = +0.5	a = +0.6	b = +0.6	a - b = 0.0
Observed	b+a = +1.3	a = +0.4	a = 0	a = +0.4
C - 0	-0.8			-0.4

pt.	pos. $\angle$	resid.
1	180.0	+ 131
2	199.6	+ 62
3	239.4	- 75
4	267.3	- 3
5	294.5	- 81
6	307.0	+ 56
7	331.4	+ 117
8	390.4	+ 52

MC 1520

Lagoon Center

1913 July 8. 7

	x	$y - y_0$	$(y - y_0)^2$	K^2	$0 - C$
1	19.7274	0.0000	0.0000	4.6677	+ 125
2	19.0000	-0.7274	0.5291	4.6651	+ 99
3	17.8720	-1.8554	3.4425	4.6582	+ 30
4	17.5694	-2.1580	4.6570	4.6675	+ 123
5	17.7644	-1.9630	3.8534	4.6587	+ 35
6	18.0000	-1.7274	2.9839	4.6713	+ 161
7	18.6916	-1.0358	1.0729	4.6734	+ 182
8	19.0000	-0.7274	0.5291	4.6651	+ 99

Comp. $K^2 = 4.6552$

	y	$y - y_0$	$ y - y_0 $	$(y - y_0)^2$
1	19.9422	-2.1604	-1	4.6677
2	20.0690	-2.0336	-1	4.1360
3	21.0000	-1.1026	0	1.2157
4	22.0000	-0.1026	0	0.0105
5	23.0000	+0.8974	0	0.8053
6	23.4016	+1.2990	0	1.6874
7	24.0000	+1.8974	+1	3.6005
8	24.1362	+2.0336	+1	4.1360

Approximate Center

$$x = 19.0 \quad y = 20.0690$$

$$24.1362$$

$$44.2052$$

$$\text{mean } y = 22.1026$$

$$y - \text{min} = 19.9422$$

$$K = 2.1604$$

$$x - \text{min} = 17.5670$$

$$\text{mean } x = 19.7274$$

$$\text{Center } \begin{cases} x_0 = 19.7274 \\ y_0 = 22.1026 \end{cases}$$

MC 1520

Intrinsic Center

1913 Feb 6. 7

	x	$x - x_0$	$(x - x_0)^2$	K^2	$0 - C$
1	19.7274	0.0000	0.0000	4.6677	+1.25
2	19.0000	-0.7274	0.5291	4.6651	+ .99
3	17.8720	-1.8554	3.4425	4.6582	+ .30
4	17.5694	-2.1580	4.6570	4.6675	+1.23
5	17.7644	-1.9630	3.8534	4.6587	+ .35
6	18.0000	-1.7274	2.9839	4.6713	+1.61
7	18.6916	-1.0358	1.0729	4.6734	+1.82
8	19.0000	-0.7274	0.5291	4.6651	+ .99

Comp. $K^2 = 4.6552$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	17.9422	-2.1604	-1	4.6677
2	20.0690	-2.0336	-1	4.1360
3	21.0000	-1.1026	0	1.2157
4	22.0000	-0.1026	0	0.0105
5	23.0000	+0.8974	0	0.8053
6	23.4016	+1.2990	0	1.6874
7	24.0000	+1.8974	+1	3.6005
8	24.1362	+2.0336	+1	4.1360

Approximate Center

 $x = 19.0$ $y = 20.0690$ 24.1362

44.2052

mean $y = 22.1026$ $y = 22.1026$ 19.9422

39.0444

mean $x = 17.5670$ mean $x = 19.7274$ Center $\left\{ \begin{array}{l} x_0 = 19.7274 \\ y_0 = 22.1026 \end{array} \right.$

Formation of Journals

	ab	an	bn
1	- 0.00	+ 0.0	- 270.0
2	+ 1.48	- 72.2	- 201.0
3	+ 2.05	- 55.9	- 33.0
4	+ 0.22	- 265.8	- 123
5	- 1.76	- 68.6	+ 31.5
6	- 2.25	- 278.2	+ 209.2
7	- 1.97	- 189.1	+ 395.8
8	- 1.48	- 72.2	+ 201.0
	<u>- 3.71</u>	<u>- 1002.0</u>	<u>+ 271.2</u>

Residuals

	O	C	O-C
1	+ 125	- 40 - 6 = -6	+ 131
2	+ 99	+ 42 - 5 = +37	+ 62
3	+ 30	+ 108 - 3 = +105	- 75
4	+ 123	+ 126 - 0 = +126	- 3
5	+ 35	+ 114 + 2 = +116	- 81
6	+ 161	+ 101 + 4 = +105	+ 56
7	+ 182	+ 60 + 5 = +65	+ 117
8	+ 99	+ 42 + 5 = +47	+ 52

Average = 72

5.39
x 6.13

32.74
11.52

MC 15-20

C

1 0.00
2 -0.73
3 -1.86
4 -2.16
5 -1.96
6 -1.73
7 -1.04
8 -0.73

-3.82
-4.48
+4.48

-3.82

+17.0
-3.7

+3.7

+17.0

with

+17.07
-3.71
-10.21

+17.07 a = -1.002 + 1.14 + 1.89 = 6.99

a = -41.0

+14.76
-4.69
+2.96
+4.55

b = +30.8

c = +18.5

+2.96
-6.45
+1.42
+2.62

+1.94
-2.96
+1.87
+2.54

+1.20
+3.71
-1.22
-2.22
-6.15
-2.22
-2.18

-1.20
+3.71
-1.22
-2.22
-6.15
-2.22
-2.18

+1.70
-3.71
-1.22
-2.22
-6.15
-2.22
-2.18

ht. 26

0-6

+132
+34
-73 (146)
-90
-82 (164)
-14
+73
+20

page 84

7
1

c = +18.5

b = +30.8

a = -41.0

M 1520 Moon's Center.

1913 Sept. 26.

8

Conditional Equations

	a	b	0	c	0-c
1	0.00	-2.16	= +1.25	0-7 = -7	+1.32
2	-0.73	-2.03	= +99	+72-7 = +65	+34
3	-1.86	-1.10	= +30	+92-4 = +88	-73 (146)
4	-2.16	-0.10	= +1.23	+213+0 = +213	-90
5	-1.96	+0.90	= +35	+97+3 = +100	-82 (164)
6	-1.73	+1.30	= +1.61	+171+4 = +175	-14
7	-1.04	+1.90	= +1.82	+103+6 = +109	+73
8	-0.73	+2.03	= +99	+72+7 = +79	+20

Average 84

~~$$-3.82 - 4.84 = +36.2$$~~

~~$$-4.48 + 5.68 = +460$$~~

~~$$+4.48 + 5.68 = +4.25$$~~

~~$$+11.36 = +35 \quad b = +3.1$$~~

~~$$-3.82 = +36.2 + 15 = +377 \quad a = -98.6$$~~

Normal Equation

$$+17.07 - 3.71 = -1002$$

$$-3.71 + 20.26 = +271$$

$$+3.71 - 0.81 = -218$$

$$+19.45 = +53$$

$$b = +2.7$$

$$+17.07a = -1002 + 10 = -992$$

$$a = -58.1$$

With 3 unknowns.

$$+17.07 - 3.71 - 10.21 = -1002$$

$$-3.71 + 20.26 - 0.74 = +271$$

$$-10.21 - 0.74 + 8.00 = +854$$

$$c = +18.5$$

$$b = +30.8$$

$$a = -41.0$$

1161520

Moon's Center

1913 Sept. 26

8

Conditional Equations

	a	b	0	c	0-c
1	0.00	-216	= +1.25	0-7 = -7	+1.32
2	-0.73	-203	= +99	+72-7 = +65	+34
3 (144)	-1.86	-110	= +30	+92-4 = +88	-73 (146)
4	-2.16	-0.10	= +1.23	+213+0 = +213	-90
5 (144)	-1.96	+0.90	= +35	+97+3 = +100	-82 (144)
6	-1.73	+1.20	= +1.61	+171+4 = +175	-14
7	-1.04	+1.90	= +1.82	+103+6 = +109	+73
8	-0.73	+2.03	= +96	+72+7 = +79	+20

~~$$-382 - 489 = +362$$~~

~~$$-448 + 568 = +460$$~~

~~$$+448 + 568 = +425$$~~

~~$$+1136 = +35 \quad b = +3.1$$~~

~~$$-382 = +362 + 15 = +377 \quad a = -98.6$$~~

Normal Equation

$$\begin{aligned} +1707 - 371 &= -1002 \\ -371 + 2026 &= +271 \end{aligned}$$

$$+371 - 081 = -218$$

$$+1995 = +53$$

$$b = +2.7$$

$$+1707 = -1002 + 10 = -992$$

$$a = -58.1$$

15-20 Moon's Mean Position (1912.0)

9

$$\begin{array}{rcl}
 X_0 & = & 19.7274^{\vee} \\
 \frac{1}{2}a & = & \frac{-29}{19.7245^{\vee}} \\
 Y_0 & = & 22.1026^{\vee} \\
 \frac{1}{2}b & = & \frac{+1}{22.1027^{\vee}}
 \end{array}$$

From Plate Constants $X = 19.5294^{\vee}$ $Y = 22.1256^{\vee}$

$$\begin{array}{rcl}
 \bar{x} & = & +1.5224 \\
 \log & = & 0.18253^{\vee} \\
 \text{wss} & = & 9.96169^{\vee} \\
 \text{wms} & = & 8.50724^{\vee}
 \end{array}$$

$$\text{..}(x-A) \quad 171360^{\vee}$$

$$x-A \quad +51.71^{\vee}$$

$$A \quad 4 \ 08 \ 37^{\vee}$$

$$X_0 \quad 4^{\vee} \ 109 \ 28.71^{\vee}$$

$$\text{Rea} \quad + \quad 0.56$$

$$a' \quad 4 \ 09 \ 29.27$$

$$y = +0.1256$$

$$\log \tan \delta = 9.6424^{\vee}$$

$$\text{..} \delta = 0.3651^{\vee}$$

$$\text{..} \gamma_1 = 70609^{\vee}$$

$$\gamma_1 = +12$$

$$\text{..} \gamma_0 = +0.1244^{\vee}$$

$$\log \gamma_0 = 9.09482^{\vee}$$

$$\text{..} \delta = 7.33115^{\vee}$$

$$\text{..} (\delta/\gamma_0) = 1.76367^{\vee}$$

$$\delta - D = +58.0^{\vee}$$

$$D = +23 \ 41 \ 47^{\vee}$$

$$\delta_0 = +23^{\circ} \ 42' \ 45.0''^{\vee}$$

$$\text{Red} \quad +9.0$$

$$\delta' = +23 \ 42 \ 54.0$$

1520 Moon's Mean Position (19120)

9

$$X_0 = 19.7274$$

$$Y_0 = 22.1026$$

$$\Delta X = -29$$

$$\Delta Y = +2$$

$$19.7245$$

$$22.1027$$

From Plate Constant $X = 19.5224$ $Y = 22.1256$

$$\bar{x} = +1.5224$$

$$\eta = +0.1256$$

$$\log = 0.18258$$

$$\log \tan S = 9.6424$$

$$\log \omega S = 9.96169$$

$$S = 0.3651$$

$$\log \omega \sin \delta = 8.50729$$

$$\eta_1 = 7.0609$$

$$(x - A) = 1.71360$$

$$\eta_2 = +12$$

$$A - M = +5.179$$

$$\eta_0 = +0.1244$$

$$A = 4.0837$$

$$\log \eta_0 = 9.09482$$

$$X_0 = 4.092801$$

$$\log \eta_1 = 7.33115$$

$$R_{\text{red}} = 0.56$$

$$(x - 1) = 1.76367$$

$$x = 4.092927$$

$$J - D = +58.0$$

$$D = +23.41.47$$

$$S_0 = +23.42.45.0$$

$$R_{\text{red}} = +9.0$$

$$S = +23.42.54.0$$

Red. ad l. aph.

$$S = +23^{\circ} 43'$$

$$\begin{array}{rcl}
 H + \alpha & 3 & 31 = 52^{\circ} 45' \\
 H & 23 & 22 \\
 \alpha & 4 & 09 \\
 G & 16 & 35 \\
 G + \alpha & 20 & 44 = 311^{\circ}
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos(G + \alpha) & 9 & 8169 \\
 q & 0 & 9088 \\
 \sin & 9 & 8778m \\
 \tan & 9 & 6425 \\
 \frac{1}{\tan} & 8 & 8239
 \end{array}$$

$$\begin{array}{rcl}
 q' & 0 & 7257 \\
 q & 9 & 2533m
 \end{array}$$

$$\begin{array}{rcl}
 b & - & 0.44 \\
 g & - & 0.18 \\
 h & + & 1.18 \\
 \hline
 & + & 0.56
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos S & 9 & 9617 \\
 \dots i & 0 & 1646m \\
 \dots (i) & 0 & 1263m
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S & 9 & 6045 \\
 \dots \cos(H + \alpha) & 9 & 7820 \\
 \dots h & 1 & 3100 \\
 \dots \sin & 9 & 9009 \\
 \dots \sec S & 0 & 0383 \\
 \dots \frac{1}{\sin} & 8 & 8239
 \end{array}$$

$$\begin{array}{rcl}
 \log h' & 0 & 6965 \\
 \dots h & 0 & 0731
 \end{array}$$

$$\begin{array}{rcl}
 g' & + & 5.32 \\
 h' & + & 4.97 \\
 i & - & 1.33 \\
 \hline
 & + & 8.96
 \end{array}$$

1520

Lunar Parallax

10

$$\begin{aligned} \alpha' &= 4 \quad 09 \quad 29.27 \\ \delta &= 3 \quad 06 \quad 11.0 \\ \theta - \alpha' &= -1 \quad 03 \quad 17.8 \\ &= -15^\circ \quad 49' \quad 27'' \end{aligned}$$

$$- \quad \quad \quad 6 \quad 41$$

$$-15 \quad 42 \quad 46$$

$$\begin{aligned} 9.95727 \\ 0.00000 \\ 0.01654 \\ \hline 9.97381 \end{aligned}$$

$$\gamma = 43 \quad 16 \quad 24$$

$$23 \quad 42 \quad 54$$

$$19 \quad 33 \quad 30$$

$$\begin{aligned} 9.82640 \\ 8.24535 \\ 9.52474 \\ 0.16400 \\ \hline 7.76049 \end{aligned}$$

$$\delta - \delta' = +19 \quad 48.3$$

$$\delta : \gamma \quad 24 \quad 02 \quad 42.3$$

$$\text{Nautical } \delta : +24 \quad 02 \quad 41.1$$

o-c

u-c

$$+1.2$$

$$\delta' : +23^\circ \quad 42' \quad 54.0$$

$$\pi = 60' \quad 29.1$$

$$\begin{aligned} 9.86913 \\ 8.24535 \\ 9.43566 \\ 0.03942 \\ \hline 7.58956 \end{aligned}$$

$$\alpha - \alpha' = -13' \quad 21.65$$

$$- \quad -5' \quad 34.4$$

$$\alpha \quad 4 \quad 08 \quad 35.83$$

$$\alpha = 4 \quad 08 \quad 35.16$$

$$+0.67$$

1912
proj
proj

1520

Human Paralane

10

$$\alpha' = 4 \quad 09 \quad 29.27$$

$$\delta = 3 \quad 06 \quad 11.5$$

$$S = +23^\circ 42' 54''$$

$$\theta - \alpha' = -1 \quad 03 \quad 17.8$$

$$\pi = 60' 29.1$$

$$= -15^\circ 49' 27''$$

$$= 6 \quad 41$$

$$= -15 \quad 42 \quad 46$$

$$995727$$

$$000000$$

$$001654$$

$$997381$$

$$986913$$

$$824535$$

$$993566$$

$$003942$$

$$758956$$

$$\alpha - \alpha' = 13 \quad 21 \quad 60$$

$$= -53' 49''$$

$$\gamma = 43 \quad 16 \quad 24$$

$$23 \quad 42 \quad 54$$

$$19 \quad 33 \quad 30$$

$$982640$$

$$824535$$

$$952545$$

$$016374$$

$$776094$$

$$S - S' = +19 \quad 49.5$$

$$S = +24 \quad 02 \quad 43.5$$

$$\alpha = 4 \quad 08 \quad 35.83$$

$$\text{Horizontal } S = +24 \quad 02 \quad 41.1$$

$$\alpha = 4 \quad 08 \quad 35.16$$

$$\theta - \alpha$$

$$+ 2.4$$

$$+ 0.67$$

$$\theta - \alpha$$

1
6.7
21.
2
2.6
1.3
3
2.4
2

MC 1521

Stars measures.

a

w

1913 July 1.

11

1		2		3		4	
8.2	19142	15278	19590	14918			
21.3	1603038	840000	1446060	1303030			
	4038	00	5560	4140			
	50	98	95	30			
	<u>213108</u>	<u>3108</u>	<u>81865</u>	<u>1885</u>			
24.8	16454	19463	17886	18220			
13.1	1555860	1037070	16047	1006970			
	50	6270	4740	7070			
	67	75	95	88			
	<u>130899</u>	<u>0893</u>	<u>24.8157</u>	<u>8167</u>			
25.0	10599	814040	1097067	9015			
20.0	1010303	40	72	832020			
	0803	7648	10280	15			
	<u>30.0494</u>	<u>0500</u>	<u>25.0690</u>	<u>0697</u>			

Grade 2 or 1

MC 1521

Stars measured.

1913 July 1.

11

	α	δ	α	δ
1	19 14 2	15 27 8	19 59 0	14 9 18
2	160 30 38	84 00 00	184 60 60	130 20 30
21.3	40	00	55	41 40
	50	98	95	30
	<u>21 31 08</u>	<u>31 08</u>	<u>8 18 65</u>	<u>18 85</u>
2	164 54	194 63	178 86	182 20
248	155 58 60	103 70 70	160 47	100 69 70
13.1	50	62	47 40	70
	67	75	95	38
	<u>13 08 99</u>	<u>08 93</u>	<u>24 81 57</u>	<u>81 67</u>
3	105 99	814 0 40	109 70 67	90 15
450	1010 503	40	72	8320 20
200	08	7648	102 50	15
	<u>30 04 94</u>	<u>05 00</u>	<u>21 06 90</u>	<u>06 97</u>

Grade 2 or 1

14
10
19
2
16
2
3
17
21
4
17
2
5
17
2
6
18
2

MCN-21 Moon measures.

1913 July 1.

125

$\frac{1}{19.0}$ 1068092 16775
 $\frac{19.9}{10150}$ 90 1624017
 20

possibly on termination

19.94639451min in q - about 19.9150

$\frac{2}{16.0}$ 19328 15-9.48
 $\frac{20.5}{1542940}$ 784930
 38
 40 20
 66
20.3897 3874

$\frac{3}{17.5}$
 21.0

18562 16062
 13330 28 1131019
 38
 72 80
17.4765 4755

$\frac{4}{17.2}$
 22.0

17500 16104
 9371 64 1422030
 70
 16 29
17.1855 1883 30

$\frac{5}{17.5}$
 23.0

17435 14658
 11364 63 1074143
 60
 55 40
17.3915 3925 78

$\frac{6}{18.0}$ 17289
 $\frac{23.7}{962926}$ 30
 07
23.7675

18400 1
 1608064
 70
 18
7667

MICHU Moon Measures

1913 July 1.

125

$\frac{1}{190}$ 1068092 16775
 199 9.0 16240,7
 199 10150 20

possibly on
 terminator

1994639951mean in γ = about 199150

$\frac{2}{180}$ 19328 159.48
 20 1542940 984930
 38 40 20
 40 66
20.3897 3874

$\frac{3}{175}$
 21.0

18562 16062
 13320 28 11310,9
 38 19,9
 72 80
174765 4755

$\frac{4}{172}$
 27.0

17500 16104
 9371 64 1422030
 70 29
 16 30
171855 1883

$\frac{5}{175}$
 23.0

17435 14658
 11364 63 1074143
 60 40
 55 78
173915 3925

$\frac{6}{180}$
 23.7

17289 18400 1
 962926 1608064
 30 70
 07 18
237675 7667

MC 1521

a

Moon-measures

v

1913 July 1.

x

13

7

18.4

24.0

8

19.0

24.2

19508

17380 85

81

30

24.2130

16337

848079

7879

55

.2128

16620

1015561

4258

28

18.3530

v

18265

14745 52

41

69

.3521

MG 1521

a

Hydrogen measures

4

v

1913 July 1

x

v

13

2
15.4
29.0

16620
1015561
4258
28

183530

18265
1474552
41
69
3521

8
19.0
29.2
1950.8
17380.85-
81
30
242130

16337
845079
7879
55
2128

1913 July 1.

14

MC 15th 26. Trinus. etc
 Exp to stars 1912 Jan 1 3^h 13^m -3^h 25^m
 ... moon 3 19 07.3^h -3 19 07.7^h
 clock slow 1 07.8^h ✓

M. Sid T. 3 20 15.3^h G-α^h - 6^h 49^m
 H Long 4 44 31.05^m
 G. Sid T. 8 04 46.35^m
 Sid. T. in moon 18 39 07.54^m
 Interval 13 25 38.81^m
 Reduction 2 11.99^m
 G. M. T. 13 23 26.82^m

Brownhaut Alm. R.A. Decl
 Moon 13^h 4^h 08^m 10.57^s + 24 01 12.1^s
 Motion in m 2 6 1.10^s 9.429^s
 ... 23.447^s + 1 01.22^s + 3 41.0^s
 Tabular place 4 09 11.79^s + 24 04 53.1^s

Moon's parallax 60' 29.5^s ✓
 ... semidiam 16 30.5^s ✓

939 = 14.65^s ✓
 9905 = 16.5^s

R. = 990.5^s ✓
 Augmentation + 16.5^s ✓
 Irradiation (grade 2) - 0.5^s ✓
 R. = 1006.5^s ✓
 R. = 2157.5^s ✓
 (α+1) R. = 2157.9^s ✓
 R. = 4656.6^s ✓

α = +1.8

74

M.C. 15-28 Trains etc

Exp. to train 1912 Jan 1 3^h 13^m -3^h 25^m

 moon 3 19 075-3 19 077

cloudy slow 1 078

H. S. d. T.	3	20	15.3
L. Long	4	44	31.05
G. S. d. T.	8	64	46.35
S. d. T. in horn	18	39	07.54
Intervals	13	25	38.81
Reduction		2	11.99
G. h. T.	13	23	26.82

			R	G		Black	
Green Hunt Alum							
Green 13 th	4	08	10	57	+24	01	121
fraction 1 st	3	61	10		9429		
Green 23.447		11	01	22		3	410
Tabular place	4	09	11	79	+24	09	531

<i>Microgaster parallax</i>	60' 29.5"	✓
<i>Microgaster</i>	16 30.5"	

$934 - 19.65$
 $9925 - 165$
 $R = 990.5$
 Augmentation $+ 16.5$
 information (from 3) $- 0.5$
 $R = 1006.5$
 $R = 2157.5$
 $(a+1) R = 2157.9$
 $R^2 = 46566$

MC 1521

1913 July 8.

15

Plate Constants.

x	81875	24.8162	25.0694
y	91157	25.6088	25.9228
z	-9282	-9926	-8534
u	21.3108	13.0896	30.0497
v	21.5881	13.5041	30.4644
$u-v$	-2773	-4145	-4147

$$\begin{array}{rcll}
 z-3 & -82.17 & -1.82 & +1.1046 \\
 -9282 & -1749 & -1.1031 & -1.5 = -1.1046 = 0 \\
 -9926 & -1075 & -1.1001 & -45 = -1.1046 = 0 \\
 -8534 & -2467 & -1.1001 & -45 = -1.1046 = 0 \\
 19.3429 & -1813 & -30 & -20.2627
 \end{array}$$

$$\begin{array}{rcll}
 u-v & +822 & -4 & +2123 \\
 -2773 & +671 & -2102 & -21 = -2123 = 0 \\
 -4145 & +2035 & -2110 & -13 = -2123 = 0 \\
 -4147 & +2055 & -2092 & -30 = -2122 = +1 \\
 22.0796 & +1586 & -22 & = 22.4483
 \end{array}$$

Observed	$b+d$	$+0.1$	$a = +1.8$	$e = +1.0$	$a-e = +0.8$
Tabular		0.0	+0.6	+0.6	0.0
$C-O$		-0.1			-0.8

MC 1521

1913 July 8.

15

Plate constants

x	81875	248162	250694
y	91157	258088	259228
$x-y$	-9282	-9926	-8534
y	213108	130896	300497
x	215881	135041	304644
$y-x$	-2773	-4145	-4147

$x - y$	- 8213		- 182			111046
- 9282	- 1749	- 11031	- 15	- 11046	-	0
- 9926	- 1075	- 11001	- 45	- 11046	-	0
- 8534	- 2967	- 11001	- 45	- 11046	-	0
19.3429	- 1813		- 35			- 20.2627

$y-x$	+822	-4	+2123		
-2773	+671	-2102	-21	-2123	=0
-4145	+2035	-2110	-13	-2123	=0
-4147	+2055	-2092	-30	-2122	=1
22.0796	+1586	-22			=224483

Observed	$k+d$	+0.1	a	+1.8	x	+1.0	$a-b$	+0.8
Tabular		0.0		+0.6		+0.6		0.0
$C-O$		-0.1						-0.8

pt.	pos. c.	red.
1	189.3	+151
2	218.6	+63
3	240.2	-57
4	267.9	-19
5	295.2	-37
6	321.4	-58
7	332.5	+122
8	350.7	+123

MC 1521

Moon's Center

1913 July 9.

16

	x	$x - x_0$	$(x - x_0)^2$	R^2	$y - c$
1	19.0000	-0.3504	-0.1228	4.672.1	+11.55
2	18.0000	-1.3504	1.8236	4.6794	+22.9
3	17.4760	-1.8744	3.5134	4.6766	+2.00
-4	17.1869	-2.1635	4.6808	4.6870	+30.4
5	17.3920	-1.9584	3.8354	4.6845	+27.9
6	18.0000	-1.3504	1.8236	4.6749	+18.3
7	18.3526	-0.9978	0.9956	4.6881	+31.5
8	19.0000	-0.3504	0.1228	4.6789	+22.3

Comp. $R^2 = 4.6566$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	19.9457	-2.1328	-1	4.5493
2	20.3886	-1.6899	0	2.8558
3	21.0000	-1.0785	0	1.1632
4	22.0000	-0.0785	0	0.0062
5	23.0000	+0.9215	0	0.8491
6	23.7671	+1.6886	0	2.8513
7	24.0000	+1.9215	+1	3.6925
8	24.2129	+2.1344	+1	4.5561

Approx. Center

$x = 19.0 \quad y = 19.9457$

$\underline{24.2129}$

44.1586

22.0793

mean $y = 22.0785$

$y = \text{mean} = 19.9150$

$R = 2.1635$

$x = \text{min} = 17.1869$

$x_0 = 19.3504$

$x = 18.0 \quad y = 20.3886$

$\underline{23.7671}$

44.1557

22.0779

Center $\left\{ \begin{array}{l} x_0 = 19.3504 \\ y_0 = 22.0785 \end{array} \right.$

N161521

approx Center

1915 July 9.

16

	x	$x - x_0$	$(x - x_0)^2$	R	$0 - C$
1	190000	-03504	-0.1228	4672	+155
2	180000	-13504	18236	46794	+264
3	174760	-18744	35134	46766	+200
4	171869	-21635	46808	46870	+304
5	173920	-19584	38354	46845	+274
6	180000	-13504	18236	46749	+143
7	183526	-09978	09956	46881	+315
8	190000	-03504	0.1228	46789	+223

Comp $\Sigma^2 = 46566$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	19.9457	-2.1328	-1	4.5493
2	20.3886	-1.6899	0	2.8558
3	21.0000	-1.0785	0	1.1632
4	22.0000	-0.0785	0	0.0062
5	23.0000	0.9215	0	0.8491
6	23.7671	1.6886	0	2.8513
7	24.0000	1.9215	+1	3.6925
8	24.2129	2.1344	+1	4.5561

Approx Center

$x = 190$ $y = 19.9457$
 $\quad \quad \quad 24.2129$
 $\quad \quad \quad 44.1586$
 $\quad \quad \quad 22.0793$
 $\quad \quad \quad 22.0785$
 $y = 21.94150$
 $\quad \quad \quad 2.1635$
 $\quad \quad \quad 17.1869$
 $\quad \quad \quad 19.3504$

$x = 180$ $y = 20.3886$
 $\quad \quad \quad 23.7671$
 $\quad \quad \quad 44.1557$
 $\quad \quad \quad 22.0779$

Center $\left\{ \begin{array}{l} x_0 = 193504 \\ y_0 = 220795 \end{array} \right.$

Formation of normals.

	ab	an	bn
1	+ 0.75	- 54.2	- 330.2
2	+ 2.28	- 307.8	- 385.3
3	+ 2.02	- 374.0	- 216.0
4	+ 0.17	- 656.6	- 24.3
5	- 1.80	- 546.8	+ 256.7
6	- 2.28	- 247.0	+ 309.3
7	- 1.92	- 315.0	+ 604.8
8	- 0.75	- 78.0	+ 475.0

$$(ab) = -1.53 \quad (an) = -2579.4 \quad (bn) = +690.0$$

normals.

$$\begin{aligned} + 16.92 - 1.53 &= -2579 \\ - 1.53 + 20.52 &= +690 \end{aligned}$$

$$\begin{aligned} + 1.53 - 0.14 &= -233 \\ + 20.38 &= +457 \end{aligned}$$

$$b = +22.4$$

$$\begin{aligned} - 0.11 + 1.53 &= +51 \\ + 16.81 &= -2528 \end{aligned}$$

$$a = -150.5$$

	a	b	a-b
+	52-48 = +4	+155	+151
+	203-38 = +165	-228	+63
+	281-24 = +257	+200	-57
+	325-2 = +323	+304	-19
+	295+21 = +316	-279	-37
+	203+38 = +241	+183	-58
+	150+43 = +193	+315	+122
+	52+48 = +100	+223	+123

$$\text{Average} = 76$$

MC 1521

Miron's Center

1913 Sept 26. 17

Conditional Equations.

a b

$$1 - 0.35 - 2.13 = +155$$

$$2 - 1.35 - 1.69 = +228$$

$$3 - 1.87 - 1.68 = +200$$

$$4 - 2.16 - 0.08 = +304$$

$$5 - 1.96 + 0.92 = +279$$

$$6 - 1.35 + 1.69 = +183$$

$$7 - 1.00 + 1.92 = +315$$

$$8 - 0.35 + 2.13 = +223$$

Normals.

$$b = +22.4$$

$$a = -150.5$$

MC 1521

Lowry Center

1912 Sept 26

17

Conditional Equations

a b

1	-0.35	-2.13	= +15.5
2	-1.35	-1.69	= +22.8
3	-1.87	-1.08	= +20.0
4	-2.16	-0.08	= +30.4
5	-1.96	+0.92	= +27.9
6	-1.35	+1.69	= +14.3
7	-1.00	+1.92	= +31.5
8	-0.35	+2.13	= +22.3

Normals

$$b = +22.4$$

$$a = -15.5$$

1521 Moon's Mean Position (1912.0)

$$\begin{array}{r} X_0 = 19.3504 \\ - 75 \\ \hline X = 19.3429 \end{array}$$

$$\begin{array}{r} Y_0 = 22.0785 \\ + 11 \\ \hline Y = 22.0796 \end{array}$$

From Plate Constants $X = 20.2627$ $Y = 22.4483$

$$\begin{array}{r} \bar{x} = +2.2627 \\ \log \bar{x} = 0.35462 \\ - \text{wgs} \quad 9.96156 \\ - \text{const} \quad 8.50724 \\ - (\alpha - 4) \quad 1.88582 \end{array}$$

$$X - 4 \quad + \quad 1 \quad 16.88$$

$$A \quad 4^h \quad 08^m \quad 37^s$$

$$d_0 \quad 4 \quad 09 \quad 53.88$$

$$\text{Red.} \quad +0.56$$

$$d' = 4 \quad 09 \quad 54.44$$

$$\eta = +0.4483$$

$$\begin{array}{r} \log \tan S = 9.6424 \\ S^2 = 0.7092 \\ \eta_1 = 7.4050 \end{array}$$

$$\eta_1 = 1 \quad 25$$

$$\eta_0 = +0.4458$$

$$\begin{array}{r} \log m_0 = 9.64914 \\ - \text{const} \quad 7.33115 \end{array}$$

$$-(d-D) = 2.31799$$

$$S - D = +3 \quad 28.0$$

$$D \quad +23 \quad 41 \quad 47$$

$$S_0 \quad +23^\circ 45' 15''$$

$$\text{Red.} \quad +9.0$$

$$d' = +23 \quad 45 \quad 24.0$$

1521 Moons Mean Position (1912.0)

$$\begin{array}{r}
 X = 193504 \\
 - \quad - \quad - \quad 75 \\
 \hline
 X = 193429
 \end{array}$$

$$\begin{array}{r}
 Y_0 = 220755 \\
 + 11 \\
 \hline
 220796
 \end{array}$$

From Plate Constant $X = 20.2627$ $Y = 22.4483$

$$Z = +2.2627$$

$$\eta = +0.4483$$

$$\log Z = 0.35462$$

$$\log S = 9.46156$$

$$\log \eta = 8.50724$$

$$(Z-A) = 1.88582$$

$$\log \tan S = 9.6424$$

$$S^2 = 0.7092$$

$$\eta_1 = 740.50$$

$$\eta_1 = 1 \quad 25$$

$$Z-A = 1 \quad 16.88$$

$$\eta_0 = +0.4458$$

$$A = 4^h 08^m 37^s$$

$$\log \eta_0 = 9.64914$$

$$\log \eta = 7.33115$$

$$H_0 = 4 \quad 09 \quad 53.88$$

$$(Z-A) = 2.31799$$

$$S-D = +3 \quad 28.0$$

$$D = +23 \quad 41 \quad 47$$

$$S_0 = +23^\circ 45' 15''$$

$$\delta = 23 \ 45'$$

$$\alpha_0 = \begin{array}{r} 3 \ 32 = 53^\circ \\ 23 \ 22 \\ 4 \ 10 \\ 16 \ 35 \\ 20 \ 45 = 311^\circ 15' \end{array}$$

$$\begin{array}{r} 9.8191 \\ 0.9083 \\ 9.6435 \\ 8.8239 \\ \hline 9.8761 \\ 0.7274 \\ \hline 9.2518 \end{array}$$

$$\begin{array}{r} + 0.44 \\ - 0.18 \\ + 1.18 \\ \hline + 0.58 \end{array}$$

$$\begin{array}{r} 9.9616 \\ 0.1701 \\ \hline 0.1316 \end{array}$$

$$\begin{array}{r} 9.6050 \\ 9.7795 \\ 1.3100 \\ 0.0384 \\ 8.8239 \\ \hline 9.9024 \\ 0.6945 \\ \hline 0.0747 \end{array}$$

$$\begin{array}{r} + 5.34 \\ + 4.95 \\ - 1.35 \\ \hline + 8.94 \text{ or } + 9.0 \end{array}$$

1521

Lunar Parallax

19

$$\begin{array}{r}
 \alpha' = 4^h 09^m 54.44^s \checkmark \\
 \theta = 3 \quad 20 \quad 15.3^s \checkmark \\
 \alpha - \alpha' = 49 \quad 39.1^s \checkmark \\
 \quad \quad \quad 12^m 24' 46'' \checkmark \\
 \quad \quad \quad \quad \quad 5 \quad 16' \checkmark \\
 \quad \quad \quad 12 \quad 19 \quad 30^s \checkmark
 \end{array}$$

$$\begin{array}{r}
 9.95727^s \checkmark \\
 0.00000^s \checkmark \\
 0.01012^s \checkmark \\
 \hline
 9.96739^s \checkmark
 \end{array}$$

$$\begin{array}{r}
 \gamma = 42 \quad 50 \quad 58^s \checkmark \\
 \quad \quad 23 \quad 45 \quad 24^s \checkmark \\
 \quad \quad 19 \quad 05 \quad 34^s \checkmark
 \end{array}$$

$$\begin{array}{r}
 9.82640^s \checkmark \\
 8 \quad 24 \quad 54.0^s \checkmark \\
 9 \quad 51 \quad 46.8^s \checkmark \\
 0.16744^s \checkmark \\
 \hline
 7.75392^s \checkmark
 \end{array}$$

$$\delta - \delta' = +19 \quad 30.4^s \checkmark$$

$$\delta = +24 \quad 04 \quad 54.4^s \checkmark$$

$$\text{Nautilius } \delta = +24 \quad 04 \quad 53.1^s \checkmark$$

$$\alpha - \alpha' = +1.3^s \checkmark$$

$$\delta' = +23^{\circ} 45' 24.0'' \checkmark$$

$$\pi = 60' 29.5'' \checkmark$$

$$\begin{array}{r}
 9.86913^s \checkmark \\
 8.24540^s \checkmark \\
 9.33234^s \checkmark \\
 0.03954^s \checkmark \\
 \hline
 7.48641^s \checkmark
 \end{array}$$

$$\alpha - \alpha' = 10' 32.17'' \checkmark$$

$$= -42.14'' \checkmark$$

$$\alpha = 4 \quad 09 \quad 12.30^s \checkmark$$

$$\alpha = 4 \quad 09 \quad 11.79^s \checkmark$$

$$+ 0.51'' \checkmark$$

α J 21

Lensar Parallaxes

19

$$\alpha' = 4^h 09^m 54.44$$

$$\delta = 3^{\circ} 20' 15.3''$$

$$\alpha - \alpha' = 49.391$$

$$= 12^{\circ} 24' 46''$$

$$= 5.16$$

$$12 \quad 19 \quad 30$$

$$9.95727$$

$$000000$$

$$001012$$

$$9.96739$$

$$\gamma = 42^{\circ} 50' 58''$$

$$23^{\circ} 45' 24''$$

$$19^{\circ} 05' 34''$$

$$9.82640$$

$$8.24540$$

$$9.51468$$

$$0.16744$$

$$7.75392$$

$$\delta - \delta' = +19^{\circ} 30.4'$$

$$\delta = +29^{\circ} 04' 54.4''$$

$$\text{Nautilius } \delta = +29^{\circ} 04' 53.1''$$

$$\alpha - \alpha'$$

$$= 1.3$$

$$+ 0.51$$

$$\delta' = +23^{\circ} 45' 24.0''$$

$$\pi = 60' 29.5''$$

$$9.86913$$

$$8.24540$$

$$9.33234$$

$$003954$$

$$7.48641$$

$$\alpha - \alpha' = 10' 32.17''$$

$$= -42.14''$$

$$\alpha = 4^h 09^m 12.30$$

$$\alpha = 4^h 09^m 11.79$$

MC 1529

Star measures.

1913 July 2

20.

	d	4	n	d	x	N
1	12185		11100	17687		16181
0.2			0295			
15.0	12160			895147		1491009
	60	60	11056	5047		08
mg				95		85
53	150025		.0033	9.1261		.1272
2						
136	16473		19220	16181		15480
25.5	11600		1411007	1221608		745038
mg			10	10		4538
77	95		28	85		80
	91					
	25.4884		.4885	13.6028		.6036
3						
278	14600		17780	15032		17750
269	5890		1650908	12470		1027875
mg			05	9099		7579
69	88		95	38		65
	14					
	26.8723		.8725	22.7459		.7485
4						
261	18688		15846	18743		17121
11.3	1618080		835352	962128		1622629
mg			47	21		20
52	79		45	34		28
	88					
	11.2508		.2507	26.0888		.0897

faint images

grades 2

MC 1529

Star measms

1913 July 2

w

	d	y	n	d	y	n
1	12185		1110095	17687		16181
92	12160		02	895147		1491009
100	6060		11066	50		08
mg				95		85
2	<u>150025</u>		<u>0033</u>	<u>91261</u>		<u>1272</u>
136	16473		19220	16181		15480
255	11600		1411007	1221608		945038
mg	95		10	10		45
77	91		28	85		80
	<u>254884</u>		<u>4885</u>	<u>136028</u>		<u>6036</u>
3						
224	19600		17780	15032		17750
269	58909		1650908	12970		1027579
mg	88		05	9099		75
69	14		95	38		65
	<u>268723</u>		<u>8725</u>	<u>227459</u>		<u>7485</u>
4						
261	18688		15846	18740		17121
113	1618080		835352	962128		1622029
mg	79		47	21		20
52	88		45	34		28
	<u>112508</u>		<u>2507</u>	<u>260888</u>		<u>0897</u>

faint image

grace 2

MC1529 upon measures.

$$\begin{array}{r} 16412 \\ 122756 \\ 70 \\ 22 \\ \hline 194142 \end{array}$$

$$\begin{array}{r} 19238 \\ 1339088 \\ 95-88 \\ 52 \\ \hline 4145 \end{array}$$

$$\begin{array}{r} 2 \\ 124 \\ 20.0 \end{array}$$

$$\begin{array}{r} 3 \\ 16.9 \\ 21.0 \end{array}$$

may be a
mountain

min in α = approx.

$$\begin{array}{r} 4 \\ 17.1 \\ 22.0 \end{array}$$

$$\begin{array}{r} 5 \\ 17.7 \\ 22.0 \end{array}$$

$$\begin{array}{r} 18.0 \\ 23.6 \\ 18869 \\ 17436 \\ 39 \\ 80 \\ \hline 231433 \end{array}$$

$$\begin{array}{r} 16759 \\ 819000 \\ 0000 \\ 65 \\ \hline 1433 \end{array}$$

$$\begin{array}{r} 16268 \\ 992036 \\ 28 \\ 70 \\ \hline 17.3657 \end{array}$$

$$\begin{array}{r} 12561 \\ 12211 \\ 6011 \\ \hline 16.9646 \\ 16.9530 \end{array}$$

$$\begin{array}{r} 1218990 \\ 8290 \\ 11460 \\ \hline 19.0727 \end{array}$$

$$\begin{array}{r} 15380 \\ 1326070 \\ 6570 \\ 86 \\ \hline 17.7884 \end{array}$$

$$\begin{array}{r} 15528 \\ 1488080 \\ 7880 \\ 40 \\ \hline .8653 \end{array}$$

$$\begin{array}{r} 1308888 \\ 9088 \\ 12740 \\ \hline .9651 \end{array}$$

$$\begin{array}{r} 14480 \\ 1375940 \\ 40 \\ \hline .0740 \end{array}$$

$$\begin{array}{r} 17144 \\ 922060 \\ 4230 \\ 50 \\ \hline .7909 \end{array}$$

MC 1524 upon measures

$$\begin{array}{r}
 1 \quad 16412 \quad 19238 \\
 100 \quad 1227576 \quad 1339088 \\
 174 \quad 70 \quad 9588 \\
 \quad 22 \quad 52 \\
 \hline
 194142 \quad 4145
 \end{array}$$

$$\begin{array}{r}
 2 \\
 174 \\
 200
 \end{array}$$

$$\begin{array}{r}
 3 \\
 169 \\
 210
 \end{array}$$

may be a
mountain

4

main in α = after.

$$\begin{array}{r}
 4 \\
 171 \\
 220
 \end{array}$$

$$\begin{array}{r}
 5 \\
 177 \\
 220
 \end{array}$$

$$\begin{array}{r}
 180 \quad 18869 \\
 236 \quad 17436 \quad 35- \\
 \quad 39 \\
 \quad 80 \\
 \hline
 231433
 \end{array}$$

$$\begin{array}{r}
 16759 \\
 819000 \\
 \quad 0000 \\
 \quad 65 \\
 \hline
 1433
 \end{array}$$

$$\begin{array}{r}
 16268 \\
 992036 \\
 \quad 28 \\
 \quad 70 \\
 \hline
 173657
 \end{array}$$

$$\begin{array}{r}
 12561 \\
 12211 \\
 \quad 0011
 \end{array}$$

$$\begin{array}{r}
 169646 \\
 \hline
 169530
 \end{array}$$

$$\begin{array}{r}
 1218990 \\
 \quad 8290 \\
 11460
 \end{array}$$

$$\begin{array}{r}
 190727
 \end{array}$$

$$\begin{array}{r}
 15380 \\
 1326070 \\
 \quad 6570 \\
 \quad 86
 \end{array}$$

$$\begin{array}{r}
 177884
 \end{array}$$

$$\begin{array}{r}
 18528 \\
 1488080 \\
 \quad 7880 \\
 \quad 40 \\
 \hline
 3653
 \end{array}$$

$$\begin{array}{r}
 130888 \\
 \quad 9088 \\
 12740 \\
 \hline
 9651
 \end{array}$$

$$\begin{array}{r}
 14480 \\
 1373940 \\
 \quad 4040
 \end{array}$$

$$\begin{array}{r}
 6740
 \end{array}$$

$$\begin{array}{r}
 17144 \\
 922060 \\
 \quad 4230 \\
 \quad 50
 \end{array}$$

$$\begin{array}{r}
 7909
 \end{array}$$

MC 1524

19103 July 2

22

moon measure

$$\begin{array}{r}
 2 \quad 15817 \quad 15816 \\
 190 \quad 14220 \quad 10427 \\
 23.5 \quad 30 \quad 30 \\
 \quad 30 \quad 30 \\
 \quad 30 \quad 30 \\
 \hline
 234193 \quad 4606 \\
 \text{max } q = \text{appr. } 234640
 \end{array}$$

$$\begin{array}{r}
 8 \quad 17779 \quad 14877 \\
 200 \quad 1492743 \quad 771012 \\
 239 \quad 5049 \quad 10 \\
 \quad 93 \quad 80 \\
 \hline
 232891 \quad 2832
 \end{array}$$

$$\begin{array}{r}
 18660 \quad 15160 \\
 1340000 \quad 1041000 \\
 \quad 20 \quad 00 \\
 \quad 72 \quad 70 \\
 \hline
 20.4741 \quad 4762
 \end{array}$$

possibly on
terminator

NIC 1524, Standard Coordinates 1913 July 2. 23

Cape No. 913 mag 8.3

Cape No. 916 mag 7.7

C 6^h 16^m 11.68

6^h 18^m 41.22

C 46

18

C 71

21

Mean 6 16 11.70

6 18 41.20

Prece +44.92^v

+45.40^v

d 6 16 56.62

6 19 26.60

A 6 22 03

6 22 03^v

d-A - 5 06.38^v

- 2 36.40^v

sin(d-A) - 306.35^v

-158.40 - 156.40^v

log 2.48622^v

2.19976^v 2.19424^v

cos 99.5099^v

9.94562^v 9.94562^v

tan 0.94445^v

0.65262^v 0.64710^v

Σ -8.7994^v

-4.4939 - 4.4371^v

Σ - 27^v

- 4^v

Σ 9.1979^v

13.5057^v 13.5625^v

Σ 9.1266^v

13.6032 13.6032^v

$\Sigma - 3$ - 713

+975 + 407^v

C +26° 42' 57.3

+28 05 06.0

L 1

07.1

E 1

07.4

Mean +26 42 57.2

+28 05 06.8

Prece -17.4^v

-20.0^v

d +26 42 39.8

+28 04 46.8^v

D +27 37 51

+27 37 51^v

d-D - 55 11.2

+ 26 55.8^v

Tan(d-D) - 3311.5^v

+1715.8 +1615.8^v

log 3.52002^v

3.23427^v 3.20839^v

tan 0.85117^v

0.56542 0.53954^v

Σ 9.7017^v

9.7261 9.7271^v

Σ 1.8889^v

13052 12942^v

Σ 8.6440

8.0847 8.0787^v

Σ -7.0985^v

+3.6764 +3.4637^v

Σ + 441

+ 122 - 119^v

Σ 149456^v

25.6886 25.4756^v

Σ 150029^v

25.4884 25.4884^v

Σ + 563

-2002 +128^v

Σ 9-7

1913 July 23

Standard Observations				1913 July 23			
Cape W	913	mg	8.3	Cape W	916	mg	7.7
C	6	16	11.68	C	6	18	41.22
C			46				18
C			71				21
Mean	C	16	11.70	C	18	41.20	
Procc			+4492			+4540	
d	C	16	56.62	C	19	26.60	
A	C	22	03	C	22	03	
X-A		-5	06.38		-2	36.40	
Lin (d-A)			-306.35		-158.40	-156.40	
log		248622			219976	219424	
W.S.		995099			994562	994562	
Σ		094445			065262	064710	
Σ		-87994			-44434	-44371	
Σ		-27			-4	-4	
Σ		91979			135057	135625	
X		91266			136032	136032	
X-A		-713			-975	+407	
C		+26° 42' 57.3			+28 05 06.0		
C						07.1	
Σ						07.4	
Mean	+26	42	57.2		+28 05 06.8		
Procc			-17.4		-20.0		
S	+26	42	34.8		+28 04 46.8		
D	+27	37	51		+27 37 51		
S-A		-55	11.2		+26 55.8		
Tan (d-A)			-331.15		+1715.8	+1615.8	
log		352002			3.23427	3.20839	
W.S.		085117			056542	053954	
Tan S		97017			97261	97261	
Σ		18889			13052	12942	
Σ		86440			80847	80737	
Σ		-70985			+36764	+34637	
Σ		+441			+122	+119	
Σ		149456			256886	254756	
Σ		150029			254884	254884	
Σ		+563			-2002	+128	
X-A							

MC 1524

Standard Over

1913 July 2

29

Cape No 925 mag 9

G. 9 (Cambridge) No 3302 mag. 8.2

C 6 24 03.45

G. 9 6 24 29.55

L 51

E 41

Mean 6 24 03.46

Prec + 45.45

K 6 24 48.91

A 6 22 03

K-A + 2 45.91

sin(K-A) + 165.91

log 2.21988

cos 9.94483

30 0.67195

Σ + 4.6984

Σ + 5

Σ 22.6989

Σ 22.7472

Σ - 3 + 483

C + 28° 16' 41.1

L 42.0

E 42.0

Mean + 28 16 41.7

Prec + 25.6

S + 28 16 16.1

D + 27 37 51

S-D + 38 25.1

tan(S-D) + 2305.2

log 3.36271

no 0.69386

tan S 9.7306

Σ 13439

Σ 8.1279

Σ

Σ + 4.9416

Σ + 134

Σ 269550

Σ 26.8724

Σ - 826

+ 2 17.94

6 26 47.49

L 22 03

+ 4 44.49

+ 284.47

2.45404

9.95274

0.91462

+ 8.2038

+ 7

26.2075

26.0892

- 1183

+ 26 16 15.8

- 1 22.8

+ 26 14 53.0

+ 27 37 51

- 1 22 58.0

- 4979.0

3.69714

0.02829

9.6929

18280

8.5743

Σ

- 10.6732

+ 375

11.3643

11.2508

- 1135

1912phae

Standard Catalogue

1913 July 2

24

Cape 2m 925 mag 9

G 3 (Cambridge) 2m 3302 mag 8.2

L 6 24 03 45

G 3 6 24 29 55

L 51

E 41

Mean 6 24 03 46

Proc + 45 45

+ 2 179 4

A 6 24 48 91

6 26 47 49

A 6 22 03

6 22 03

A - A + 2 45 91

+ 4 44 49

S - (A - A) + 1 65 91

+ 28 44 7

log 2.21 9 88

2.45 40 4

cos 9 9 44 83

9 9 52 74

S₀ 0 6 71 95

0 9 19 62

S₁ + 4 69 84

+ 8 20 38

S₂ + 5

+ 27

S₃ 2 26 98 9

2 6 20 75

S₄ 2 27 47 2

2 6 08 92

S₅ + 9 83

- 11 83

L + 28 16 41 1

+ 26 16 15 8

L 42 0

E 42 0

Mean + 28 16 41 7

Proc + 25 6

S + 28 16 16 1

+ 26 14 53 0

D + 27 37 51

+ 27 37 51

S - D + 38 25 1

- 1 22 58 0

Tan (S - D) + 23 05 2

- 49 79 0

log 3.36 27 1

3.69 71 4

cos 0 6 93 86

0 28 29

Tan S 9 73 06

9 69 29

S₁ 1 34 39

1 82 80

S₂ 8 12 79

8 57 43

S₃ + 4 94 16

- 10 67 32

S₄ + 1 34

+ 37 5

S₅ 2 69 55 0

11 36 43

S₆ 2 68 72 4

11 25 08

S₇ - 8 26

- 11 35

MC 1524

Center of Plate

1913 July 9.

20

x	y	R. a.	Decl.
9.1266	15.0029	6 16 57	+26 42 40
13.6032	25.4884	19 25	+28 04 47
22.7472	26.8724	24 49	+28 16 16
26.0892	11.2508	26 47	+26 14 53
17.157	78.61	87 58	78 36
17.89	19.65	6 22 00	+27 19 39
-18	-22	+03	+18 12
0.11	235	6 22 03	+27 37 51
31	465		
	1092		
	1080		

$$A = 6^h 22^m 03^s$$

$$D = +27^\circ 37' 51''$$

$x-3$	$y-4$	Decl.	Reduction
-713	-1598	-23 11 +37	-2274
+407	-2715	-23 08 +59	-2254
+483	-2862	-23 79 +91	-2288
-1183	-1198	-23 81 +104	-2277
19.1306	-2266	+77	19.1390

4-7	+1012	+4	-1509
+563	+922	+1485 +15	+1500
+128	+1374	+1502 +25	+1527
-826	+2297	+1471 +27	+1498
-1135	+2635	+1500 +11	+1511
21.2813	+1932	+21	21.3257

Obs.	$b+a = +53$	$a = -5.3$	$a = -0.4$	$a-e = -4.9$
Tables	+3.7	-2.6	-1.4	-1.2
$C-O =$	-1.6			-3.7

MC 1524

Center of Plate

1913 July 9

α	δ	R	a.	Decl.
91.266	15.0029	6	16 57	+26 42 40
13.6032	25.4884	19	25	+28 04 47
22.7472	26.8724	24	49	+28 16 16
26.0892	11.2508	26	47	+26 14 53
7171.57	78.61	27	58	78 36
17.89	19.65	6	22 00	+27 19 39
-1.8	-22		+0.3	+18 12
0.11	235	6	22 03	+27 37 51
31	46			
	1092			

A = $6^h 22^m 03.7^s$
 D = $+27^\circ 37' 51''$

α	δ	Reduction	α	δ
-3	-106	$+4.2$	7	273
-713	-1598	-23 11 + 37	-2274	-1
+407	-2715	-23 08 + 59	-2254	+19
+483	-2862	-23 79 + 91	-2288	-15
-1183	-1198	-23 81 + 109	-2277	-4
19.1315	-2266	+77		19.1399

α	δ	α	δ
4-7	+1012	+4	-1509
+563	+962	+1485	+15
+128	+1374	+1502	+25
-826	+2297	+1471	+27
-1135	+2635	+1500	+11
21.2816	+1932	+21	-21.3260

Obs	$b+d$	α	δ	α	δ
Tables	+5.7	-5.3	-0.4	-4.9	
		-2.6	-1.4		
					-3.7

$L-O = -1.6$

July 2

26

MIC 1529	Times	etc	
Exp to stars 1912 Jan 3	2 ^m	13 ^m	2 ^m 25 ^m
moon	2	18	4 2.3 ^v - 2 18 4 2.8 ^v
clock slow		01	0 9.1
H Sid T	2	19	51 65 ^v 8-2- - 4 ^m
H long.	4	44	3 1.05 ^v
G. Sid T	7	04	22 70 ^v
Sid T, m. moon	18	47	00.66 ^v
Interval	12	17	22.04 ^v
Reduction		2	00.80 ^v
G. M. T.	12	15	21 24 ^v

From Mount Wilson

moon 12^mmotion in 1^m15.354^v

Tchulaplace

R.A.

Decl.

6^m 18^m 59.24^v + 27° 58' 50" 0^v2.8900^v0.050^v+ 44 37^v+ 00.8^v6 19 43.61^v + 27 58 59.8^v

Moon's parallax

Semi-diameter

61' 28.0^v16 46.5^v934 = 10.15^v1006.5 = 11.5^vR = 1006.5^vang = + 11.5^vInradius (2) - 0.5^vR = 1017.8^vR = 2.1818^v

a = -5.3

(1+a) R = 2.1806^vR = 4.7558^v

July 2

26

MIC 1529

Trans etc

Exp to stars 1912 Jan 3 2^m 13^m ✓ - 2^m 25^m
 moon 2 18 42.3 - 2 18 42.8
 clock show 01 09.1

Starid T. 2 19 51.65
 H. long. 4 44 31.05
 G. Sid T. 7 04 22.70
 Sat. in moon 15 47 00.66
 Interval 12 17 22.04
 Radiation 2 00.80
 G. M. T. 12 15 21.24

From Mount Wilson

R. G.

Recl.

moon 12^m 6^m 18^m 59.24 + 27 58 50.0
 moon - 1^m 2.8900 0.050
 15.354 + 44.37 + 00.8
 Ichula place 6 19 43.61 + 27 58 59.8

Moon parallel

61' 28.0

Semi-diam.

16 46.5

934 = 10.15

R = 1006.5

1006.5 = 11.8

ang = +11.6

Inradius (2) - 0.5

R = 1017.8

R = 21814

a = -5.3

(1+a) R = 21802

R = 47533

MC15-24 Moon's Center.

1913 July 10 27

	x	$x - x_0$	Δx	$(x - x_0)^2$	R^2	$O - C$
1	18.0000	-1.1360	+7	1.2889	4.7682	+1.49
2	17.3655	-1.7705	+5	3.1329	4.7708	+1.65
3	16.9648	-2.1712	+1	4.7136	4.7920	+3.87
4	17.0734	-2.0626	-3	4.2556	4.7739	+2.06
5	17.7896	-1.3464	-7	1.8147	4.7721	+1.88
6	18.0000	-1.1360	-7	1.2921	4.7629	+9.6
7	19.0000	0.1360	9	0.0188	4.7699	+1.66
8	20.0000	+0.8640	-8	0.7451	4.7583	+5.0
9	20.4752	+1.3392	-7	1.7916	4.7493	-9.0

Computed $R^2 = 4.7533$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	19.4144	-1.8656	+3	3.4793
2	20.0000	-1.2800	+2	1.6379
3	21.0000	-0.2800	0	0.0784
4	22.0000	+0.7200	-1	0.5183
5	23.0000	+1.7200	-3	2.9574
6	23.1433	+1.8633	-3	3.4708
7	23.4600	+2.1800	-3	4.7511
8	23.2836	+2.0036	-3	4.0132
9	23.0000	+1.7200	-2	2.9577

Approx. Center.

$$x = 18.0 \quad y = 19.4144$$

$$23.1433$$

$$42.5577$$

$$\text{mean } y = 21.2788$$

$$y - \text{max} = 23.4640$$

$$2.1852$$

$$x - \text{min} = 16.9530$$

$$x_0 = 19.1382$$

$$y = 23.0 \quad x = 17.7896$$

$$20.4752$$

$$38.2648$$

$$\text{mean } x = 19.1324$$

$$x - \text{min} = 16.9530$$

$$R = 2.1794$$

$$y - \text{max} = 23.4640$$

$$y_0 = 21.2846$$

$$\text{Assume } \begin{cases} x_0 = 19.1360 \\ y_0 = 21.2800 \end{cases}$$

corrected

$$x_0 = 19.1300$$

$$y_0 = 21.2825$$

See next page

MC 11-29 Approx Center

1913 July 10 27

	x	$x - X_0$	Δx	$(x - X_0)^2$	R^2	$O - C$
1	180000	-11360	+7	12889	47682	+149
2	173655	-17705	+5	31329	47708	+165
3	169648	-21712	+1	47136	47920	+387
4	170739	-20626	-3	42550	47739	+206
5	177896	-13969	-7	19147	47721	+188
6	180000	-11360	-7	12921	47629	+96
7	190000	+01360	+9	80188	47699	+166
✓	200000	+08640	+8	07451	47583	+50
9	204752	+13392	-7	17916	47493	-90

Config. R^2 : 47533

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	194144	-18656	+3	34793
2	200000	-12800	+2	16379
3	210000	+02800	+0	00784
4	220000	+07200	-1	05183
5	230000	+17200	-3	29574
6	231433	+18633	-3	34708
7	234640	+21800	-3	47511
8	232836	+20036	-3	40132
9	236000	+17200	-2	29577

Approx Center

$$x = 180 \quad y = 194144$$

$$\underline{231433}$$

$$425577$$

$$\text{mean } y = 212788$$

$$y - \text{mean} = \underline{234640}$$

$$21852$$

$$\text{mean } x = \underline{169530}$$

$$X_0 = 191352$$

$$y = 23022137896$$

$$\underline{204752}$$

$$282648$$

$$\text{mean } y = 191329$$

$$x - \text{mean } x = \underline{169530}$$

$$R = 21794$$

$$y - \text{mean} = \underline{234640}$$

$$Y_0 = 212846$$

$$\text{Assume } \begin{cases} X_0 = 191360 \\ Y_0 = 212800 \end{cases}$$

kt.	pus. L	quad.
1	211.1	+58
2	234.1	-2
3	262.6	+141
4	289.2	-55
5	322.1	-20
6	328.9	-93
7	356.6	+76
8	23.5	+76
9	380	+43

1524

Moon's Center

	x	$xc - X_0$	Δx	$(x - X_0)^2$	$(xc - X_0)^2 + (y - Y_0)^2$	$o - c$
1	18.0000	-0.1300	+7	1.2753	4.7640	+ 90
2	17.3655	-1.7645	+5	3.1117	4.7560	+ 10
3	16.9648	-2.0652	+1	4.6876	4.7674	+ 124
4	17.0734	-2.0566	-3	4.2308	4.7455	- 95
5	17.7896	-1.3404	-7	1.7986	4.7474	- 76
6	18.0000	-1.1300	-7	1.2785	4.7399	- 151
7	19.0000	0.1300	-9	0.0172	4.7573	+ 23
8	20.0000	0.8700	-8	0.7555	4.7587	+ 37
9	20.4752	1.3452	-7	1.8076	4.7567	+ 17

Computed $R^2 = 4.7550$

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	19.4144	-1.8681	+3	3.4887
2	20.0000	-1.2825	+2	1.6443
3	21.0000	0.2825	0	0.0798
4	22.0000	0.7175	-1	0.5147
5	23.0000	1.7175	-3	2.9488
6	23.1433	1.8608	-3	3.4614
7	23.4600	2.1775	-3	4.7401
8	23.2836	2.0011	-3	4.0032
9	23.0000	1.7175	-2	2.9491

Approximate Center $\begin{cases} X = 19.1300 \\ Y_0 = 21.2825 \end{cases}$

Known Center

	x	y	$x - X_0$	$y - Y_0$	$(x - X_0)^2$	$(y - Y_0)^2$	$(x - X_0)(y - Y_0)$	$O - C$
1	18.0000	-1.3000	-7	-1.3000	49	1.69	-10.01	+1.90
2	17.3655	-1.7645	-7.5	-1.7645	56.25	3.11	-13.24	+2.9
3	16.9648	-2.652	-8.0352	-2.652	64.56	7.03	-21.24	+1.24
4	17.0739	-2.0566	-7.9261	-2.0566	62.82	4.23	-16.35	-9.5
5	17.7896	-1.3404	-7.2104	-1.3404	51.99	1.79	-9.57	-7.6
6	18.0000	-1.3000	-7	-1.3000	49	1.69	-10.01	-1.34
7	19.0000	-0.1300	1.7	-0.1300	2.89	0.017	-0.221	+2.3
8	20.0000	0.8700	2.7	0.8700	7.29	0.757	2.379	+3.7
9	20.4752	1.3452	3.1752	1.3452	10.08	1.807	4.756	+1.9

Computed $R^2 = 4.7530$

	x	y	$x - X_0$	$y - Y_0$	$(x - X_0)^2$	$(y - Y_0)^2$	$(x - X_0)(y - Y_0)$
1	19.4144	-1.8681	0.3144	-3.1681	0.0988	10.037	-0.996
2	20.0000	-1.2825	0.9000	-2.2825	0.81	5.19	-2.054
3	21.0000	-0.2825	1.9000	-1.2825	3.61	1.65	-2.437
4	22.0000	0.7175	2.9000	-0.2825	8.41	0.08	-0.815
5	23.0000	1.7175	3.9000	0.7175	15.21	0.515	2.798
6	23.1433	-1.8608	4.0433	-2.8608	16.35	8.18	-11.57
7	23.4600	-2.1775	4.3600	-3.1775	19.01	10.10	-13.86
8	23.2836	-2.0011	4.1836	-3.0011	17.50	9.01	-12.55
9	23.0000	-1.7175	3.9000	-2.7175	15.21	7.39	-10.58

Approximate Center $\left\{ \begin{array}{l} X = 19.1300 \\ Y = 21.2825 \end{array} \right.$

Residuals

	C	O	O-C		C	O	O-C
- 13 + 6 + 17 = +10	-1	-11	-6 + 8 + 0 = +2	-9	-11		
- 19 + 10 + 17 = +8	+19	+11	- 9 + 14 + 0 = +5	+18	+13		
- 31 + 10 + 17 = -4	-15	-11	-15 + 15 + 0 = 0	-11	-11		
- 36 + 4 + 17 = -15	-4	+11	-17 + 6 + 0 = -11	+2	+13		

	C	O	O - C
+ 3 + 19 = 31 = - 9	- 19	- 10	
+ 5 + 32 = 31 = + 6	+ 16	+ 10	
+ 8 + 34 = 31 = + 11	+ 1	- 10	
+ 10 + 14 = 31 = - 7	+ 3	- 10	

	C	O	O-C
- 7 - 2 + 17 = +8	0	- 8	
- 11 - 3 + 17 = +3	+11	+ 8	
- 18 - ~~3~~ + 17 = -4	-12	- 8	
- 20 - 1 + 17 = -4	+3	+ 7	

ML 1524-1525 Plate Count. 1913 July 16.

				1524		1525	
a	b	c		x-3	y-m	x-3	y-m
9.20 + 14.95 + 1 =				-1	-9	-19	0
13.56 + 25.48 + 1 =				+19	+18	+16	+11
22.70 + 26.96 + 1 =				-15	-11	+1	-12
26.21 + 11.36 + 1 =				-4	+2	+3	+3
+ 11.38 + 20.22 + 1 =				+9.00	+4.50	-1.50	+5.50
+ 2.44 + 19.16 + 1 =				-9.50	-4.50	+2.00	-4.50
+ 17.70 + 13.16 + 1 =				-2.50	-3.50	-8.00	+1.50
+ 18.13 + 26.22 + 1 =				+2.00	+3.50	+8.50	-0.50
- 13.08 + 1.06 =				+18.50	+9.00	-3.50	+10.00
- 0.43 - 13.06 =				-4.50	-7.00	-16.50	+2.00
+ 0.43 - 0.03 =				-0.61	-0.30	+0.12	-0.33
- 13.09 =				-5.18	+7.30	-16.38	+1.67
b =				+0.39	+0.56	+1.25	-0.13
a =				-1.38	-0.64	+0.37	-0.78

+9.0	+9.5	-2.5	+2.0	+4.5	-4.5	-3.5	+3.5
+15.7	+33.7	+24.4	+25.0	+7.3	+15.6	+11.3	+11.6
<u>-7.9</u>	<u>-7.5</u>	<u>-15.1</u>	<u>-10.2</u>	<u>-11.3</u>	<u>-10.7</u>	<u>-7.4</u>	<u>-14.7</u>
+16.8	+16.7	+16.8	+16.8	+0.5	+0.4	+0.4	+0.4

-1.5	+2.0	-8.0	+8.5	+5.5	-4.5	+1.5	-0.5
-4.2	-9.1	-6.6	-6.7	+8.9	+19.1	+13.8	+14.2
<u>-25.3</u>	<u>-23.9</u>	<u>-16.4</u>	<u>-32.8</u>	<u>+2.6</u>	<u>+2.5</u>	<u>+1.7</u>	<u>+3.4</u>
-31.0	-31.0	-31.0	-31.0	+17.0	+17.1	+17.0	+17.1

	1529	1913	21
$9.20 + 14.95 + 1 =$	-1	-9	-19
$13.56 + 25.48 + 1 =$	+19	+18	+16
$22.70 + 26.96 + 1 =$	-15	-11	+1
$26.21 + 11.36 + 1 =$	-4	+2	+3
$+ 11.38 + 20.22 + 1 =$	+9.00	+4.50	-1.50
$+ 24.46 + 19.16 + 1 =$	-9.50	-4.50	+2.00
$+ 17.70 + 13.16 + 1 =$	-2.50	-3.50	-8.00
$+ 18.13 + 26.22 + 1 =$	+2.00	+3.50	+8.50
$- 13.08 + 10.6 =$	+18.50	+9.00	-3.50
$- 0.43 - 13.06 =$	-4.50	-7.00	-16.50
$+ 0.43 - 0.03 =$	-0.61	-0.30	+0.12
$- 13.09 =$	+7.99	+2.30	-16.38
$b =$	+8.39	+6.56	-16.25
$a =$	+1.38	-0.44	+0.37

+9.0	+9.5	-2.5	+2.0
+15.7	+33.4	+24.4	+25.0
-7.9	-27.5	-15.1	-10.2
+16.8	+16.7	+16.8	+16.8

+9.5	-4.5	-3.5	+3.5
+7.3	+15.6	+11.3	+11.6
-11.3	-10.7	-7.4	-14.7
+0.5	+0.4	-0.4	+0.4

-1.5	+2.0	-8.0	+8.5
-4.2	-9.1	-6.6	-6.7
-25.3	-23.9	-16.4	-32.8
-31.0	-31.0	-31.0	-31.0

+5.5	-4.5	+1.5	-0.5
+8.9	+19.1	+13.4	+14.2
-2.6	+2.5	-1.7	+3.9
+17.0	+17.1	+17.0	+17.1

Formation of Normals

ab	av	bv
1 + 2.11	- 1015	- 1680
2 + 2.25	- 17.6	- 12.8
3 + 0.61	- 2690	- 347
4 - 1.48	+ 1974	- 684
5 - 2.31	+ 1019	- 1308
6 - 2.10	+ 1708	- 2808
7 - 0.28	- 30	+ 50.1
8 + 1.74	+ 322	+ 740
9 + 2.32	+ 295	+ 292
<u>5286</u>	<u>+140.7</u>	<u>-542.2</u>

Residuals

c	o-c
- 13 + 45 = + 32	+ 58
- 19 + 21 = + 12	- 2
24 + 7 = - 17	+ 141
- 23 - 17 = - 40	- 55
- 15 - 41 = - 56	- 20
- 13 - 45 = - 58	- 93
- 11 - 52 = - 53	+ 76
+ 9 - 48 = - 39	+ 76
+ 15 - 41 = + 26	+ 43
Average = 63	

Normal Equations

$$\begin{aligned}
 + 18.96 + 2.86 &= + 141 \\
 + 2.86 + 23.83 &= - 542 \\
 - 2.86 - 0.43 &= - 21 \\
 + 23.40 &= - 563 \\
 + 18.96 &= + 141 + 69 = + 210
 \end{aligned}$$

$$b = - 24.1$$

$$a = + 11.1$$

MC 1524

Moon's Center

1913 Sept. 26.

Conditional Equations

	a	b	c	0-c
2	1	-1.13 - 1.87 =	+90	+18 + 21 = +39 +68
1	2	-1.76 - 1.28 =	+10	+28 + 15 = +43 -16
5	3	-2.17 - 0.28 =	+124	+17 + 2 = +19 +51 (+102)
0	4	-2.06 + 0.72 =	-95	+33 - 8 = +25 -103
3	5	-1.34 + 1.72 =	-76	+21 - 20 = +1 -60
6	6	-1.13 + 1.86 =	-151	+18 - 21 = -3 -131
6	7	-0.13 + 2.18 =	+23	-2 - 25 = -23 +63
13	8	+0.87 + 2.00 =	+37	-14 - 23 = -37 +91
	9	+1.35 + 1.72 =	+17	-42 - 10 = -52 +38 (+76)

Average = 79

$$\begin{aligned} 4) & -6.03 - 2.57 = +126 \\ 5) & -0.05 - 8.62 = -82 \end{aligned}$$

$$+1.05 + 0.95 = -22$$

$$+9.07 = -104$$

$$b = -11.5$$

$$-6.03 = +126 - 30 = +96 \quad a = -16.0$$

Moon's mean Position (1912.0)

$$X_0 = 19.1300 + 65 = 19.1306 \quad Y_0 = 21.2825 - 12 = 21.2813$$

$$\text{Small const. } X = 19.1390 \quad Y = 21.3257$$

Small corr.

$$Z = +1.1390$$

$$\log Z = 0.05652$$

$$\log S = 9.94776$$

$$\log \text{const} = 8.50724$$

$$(d-A) = 1.60152$$

$$d-A = +39.95$$

$$A = 6^h 22^m 03^s$$

$$d_0 = 6^h 22^m 42.95^s$$

$$\text{Red} = +1.05$$

$$d' = 6^h 22^m 44.00^s$$

$$y = -0.6743$$

$$\log \tan S = 9.7165$$

$$S = 0.1121$$

$$\eta_1 = 6.8820$$

$$\eta_1 = +8$$

$$\eta_0 = -0.6751$$

$$\log \eta_0 = 9.82937$$

$$\log \text{const} = 7.33115$$

$$(d-D) = 2.49822$$

$$d-D = -5.14.9$$

$$D = +27.37.51$$

$$S_0 = +27^{\circ} 32' 36.1''$$

$$\text{Red} = +7.1$$

$$d' = 727.32.43.2$$

Red. and l. after

$$H + \alpha_0 \quad 5 \quad 38 \quad -84^\circ 30'$$

$$H \quad 23 \quad 15$$

$$\alpha_0 \quad 6 \quad 23$$

$$G \quad 16 \quad 42$$

$$G + \alpha_0 \quad 23 \quad 05 = 346^\circ 15'$$

$$S = +27^\circ 33'$$

$$l \cos S = 9.94478$$

$$l \quad = 0.2402m$$

$$(l) = 0.1880m$$

$$l \cos(G + \alpha) \quad 9.9874$$

$$g \quad 0.9034$$

$$\sin \quad 9.3760m$$

$$\tan \quad 9.7174$$

$$T_1 = 8.8239$$

$$l (g') \quad 0.8908$$

$$(g) \quad 8.8207m$$

$$l \sin S \quad 9.6651$$

$$\cos(H + \alpha) \quad 8.9816$$

$$h \quad 1.3095$$

$$\sin \quad 9.9980$$

$$\sec S \quad 0.0522$$

$$T_1 = 8.8239$$

$$(h') \quad 9.9562$$

$$(h) \quad 0.1836$$

$$l \quad -0.41$$

$$g \quad -0.07$$

$$h \quad +1.53$$

$$+1.05 \checkmark$$

$$42.98$$

$$9.83$$

$$g' \quad +7.78$$

$$h' \quad +0.90$$

$$l \quad -1.54$$

$$+7.14 \checkmark$$

MC 1524

Mooms Center

1913 Sept 26

Conventional Equations

	a	b	c	d	e	f	g
1	-1.13	-1.87	-	+9.0	+1.8	+2.1	+3.9
2	-1.76	-1.28	-	+1.4	+2.8	-1.5	+4.3
3	-2.17	-0.28	-	+1.24	+1.7	-2	+1.9
4	-2.06	+0.72	-	-9.7	+3.3	-8	-2.5
5	-1.34	+1.72	-	-7.6	+2.1	-2.0	+1
6	-1.13	+1.86	-	-1.51	+1.8	-2.1	-3
7	-0.13	-2.18	-	+2.3	-2	-2.5	-3.3
	+0.87	+2.00	-	+3.2	-1.4	-2.3	-3.7
	+1.35	+1.72	-	+8.7	-8.7	-1.0	-2.1

$$\begin{aligned}
 & -6.03 - 2.57 = +1.26 \\
 & -4.05 + 8.62 = -8.2 \\
 & +1.05 + 0.45 = -2.2 \\
 & +9.07 = -10.9 \\
 & -6.03 = +1.26 - 3.0 = +9.6 \quad a = -16.0
 \end{aligned}$$

Mooms mean Position (1912.0)

$$X_0 = 19.1300765 = 19.1305 \quad Y_0 = 21.242516 = 21.2819$$

$$\text{Sun Plate Constant } X = 19.1399 \quad Y = 21.3259$$

Small cor.

$$\begin{aligned}
 \delta & = +1.1399 \\
 \log \delta & = 0.05686 \\
 \log \delta & = 9.99776 \\
 \log \delta & = 8.50724
 \end{aligned}$$

$$(d-4) = 1.60188$$

$$d-4 = +39.98$$

$$A = 6^{\circ} 22' 03''$$

$$d_0 = 6^{\circ} 22' 42.98''$$

$$\text{Red} = +1.05$$

$$\alpha = 6^{\circ} 22' 44.00''$$

$$y = -0.6749$$

$$\log \tan \delta = 9.7165$$

$$\log \delta = 0.1121$$

$$\log \delta = 6.8820$$

$$\log \delta = +8$$

$$\log \delta = -0.6749$$

$$\log \delta = 9.8299$$

$$\log \delta = 7.3311$$

$$(d-0) = 249.803$$

$$S-0 = -5.148$$

$$D = +27^{\circ} 37' 51''$$

$$S_0 = +27^{\circ} 32' 36.2''$$

$$\log \delta = 7.1$$

$$\log \delta = 3.2$$

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Lunar Parallax.

$$\begin{array}{r}
 \alpha' = 6 \quad 22 \quad 44.00 \checkmark \\
 \theta = 2 \quad 19 \quad 51.65 \checkmark \\
 - 4 \quad 02 \quad 52.4 \checkmark \\
 = -60^{\circ} \quad 43' \quad 06'' \checkmark \\
 - \quad 22 \quad 27 \checkmark \\
 60 \quad 20 \quad 39 \checkmark
 \end{array}$$

$$\begin{array}{r}
 995727 \checkmark \\
 999999 \checkmark \\
 030559 \checkmark \\
 \hline
 026285 \checkmark
 \end{array}$$

$$\begin{array}{r}
 \gamma = 61 \quad 22 \quad 04 \checkmark \\
 27 \quad 32 \quad 43 \checkmark \\
 33 \quad 49 \quad 21 \checkmark
 \end{array}$$

$$\begin{array}{r}
 982640 \checkmark \\
 825234 \checkmark \\
 974556 \checkmark \\
 0.05665 \checkmark \\
 \hline
 7.88095 \checkmark
 \end{array}$$

$$\delta - \delta' = +26 \quad 081 \checkmark$$

$$\delta = +27 \quad 58 \quad 51.3 \checkmark$$

$$\text{Nautical } \delta = +27 \quad 58 \quad 50.8 \checkmark$$

$$0 - c \quad + \quad 0.5 \checkmark$$

$$\delta' = +27^{\circ} \quad 32 \quad 43 \checkmark$$

$$\pi = 61' \quad 28.0 \checkmark$$

$$\begin{array}{r}
 9.86913 \checkmark \\
 8.25234 \checkmark \\
 994063 \checkmark \\
 005399 \checkmark \\
 \hline
 8.11609 \checkmark
 \end{array}$$

$$\kappa - \kappa' = -44 \quad 54.81 \checkmark$$

$$= -2^m \quad 59.65 \checkmark$$

$$\alpha = 6 \quad 19 \quad 44.35 \checkmark$$

$$\alpha = 6 \quad 19 \quad 43.61 \checkmark$$

$$+ 0.74 \checkmark$$

