

KG

11366

v. 898



Vol. XXII

Harvard Sunnar

Plates

No.

1332

1375

1376



Harvard Lunar Plates

Measures and Reductions

Mary Fowler

Volume XXI

Plate No.	Date	Page
1332	1911, Oct. 13	1.
1375	1911 Oct + Nov. 2	9
1376	1911 Nov. 2	20

Plate MC 1332

1913 May 26.

1

Comparison Stars - Measures.

	d	N	d	N
1	17278	18998	17991	15882
1.7	13874	12377	15130	872725
204	71	9288	22	20
	85	92	87	80
	<u>20.3408</u>	<u>3393</u>	<u>7.7135</u>	<u>7.159</u>

2	16880	18728	14791	18481
13.7	9595	16000	12380	10845
97	9597	9501	7980	3540
	70	20	79	76
	<u>9.7277</u>	<u>7274</u>	<u>13.7594</u>	<u>7.637</u>

3	16882	18950	17181
27.3	13980	11810	14296
273	80	08	9900
	82	50	90
	90	21	
	<u>27.2903</u>	<u>27.2862</u>	<u>2886</u>

Remeasures.

2	15431	17531
	1300520	989000
	1010	9594
	10	21
	<u>13.7585</u>	<u>7.628</u>
1	15949	16900
	1309195	973038
	90	4238
	51	88
	<u>7.7142</u>	<u>7.154</u>
3	19094	15415
	1197680	1251008
	7875	15
	94	17
	<u>27.2883</u>	<u>2905</u>

1911phae.proj.1

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Plate MC 1332

1913 May 26.

1

Comparison Stars - Measures

	d	N	d	N
1	17278	18998	17991	15882
77	13874	12377	15130	872225-
24	71	9288	22	28
	85	92	87	80
	<u>20.3408</u>	<u>3393</u>	<u>27135</u>	<u>7159</u>
2	16880	18728	14791	18481
137	9595	16000	12380	10845
97	9597	9901	7980	3540
	70	20	79	76
	<u>9.7277</u>	<u>7274</u>	<u>13.7594</u>	<u>7637</u>
3	16882	15488	18950	17181
273	13980	8320	11810	14296
273	80	254	08	9900
	90	21	50	90
	<u>272903</u>	<u>2903</u>	<u>27.2862</u>	<u>2886</u>

Re-measures

2	15431	17531
	1300520	989000
	1010	9594
	10	21
	<u>13.7585</u>	<u>7628</u>
1	15949	16900
	1309195	973038
	90	4238
	51	88
	<u>77142</u>	<u>7154</u>
3	19094	15415
	1197880	1251008
	7875	15
	94	17
	<u>272883</u>	<u>2905</u>

1
17
19
2
17
2
3
17
2
2
18
2
5
18
21
mm
mm
6
18
2

MC1532 Moon measures.

1913 May 26.

$\frac{1}{17.0}$ 18918 15995
 19.7 1126268 1364950
 60 50
 21 98

possibly on terminator.

197657
 2
 17.7
 200

7654

1.8808 1.5360
 1693095 722945
 0090 95
 08 50

17.8103

8129

$\frac{3}{18.0}$ 17908 15275
 20.2 1675958 643539
 52 21
 18 .84

20.1153

1149

$\frac{4}{18.6}$
 21.0

17830 14523
 15310 703621
 09 19 28
 30 11
18.7483 7486

17741 14192
 1712927 517070
 24 70
 48 00
18.9385 9429

16740 17734
 1604971 857161
 73 69 60
 35 25
18.9331 9362

$\frac{5}{18.9}$
 21.7
 max
 min

$\frac{6}{18.9}$
 22.0

MC1532 Moon measures.

1913 May 26.

$\frac{1}{170}$ 18918 15995
 11262 68 13649 50
 19.7 60 50
 21 98

possibly on terminator

197657
 $\frac{2}{177}$
 200

7654

18808
 16930 05
 0090
 08

15360
 7229 45
 95
 50

178103

8129

$\frac{3}{180}$ 17908
 16759 58
 22 52
 18
201153

15275
 643539
 21
 84
1149

$\frac{4}{186}$
 210

17830
 15310 19
 09
 30
187483

14523
 7036 21
 28
 11
7486

$\frac{5}{189}$
 217
 max
 26

17741
 17129 27
 24
 48
189385

14192
 5170 70
 70
 00
9429

$\frac{6}{189}$
 220

16740
 16049 71
 73 69
 35
189331

17934
 8571 61
 60 61
 25
9362

MC1332 Moon Measured

1913 May 26.3

 $\frac{7}{18.5}$
 23.0

 α α
 $\frac{1}{11720}$ 25
 19
 45
18.6083
 α α
 $\frac{1}{1095247}$ 20
1.6074
 $\frac{8}{18.0}$ 19110 16160
 23.6 12828 28 1243350
 20 5046
 11 70
23.6286 .6281
 $\frac{9}{17.5}$ scratch -
 238 17974 15135 16265 15789
 951019 1359005 1203030 1003524
 11 00 30
 81 38 67 80
23.8467 .8462 17.5764 .5757

 Max in η = approximately 23.9800

WIC1332 Moon Measured

1913 May 26.5

$\frac{7}{185}$
230

$\frac{d}{15634}$
 $\frac{11720}{19}$ 25
45
186083

$\frac{N}{17020}$
 $\frac{1095247}{5047}$
20
6074

$\frac{g}{180}$ 19110
236 12820 28
20
11
236286

16160
1243350
5046
70
6281

$\frac{g}{175}$ scratch -
238 17974
951019
11
81
238467

15135 16265
13590 05 12030 20
00 30
38 67
8462 175764

15789
10035
2521
80
5757

max in g = approximately 23.9800

MG 1332

1913 May 27.

4

Center of plate $\left\{ \begin{array}{l} A = 6^h 55^m 31^s \\ D = +27^\circ 37' 32'' \end{array} \right.$

Star	1	2	3
$x =$	7.7148	137611	272884
$y =$	92045	153203	287326
$x - 3$	-1.4897	-1.5592	-1.4442
$y =$	203400	97276	272903
$m =$	203040	97318	273871
$y - m$	+360	-42	-968

$$\begin{array}{rcl}
 x - 3 & - 65.44 & + 1.6227 \\
 - 1.4897 - 1330 & = - 1.6227 & = 0 \\
 - 1.5592 - 636 & = - 1.6228 & = -1 \\
 - 1.4442 - 1785 & = - 1.6227 & = 0 \\
 16.8248 - 1430 & & = 18.3045
 \end{array}$$

$$\begin{array}{rcl}
 + 67.52 & + 0.84 & - 896 \\
 + 360 + 521 & = + 881 + 16 & = + 897 = +1 \\
 - 42 + 929 & = + 887 + 8 & = + 895 = -1 \\
 - 968 + 1842 & = + 884 + 22 & = + 896 = 0 \\
 21.8708 + 113.6 & + 17 & = 21.8965
 \end{array}$$

$$\begin{array}{rcl}
 b + a & = 0.0 & a = 0.9 \\
 & - 2.1 & 0.0 \\
 & & e = 0.9 \\
 & & - 0.8
 \end{array}$$

tables
observation

M161332

1918 May 27

4

Center of plate $\left\{ \begin{array}{l} A = 6^h 55^m 31^s \\ D = +27^\circ 37' 32'' \end{array} \right.$

Star	1	2	3
x :	7.7148	1.37611	27.2884
y :	9.2045	1.53203	28.7326
z :	-1.4897	-1.5592	-1.4442

y :	20.3400	9.7276	27.2903
z :	20.3040	9.7318	27.3871
$y - z$:	+360	-42	-968

$x - z$	-6.544		+1.6227
-1.4897 - 1.330:	-1.6227	=	0
-1.5592 - 6.36:	-1.6228	=	-1
-1.4442 - 1.785:	-1.6227	=	0
16.8248 - 14.30		=	18.3132

+67.52	+0.84	-896
+360 + 521 = +881	+16 = +897	= +1
-42 + 929 = +887	8 = +895	= -1
-968 + 1842 = +874	+22 = +896	= 0
21.8708 + 1136	+17	= 21.8975

$$t + a = 0.0$$

$$-2.1$$

$$a = 0.9$$

$$0.0$$

$$e = 0.9$$

$$-0.8$$

tables
observation

M 61332

1918 May 27.

5

Times etc.
 Exp total 1911 Oct 13 $6^h 26^m$ - $6^h 38^m$
 " Moon $6^h 32^m 14.6^s$ - $6^h 32^m 14.8^s$
 clock slow $0^m 42.3^s$

H Sid T. $6^h 32^m 57.0^s$
 H Long $4^h 44^m 31.0^s$
 G Sid T. $11^h 17^m 28.0^s$
 Sid T. known $13^h 23^m 42.96^s$
 Interval $21^h 53^m 45.09^s$
 Reduction $3^m 35.23^s$
 G. m. T. $21^h 50^m 09.86^s$

fromhautalm.

R. A.

Decl.

motion $\sim 2^h$ $6^h 55^m 50.17^s$ + $27^\circ 51'$ $23.8''$
 motion $\sim 1^m$ 2.6667^s $2.364''$
 " -9.8357^s $-26.23''$ + $23.3''$
 Tabular place $6^h 55^m 23.94^s$ + $27^\circ 51'$ $47.1''$

Moon's parallax
 " Secidiam

$59'$ $17.9''$
 $16'$ $11.0''$

M 1332

1918 May 27.

5

Times etc.
 Ent. total 1911 Oct 13 $6^h 26^m - 6^h 38^m$
 .. known $6 \quad 32 \quad 146 - 6 \quad 32 \quad 148$
 clock shown $0 \quad 423$

H Sid T $6 \quad 32 \quad 57.0$
 H Long $4 \quad 44 \quad 31.05$
 G Sid T $11 \quad 17 \quad 240.5$
 Sid T known $13 \quad 23 \quad 42.96$
 Interval $21 \quad 53 \quad 45.09$
 Rectification $3 \quad 3523$
 G in T $21 \quad 50 \quad 09.86$

from Kant. elem. R. G. Beck
 known $\sim 2^h$ $6^h 55^m 50.17 + 27^\circ 51' 23.8$
 known $\sim 1^h$ $26667 \quad 2364$
 .. -9.8357 $-26.23 + 23.3$
 Tabular place $6^h 55^m 23.94 + 27^\circ 51' 47.1$

Moon's parallax $59' 17.9$
 Semidiam $16' 11.0$

Formation of Normals

	ab	ac	bc
1	- 0.35 +	34.6 -	438.0
2	- 1.83 +	169.0 -	324.0
3	- 2.05 +	43.1 -	65.0
4	- 1.67 -	310.0 +	141.0
5	+ 0.00 -	57.0 -	0.0
6	+ 0.27 -	252.2 -	15.4
7	+ 2.00 -	392.0 -	249.0
8	+ 2.05 +	39.6 +	59.7
9	+ 1.46 +	55.5 +	148.0
	- 0.12 -	669.4 -	742.7

$$[a] = +12.12$$

$$[a] = +19.93$$

$$[b] = -1.62$$

$$[b] = +20.06$$

$$[c] = -3$$

	res. $\angle$	res. d
1	175.5	-3.4
2	152.4	+7.6
3	146.5	-2.4
4	114.5	-7.8
5	90.0	+10.9
6	86.5	+1.8
7	57.6	-12.2
8	33.5	+4.1
9	20.6	+1.2

MC1332

Moon's Center

1913 May 27.

6

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.0000	+0.1665	0.0278	4.4638	+208
2	17.8116	+0.9781	0.9567	4.4603	+173
3	18.0000	+1.1665	1.3607	4.4467	+37
4	18.7484	+1.9149	3.6668	4.4268	-162
5	18.9407	+2.1072	4.4403	4.4403	-27
6	18.9346	+2.1011	4.4146	4.4310	-120
7	18.6078	+1.7743	3.1481	4.4209	-221
8	18.0000	+1.1665	1.3608	4.4464	+34
9	17.5760	+0.7425	0.5513	4.4505	+75

mean = 4.4430

-3

	y	$y - y_0$	$(y - y_0)^2$
1	19.7656	-2.1062	4.4360
2	20.0000	-1.8718	3.5036
3	20.1151	-1.7567	3.0860
4	21.0000	-0.8718	0.7600
5	21.8718	0.0000	0.0000
6	22.0000	+0.1282	0.0164
7	23.0000	+1.1282	1.2728
8	23.6284	+1.7566	3.0856
9	23.8464	+1.9746	3.8992

Approximate Center

$$x = 18.0 \quad y = 20.1151$$

$$\underline{23.6284}$$

$$43.7435$$

$$\text{mean } y = 21.8718$$

$$y - \text{max} = 23.9800$$

$$R = 2.1072$$

$$x - \text{max} = 18.9407$$

$$\text{mean } x = 16.8335$$

$$\text{Assume } \begin{cases} x_0 = 16.8335 \\ y_0 = 21.8718 \end{cases}$$

MC1332

Moon's Center

1913 May 27.

6

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.0000	+0.1665	0.0278	4.4638	+208
2	17.8116	+0.9781	0.9567	4.4603	+173
3	18.0000	+1.1665	1.3607	4.4467	+37
4	18.7484	+1.9149	3.6668	4.4268	-162
5	18.9407	+2.1072	4.4403	4.4403	-27
6	18.9346	+2.1011	4.4146	4.4310	-120
7	18.6078	+1.7743	3.1481	4.4269	-221
8	18.0000	+1.1665	1.3608	4.4464	+34
9	17.5760	+0.7425	0.5513	4.4505	+75
mean = 4.4430				-3	

	y	$y - y_0$	$(y - y_0)^2$
1	19.7656	-2.1062	4.4360
2	20.0000	-1.8718	3.5036
3	20.1151	-1.7567	3.0860
4	21.0000	-0.8718	0.7600
5	21.8718	0.0000	0.0000
6	22.0000	+0.1282	0.0164
7	23.0000	+1.1282	1.2728
8	23.6284	+1.7566	3.0856
9	23.8464	+1.9746	3.8992

Approximate Center

$$x = 18.0 \quad y = 20.1151$$

$$\underline{23.6284}$$

$$43.7435$$

$$\text{mean } y = 21.8718$$

$$y - \text{mean} = 23.9800$$

$$R = 21.072$$

$$x - \text{mean} = 18.9407$$

$$\text{mean } x = 16.8335$$

$$\text{Assume } \begin{cases} x_0 = 16.8335 \\ y_0 = 21.8718 \end{cases}$$

MC1332 Moon's Center

1918 May 28

7

Conditional Equations.

	a	b	c	0		c	0-c
1	+ 0.17	- 2.11	+ 1	= + 208	- 30 + 41 + 231 = + 242	- 34	
2	+ 0.98	- 1.87	+ 1	= + 173	- 171 + 37 + 231 = + 97	+ 76	
3	+ 1.17	- 1.76	+ 1	= + 37	- 204 + 34 + 231 = + 61	- 24	
4	+ 1.91	- 0.87	+ 1	= - 162	- 332 + 17 + 231 = - 84	- 78	
5	+ 2.11	+ 0.00	+ 1	= - 27	- 367 - 0 + 231 = - 136	+ 109	
6	+ 2.10	+ 0.13	+ 1	= - 120	- 366 - 3 + 231 = - 138	+ 18	
7	+ 1.77	+ 1.13	+ 1	= - 221	- 308 - 22 + 231 = - 99	- 122	
8	+ 1.17	+ 1.76	+ 1	= + 34	- 204 - 34 + 231 = - 7	+ 41	
9	+ 0.74	+ 1.97	+ 1	= + 75	- 129 - 39 + 231 = + 63	+ 12	

Normal Equations.

$$\begin{aligned}
 + 19.93 - 0.12 + 12.12 &= - 669 \\
 - 0.12 + 20.06 - 1.62 &= - 743 \\
 + 12.12 - 1.62 + 9.00 &= - 3
 \end{aligned}$$

$$\begin{aligned}
 + 0.12 - 0.00 + 0.07 &= - 4 \\
 - 12.12 + 0.07 - 7.38 &= + 407
 \end{aligned}$$

$$\begin{aligned}
 + 20.06 - 1.55 &= - 747 \\
 - 1.55 + 1.62 &= + 404
 \end{aligned}$$

$$\begin{aligned}
 + 1.55 - 0.12 &= - 58 \\
 + 1.50 &= + 346
 \end{aligned}$$

$$\begin{aligned}
 - 147 + 1.55 &= + 384 \\
 + 18.59 &= - 363
 \end{aligned}$$

$$\begin{aligned}
 - 0.90 + 0.12 - 0.67 &= + 0 \\
 + 150.10 - 20.06 + 11.50 &= - 37
 \end{aligned}$$

$$\begin{aligned}
 + 19.03 &+ 11.45 = - 669 \\
 + 150.00 &+ 109.88 = - 780
 \end{aligned}$$

$$\begin{aligned}
 - 15.65 &- 11.45 = + 81 \\
 + 3.38 &= - 588
 \end{aligned}$$

$$\begin{aligned}
 - 258 + 256 \\
 \text{Average} &= 57
 \end{aligned}$$

$$\begin{aligned}
 \frac{\Delta x}{\Delta a} &= - 1.28
 \end{aligned}$$

$$\frac{\Delta y}{\Delta b} = + 0.16$$

$$\begin{aligned}
 + 231 \\
 c &= + 229
 \end{aligned}$$

$$b = - 20$$

$$a = - 174$$

1332

Red ad locus apt

8: + 27° 37'

H+x 11 30: 172° 30'

H 9 134

x 6 56

G 21 42

G+x 4 38: 69° 30'

Aul-S 96661

COT(H+x) 999.63m

h 12778

h 91157

sec 5 0.0525

8.8239

h' 09402

h 92699

f +1.82

8 +0.47

h +0.19

+2.48

f +504

h -871

i +078

+311

MC1332 Moon's Center

19.2 May 2007 7

Conditional Equations

	a	b	c	0		c	0-c
1	+ 0.17	- 2.11	+ 1.0	+ 208	- 30 + 41 + 231 =	+ 242	- 34
2	+ 098	- 1.87	+ 1.0	+ 173	- 171 + 37 + 231 =	+ 97	+ 76
3	+ 1.17	- 1.76	+ 1.0	+ 37	- 204 + 34 + 231 =	+ 61	- 24
4	+ 1.91	- 0.87	+ 1.0	- 1.62	- 332 + 17 + 231 =	- 84	- 78
5	+ 2.11	+ 0.00	+ 1.0	- 27	- 367 - 0 + 231 =	- 136	+ 109
6	+ 2.10	+ 0.13	+ 1.0	- 1.20	- 366 - 3 + 231 =	- 138	+ 18
7	+ 1.77	+ 1.13	+ 1.0	- 2.21	- 308 - 22 + 231 =	- 99	- 122
8	+ 1.17	+ 1.76	+ 1.0	+ 34	- 204 - 34 + 231 =	- 7	+ 41
9	+ 0.74	+ 1.97	+ 1.0	+ 7.5	- 129 - 39 + 231 =	+ 63	+ 12

Normal Equations

$$\begin{aligned}
 &+ 19.93 - 0.12 + 1.212 = - 669 \\
 &- 0.12 + 2006 - 1.62 = - 743 \\
 &+ 1212 - 1.62 + 900 = - 3
 \end{aligned}$$

$$\begin{aligned}
 &+ 0.12 - 0.00 + 0.07 = - 4 \\
 &- 1212 + 0.07 - 738 = + 407
 \end{aligned}$$

$$\begin{aligned}
 &+ 2006 - 1.55 = - 747 \\
 &- 1.55 + 1.62 = + 404
 \end{aligned}$$

$$\begin{aligned}
 &+ 1.55 - 0.12 = - 58 \\
 &+ 1.50 = + 346
 \end{aligned}$$

$$\begin{aligned}
 &- 147 + 1.55 = + 384 \\
 &+ 1859 = - 363
 \end{aligned}$$

$$\begin{aligned}
 &- 0.90 + 0.12 - 0.67 = + 0 \\
 &+ 150.10 - 2006 + 111.50 = - 37
 \end{aligned}$$

$$\begin{aligned}
 &+ 19.03 & + 11.45 = - 669 \\
 &+ 150.00 & + 109.88 = - 780
 \end{aligned}$$

$$\begin{aligned}
 &- 15.65 & - 11.45 = + 81 \\
 &+ 3.38 & = - 588
 \end{aligned}$$

$$\begin{aligned}
 &- 258 + 256 \\
 &\text{Average} = 57
 \end{aligned}$$

$$\begin{aligned}
 &+ 231 \\
 &c = + 229
 \end{aligned}$$

$$b = - 20$$

$$a = - 174$$

1332

Red. ad locum aph.

$$\delta = +27^{\circ} 37'$$

$$\begin{array}{rcl} H + \alpha & 11^{\circ} & 30 = 172^{\circ} 30' \\ H & 4 & 34 \\ \alpha & 6 & 56 \\ G & 21 & 42 \\ G + \alpha & 4 & 38 = 69^{\circ} 30' \end{array}$$

$$\begin{array}{rcl} \log S & 9.9475 \\ l & 0.8836 \\ (L) & 0.8311 \end{array}$$

$$\begin{array}{rcl} \log(G + \alpha) & 9.5443 \\ g & 1.1584 \\ \sin \dots & 9.9716 \\ \tan S & 9.7186 \\ & 8.8239 \end{array}$$

$$\begin{array}{rcl} \log S & 9.6661 \\ \cos(H + \alpha) & 9.9963 \\ h & 1.2778 \\ \sin \dots & 9.1157 \\ \sec S & 0.0525 \\ & 8.8239 \end{array}$$

$$\begin{array}{rcl} g' & 0.7027 \\ g & 9.6725 \end{array}$$

$$\begin{array}{rcl} h' & 0.9402 \\ h & 9.2699 \end{array}$$

$$\begin{array}{rcl} l & +1.82 \\ g & +0.47 \\ h & +0.19 \\ \hline & +2.48 \end{array}$$

$$\begin{array}{rcl} g' & +5.04 \\ h' & -8.71 \\ l & +6.78 \\ \hline & +3.11 \end{array}$$

1332 Moon's mean Position (1911.0) 1913 May 28. 8

$$Y_0 = 168335 \quad Y_0 = 218718$$

$$\frac{1}{2}a = \frac{-87}{168248}$$

$$\frac{-10}{218708}$$

$$18.3045$$

$$21.8965$$

From Prelim Plate constant $X = 18.3132$ $Y = 21.8975$

$$\xi = +0.3132$$

$$\log \xi = 9.49582$$

$$\cos \delta = 9.94749$$

$$\sin \delta = 8.50724$$

$$(x-A) = 1.04109$$

$$x-A = +10.99$$

$$A = 65531$$

$$\alpha_0 = 6^h 55^m 41.99^s$$

$$\eta = -0.1025$$

$$\log \tan \delta = 9.7186$$

$$\delta = 89916$$

$$\eta_1 = 57636$$

$$\eta_1 = +1$$

$$\eta_0 = -0.1026$$

$$\log \eta_0 = 9.01115$$

$$\cos \delta = 7.33115$$

$$\log (s-D) = 1.68000$$

$$s-D = -479$$

$$D = +27 \quad 37 \quad 32$$

$$s_0 = +27^\circ 36' 44.1''$$

$$\xi = +0.3045$$

$$\log \xi = 9.48359$$

$$\cos \delta = 9.94749$$

$$8.50724$$

$$(x-A) = 1.02886$$

$$x-A = +10.69$$

$$A = 65531$$

$$\alpha_0 = 6^h 55^m 41.69^s$$

$$Red = +2.48$$

$$\alpha' = 6^h 55^m 44.17^s$$

$$\eta = -0.1035$$

$$\eta_1 = +1$$

$$\eta_0 = -0.1036$$

$$\log \eta_0 = 9.01536$$

$$7.33115$$

$$\log (s-D) = 1.68421$$

$$s-D = -48.3$$

$$D = +27 \quad 37 \quad 32$$

$$s_0 = +27^\circ 36' 43.7''$$

$$Red = +3.1$$

1332 *Lunar Parallax*

x 6 55 44.17 S 15 55 + 27° 36' 46.8"

0 6 32.570

+ 22 47.2

- 5° 41' 48"

- 2 28

- 2 28

- 2 28

- 1 57 39.20

- 1 57 39.20

9.95027

0 0 0 0 0

0 0 0 2 1 2

9.95939

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9.95939

11. 70 9 17.9

9.86913

8.23675

8.99678

0.05352

7.15618

7.15618

7.15618

7.15618

7.15618

7.15618

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7.15618

7.15618

7.15618

x - 4 55.53

- 19.70

Y 42 19 30

27 36 47

1.4 42 43

9.82640

8.23675

9.40476

0.17177

7.63968

7.63968

7.63968

7.63968

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7.63968

x = 6 55 24.47

x = 6 55 23.94

+ 0.53

+ 0.04

+ 0.49

Moon's mean Position (1911.0) 1913 May 24 8

$$X_0 = 16.8335 \quad Y_0 = 21.8718$$

$$\begin{array}{r} 16.8335 \\ - 87 \\ \hline 16.8248 \end{array}$$

$$\begin{array}{r} 21.8718 \\ - 10 \\ \hline 21.8708 \end{array}$$

$$18.3045$$

$$21.8965$$

From Plate constant $X = 18.3132 \quad Y = 21.8975$

$$z = +0.3132$$

$$\log z = 9.49582$$

$$\log s = 9.94749$$

$$\log r = 8.50724$$

$$(d-A) = 1.04109$$

$$d-A = + 10.99$$

$$A = 6 \quad 55 \quad 31$$

$$\alpha_0 = 6 \quad 55 \quad 41.99$$

$$\eta = -0.1025$$

$$\log \tan \delta = 9.7186$$

$$\eta_2 = 89.916$$

$$\eta_1 = 57.636$$

$$\eta_0 = +1$$

$$\eta_0 = -0.1026$$

$$\log \eta_0 = 9.01115$$

$$\log r = 7.33115$$

$$\log (d-D) = 1.68000$$

$$d-D = - 47.9$$

$$D = + 27 \quad 37 \quad 32$$

$$S_0 = + 27 \quad 36 \quad 44.1$$

$$z = +0.3045$$

$$\log z = 9.48359$$

$$\log s = 9.94749$$

$$\log r = 8.50724$$

$$(d-A) = 1.02886$$

$$d-A = + 10.69$$

$$A = 6 \quad 55 \quad 31$$

$$\alpha_0 = 6 \quad 55 \quad 41.69$$

$$R.A. = + 24.8$$

$$\alpha = 6 \quad 55 \quad 44.17$$

$$\eta = -0.1035$$

$$\eta_0 = +1$$

$$\eta_0 = -0.1036$$

$$\log \eta_0 = 9.01536$$

$$7.33115$$

$$\log (S-D) = 1.68421$$

$$S-D = - 48.3$$

$$D = + 27 \quad 37 \quad 32$$

$$S_0 = + 27 \quad 36 \quad 43.7$$

$$R.A. = + 24.8$$

1332 Lunar Parallax

$$\alpha' = 6^h 55^m 44.17^s \checkmark$$

$$\theta = 6^h 32^m 57.0^s \checkmark$$

$$- 22 \quad 47.2 \checkmark$$

$$- 50 \quad 41' \quad 48'' \checkmark$$

$$- \quad \quad \quad 2 \quad 28 \checkmark$$

$$- \quad \checkmark \quad 39 \quad 20 \checkmark$$

$$9 \quad 9 \quad 5 \quad 7 \quad 2 \quad 7 \checkmark$$

$$0 \quad 0 \quad 0 \quad 0 \quad 0 \quad 0$$

$$0 \quad 0 \quad 0 \quad 2 \quad 1 \quad 2 \checkmark$$

$$9 \quad 9 \quad 5 \quad 9 \quad 3 \quad 9 \checkmark$$

$$\gamma = 42 \quad 19 \quad 30 \checkmark$$

$$27 \quad 36 \quad 47 \checkmark$$

$$14 \quad 42 \quad 43 \checkmark$$

$$9 \quad 8 \quad 2 \quad 6 \quad 4 \quad 0 \checkmark$$

$$8 \quad 2 \quad 3 \quad 6 \quad 7 \quad 5 \checkmark$$

$$9 \quad 4 \quad 0 \quad 4 \quad 7 \quad 6 \checkmark$$

$$0 \quad 1 \quad 7 \quad 1 \quad 7 \quad 7 \checkmark$$

$$7 \quad 6 \quad 3 \quad 9 \quad 6 \quad 8 \checkmark$$

$$\delta - \delta' = + 14 \quad 59.7 \checkmark$$

$$\delta = + 27 \quad 51 \quad 46.5 \checkmark$$

$$\text{Lunar Altitude } \delta = + 27 \quad 51 \quad 47.1 \checkmark$$

$$O - C \quad \quad \quad - \quad 0.6 \checkmark$$

$$\text{Red. Altitude} \quad \quad \quad + \quad 0.1 \checkmark$$

$$O - C \quad \quad \quad - \quad 0.5 \checkmark$$

$$\delta' = + 27^{\circ} 36' 46.8'' \checkmark$$

$$\pi = 59' 17.9'' \checkmark$$

$$9.86913 \checkmark$$

$$8.23675 \checkmark$$

$$8.99678 \checkmark$$

$$0.05352 \checkmark$$

$$7.15618 \checkmark$$

$$\alpha - \alpha' = - 4' 55.53'' \checkmark$$

$$- \quad - \quad 19' 70'' \checkmark$$

$$2 = 6 \quad 55 \quad 2447 \checkmark$$

$$X = 6 \quad 55 \quad 2394 \checkmark$$

$$+ 0.53 \checkmark$$

$$- 0.04 \checkmark$$

$$+ 0.49 \checkmark$$

MC1375 Comp Stars-Measures 1913 May 27

9

	d	n	d	n
1	16651	17620	17302	16440
67	7530	16730	14240	9470
14.9	35-30	33	37	70
	48	10	00	28

14.9116

.9114

6.6940

.6962

2	16867	16055	15070	14778
13.6	13920	8995	11079	8745
11.4	22	9500	80	51
	55	49	54	69

11.2940

.2947

13.6016

.6023

3	18871	14784	14622	19100
21.5	13955	9701	9040	14661
20.5	53	98	38	70
	56	82	08	00

30.4909

.4915

21.4423

.4433

4	17590	16395	19049	18335
27.1	9443	14531	9830	17525
20.8	50	30	30	21
	80	92	30	35

20.8134

.8126

27.0800

.0813

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MC1375 Comp. Stars Measures 1913 May 27

9

	d	n	d	n
1	16651	17620	17302	16440
67	7530	16730	14240	9470
149	35-30	33	37	70
	48	10	00	28
	<u>14.9116</u>	<u>.9114</u>	<u>6.6940</u>	<u>.6962</u>
2	16867	16055	15070	14778
13.6	13920	8995	11079	8745
11.4	22	95	80	51
	55	49	54	69
	<u>11.2940</u>	<u>.2947</u>	<u>13.6016</u>	<u>.6023</u>
3	18871	14789	14622	19100
215	13955	9701	9040	14661
305	53	98	38	70
	56	82	08	00
	<u>30.4909</u>	<u>.4915</u>	<u>21.4423</u>	<u>.4433</u>
4	17590	16395	19049	18335
271	9443	14531	9830	17525
208	50	30	30	21
	80	92	30	31
	<u>20.8134</u>	<u>.8136</u>	<u>27.0800</u>	<u>.0813</u>

MC1375 Moon Measures.

1913 May 27.

10

	d	n	d	n
1	19296	15387		
18.0	14035 ³⁸	1064051		
20.5	50	2930		
	81	81		
	<u>20.5250</u>	<u>.5254</u>		

2	17420	15324		
20.6	11479 ⁹²	1125350		
	90	50		
	08	20		
	<u>20.5926</u>	<u>.5929</u>		

3		18529	16025
164		11300	13190
21.0		95 ⁹⁵	88 ⁰¹
		11	12
		<u>162781</u>	<u>2828</u>

4	16069	15229	
21.3	13070 ⁸⁵	8256	
	78	4746	
	60	26	
	<u>21.2988</u>	<u>3023</u>	

5		15726	19031
15.7		12314 ⁹⁵	12401 ¹⁰
22.0		05 ¹⁰	27
		00	29
		<u>15.6589</u>	<u>.6617</u>

6		16074	18060
15.6		11983 ⁸⁰	12126 ²⁹
22.5		79	26
max		55	60
76		<u>15.5915</u>	<u>.5933</u>

7		15000	18096
15.7		11490 ⁹⁹	11581 ⁹⁹
23.0		90	85 ⁹⁹
		90	96
		<u>15.6497</u>	<u>.6508</u>

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MC1375 Moon Measures

1913 May 27

10

	d	n
1	19296	15387
180	14035 ³⁸	1064051
215	50	2930
	81	81
	<u>205250</u>	<u>5254</u>

2	170	17420	15324
206	11479	92	1125550
	90	50	
	08	20	
	<u>205926</u>	<u>5929</u>	

3
164
210

18529	16025
11300	1319001
95 ⁹⁵	88
11	12
<u>162781</u>	<u>2828</u>

4	160	16069	15229
213	13070	85	8256
	78	4746	
	60	26	
	<u>212988</u>	<u>3023</u>	

5
157
220

15726	19031
12314	1240110
05 ⁹⁵	27
00	29
<u>156589</u>	<u>6617</u>

6
156
225
more
76

16074	18060
11988	1212629
79	26
55	60
<u>155915</u>	<u>1933</u>

7
157
230

15000	18096
11490	1158199
90	85 ⁹⁹
90	96
<u>156497</u>	<u>6508</u>

11/16
8
16
23

9
16
23

MC1375 moon measures.

1913 May 27.

11

	α	δ	α	δ
8	14300	15726		
16.0	688280	1313223		
23.7	90	2523		
	87	26		
	<u>23.7406</u>	<u>7401</u>		

18492

9
16.8
24.0

 $\eta = \text{min} = \text{about } \underline{21.4930}$

NIC1375 moon measures

1913 May 27.

11

	a	y	v
8	14300		15726
160	688280		1313223
237	90		2523
	87		26
	<u>237406</u>		<u>7401</u>

$$\begin{array}{r} 9 \\ 16\overline{)3} \\ \hline 24.0 \end{array}$$
184970y - min = about 214930

MC1375, Comp. Stars Stand. Cords. 1913 May 28. 12

Cape no 3315 mag 8.4

Cape no. 3322 mag 8.6

C	23	36	01	20	✓
L				32	
E				21	
mean	23	36	01	24	✓
prec				+33.98	✓
q	23	36	35	22	✓
A	23	42	27		✓
q-A	-	5	51	78	✓
sin(q-A)				-351.74	
log...				2.54622	✓
cos...				9.99678	✓
tan...				105024	✓
...				-112264	
...				42	
...				6.7694	
...				6.6951	
...				-743	

	23	39	38	80	✓
				86	
				89	
	23	39	38	83	✓
				+33.96	✓
	23	40	12	79	✓
	23	42	27		✓
	-	2	14	21	✓
				-134.21	
				2.12778	✓
				9.99634	✓
				0.63136	✓
				-42792	✓
				10	
				13.7198	✓
				136020	
				-1178	✓

C	-7	01	54	05	✓
L				60	
E				73	
mean	-7	+01	54	4	✓
prec				+33.93	✓
q	-6	58	15	1	✓
D	-6	17	17		
q-D	-	40	58	1	✓
tan(q-D)				-2458.2	✓
log...				3.39062	✓
...				0.72177	✓
...				9.0873	
...				9.1462	✓
...				21005	
...				8.2412	✓
...				-15.2695	
...				174	
...				16.7131	
...				14.9115	
...				-1.8016	

	-7	29	28	6	✓
				7	
				29.8	
	-7	29	29	0	✓
				+33.97	✓
	-7	25	49	3	✓
	-6	17	17		✓
	-1	08	32	3	✓
				-4112.8	✓
				3.61414	✓
				0.94529	✓
				9.1153	✓
				12627	✓
				7.4314	✓
				-8.8164	
				27	
				13.1809	
				11.2944	
				-1.8865	

MC1375, Comp Stars Stand Corvado. 1913 May 28. 12

Cape no 3315 mag 8.4

Cape no 3322 mag 8.6

C 23" 36" 01.20

23" 39" 38.80

L 32

86

E 21

84

mean 23 36 01.24

23 39 38.83

P.M.S. + 3398

+ 3396

a 23 36 35.22

23 40 12.79

A 23 42 27

23 42 27

A-A - 5 51.78

- 2 14.21

sin(A-A) - 351.74

- 134.21

log... 2.54622

2.12778

... 999678

999634

... 105024

063136

30 - 112264

- 92792

31 - 42

- 10

3 67694

137198

x 66951

136020

x-3 - 743

- 1178

C - 7° 01' 54.05

- 7° 29' 28.6

L 60

E 73

mean - 7 + 0.1 54.4

- 7 29 29.0

P.M.S. + 3 39.3

+ 3 39.7

S - 6 58 15.1

- 7 25 49.3

D - 6 17 17

- 6 17 17

S-D - 40 58.1

- 1 08 32.3

tan(S-D) - 24582

- 41128

log... 3.39062

3.61414

... 0.72177

0.94529

... 9.0873

tanδ 9.1462

9.1153

ε² 20985

12627

m₁ 82482

74314

m₂ - 152695

- 88164

m₃ - 174

- 27

m₄ 167131

131809

m₅ 194115

112944

m₆ - 18016

- 18865

h-7

a. 5 (Straight) ¹⁹⁰⁰ m. 8146 m. 77Cape ⁴ no 3334 m. 8.9 13a. 5. 23^h 43^m 37^s 7Cape 23^h 46^m 37^s 22^v

2

25

2

21

mean 23 46 37.23

Prec + 33.89^v+ 33.89^vq 23 44 11.06^v23 47 11.12^vA 23 42 27^v23 42 27^vx-A + 1 44.06^v+ 4 44.12^vsin(x-A) + 1.04.06^v+ 284.10^vlog 2.01728^v2.45347^vcos 9.99839^v9.99748^vS₀ 052291^v0.95819^vS₀ + 3.3335^v+ 9.0822^vS₁ + 1.0^v+ 1.9^vS 21.3345^v27.0841^vx 21.4428^v27.0806^vx-3 + 1.083^v- 35^va. 5. -4° 59' 29" 2^vC - 6° 14' 07.7^v

L 08.3

S 08.6

mean - 6 14 08.2

Prec + 3 40.0^v+ 3 40.2^vS - 4 55 49.2^v

- 6 10 28.0

O - 6 17 17^v- 6 17 17^vS-O + 1 21 27.8^v

+ 06 49.0

tan(S-O) + 4888.7^v

+ 409.0

log 3.68919^v

2.61172

mo 1.02034^v

9.94287

tan S 8.9358^v9.0342^vS² 1.0458^v

1.9164

m₁ 7.0350^v8.0040^vm₀ + 1.04795^v

+ 0.8767

m₁ - 1.1^v

- 1.01

m₂ 32.4784^v

22.8666

m₃ 30.4912^v20.8135^vm₄ - 1.9872^v

- 2.0531

MIC 1375

Center of Plate

x	y	$R. A.$	$Decl.$
6.69	14.91	23 ^h 36 35	-7 58 15
13.60	11.29	40 13	-7 25 49
21.44	30.49	44 11	-4 55 49
27.04	20.81	47 11	-6 10 28
4168.81	7750	1 167 70	1524 198 191
1720	1938	23 42 02	-6 37 35
		+ 25	+ 20 18
8.0	262	23 42 27	-6 17 17
31	465		
248	1218"		
	20' 18"		

$$A = 23^h 42' 27''$$

$$D = -6^{\circ} 17' 17''$$

Preliminary Reduction

$$\begin{aligned}
 x-3 &= 1174 & -2x &= 2502 \\
 -743 &= 1745 & -7 &= -2495 & = +7 \\
 -1178 &= 1321 & -14 &= -2513 & = -11 \\
 +1083 &= 3567 & -21 &= -2505 & = -3 \\
 -35 &= 2435 & -27 &= -2497 & = +5 \\
 176223 &= 2635 & -18 & & = 176072
 \end{aligned}$$

$$\begin{aligned}
 y-m &= +1232 + 24 & +17166 &= \\
 -18016 &= 823 + 30 & -17169 &= +3 \\
 -18865 &= 1673 + 22 & -17170 &= -4 \\
 -19872 &= 2637 + 61 & -17174 &= -8 \\
 -20531 &= 3331 + 42 & -17158 &= +8 \\
 275217 &= 2168 + 45 & &= 274596
 \end{aligned}$$

MC1375

Center of Plate

x	y	R. A.	Decl.
6.69	14.91	23 ^h 36 35	-7 58 15
13.60	11.29	40 13	-7 25 49
21.44	20.49	44 11	-4 55 49
27.08	20.81	47 11	-6 10 28
468.81	77.50	1 167 70	-24 148 141
17.20	19.38	23 42 02	-6 37 35
-18	-22	+25	+20 18
.80	262	23 42 27	-6 17 17
31	465		
24.8	1218"		

20' 18"

A = 23^h 42^m 27^s
 B = -6° 17' 17"

Preliminary Reduction

x-3	-1174	-22	+2502
-743	-1745	-17	-2495
-1178	-1321	-14	-2513
+1083	-3567	-21	-2505
-35	-2435	-27	-2497
17.6223	-2635	-18	-17.6072

y-m	+1232	+24	+1.7166
-1.8016	+823	+30	-1.7163
-1.8865	+1673	+22	-1.7170
-1.9872	+2637	+61	-1.7174
-2.0531	+3331	+42	-1.7158
22.5217	+2168	+45	-24.4596

Tables a ~ +0.6 e ~ -3.7 a - e ~ +4.3 b + a ~ -3.3
 Obs a ~ +0.8 e ~ -2.4 a - e ~ +3.2 b + a ~ -5.1

19

MIC 1375	Times etc				
Sept 11 Nov 2	1 ^h	04 ^m		1 ^h	16 ^m
noon	1	09	30.4	1	09 30.7
clock slow		0	43.2		
H. R. T.	1	10	137.5		
H. Long	4	44	31.05		
G. Sid. T.	5	54	44.80		
Sid. T. m. noon	14	42	34.06		
Interval	15	12	10.74		
Reduction		2	29.44		
G. m. T.	15	09	41.30		

From Rank Alum			RA.		Decl.
noon 15 ^h	23 ^h	43 ^m	01 ^s 59 ^u	-5	18 10.5
Motion in 1 ^m 1.9611				15343	
" 9.6883			+1900	+2	28.6
Tabular place	23	43	20.59	-5	15 41.9
uniquis age			12 days		
Moons Parallax			57'		12.7
Semidian			15		37.0

M.C. 1375 Times etc 19
 Sept 1911 Nov. 2 1^h 04^m - 1^h 16^m
 moon 1 09 30.4 - 1 09 30.7
 double slow 0 43.2

H. R. 1 T 1 10 1375
 H. R. 4 44 3105
 G. S. 1 T 5 54 4480
 S. 1 T in Moon 14 42 3406
 Interval 15 12 1074
 Reduction 2 29.44
 G. in T. 15 09 41.30

from Nant Allen RA Head
 Nov 15^h 23^h 43^m 01^s 59 - 5 18 10.5
 volume in 1.9611 15343
 9.6883 + 1900 + 2 28.6
 volume in 23 43 2059 - 5 15 41.9

Proton's parallelax 57' 12.7
 Luminidian 15 37.0

MC1375-1376 Plate constants

1913 May 29

15

$$\begin{array}{rcl}
 a & b & c \\
 +6.77 + 16.71 + 1 = +7 & +3 & +3 \\
 +13.72 + 13.18 + 1 = -1 & -4 & -8 \\
 +21.33 + 32.48 + 1 = -3 & -8 & +3 \\
 +27.08 + 22.87 + 1 = +5 & +8 & +4
 \end{array}$$

$$\begin{array}{rcl}
 +10.24 + 14.94 + 1 = -2.00 & -0.50 & -2.50 & 0.00 \\
 +24.20 + 27.68 + 1 = +1.00 & 0.00 & +3.50 & +1.00 \\
 +14.05 + 24.60 + 1 = +2.00 & -2.50 & +3.00 & +0.50 \\
 +20.40 + 18.02 + 1 = -3.00 & +2.00 & -2.00 & +0.50
 \end{array}$$

$$\begin{array}{rcl}
 -13.96 - 12.74 = -3.00 & -0.50 & -3.00 & -1.00 \\
 -6.35 + 6.58 = +5.00 & -4.50 & +5.00 & -0.00
 \end{array}$$

$$\begin{array}{rcl}
 +6.35 + 5.80 & +1.37 & +0.23 & +2.73 & +0.46 \\
 +12.38 & +4.63 & -4.27 & +7.73 & +0.46 \\
 b = & +0.51 & -0.35 & +0.67 & +0.04 \\
 a = & -0.25 & +0.35 & -0.14 & +0.04
 \end{array}$$

$$\begin{array}{rcl}
 -2.0 & +1.0 & +2.0 & -3.0 & -0.5 & -0.0 & -2.5 & +2.0 \\
 +2.6 & +6.0 & +3.5 & +5.1 & -3.6 & -8.5 & -4.9 & -7.1 \\
 -7.6 & -14.1 & -12.5 & -9.2 & +5.2 & +9.7 & +8.6 & +6.3 \\
 -7.0 & -7.1 & -7.0 & -7.1 & +1.1 & +1.2 & +1.2 & +1.2
 \end{array}$$

$$\begin{array}{rcl}
 -2.5 & +3.5 & +3.0 & -2.0 & 0.0 & +1.0 & +0.5 & +0.5 \\
 +1.4 & +3.4 & +2.0 & +2.9 & -0.4 & -1.0 & -0.6 & -0.8 \\
 -9.3 & -17.3 & -15.4 & -17.3 & -0.6 & -1.1 & -9.8 & -0.7 \\
 -10.4 & -10.4 & -10.4 & -10.4 & -1.0 & -1.1 & -1.1 & -1.0
 \end{array}$$

c for (x-3) 1376

Residuals

c for (y-4) 1375

$$\begin{array}{rcl}
 -2 + 8 - 7 = -1 & +7 & +8 & +2 & 6 + 1 = -3 & +3 & +6 \\
 -4 + 7 - 7 = -4 & -11 & -7 & +5 & 5 + 1 = +1 & -4 & -5 \\
 -5 + 16 - 7 = +4 & -3 & -7 & +7 & 11 + 1 = -3 & -8 & -5 \\
 -7 + 11 - 7 = -3 & +5 & +8 & +9 & 8 + 1 = +2 & +8 & +6 \\
 \\
 -1 + 10 - 10 = -1 & +3 & +4 & +0 & 1 - 1 = 0 & +2 & +2 \\
 -2 + 8 - 10 = -4 & -8 & -4 & +1 & 1 - 1 = +1 & -2 & -3 \\
 -3 + 20 - 10 = +7 & +3 & -4 & +1 & 1 - 1 = +1 & -1 & -2 \\
 -4 + 14 - 10 = 0 & +4 & +4 & +1 & 1 - 1 = +1 & +3 & +2
 \end{array}$$

MCI 375-1376 Plate constants

1913 May 29.

15

α		μ	δ	$\alpha - \alpha_0$	$\mu - \mu_0$	$\delta - \delta_0$	$\alpha - \alpha_0$	$\mu - \mu_0$	$\delta - \delta_0$
+ 6.77	+ 16.71	+ 1		+ 7	+ 3	+ 3	+ 2		
+ 13.72	+ 13.18	+ 1		- 11	- 4	- 8	- 2		
+ 21.33	+ 32.48	+ 1		- 3	- 8	+ 3	- 1		
+ 27.08	+ 22.87	+ 1		+ 5	+ 8	+ 4	+ 3		
+ 10.24	+ 14.94	+ 1		- 2.00	- 0.50	- 2.50	0.00		
+ 24.20	+ 27.68	+ 1		+ 1.00	0.00	+ 2.50	+ 1.00		
+ 14.05	+ 24.60	+ 1		+ 2.00	- 2.50	+ 3.00	+ 0.50		
+ 20.40	+ 18.02	+ 1		- 3.00	+ 2.00	- 2.00	+ 0.50		
- 13.96	- 12.74			- 3.00	- 0.50	- 6.00	- 1.00		
- 6.35	+ 6.58			+ 5.00	- 4.50	+ 5.00	- 0.00		
+ 6.35	+ 5.80			+ 1.37	+ 0.23	+ 2.73	+ 0.46		
	+ 12.38			+ 1.637	- 4.27	+ 7.23	+ 0.46		
				+ 0.51	- 0.35	+ 0.62	+ 0.04		
				- 0.25	+ 0.35	- 0.29	+ 0.04		

- 2.0	+ 1.0	+ 2.0	- 3.0	- 0.5	- 0.0	- 2.5	+ 2.0
+ 2.6	+ 6.0	+ 3.5	+ 5.1	- 3.6	- 8.5	- 4.9	- 7.1
- 7.1	- 14.1	- 12.5	- 9.2	- 1.2	+ 9.7	- 8.6	+ 6.3
- 7.0	- 7.1	- 7.0	- 7.1	+ 1.1	+ 1.2	+ 1.2	+ 1.2

C for (x-3) 1375

C for (y-7) 1375

- 2.5	+ 3.5	+ 3.0	- 2.0	0.0	+ 1.0	+ 0.5	+ 0.5
+ 3.4	+ 3.4	+ 2.0	+ 2.9	- 0.4	- 1.0	- 0.6	- 0.8
- 9.3	- 17.3	- 15.4	- 11.3	- 0.6	- 1.1	- 9.8	- 0.7
- 10.2	- 10.4	- 10.4	- 10.4	- 1.0	- 1.1	- 1.1	- 1.0

C for (x-3) 1376

Residuals.

C for (y-7) 1376

α		μ	δ	$\alpha - \alpha_0$	$\mu - \mu_0$	$\delta - \delta_0$	α		μ	δ
- 2	+ 8	- 7	- 1	+ 7	+ 8	+ 2	- 6	+ 1	- 3	+ 6
- 4	+ 7	- 7	- 9	- 11	- 7	+ 5	- 5	+ 1	+ 1	- 5
- 5	+ 16	- 7	+ 4	- 3	- 7	+ 7	- 11	+ 1	- 3	- 5
- 7	+ 11	- 7	- 3	+ 5	+ 8	+ 9	- 8	+ 1	+ 2	+ 6
- 1	+ 10	- 10	- 1	+ 3	+ 4	- 0	+ 1	- 1	0	+ 2
- 2	+ 8	- 10	- 4	- 8	- 4	+ 1	+ 1	- 1	+ 1	- 3
- 3	+ 20	- 10	+ 7	+ 3	- 9	+ 1	+ 1	- 1	+ 1	- 2
- 4	+ 14	- 10	0	+ 4	+ 4	+ 1	+ 1	- 1	+ 1	+ 2

Formation of Normals

wt	ab	an	an
1	-0.19 +	1.57 -	87.0
2	+1.19 +	44.6 +	138.6
3	+2.09 +	36.2 +	41.0
4	+1.97 -	29.2 -	21.9
5	+1.02 +	39.2 +	10.4
6	-0.00 +	67.0 -	0.0
7	-0.96 -	102.4 +	25.4
8	-1.97 +	13.0 -	9.7
	+3.10 +	84.1 +	96.8

$$[ac] = -10.97 \quad [aa] = +19.33$$

$$[ba] = -4.48 \quad [bb] = +135.2 \quad [cn] = -3$$

pt	pos. L	resid
1	169.2	{+120} $\frac{1}{2}$ wt
2	197.8	-7.2
3	221.0	-1.3
4	233.0	+3.8
5	255.2	0
6	270.0	-2.2
7	284.0	+4.9
8	307.0	-4.4

MC1375

Moon's Center

16

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$	
1	15.0000	+0.3800	-6	0.1439	4.1319	+87	$\frac{1}{2} \text{ wt}$
2	17.0000	-0.6200	-6	0.3851	4.1073	-72	
3	16.2804	-1.3396	-5	1.7959	4.1118	-27	
4	16.0000	-1.6200	-4	2.6257	4.1163	+18	
5	15.6603	-1.9597	-2	3.8412	4.1125	-20	
6	15.5924	-2.0276	0	4.1112	4.1112	-33	
7	15.6502	-1.9698	+1	3.8797	4.1197	+52	
8	16.0000	-1.6200	+4	2.6231	4.1137	-8	
mean						4.1145	-3

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.5252	-1.9953	+17	3.9880
2	20.5928	-1.9277	-16	3.7222
3	21.0000	-1.5205	-13	2.3159
4	21.3006	-1.2199	-10	1.4906
5	22.0000	-0.5205	-4	0.2713
6	22.5205	0.0000	0	0.0000
7	23.0000	+0.4895	+4	0.2400
8	23.7404	+1.2199	+10	1.4906

Approximate Center

$$x = 16.0 \quad y = 21.3006$$

$$\underline{23.7404}$$

$$45.0410$$

$$\text{mean } y = 22.5205$$

$$y - \text{min} = 20.4930$$

$$R = 20.275$$

$$x - \text{min} = 15.5924$$

$$\text{mean } x = 17.6199$$

$$\text{Assume } \begin{cases} x_0 = 17.6200 \\ y_0 = 22.5205 \end{cases}$$

MC1375

moons center

16

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)$	$y - y_0$
1	18.0000	+0.3800	-6	0.1439	4.1319	+87
2	17.0000	-0.6200	-6	0.3851	4.1073	-72
3	16.2804	-1.3396	-5	1.7959	4.1118	-27
4	16.0000	-1.6200	-9	2.6257	4.1163	+18
5	15.6603	-1.9597	-2	3.8412	4.1125	-20
6	15.5924	-2.0276	0	4.1112	4.1112	-33
7	15.6502	-1.9698	+1	3.8797	4.1197	+52
8	16.0000	-1.6200	+4	2.6231	4.1137	-8
mean					4.1145	-3

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.5252	-1.9953	+17	3.9880
2	20.5928	-1.9277	-16	3.7222
3	21.0000	-1.5205	-13	2.3159
4	21.3006	-1.2199	-10	1.4906
5	22.0000	-0.5205	-4	0.2713
6	22.5205	0.0000	0	0.0000
7	23.0000	+0.4895	+4	0.2400
8	23.7404	+1.2199	+10	1.4906

Approximate Center

$$x = 16.0 \quad y = 21.3006$$

$$\frac{23.7404}{45.0410}$$

$$\text{mean } y = 22.5205$$

$$y_{\text{min}} = 20.4930$$

$$R = 20.275$$

$$x_{\text{min}} = 15.5924$$

$$\text{mean } x = 17.6199$$

$$\text{Assume } \begin{cases} x_0 = 17.6200 \\ y_0 = 22.5205 \end{cases}$$

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MC1375 Conditional Equations

1913 May 29.

17

x	a	b	c	0	L	$0-L$
1	+ 0.19	- 1.00	+ 1	+ 87	+ 9 - 23 + 41 = + 27	+ 60
2	- 0.62	- 1.93	+ 1	- 72	- 38 - 44 + 82 = 0	- 72
3	- 1.34	- 1.52	+ 1	- 27	- 61 - 35 + 82 = - 14	- 13
4	- 1.62	- 1.22	+ 1	+ 18	- 74 - 28 + 82 = - 20	+ 38
5	- 1.96	- 0.52	+ 1	- 20	- 90 - 12 + 82 = - 20	0
6	- 2.03	+ 0.00	+ 1	- 33	- 93 + 0 + 82 = - 11	- 22
7	- 1.97	+ 0.49	+ 1	+ 52	- 90 + 11 + 82 = + 3	+ 49
8	- 1.62	+ 1.22	+ 1	- 8	- 74 + 28 + 82 = + 36	- 44

Normal Equations.

$$-151 + 147$$

$$\text{Average} = 40$$

$$+ 19.33 + 3.10 - 10.97 = + 84$$

$$+ 3.10 + 13.52 - 4.48 = + 97$$

$$- 10.97 - 4.48 + 7.50 = - 3$$

$$- 3.10 - 0.50 + 1.76 = - 13\frac{1}{2}$$

$$+ 10.97 + 1.76 - 6.21 = + 47\frac{1}{2}$$

$$+ 13.02 - 2.72 = + 73\frac{1}{2}$$

$$- 2.72 + 1.29 = + 44\frac{1}{2}$$

$$+ 2.72 - 0.567 = + 15$$

$$+ 0.72 = + 59\frac{1}{2}$$

$$- 5.74 + 2.72 = + 94$$

$$+ 7.28 = + 167\frac{1}{2}$$

$$- 7.59 - 3.10 + 5.20 = - 2$$

$$- 33.12 - 13.52 + 22.64 = - 9$$

$$+ 11.74 - 5.77 = + 82$$

$$- 30.02 + 18.16 = + 88$$

$$- 9.55 + 5.77 = + 28$$

$$+ 2.19 = + 100$$

$$a = + 46$$

$$L = + 23$$

$$c = + 82$$

$$\frac{\Delta y}{\Delta x} = + 0.44$$

$$\frac{\Delta x}{\Delta y} = + 1.12$$

M101375 Conditional Equations

1913 May 29.

17

x	a	b	c	0		c	$0 - c$
1	+ 0.19	- 1.00	+ 1.00	+ 87	+ 9 - 23 + 41 =	+ 27	+ 60
2	- 0.62	- 1.93	+ 1.00	- 72	- 38 - 44 + 82 =	0	- 72
3	- 1.34	- 1.52	+ 1.00	- 27	- 61 - 35 + 82 =	- 14	- 13
4	- 1.62	- 1.22	+ 1.00	+ 18	- 74 - 28 + 82 =	- 20	+ 38
5	- 1.96	- 0.52	+ 1.00	- 20	- 90 - 12 + 82 =	- 20	0
6	- 2.03	+ 0.00	+ 1.00	- 33	- 93 + 0 + 82 =	- 11	- 22
7	- 1.97	+ 0.49	+ 1.00	+ 52	- 90 + 11 + 82 =	+ 3	+ 49
8	- 1.62	+ 1.22	+ 1.00	- 8	- 74 + 28 + 82 =	+ 36	- 44

Normal Equations

- 151 + 197

Average $c = 40$

$$\begin{aligned}
 + 1933 + 310 - 1097 &= + 84 \\
 + 310 + 1352 &= 448 = + 97 \\
 - 1097 - 448 + 750 &= - 3
 \end{aligned}$$

$$\begin{aligned}
 - 310 - 050 + 1.76 &= - 13 \frac{1}{2} \\
 + 1097 + 176 - 621 &= + 47 \frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 + 1302 - 272 &= + 73 \frac{1}{2} \\
 - 272 + 129 &= + 44 \frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 + 272 - 0567 &= + 15 \frac{1}{2} \\
 + 072 &= + 59 \frac{1}{2}
 \end{aligned}$$

$$c = + 82$$

$$\begin{aligned}
 - 574 - 272 &= + 94 \\
 + 728 &= + 167
 \end{aligned}$$

$$b = + 23$$

$$\begin{aligned}
 - 759 - 310 + 520 &= - 2 \\
 - 3312 - 1352 + 2264 &= 9
 \end{aligned}$$

$$\begin{aligned}
 + 1174 &= 577 = + 82 \\
 - 3002 &+ 1816 = + 88
 \end{aligned}$$

$$\begin{aligned}
 - 955 &+ 577 = + 28 \\
 + 219 &= + 100
 \end{aligned}$$

$$a = + 46$$

1375 Red ad Cocoon app.

$$S = -5^{\circ} 58'$$

$$++\alpha \quad 2 \quad 54 = 43^{\circ} 30''$$

$$H \quad 3 \quad 12$$

$$\alpha \quad 23 \quad 42$$

$$G \quad 21 \quad 51$$

$$S+\alpha \quad 21 \quad 33 = 323^{\circ} 15'$$

$$L \cos S \quad 99976$$

$$L \quad \underline{0.7970}$$

$$(L) \quad 0.7946$$

$$L \sin S \quad 9.0170m$$

$$\cos(H+\alpha) \quad 9.8606$$

$$L \quad 1.2892$$

$$\sin \quad 9.8378$$

$$\sec S \quad 0.0024$$

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

$$(8') \quad 1.0848$$

$$(8) \quad 8.8012$$

$$(h') \quad 0.1668m$$

$$(h) \quad 9.9533$$

$$h \quad +1.96$$

$$g \quad +0.06$$

$$u \quad +0.90$$

$$\underline{+2.92}$$

$$g' \quad +1.216$$

$$h' \quad -1.47$$

$$i \quad +6.23$$

$$\underline{+1.692}$$

MC1375

1913 May 29.

18

Moon's Mean Position (1916.0)

$$\begin{array}{r} X_0 = 17.6200 \\ \text{corr} = +23 \\ \hline 17.6223 \end{array}$$

$$\begin{array}{r} Y_0 = 22.5205 \\ \text{corr} = +12 \\ \hline 22.5217 \end{array}$$

From Preliminary Red $X = 17.6072$ $Y = 24.4596$

Plate Constant $a_x = -4$ $+6$

$b_y = +12$ -9

$c = -7$ $+1$

17.6073 24.4594

$$z = -0.3927$$

$$\log 5 = 9.59406$$

$$\cos 5 = 9.99764$$

$$\text{const} = 8.50724$$

$$(X - X_0) = 1.08918$$

$$A - A = +12.28$$

$$A = 23 \ 42 \ 27$$

$$X_0 = 23 \ 42 \ 14.72$$

$$\text{Red} = +29.2$$

$$X = 23 \ 42 \ 17.64$$

$$\eta = +2.4594$$

$$\tan 5 = 9.0418$$

$$\eta_2 = 9.1881$$

$$\eta_1 = 5.2833$$

$$\eta_1 = 0$$

$$\log \eta_0 = 0.39083$$

$$\text{const} = 7.33115$$

$$(A - D) = 3.05968$$

$$S = +19 \ 07.5$$

$$D = -6 \ 17 \ 17$$

$$S_0 = -5 \ 58 \ 09.7$$

$$\text{Red} = +16.9$$

$$S' = -5 \ 57 \ 52.8$$

1375 Red ad Locum app.

$$S = -5^{\circ} 58'$$

$$H + \alpha \quad 2 \quad 54 = 43^{\circ} 50'$$

$$H \quad 3 \quad 12$$

$$\alpha \quad 23 \quad 42$$

$$G \quad 21 \quad 51$$

$$G + \alpha \quad 21 \quad 33 = 323^{\circ} 15'$$

$$l \cos S \quad 9.9976$$

$$l \quad 0.7970$$

$$(l) \quad 0.7946$$

$$l \sin S \quad 9.0170m$$

$$\cos(H + \alpha) \quad 9.8606$$

$$h \quad 1.2892$$

$$\sin \alpha \quad 9.8378$$

$$\sec S \quad 0.0024$$

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

$$l \cos(G + \alpha) \quad 9.9038$$

$$g \quad 1.1810$$

$$\sin \alpha \quad 9.7769m$$

$$\tan S \quad 9.0194m$$

$$8.8239$$

$$(g') \quad 1.0848$$

$$(g) \quad 8.8012$$

$$(h') \quad 0.1668m$$

$$(h) \quad 9.9533$$

$$f \quad +1.96$$

$$g \quad +0.06$$

$$h \quad +0.90$$

$$+2.92 \checkmark$$

$$g' \quad +1.216$$

$$h' \quad -1.47$$

$$l \quad +6.23$$

$$+1.692 \checkmark$$

MC1375

1913 May 29.

18

Moon's Mean Position (1911.0)

$$\begin{array}{r} X_0 = 17.6200 \\ \text{corr} = +23 \\ \hline 17.6223 \end{array}$$

$$\begin{array}{r} Y_0 = 22.5205 \\ \text{corr} = +12 \\ \hline 22.5217 \end{array}$$

From Preliminary Red. $X = 17.6072$ $Y = 24.4596$

Plate Constant $a = -4$ $+6$

$b = +12$ -9

$c = -7$ $+1$

17.6073 24.4594

$$z = -0.3927$$

$$9.59406m$$

$$\cos \delta = 9.99764$$

$$\sin \delta = 8.50724$$

$$(X-A) = 1.08918m$$

$$A = 4 \quad + 1228$$

$$A = 23 \quad 42 \quad 27$$

$$X_0 = 23 \quad 42 \quad 14.72$$

$$\text{Red} = + 292$$

$$X = 23 \quad 42 \quad 17.64$$

$$Y = + 24.4594$$

$$\tan \delta = 9.0418m$$

$$\delta = 9.1881$$

$$\eta_1 = 5.2833m$$

$$\eta_2 = 0$$

$$\log \eta_0 = 0.39083$$

$$\text{Const} = 7.33115$$

$$(X-D) = 30.5968$$

$$S = + 19 \quad 07.5$$

$$D = -6 \quad 17 \quad 17$$

$$S_0 = -5 \quad 58 \quad 09.7$$

$$\text{Red} = + 10.9$$

$$S = -5 \quad 57 \quad 52.8$$

Lunar Parallax.

$$\begin{array}{r}
 1375 \\
 \alpha = 23^{\circ} 42' 17.64'' \\
 \theta = 1 \quad 10 \quad 1375'' \\
 \theta - \alpha = +1 \quad 27 \quad 56.1'' \\
 = +21^{\circ} 59' 02''
 \end{array}$$

$$+ \quad 9 \quad 57''$$

$$+ 21 \quad 51 \quad 05''$$

$$9.95727''$$

$$0.00000$$

$$0.03238''$$

$$9.98965''$$

$$\gamma = 44 \quad 19 \quad 00''$$

$$- 5 \quad 57 \quad 53''$$

$$50 \quad 16 \quad 53''$$

$$9.82640''$$

$$8.22119''$$

$$9.88604''$$

$$0.15576''$$

$$8.08939''$$

$$s - s' = +42 \quad 14.1''$$

$$s = -5 \quad 15 \quad 38.7''$$

$$\text{Wentzel's } s = -5 \quad 15 \quad 41.9''$$

$$O - C \quad + \quad 3.2''$$

$$\text{Red Island Radial} \quad - \quad 0.5''$$

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

$$s' = -5^{\circ} 57' 52.8'' \quad 19$$

$$\mu = 57' 12.7''$$

$$9.86913''$$

$$8.22119''$$

$$9.57327''$$

$$0.00184''$$

$$7.66543''$$

$$\alpha - \alpha' = +45' 54.67''$$

$$= +1^{\circ} 03.64''$$

$$\alpha = 23 \quad 43 \quad 21.28''$$

$$\alpha = 23 \quad 43 \quad 20.59''$$

$$+ 0.69''$$

$$- 0.08''$$

$$+ 0.61''$$

1375 Lunar Parallax

$$\alpha = 23^{\circ} 42' 17.64''$$

$$\theta = 1^{\circ} 10' 13.75''$$

$$\alpha - \alpha' = +1^{\circ} 27' 56.1''$$

$$+ 21^{\circ} 59' 02''$$

$$+ 7' 57''$$

$$+ 21' 51'' 05''$$

$$995727$$

$$000000$$

$$003238$$

$$998965$$

$$Y = 44' 19'' 00''$$

$$- 5' 57' 53''$$

$$50' 16' 53''$$

$$982640$$

$$822119$$

$$988604$$

$$015576$$

$$808939$$

$$S - S' = +42' 14.1''$$

$$S = -5' 15' 38.7''$$

$$\text{Wentzel's } S = -5' 15' 41.9''$$

$$O - C + 3.2''$$

$$\text{Red Island radius} - 0.5''$$

$$O - C + 2.7''$$

$$S = -5^{\circ} 57' 52.8''$$

$$\text{Wentzel's } S = 57' 12.7''$$

$$986913$$

$$822119$$

$$957327$$

$$000184$$

$$766543$$

$$\alpha - \alpha' = +11' 54.67''$$

$$= +1' 03.69''$$

$$\alpha = 23^{\circ} 43' 21.28''$$

$$\alpha = 23^{\circ} 43' 20.59''$$

$$+ 0.69''$$

$$- 0.08''$$

$$+ 0.61''$$

MC1376

1913 May 28

20

Comparison Stars Measures

	α	ν	α	ν
1	18927	15079	793639	7888
60	17606	638585	3539	780508
19.2	0811	89	7861	0108
	16	61		
	<u>14.1318</u>	<u>.1323</u>	<u>6.0076</u>	<u>.0083</u>
2	18015	18870	17410	14860
12.9	1303943	1383039	1647979	577177
105	40	35	82	7877
	09	64	95	59
	<u>10.4971</u>	<u>.4968</u>	<u>12.9072</u>	<u>.9084</u>
3	16850	16640	18322	18400
20.8	1009797	1339090	1630098	1041014
21.6	90	86	04	11
	40	30	19	95
	<u>29.6748</u>	<u>6752</u>	<u>20.7980</u>	<u>.7984</u>
4				
16.4	.943230	11066	15691	17500
20.0	28	1088323	9810	1337874
	9239	7088	0507	41
			84	93
	<u>19.9809</u>	<u>.9811</u>	<u>26.4119</u>	<u>.4119</u>

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NIC1376

1913 May 28

20

Comparison Stars - Measures

α	ν	α	ν
$\begin{array}{r} 1 \\ 18927 \\ 60 \\ 17606 \\ 142 \\ 0811 \\ 16 \\ \hline 14.1318 \end{array}$	$\begin{array}{r} 15079 \\ 6385- \\ 89 \\ 61 \\ \hline 1323 \end{array}$	$\begin{array}{r} 793639 \\ 3537 \\ 7861 \\ \hline 6.0076 \end{array}$	$\begin{array}{r} 7888 \\ 780508 \\ 01 \\ \hline .0083 \end{array}$
$\begin{array}{r} 2 \\ 18015 \\ 12.9 \\ 1303943 \\ 105 \\ 40 \\ 09 \\ \hline 104971 \end{array}$	$\begin{array}{r} 18870 \\ 1383039 \\ 35- \\ 64 \\ \hline 4968 \end{array}$	$\begin{array}{r} 17410 \\ 1647979 \\ 82 \\ 95 \\ \hline 12.9072 \end{array}$	$\begin{array}{r} 14860 \\ 57717 \\ 78 \\ 59 \\ \hline 9084 \end{array}$
$\begin{array}{r} 3 \\ 16850 \\ 20.8 \\ 1009797 \\ 29.6 \\ 90 \\ 40 \\ \hline 29.6748 \end{array}$	$\begin{array}{r} 16640 \\ 1339090 \\ 86 \\ 30 \\ \hline 6752 \end{array}$	$\begin{array}{r} 18322 \\ 1630098 \\ 04 \\ 19 \\ \hline 20.7980 \end{array}$	$\begin{array}{r} 18400 \\ 1041014 \\ 11 \\ 95 \\ \hline 7984 \end{array}$
$\begin{array}{r} 4 \\ 26.4 \\ 20.0 \\ 943230 \\ 28 \\ 9239 \\ \hline 19.9809 \end{array}$	$\begin{array}{r} 11066 \\ 1088373 \\ 7088 \\ \hline 9811 \end{array}$	$\begin{array}{r} 15691 \\ 981002 \\ 0507 \\ 84 \\ \hline 26.4119 \end{array}$	$\begin{array}{r} 17500 \\ 1337874 \\ 81 \\ 93 \\ \hline 4119 \end{array}$

NIC 1376

1913 May 28

21

Moon Measures

d

y

N

d

x

N

17.0	19251	15640
20.4	16405 ⁰⁹	848591
	03	96
	47	39
	<u>20.2844</u>	<u>2852</u>

17.6	18280	15610
20.3	15685 ⁹⁵	819189
	00	85
	74	10
	<u>20.2585</u>	<u>2578</u>

17.0	17350	14554
20.4	13631 ³⁰	826872
	27	73
	40	54
	<u>20.3717</u>	<u>3777</u>

17.0	17112	18820
20.2	15780 ⁷³	1060917
	78	05
	06	20
	<u>21.1334</u>	<u>1290</u>

17.7	17398	18250
20.0	14000 ⁹⁵	1162718
	00	29
	88	35
	<u>15.6603</u>	<u>6615</u>
17.6	17360	18268
20.3	13730 ³²	1187066
	30	72
	49	68
	<u>15.6375</u>	<u>6399</u>

NIC 1376

1913 May 28

21

Moon - Measures

	α	δ
1	180	19251
204	16405	09
	03	
	47	
	<u>20.2844</u>	

15640
848591
9611
39
<u>2852</u>

	α	δ
2	176	18280
203	15685	95
min	00	
	74	
	<u>20.2585</u>	

15610
819189
81
10
<u>2578</u>

	α	δ
3	170	17350
204	13631	20
	27	
	40	
	<u>20.3717</u>	

14554
826872
73
59
<u>3717</u>

	α	δ
4	160	17112
212	15780	73
	78	
	06	
	<u>21.1334</u>	

18820
1069917
05
20
<u>1290</u>

5
157
220

17398
1400095
00
88
<u>156603</u>

18250
1162718
29
35
<u>6615</u>

6
156
223
min
46

17360
1372032
30
49
<u>156375</u>

18268
1187066
72
64
<u>6399</u>

MC1376 moon-measures.

1913 May 28 22

$$\begin{array}{r} 7 \\ 158 \\ 230 \end{array}$$

$$\begin{array}{r} 8 \\ 160 \\ 23.4 \\ 13970 \\ 958799 \\ 90 \\ 60 \\ \hline 23.4374 \end{array}$$

$$\begin{array}{r} 9 \\ 16.6 \\ 24.0 \end{array}$$

$$\begin{array}{r} 15603 \\ 998197 \\ 98 \\ 97 \\ \hline 4392 \end{array}$$

$$\begin{array}{r} 16286 \\ 1394550 \\ 40 \\ 70 \\ \hline 15.7662 \end{array}$$

$$\begin{array}{r} 17323 \\ 963034 \\ 41 \\ 16 \\ \hline 7685 \end{array}$$

$$\begin{array}{r} 13938 \\ 982115 \\ 16 \end{array}$$

$$\begin{array}{r} 12930 \\ 880002 \\ 99 \\ 20 \\ \hline 16.5874 \end{array}$$

$$\begin{array}{r} 15206 \\ 934532 \\ 3830 \\ 95 \\ \hline 5863 \end{array}$$

MC1376 Moon-measures.

1913 May 28 22

$$\begin{array}{r} 7 \\ 158 \\ 230 \end{array}$$

$$\begin{array}{r} 8 \\ 160 \\ 234 \\ 13970 \\ 958799 \\ 90 \\ 60 \\ \hline 234374 \end{array}$$

$$\begin{array}{r} 9 \\ 166 \\ 29.0 \end{array}$$

$$\begin{array}{r} 15603 \\ 998197 \\ 98 \\ 97 \\ \hline 4392 \end{array}$$

$$\begin{array}{r} 16286 \\ 1394550 \\ 40 \\ 70 \\ \hline 157662 \end{array}$$

$$\begin{array}{r} 17323 \\ 963034 \\ 41 \\ 16 \\ \hline 7683 \end{array}$$

$$\begin{array}{r} 13938 \\ 982115 \\ 10 \end{array}$$

$$\begin{array}{r} 12930 \\ 480002 \\ 99 \\ 20 \\ \hline 165874 \end{array}$$

$$\begin{array}{r} 15206 \\ 934532 \\ 3830 \\ 95 \\ \hline 5863 \end{array}$$

MC1376

1913 May 29.

23

Preliminary Reduction

	1	2	3	4
x	60080	129078	207982	264119
z	67694	137198	213345	270841
x-z	-7614	-8120	-5363	-6722
y	141320	104970	296750	199810
m	167131	131809	324784	228666
y-m	-25811	-26839	-28034	-28856

$$\begin{array}{rclcl}
 x-z & -1424 & & -32 & +9642 \\
 -7614 - 2007 & = -9621 & -14 & = -9639 & = +3 \\
 -8120 - 1491 & = -9611 & -39 & = -9650 & = -8 \\
 -5363 - 4214 & = -9577 & -62 & = -9639 & = +3 \\
 -6722 - 2837 & = -9559 & -79 & = -9638 & = +4 \\
 176668 - 3164 & & -53 & & = 183093
 \end{array}$$

$$\begin{array}{rclcl}
 y-m & +1492 & & +4 & +24904 \\
 -25811 + 895 & = -24916 & +14 & = -24902 & = +2 \\
 -26839 + 1923 & = -24916 & +10 & = -24906 & = -2 \\
 -28034 + 3099 & = -24935 & +30 & = -24905 & = -1 \\
 -28856 + 3935 & = -24921 & +20 & = -24901 & = +3 \\
 222849 + 2632 & & +22 & & = 250407
 \end{array}$$

$$\begin{array}{llll}
 \text{Tables } a = -0.3 & e = -4.0 & a-e = +3.7 & b+a = -4.3 \\
 \text{Obs } a = +2.8 & e = -1.0 & a-e = +3.8 & b+a = -6.4
 \end{array}$$

VIC 1376

1913 May 29

23

Preliminary Reduction

	1	2	3	4
2	60080	129078	207982	264119
3	67694	137198	213345	270841
2-3	-7614	-8120	-5363	-6722
4	141320	104970	296750	199810
m	167131	131809	324784	228666
4-m	-25811	-26839	-28034	-28856

$$\begin{array}{rclcl}
 2-3 & -1424 & & -32 & +9642 \\
 -7614 - 2007 & = -9621 & -14 & = -9639 & = +3 \\
 -8120 - 1491 & = -9611 & -39 & = -9650 & = -8 \\
 -5363 - 4214 & = -9577 & -62 & = -9639 & = +3 \\
 -6722 - 2837 & = -9559 & -79 & = -9638 & = +4 \\
 176668 - 3164 & & -53 & & = 183093
 \end{array}$$

$$\begin{array}{rclcl}
 4-m & +1492 & & +4 & +24904 \\
 -25811 + 895 & = -24916 & +14 & = -24902 & = +2 \\
 -26839 + 1923 & = -24916 & +10 & = -24906 & = -2 \\
 -28034 + 3099 & = -24935 & +30 & = -24905 & = -1 \\
 -28856 + 3935 & = -24921 & +20 & = -24901 & = +3 \\
 22849 + 2632 & & +22 & & = 250407
 \end{array}$$

MC1376 Times at 1911 Nov. 2 1^h 20^m - 1^h 32^m
 Graph to stars 1911 Nov. 2 1^h 20^m - 1^h 32^m
 Moon 1 26 30.9 - 1 26 31.3
 close slow 0 43.2

Has. Sid. T. 1 27 14.3
 H. Long 4 44 31.05
 G. Sid. T. 6 17 45.35
 Sid. T. m. Now 14 42 34.06
 Interval 15 29 11.29
 Reduction 2 32.22
 G. M. T. 15 26 39.07

Moon 15^h 23^h 43^m 0 1.59 - 5^h 18' 10".5
 Motion in 1^m 19612^h 15.349^h
 26.6512^h + 5 2.27 + 6 49.1
 Tabular place 23^h 43^m 53.86 - 5^h 11' 21".4

Moon's parallax 57 13.3
 Semidiam 15 37.1

INC 1376 Times etc.
 Exp to stars 1911 Nov 2 1^m 20^m - 1^m 32^m
 Moon 1 26 30.9 - 1 26 31.3
 change slow 0 43.2

Hard Sid T 1 27 14.3
 H Long 4 44 31.05
 G Sid T 6 11 45.35
 Sid T in room 14 42 34.06
 Interval 15 29 11.29
 Radiation 2 32.22
 G R. T 15 26 39.07

Moon 15^m 23^h 43^m 01^s 59 - 5^h 18' 10" 5
 Moon 1^m 19612 15.349
 26.6512 + 5 227 + 6 49.1
 Tabular place 23^h 43^m 53^s 86 - 5^h 11' 21" 4

Moon's parallel 57 13.3
 Scindium 15 37.2

Formation of Normals

	ab		ac		bc
1	- 0.67	+	23.2	-	140.0
2	- 0.00	+	0.0	-	52.7
3	+ 1.35	+	7.3	+	21.0
4	+ 1.91	+	16.6	+	11.5
5	+ 0.56	+	16.2	+	23.0
6	- 0.00	+	4.0	-	0.0
7	- 1.35	-	1.14	+	43.0
8	- 1.91	+	65.0	-	45.0
9	- 1.85	+	15.1	-	24.0
	- 1.96	+	179.2	-	163.2

$$[ac] = -10.67 \quad [aa] = +1899$$

$$[bc] = -379 \quad [bb] = +17.98 \quad [cc] = -1$$

pt	pos. L	resid
1	170.5	+28
2	180.0	-6
3	199.2	-23
4	235.2	+6
5	261.8	-56
6	270.0	+23
7	290.7	+80
8	304.7	-27
9	327.8	-21

MC1376 Moon's Center

1913 May 31

25

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	180000	+0.3347	-8	0.1115	4.1143	+70
2	176653	0.0000	-8	0.0000	4.1099	+26
3	170000	-0.6653	-7	0.4436	4.1062	-11
4	160000	-1.6653	-4	2.7746	4.1063	-10
5	156609	-2.0044	-1	4.0180	4.0992	-81
6	156387	-2.0266	+0	4.1071	4.1071	-2
7	157672	-1.8981	+3	3.6013	4.1133	+60
8	160000	-1.6653	+4	2.7719	4.1034	-39
9	165868	-1.0785	+6	1.1619	4.1059	-14
Mean = 4.1073						

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	202848	-2.0000	-7	4.0028
2	202582	-2.0266	-7	4.1099
3	203717	-1.9131	-7	3.6626
4	211312	-1.1536	-4	1.3317
5	220000	-0.2848	-1	0.0812
6	222848	0.0000	+0	0.0000
7	230000	+0.7152	+3	0.5120
8	234383	+1.1535	+4	1.3375
9	240000	+1.7152	+6	2.9440

Approximate Center

$x = 16.0$

$y = 21.1312$

23.4383

44.5695

Mean = 22.2848

$y - \text{mean} = 20.2582$

$R = 2.0266$

$R - \text{mean} = 15.6387$

Mean $x = 17.6653$

$$\text{Assume } \begin{cases} x_0 = 17.6653 \\ y_0 = 22.2848 \end{cases}$$

MC1376 known Center

1913 May 31

25

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)$	$O - C$
1	180000	+03347	-8	01115	41143	+70
2	176653	00000	-8	00000	41099	+26
3	170000	-06653	-7	04436	41062	-11
4	160000	-16653	-4	27746	41063	-10
5	156609	-20094	-1	40180	40992	-81
-6	156387	-20266	+0	41071	41071	-2
7	157672	-18981	+3	36013	41133	+60
8	160000	-16653	+4	27719	41034	-39
9	165868	-10785	+6	11619	41059	-14
Mean				41073		

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	202848	-20000	-7	40028
2	202582	-20266	-7	41099
3	203717	-19131	-7	36626
4	211312	-11536	-4	13317
5	220000	-02848	-1	00812
6	222848	00000	+0	00000
7	230000	+07152	+3	05120
8	234383	+11535	+4	03375
9	240000	+17152	+6	29440

Approximate Center

$$x = 16.0$$

$$y = 21.1312$$

$$23.4583$$

$$44.5695$$

$$\text{mean} = 22.2848$$

$$y - \text{mean} = 20.2582$$

$$R = 20.266$$

$$1 - \text{min} = 15.6387$$

$$\text{mean } x = 17.6653$$

$$\left\{ \begin{array}{l} X = 17.6653 \\ Y = 22.2848 \end{array} \right.$$

MC1376 Moon's Center Conditional Equations

	a	b	c	0		c	0 - c
1	+0.33	-2.00	+1	= +70	+10 - 4 + 36 =	+42	+28
2	4.00	-2.03	+1	= +26	0 - 4 + 36 =	+32	-6
3	-0.67	-1.91	+1	= -11	-20 - 4 + 36 =	+12	-23
4	-1.67	-1.15	+1	= -10	-50 - 2 + 36 =	-16	+6
5	-2.00	-0.28	+1	= -81	-60 - 1 + 36 =	-25	-56
6	-2.03	+0.00	+1	= -2	-61 + 0 + 36 =	-25	+23
7	-1.90	+0.72	+1	= +60	-57 + 1 + 36 =	-20	+80
8	-1.67	+1.11	+1	= -39	-50 + 2 + 36 =	-12	-27
9	-1.08	+1.72	+1	= -14	-32 + 3 + 36 =	+7	-21

Normal Equations

$$\begin{aligned}
 +18.99 - 1.96 - 10.67 &= +179 \\
 -1.96 + 17.98 - 3.79 &= -163 \\
 -10.67 - 3.79 + 9.00 &= -1
 \end{aligned}$$

$$\begin{aligned}
 +137 - 138 \\
 \text{Average} &= 30
 \end{aligned}$$

$$\begin{aligned}
 \frac{\Delta x}{\Delta a} &= +1.29
 \end{aligned}$$

$$\begin{aligned}
 +1.96 - 0.20 - 1.10 &= +18\frac{1}{2} \\
 +10.67 - 1.10 - 5.985 &= +100\frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 +17.78 - 4.89 &= -144\frac{1}{2} \\
 -4.89 + 3.015 &= +99\frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 \frac{\Delta y}{\Delta a} &= +0.58
 \end{aligned}$$

$$\begin{aligned}
 +4.89 - 13.5 &= -40 \\
 +1.66 &= +59\frac{1}{2}
 \end{aligned}$$

$$L = +36$$

$$\begin{aligned}
 -7.93 + 4.89 &= +161 \\
 +9.85 &= +17\frac{1}{2}
 \end{aligned}$$

$$b = +2$$

$$\begin{aligned}
 +5.51 + 1.96 - 4.65 &= +\frac{1}{2} \\
 -50.55 - 17.98 + 42.70 &= -5
 \end{aligned}$$

$$\begin{aligned}
 +24.50 &= 1532 = +179\frac{1}{2} \\
 -52.51 &+ 38.91 = -168
 \end{aligned}$$

$$\begin{aligned}
 -20.70 &+ 1532 = -66 \\
 +3.80 &= +113
 \end{aligned}$$

$$a = +30$$

NIC1376 Moon's Center Conditional Equations

	a	b	c	0		c	0 - c
1	+0.33	-2.00	+1.0	+7.0	+1.0	-4.36	+4.2
2	0.00	-2.03	+1.0	+2.6	0	-4.36	+3.2
3	-0.67	-1.91	+1.0	-1.1	-2.0	-4.36	+1.2
4	-1.67	-1.15	+1.0	-1.0	-5.0	-2.36	-1.6
5	-2.00	-0.28	+1.0	-8.1	-6.0	-1.36	-2.5
6	-2.03	+0.00	+1.0	-2	-6.1	+0.36	-2.5
7	-1.90	+0.72	+1.0	-6.0	-5.7	+1.36	-2.0
8	-1.67	+1.15	+1.0	-3.9	-5.0	+2.36	-1.2
9	-1.08	+1.72	+1.0	-1.4	-3.2	+3.36	+7

Normal Equations

+137-138

Average = 30

$$\begin{aligned}
 +18.99 - 1.96 - 1.067 &= +1.79 \\
 -1.96 + 1.798 - 3.79 &= -1.63 \\
 -1.067 - 3.79 + 9.00 &= -1
 \end{aligned}$$

$$\begin{aligned}
 +1.96 - 0.20 - 1.10 &= +1.8 \frac{1}{2} \\
 +1.067 - 1.10 - 5.985 &= +1.00 \frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 +17.78 - 4.89 &= -1.44 \frac{1}{2} \\
 -4.89 + 3.015 &= +9.9 \frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 +4.89 - 1.35 &= -4.0 \\
 +1.66 &= +5.9 \frac{1}{2}
 \end{aligned}$$

C = +36

$$\begin{aligned}
 -7.93 + 4.89 &= +1.61 \\
 +9.85 &= +1.7 \frac{1}{2}
 \end{aligned}$$

b = +2

$$\begin{aligned}
 +5.51 + 1.96 - 4.65 &= + \frac{K_2}{5} \\
 -50.55 - 1.798 + 42.70 &= -
 \end{aligned}$$

$$\begin{aligned}
 +24.50 &= 15.32 = +1.79 \frac{1}{2} \\
 -52.51 &+ 38.91 = -1.68
 \end{aligned}$$

$$\begin{aligned}
 -20.70 &+ 15.32 = -6.6 \\
 +3.80 &= +1.13
 \end{aligned}$$

a = +30

MC1376

Moon's Mean Position (1911.0)

$$X_0 = 17.6653^{\circ}$$

$$Y_0 = 22.2848^{\circ}$$

$$\pm a = +15^{\circ}$$

$$\pm b = +1^{\circ}$$

$$17.6668^{\circ}$$

$$22.2849^{\circ}$$

$$\text{From Prelim Red. } X = 18.3093^{\circ}$$

$$Y = 25.0407^{\circ}$$

$$\text{Plate Const. } ax = +3$$

$$+1$$

$$by = +16$$

$$+1$$

$$c = +10$$

$$+1$$

$$18.3090$$

$$25.0406$$

$$z = +0.3090^{\circ}$$

$$n = +3.0406$$

$$\log 5 = 9.48996^{\circ}$$

$$\log 8 = 9.99769^{\circ}$$

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

$$\log \tan \delta = 9.0192^{\circ}$$

$$53 = 8.9816^{\circ}$$

$$70 = 5.0542^{\circ}$$

$$0 = 0^{\circ}$$

$$(K-A) = 0.98503^{\circ}$$

$$m =$$

$$K-A + 9.66$$

$$\log \mu_0 = 0.48296$$

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

$$A = 23^{\circ} 42' 27''$$

$$(K-U) = 3.15181^{\circ}$$

$$\mu_0 = 23^{\circ} 42' 36.66''$$

$$\delta - D = +23^{\circ} 38.4''$$

$$\text{Red} = +2.92$$

$$D = -6^{\circ} 17' 17''$$

$$\mu = 23^{\circ} 42' 39.58''$$

$$\delta_0 = -5^{\circ} 53' 38.6''$$

$$\text{Red} = +17.0$$

$$\delta = -5^{\circ} 53' 21.6''$$

MC1376

Moon's Mean Position (19110)

$$X_0 = 17.6653$$

$$Y_0 = 22.2848$$

$$\frac{1}{2}a = +1.5$$

$$\frac{1}{2}b = +1$$

$$17.6668$$

$$22.2849$$

From Prelim Red. X: 18.3093

Y: 25.0407

Plate Const. $\alpha_x = +3$

+1

 $\log = 1.16$

+1

 $c = +10$

-1

$$18.3090$$

$$25.0406$$

$$\xi = +0.3090$$

$$\eta = +3.0406$$

$$\log 5 = 9.48996$$

$$\log 8 = 9.99767$$

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

$$\log \tan \delta = 9.0192$$

$$8.9816$$

$$-7.0 = 8.0542$$

$$\eta = 0$$

$$(A-A) = 0.98503$$

$$A-A + 9.66$$

$$\log \eta_0 = 0.48296$$

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

$$A \quad 23 \quad 42 \quad 27$$

$$(A-U) = 3.15184$$

$$\eta_0 \quad 23 \quad 42 \quad 36.66$$

$$\delta - D = +23^\circ 38' 4''$$

$$\text{Red} = +292$$

$$D = -6 \quad 17 \quad 17$$

$$X = 23 \quad 42 \quad 39.58$$

$$\delta_0 = -5^\circ 53' 38.6''$$

$$\text{Red} = +17.0$$

$$S = -5 \quad 53 \quad 21.6$$

1376

Red ad loannaph.

$$S = -5^{\circ} 54'$$

$$H + \alpha \quad 2 \quad 55 = 43^{\circ} 45'$$

$$H \quad 3 \quad 12$$

$$a \quad 23 \quad 43$$

$$G \quad 21 \quad 51$$

$$G + \alpha \quad 21 \quad 34 = 323^{\circ} 30'$$

$$l \cos(G + \alpha) \quad 9.9052^{\vee}$$

$$l \quad 1.1810$$

$$\sin \quad 9.7744^m$$

$$\tan S \quad 9.0139^m$$

$$8.8239$$

$$8' \quad 1.0862$$

$$8 \quad 8.7932$$

$$l \quad +1.96$$

$$8 \quad +0.06$$

$$l \quad +0.90$$

$$+2.92^{\vee}$$

$$\log \cos \quad 9.9977$$

$$i \quad 0.7976$$

$$(i) \quad 0.7947$$

$$\sin S \quad 9.0115^m$$

$$\cos(H + \alpha) \quad 9.8587$$

$$h \quad 1.2892$$

$$\sin \quad 9.8398$$

$$\sec S \quad 0.0023$$

$$l \quad 5.5239$$

$$2' \quad 0.1594^m$$

$$h \quad 9.9552$$

$$8' \quad +12.20^{\vee}$$

$$l \quad -1.44$$

$$i \quad +6.23$$

$$+16.99^{\vee}$$

1376

Red ad brown apph.

$$S = -5^{\circ} 54'$$

$$H + a \quad 2^{\circ} \quad 55^{\circ} = 43^{\circ} 45'$$

$$H \quad 3 \quad 12$$

$$A \quad 23 \quad 43$$

$$G \quad 21 \quad 51$$

$$G + X \quad 21 \quad 34 = 33^{\circ} 30'$$

$$\log \cos i \quad 9.9977$$

$$i \quad 0.7970$$

$$(i) \quad 0.7947$$

$$h \cos(G+X) \quad 9.9052$$

$$h \quad 1.1810$$

$$\sin \dots \quad 9.7744$$

$$\cos S \quad 9.0139$$

$$88239$$

$$8 \quad 1.0862$$

$$8 \quad 8.7932$$

$$\begin{array}{r} f \quad +1.96 \\ 8 \quad +0.06 \\ h \quad +0.90 \\ \hline +2.92 \end{array}$$

$$\sin S \quad 9.0115$$

$$\cos(H+X) \quad 9.8157$$

$$h \quad 1.2892$$

$$\sin \dots \quad 9.8298$$

$$\cos S \quad 0.0023$$

$$88239$$

$$2' \quad 0.1594$$

$$h \quad 9.9552$$

$$8' \quad +1.220$$

$$h \quad -1.44$$

$$i \quad +6.23$$

$$+16.99$$

1376 Lunar Parallax

$$\begin{array}{rcl}
 \alpha' = 23^h & 42^m & 39.58^s \\
 \theta & 1 & 27 \quad 143 \\
 \delta - \alpha & +1 & 44 \quad 34.7 \\
 & + & 26^0 \quad 08' \quad 40'' \\
 & + & 9 \quad 22 \\
 & & 25 \quad 59 \quad 18
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.04630 \\
 \hline
 9.99957
 \end{array}$$

$$\begin{array}{rcl}
 \gamma = & 45 & 14 \quad 07 \\
 & -5 & 53 \quad 22.6 \\
 & 51 & 07 \quad 29
 \end{array}$$

$$\begin{array}{r}
 9.82640 \\
 8.22127 \\
 9.89127 \\
 0.14874 \\
 \hline
 8.08768
 \end{array}$$

$$\delta - \delta' = +42 \quad 04.2$$

$$\delta = -5 \quad 11 \quad 17.4$$

$$\text{Van Allen } \delta = -5 \quad 11 \quad 21.4$$

$$O - C \quad +4.0$$

$$\text{Red Dwarf } \delta \quad -0.3$$

$$O - C \quad +3.7$$

$$\delta' = -5^0 \quad 53' \quad 21''6$$

$$\Pi = 57' \quad 1.33$$

$$\begin{array}{r}
 9.86913 \\
 8.22127 \\
 9.64408 \\
 0.00178 \\
 \hline
 7.73626
 \end{array}$$

$$\begin{array}{rcl}
 \alpha - \alpha' & = & +18 \quad 43.80 \\
 & = & +1 \quad 14.92
 \end{array}$$

$$\alpha = 23 \quad 43 \quad 54.50$$

$$\alpha = 23 \quad 43 \quad 53.86$$

$$+0.64$$

$$-0.05$$

$$+0.59$$

1376 human Parallax

$$\alpha' = 23^h 42^m 39.58^s$$

$$0 \quad 1 \quad 27 \quad 143$$

$$G - \alpha = +1 \quad 44 \quad 34.7$$

$$+ \quad 26^m \quad 08^s \quad 40''$$

$$- \quad \quad \quad 9 \quad 22$$

$$25 \quad 59 \quad 18$$

$$995727$$

$$000000$$

$$004630$$

$$000357$$

$$\gamma = 45 \quad 14 \quad 075$$

$$-5 \quad 53 \quad 226$$

$$51 \quad 07 \quad 29$$

$$982640$$

$$822127$$

$$989127$$

$$0.14874$$

$$808768$$

$$S - S' = +42 \quad 04.2$$

$$S = -5 \quad 11 \quad 17.4$$

$$\text{Wavelength } S = -5 \quad 11 \quad 21.4$$

$$O - C \quad \quad \quad -4.0$$

$$\text{Red Wavelength } \quad \quad \quad -0.3$$

$$O - C \quad \quad \quad +3.7$$

$$\delta' = -5^m 53^s 21.6''$$

$$17 \quad 57' \quad 13.3''$$

$$986913$$

$$822127$$

$$964408$$

$$000178$$

$$773626$$

$$\alpha - \alpha' = +18 \quad 43.20$$

$$= +1 \quad 14.92$$

$$\alpha = 23 \quad 43 \quad 54.50$$

$$\alpha = 23 \quad 43 \quad 53.86$$

$$+0.64$$

$$-0.05$$

$$- +0.59$$

