

KG
11366
v.878

II

654
65
78
78

$$p_{rec} = t(p + \frac{st}{200} + \mu)$$

$$\xi = [8.50724] \sin(\alpha - A) \cos \delta + \frac{\xi(\xi^2 + \eta^2)}{391000}$$

$$\eta = [7.33115] \tan(\delta - D) + [7.0534] \xi^2 \tan \delta$$

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No. 18568

Harvard Lunar Plates,

Measures and Reductions,

Mary Fowler

Vol. II

<i>Plate no.</i>	<i>Date</i>	<i>Page.</i>
<i>.864</i>	<i>1911, Jan 15</i>	<i>1</i>
<i>865</i>	<i>1911 Jan 15</i>	<i>21</i>
<i>878</i>	<i>1911 Jan 17</i>	<i>42</i>
<i>879</i>	<i>1911 Jan 17</i>	<i>58</i>

*1945
27230*

MC 864 -

1912 Oct 2.

1

Comparison Stars.

1912 Oct 5.

L Cape no. mag.
 1263 6.9
 $x = 12.1$ $y = 31.4$
 R.A.
 C $9^h 4^m 36.24^s$ ✓
 L 36.24^s ✓
 E 36.23^s ✓
 Mean 36.24^s ✓
 Prec. to 1911 $+ 37.98^s$ ✓
 1911 $9^h 5^m 14.22^s$ ✓
 A $9^h 8^m 46^s$ ✓
 $\alpha - A = -3$ 31.78^s ✓
 $\sin(\alpha - A) = -211.77^s$ ✓

\log 2.32587 ✓
 $\log \delta$ 9.96605 ✓

$\log \xi_0$ 0.79916 ✓

$\xi_0 = -6.2974^s$ ✓
 $\xi_1 = -19^s$ ✓

$\xi = 11.7007^s$ ✓

$\eta = 12.0512^s$ ✓

$\eta - \xi = +35.05^s$ ✓

Decl.
 C $+22^\circ 24' 10.2''$ ✓
 L $09.5''$ ✓
 E $08.8''$ ✓
 Mean $09.5''$ ✓
 Prec. to 1911 -2 $39.0''$ ✓
 1911 $+22^\circ 21' 39.0''$ ✓
 D 21 08 $52.1''$ ✓
 $\delta - D = +1$ 12 $38.5''$ ✓
 $\tan(\delta - D) = +4359.1''$ ✓

\log 3.63940 ✓
 $\log \eta_0$ 0.97055 ✓

$\log \tan \delta$ 9.6142 ✓

$2 \log \xi_0$ 1.5983 ✓

$\log \eta_1$ 8.2659 ✓

$\eta_0 = +9.3445^s$ ✓

$\eta_1 = +184^s$ ✓

$\eta = 31.3629^s$ ✓

$y = 31.41090^s$ ✓

$y - \eta = +461^s$ ✓

MC 864.

1912 Oct. 2.

Comparison Stars.

1912 Oct. 5.

Γ no. mag.
 Cape 1263 6.1
 $x = 12.1$ $y = 31.4$
 R.A.
 C $9^h 4^m 36.24$
 L 36.24
 E 36.23
 Mean 36.24
 Prec. to 1911 $+ 37.98$
 1911 $9^h 5^m 14.22$
 A $9^h 8^m 46$
 $x-A = -3$ 31.78
 $\sin(A-A) = -211.77$

\log $2.32587w$
 $\log \delta$ 9.96605

$\log \zeta_0$ $0.79916w$

$\zeta_0 = -6.2974$
 $\zeta_1 = -19$

$\zeta = 11.7007$

$\pi = 12.0512$

$\pi - \zeta = +3.505$

Decl. $0^h 4^m 10.2$
 C $+22^\circ 24' 10.2$
 L $23' 18.9$ 09.5
 E $23' 52$ 08.8
 Mean 09.5
 Prec. to 1911 -2 39.0
 1911 $+22^\circ 21' 39.2$
 D $21' 08$ $52.$
 $\delta - D = +1$ 12 38.5
 $\tan(\delta - D) = +4359.1$

\log 3.63940
 $\log \eta_0$ 0.97055

$\log \tan \delta$ 9.6142

$2 \log \zeta_0$ 1.5983

$\log \eta_1$ 8.2659

$\eta_0 = +9.3445$

$\eta_1 = +184$

$\eta = 31.3629$

$y = 31.41090$

$y - \eta = +461$

Companion Stars.

2. Astronomischen Gesellschaft (1875)

A. 9	no.	mag.	$x=16.5$ $y=16.2$	Dec.	
R.A.	3683	9.8		$+20^{\circ} 32' 04''$	
Prec. 1911	$9^h 05^m$	$45^s 43$		$- 8' 45.3$	
1911	$9^h 07^m$	$48^s 36$		$+20^{\circ} 23' 18.9$	
A	9	8	46	D 21 08 52	
$\alpha - A$	-	0	57.64	$8 - D + 1 12 38.5$	
$\sin(\alpha - A) =$	-		57.64	$\tan(\delta - D) =$	
log			1.76072	$8 - D = - 45 33.1$	
cos			9.97191	$\tan(\delta - D) = - 27 33.3$	
$\log \delta$			0.23987	log	3.43669
				$\log \eta$	0.76784
$\log \delta$			-1.7373	log tan	9.5702
$\log \delta$			16.2625	$2 \log \delta$	0.4797
$\log \delta$			16.4940	log η	7.1033
$\alpha - \delta$			+ 2315	η_0	-5.8592
				η_1	+ 13
				η	+16.1421
				η	+16.1595
				η	+ 174

Companion Stars.

2. Astronomischen Gesellschaft (1875)

α 3 no. mag. $x=16.5$ 3683 9.8 $y=16.2$ R.A. $9^h 05^m 45.43$ Sec. $+20^{\circ} 32' 04''$ Pec. 1911 $+2^m 07.93$ $-8' 45.3$ 1911 $9^h 7^m 48.36$ $+20^{\circ} 23' 18.9$

A 9 8 46.

D 21 08 52

 $\alpha - A - 0 57.64$ $8 - D + 1 12 38.5$ $\sin(\alpha - A) - 57.64$ $\tan(\delta - D) -$ $\delta - D = - 45 33.1$

log 1.76072 m

 $\tan(\delta - D) = - 27 33.3$

cos 9.97191

log 3.43669 m

5. 0.23987 m

 $\eta_0 0.76784 m$ $\beta_0 - 1.7373$ log tan $\delta 9.5702$ $\beta_1 - 2$ $2 \log \beta_0 0.4797$ $\beta 16.2625$ log $\eta_0 7.1033$ $\alpha 16.4940$ $\eta_0 - 5.8592$ $\alpha - \beta + .2315$ $\eta_1 + 13$ $\eta + 16.1421$ $\eta + 16.1595$ $\eta + 174$

MC 864

1911 Oct. 2.

3

Comparison Stars.

β	no.	mag.
C	1274	9.0
$\alpha = 22.2$	$\gamma = 16.6$	
R.A. C	9 ^h 18 ^m	24.12 ^v
L		24.21 ^v
E		24.12 ^v
Mean		24.15 ^v
Preced. to 1911		+ 37.49 ^v
1911	9 16	0 1.64 ^v
A	9 08	46 ^v
$\alpha - A$	+	2 15.64 ^v
$\sin(\alpha - A)$	+	135.64 ^v
\log	2.13239 ^v	
" $\cos \delta$	9.97175 ^v	
" δ_0	0.61138 ^v	
δ_0	+ 4.0868 ^v	
δ_1	+	5 ^v
δ	42.0873 ^v	
δ_2	22.3225 ^v	
$\alpha - \delta$	+	2352 ^v

Decl.		
C	+ 20° 29'	21.6 ^v
L		21.7 ^v
E		21.6 ^v
Mean		21.6 ^v
Preced. to 1911	- 2	43.0 ^v
1911	+ 20° 26'	38.6 ^v
D	21 08	52 ^v
$\delta - D$	-	42 13.4 ^v
$\tan(\delta - D)$	-	2533.5 ^v
\log	3.40373 ^v	
" η_0	0.73488 ^v	
$\log \tan \delta$	9.5714 ^v	
" δ_0	1.2228 ^v	
" η_1	7.8476 ^v	
η_0	- 5.4310 ^v	
η_1	+	70 ^v
η	- 16.5760 ^v	
γ	- 16.5480 ^v	
$\gamma \delta \eta$	-	280 ^v

Chkd
with A.S.

MC 864

1911 Oct 2.

3

Comparison Stars.

3/ no. mag.
C 1274 9.8

$\alpha = 22.2$ $\gamma = 16.6$
R.A. C $9^h 10^m 24.17$

L 24.21

E 24.12

Mean 24.15

Prect to 1911 + 37.49

1911 9 10 0 1.64

A 9 08 46.

$\alpha - A + 2$ 15.64

$\sin(\alpha - A) +$ 135.64

\log 2.13239

$\cos \delta$ 9.97175

Σ 0.61138

Σ +4.0868

Σ + 5

Σ 42.0873

Σ 22.3275

$\alpha - \Sigma +$ 2352

Rect.

C + 20° 29' 21.6

L 21.7

E 21.6

Mean 21.6

Prect to 1911 - 2 43.0

1911 + 20° 26' 38.6

D 21 08 52

$\delta - D -$ 42 13.4

$\tan(\delta - D) -$ 25 33.5

\log 3.40373

$\log \eta_0$ 0.73488

$\log \tan \delta$ 9.5714

$\log \Sigma$ 1.2228

$\log \eta_1$ 7.8476

η_0 -5.4310

η_1 + 70

η - 16.5760

η - 16.5480

η - 780

MC 864

Comparison Stars

1912 Oct 20.

4

1912 Oct 5

Astronomischen Gesellschaft (1875)

	no.	mag.
A.G.	3717	8.4
R.A.	9 ^h 11 ^m	29.74
Pack 1911 +	2 ^m	3.10
1911	9 ^h 13 ^m	32.84
A	9	8 46
$\alpha - A$	+	4 46.84
$\sin(\alpha - A)$	+	286.82

log	2.45761
" cos	9.96960
" δ_0	0.93445

δ_0	+	8.5990
δ_1	+	16

δ	26.6006
α	26.8788

$$\alpha - \delta + 2782$$

$\alpha = 26.9$	$y = 22.3$	v
Decl. + 21°	20 ^m 19.2	v
-	8, 57.6	v
+ 21°	11, 21.6	v
δ	21 08 52	v
$\delta - \delta$ +	2 29.6	v
$\tan(\delta - \delta)$ +	149.6	v

log	2.17493
" η_0	4.50608

log $\tan \delta$	9.5884
" δ_0	1.8689
" η_1	8.5107

η_0	+ 0.3207
η_1	+ 324
η	22.3531
y	22.2868

$$y - \eta = - 663$$

MC 864

Comparison Stars

1912 Oct 2.

1912 Oct 5

Astronomischen Gesellschaft. (1875)

	no.	mag.
A.S.	2717	8.4
R.A.	9 ^h 11 ^m	29.74
Preh 1911 + 2 ^m		3.10
1911	9 ^h 13 ^m	32.84
A	9	8 46
x-A	+	4 46.84
sin(x-A)	+	286.82

$$\log 2.45761$$

$$\cos 9.96961$$

$$3.0. 0.93446$$

$$3.0. + 8.5992$$

$$3.1. + 1.6$$

$$3.2. 26.6008$$

$$x 26.8788$$

$$x-3 + 2780$$

$$x = 26.9 \quad y = 22.3$$

$$\text{Decl.} + 21^{\circ} 20' 19.6''$$

$$+ 21^{\circ} 11' 21.6''$$

$$+ 21^{\circ} 08' 52.6''$$

$$8-D + 2 29.6$$

$$\tan(8-D) + 149.6$$

$$\log 2.17493$$

$$\eta_0 4.50608$$

$$\log \tan \delta 9.5884$$

$$3.0. 1.8689$$

$$\eta_1 8.5107$$

$$\eta_0 + 0.3207$$

$$\eta_1 + 324$$

$$\eta 22.3531$$

$$y 22.2868$$

$$y-\eta - 663$$

MC 864

Comparison Stars.

1912 Oct. 2.

5.

1912 Oct 5.

ζ		no.	mag.	$x = 32.9$ $y = 27.6$	
C	1288		8.5	Decl.	
R.A.				+ 21° 55'	26" 5"
C	9 ^h 16 ^m	17.57	✓		26.1
L		17.58	✓		25.5
E		17.61	✓		26.0
mean		17.59	✓		46.8
Preced to 1911	+	37.66	✓	1911 + 21° 52'	39.2
1911	9 ^h 16 ^m	55.25	✓	D	21 08 52
A	9	46.	✓	8-D +	43 47.2
X-A	+	8	9.25	Tan(S-D) +	2627.3
sin(X-A) +		48.9.15	✓		
log		2.68944	✓	log	3.41951
.. cos δ		9.96754	✓	" η_0	0.75066
.. δ_0		1.16422	✓	" tan δ	9.6037
δ_0 +	14.5-95.5		✓	2.. δ_0	2.3284
δ_1 +	86		✓	" η_1	8.9855
δ	32.6041		✓	η_0 +	5.6320
δ	32.9274		✓	η_1 +	967
$x - \delta$ +	3233		✓	η	27.7287
				y	27.6195
				$y - \eta$	- .1092

checked
with A. 9.

MC 864

1912 Oct. 2.

5.

Comparison Stars.

1912 Oct 5.

ϕ		no.	mag.		
C	1288	8.3		$\alpha = 32.9$	$\delta = 27.6$
R.A.				Decl.	
C	9 ^h 16 ^m	17.57		+ 21° 55'	26" 5
L		17.58			26.1
E		17.61			25.5
mean		17.59			26.0
Pre C 1911	+	37.66		- 2	46.8
1911	9 ^h 16 ^m	55.25		1911 + 21° 52'	39.2
A	9	46.		D	21 08 52
X-A	+	8	4.25	$\delta - D$ +	43 47.2
sin(X-A)	+		489.15	Tan($\delta - D$) +	2627.3

log 2.68944
 cos δ 9.96754
 δ_0 1.16422

δ_0 + 14.5-95.5
 δ_1 + 86

δ 32.6041
 δ 32.9274

$\alpha - \delta$ + 3233

log 3.41951
 " η_0 0.75066

" Tan δ 9.6037
 " δ_0 2.3284
 " η_1 8.9855

η_0 + 5.6320
 η_1 + 967
 η 27.7287

δ 27.6195

$\delta - \eta$ - 1092

MC 864

1912 Oct. 2.

6.

Comparison Stand.
measures.

1	d	y	N	d	y	N
12.1	16420		15580	16110		16055
31.4	12330	30	9680	6615	18	5538
	28		80	21		44
	08		90	08		60
	<u>31.4086</u>		<u>31.4094</u>	<u>12.0510</u>		<u>12.0515</u>
2	16990		15161	16950		14670
16.5	15390	98	6755	11888	85	9730
16.2	90		50	84		28
	88		58	46		70
	<u>16.1597</u>		<u>16.1593</u>	<u>16.4938</u>		<u>16.4941</u>
3	16010		14900	15668		15378
16.6	10522	24	10380	8878	78	12150
	20		78	80		50
	96		00	52		84
	<u>16.5481</u>		<u>16.5479</u>	<u>22.3222</u>		<u>22.3228</u>
4	17239		15800	17711		17580
26.9	14368	70	8668	16500	04	8798
22.3	72		63	02		00
	36		98	18		85
	<u>22.2868</u>		<u>22.2868</u>	<u>26.8790</u>		<u>26.8785</u>
5	17165		15530	15730		17211
32.9	10970	66	11715	15002	00	7938
3.8	68		15	00		34
27.6	65		15	30		10
	<u>27.6197</u>		<u>27.6193</u>	<u>32.9271</u>		<u>32.9276</u>

MC 864

1912 Oct. 7.

6.

Comparison Stars
measures.

$\frac{1}{12.1}$ 31.4	d	y	N	d	N
	16420		15580	16110	16055
	12330	30	9680	6615	5538
	28		80	21	44
	08		90	08	60
	<u>31.4086</u>		<u>31.4094</u>	<u>17.0510</u>	<u>17.0515</u>
2/	16990		15161	16950	14670
16.5	15390	08	6755	11888	9730
16.2	90		50	84	28
	88		58	46	70
	<u>16.1597</u>		<u>16.1593</u>	<u>16.4938</u>	<u>16.4941</u>
3/	16010		14900	15668	15378
16.6	10522	24	10380	8878	12150
	20		78	80	50
	96		00	52	84
	<u>16.5481</u>		<u>16.5479</u>	<u>22.3222</u>	<u>22.3228</u>
4/	17239		15800	17711	17580
26.9	14368	70	8668	16500	8798
22.3	72		63	02	00
	36		98	18	85
	<u>22.2868</u>		<u>22.2868</u>	<u>26.8790</u>	<u>26.8785</u>
5/	17165		15530	15730	17211
32.4	0970		11715	15002	7938
3.8	68	6	15	00	34
27.6	65		15	30	10
	<u>27.6197</u>		<u>27.6193</u>	<u>32.9271</u>	<u>32.9276</u>

MC 864

1912 Oct. 2

7

Points on Moon's Limb
Measured:

1/ ✓	d	y	N
18.0			
22.0	1087070		10173
	7568		1011010
	10810		0098

21.993921.9931

2/ ✓	15370	15279
17.0	876568	1189589
21.7	5862	9502
mining	75	85

possibly on
terminator.21.661021.6614

3/ ?	14740	15632
17.0	599690	1434642
	9280	4542
25.8	40	40

possibly on
terminator.

maxing.

25.874525.8711

1912 Oct 3 (m)

4/ ✓	15868	15269
18.0	1042022	1068890
25.5	1228	8086
	70	75

25.544725.5414

5/ ✓	d	N
18.0	1064850	8410
22.0	3548	828268
	10538	6880

6/ ✓	18.0107	18.0136
18.8	16480	17082
23.0	1470800	887072
	0095	7280
	92	90

18.821918.8215

MC 864

1912 Oct 2

7

Points on Moon's limb
measured.

1/ 18.0 d
22.02 1087070
7568
10810

21.9939

2/ 15370
17.0 876568
21.7 5862
75

21.6610

3/ 14740
17.0 599690
25.8 9280
40

25.8245

4/ 15868
18.0 1042072
25.5 1228
70

25.5447

5/ 18.02
22.0

6/ 18.8
23.0

N d
1017300
1011010
0098

21.9931

15279
1189589
9504
85

21.6614

15632
1434642
4542
40

25.8711

15269
1068890
18086
75

25.5414

d
1064850
3548
10538

18.0107

16480
1470800
0095
492

18.8219

N d
16473
695265
8459
78

18.9521

possibly on
terminator.

18.5701

possibly on
terminator.

1912 Oct 3 (2)

18.9665

15910

1427872

7522

N
8410
828268
6880

18.0136

17082
887072
7280
90

18.8215

864

Points on Moon's limb.
measures

1912 Oct 2.

8

1912 Oct 3 (v)

✓
7/18.9
24.0

x
d
15000
1452420
2220
02

n
16473
695265
5458
78

18.952218.9521

✓
8/18.5
25.0

16030
1172035
2530
40

16550
1085848
6660
66

18.569418.5701

✓
9/18.9 max in x
23.8

16708
1636470
6070
26

15448
578886
9488
54

18.965718.9665

10/ Very fine scratch no. 1 (North)
17.2 16050 16140 696870 15910
25.8 749502 1468500 7060 1427878
9204 9000 41 7583
50 50 20

25.855225.855217.162617.1634

11/ Fine scratch no. 2. (South)
17.8 15514 14890 16653 15632
21.8 650400 1391002 1502828 725058
17.9 1100 0014 3030 5660
21 22 00 58 42

21.73901721.73901517.837517.8584

664

Points on Moon's limb.
measures

1912 Oct 2.

8

1912 Oct 3 (v)

7/
19.9
24.0

d

W

15000

16473

1452020

695265

2270

5458

02

78

18.952218.9521

16030

16550

1172035

1085848

2530

6660

40

66

18.569418.5701

9/

18.9 max in x

23.7

16708

15448

1636470

578886

6070

9488

26

54

18.965718.9665

10 Very fine scratch no. 1 (North)

15342

17.2

16050

16140

696870

15910

25.8

749502

1468500

7060

1427878

9204

9000

41

7583

50

50

20

25.855225.855217.162617.1634

11/

Fine scratch no. 2. (South)

17.4

15514

14890

16653

15632

21.4

650400

1391002

1502828

725058

18.9

1100

0014

3030

5660

21

22

00

58

42

21
17.901721
17.901517
17.837517
17.8584

MC 864

1912 Oct. 3,

9

Points on moon's limb
measures.

12/ Course scratch (unnecessary)

$\sqrt{1.7=4}$	d	N	d	N
17.302	16900	13452	16438	15765
	977070	1057082	975252	1245053
	6574	7280	5245	5052
	10	66	30	70
$\sqrt{1}$		$\sqrt{1}$	$\sqrt{1}$	$\sqrt{1}$
<u>17.7137</u>		<u>17.7118</u>	<u>17.3318</u>	<u>17.3316</u>

13.

MC 864

Points on Moon's limb

1912 Oct. 3,

9

Mean measures. reduction of comp. stars

12 Course scratch (un necessary)

21.7-4	d	164740	N	161590	d	7.48	N
17.3-2		16900	33	13452		16438	15765
		977070	1057082		975252		1245053
		6570	7280		5248		5052
		10	66		30		70
21		17.7137		21		17.7118	
17				17		21.3318	
							17.3316

13.

41.2-5	40.2-5
174044	48276
1181282	3741392
2-8	6-14

A 9^h 48^m 46^s { center of plate
 D 21^h 03^m 52^s

1912 Oct. 12

Preliminary Reduction

Jan. 2-3 -784 -1059

1 +2505-2450 = +1055 -9

2 +2815-1260 = +1055 -4

3 +2327-1290 = +1037 -3

4 -2152-1738 = +1044 -5

5 +3233-2154 = +1079 -20

Sum -102555-1454 = -165042

3-4 +772 -1424

1 +461 + 928 = +1389 -35

2 +74 +1270 = +1344 +20

3 -222 +1213 = +991 +14

4 -642 +2067 = +1425 -18

5 1105232535 +1442 +19

Sum 23707612487 237550

MC 864

1912 Oct 3

10

Mean measured coordinates of comp. stars.

Star	x	y		
1	12.0512	31.4090	9 5 14	22 21 30
2	16.4940	16.1595	7 48	20 23 19
3	22.3225	16.5480	11 2	20 26 39
4	26.8788	22.2868	13 33	21 11 27
5	32.9274	27.6195	16 55	21 52 39
<hr/>				
	5110.6739	5114.0228	51 54 32	51 6 15 29
	22.1348	22.8046	9 ^h 10 ^m 54 ^s	21° 15' 06"
	31	465	- 2 8	- 6 14
	41348	40730		
	174044	48276		
	128.1788	32184		
	2 ^m 8 ^s	374.1390		
		6' 14"		

A = 9^h 08^m 46^s } center of plate.
 D = 21° 08' 52" }

1912 Oct 12.

Preliminary Reduction.

Star	x-3	-784	-1059	
1	+3505	-2450	= +1055	= -4
2	+2315	-1260	= +1055	= -4
3	+2352	-1290	= +1062	= +3
4	+2782	-1738	= +1044	= -15
5	+3233	-2154	= +1079	= +20
Mean	16.8555	-1854	-5	= 16.5642

	y-m	+772	-1424	
1	+461	+928	= +1389	= -35
2	+174	+1270	= +1444	= +20
3	-280	+1718	= +1438	= +14
4	-663	+2069	= +1406	= -18
5	-1092	+2535	= +1443	= +19
Mean	23.7676	+1298		23.7550

2.75

MC 864

1912 Oct 3.

10

Mean measured coordinates of comp. stars

Star	x	y		
1	17.0512	31.4090	9 5 14	22 21 30
2	16.4940	16.1595	7 48	20 23 19
3	22.3225	16.5480	11 2	20 26 39
4	26.8788	22.2868	13 33	21 11 27
5	32.9274	27.6195	16 55	21 52 39
<hr/>				
	5110.6739	5114.0228	51 54 32	51 6 15.29
	22.1348	22.8046	9 ^h 10 ^m 54 ^s	21° 15' 06"
	31	46.5	- 2 8	- 6 14
	41348	40230		
	124044	48276		
	128,1788	32184		
	2 ^m 8 ^s	374,1390		
		6' 14"		

A = 9^h 08^m 46^s } center of plate.
 D = 21° 08' 52" }

1912 Oct 12.

Star	x-z	-78 y	-1059
1	+3505	-2450	= +1055
2	+2315	-7260	= +1055
3	+2352	-1290	= +1062
4	+2782	-1738	= +1044
5	+3233	-2154	= +1079

	y-z	+77 x	-1424
1	+461	+928	= +1389
2	+174	+1270	= +1444
3	-280	+1718	= +1438
4	-663	+2069	= +1406
5	-1092	+2535	= +1443

MC 864.

1912 Oct 14.

11

	Star	a	b	$x - \bar{x}$	$y - \bar{y}$	
XY	5	32.43	+27.62	+c = +20	+8	+19
Xy	4	26.88	+22.29	+c = -15	-17	-18
Xy	3	22.32	+16.55	+c = +3	+11	+14
x	2	16.49	+16.16	+c = -4	+7	+20
xY	1	12.05	+31.41	+c = -4	-7	-35

Mean Equations

$$\begin{aligned}
 27.38 + 22.15 + c &= -2.67 & +5.00 \\
 14.27 + 23.78 + c &= -4.00 & -7.50 \\
 22.49 + 29.52 + c &= +8.00 & -8.00 \\
 21.90 + 18.33 + c &= -5.33 & +5.33
 \end{aligned}$$

$$\begin{aligned}
 13.11 - 1.63 &= +6.67 & +12.50 \\
 (p45) \quad 0.59 + 11.19 &= +13.33 & -13.33 \\
 0.59 - 0.07 &= +0.30 & +0.56 \\
 +11.26b &= +13.03 & -13.89 \\
 b &= +1.16 & -1.23 \\
 13.11a &= +6.67 + 1.89 = +8.56 & = +12.50 - 200 + 10.50 \\
 a &= +0.65 & a = +0.80
 \end{aligned}$$

+2.67	-4.00	+8.00	-5.33	+5.00	-7.50	-8.00	+5.33
-17.8	-9.3	-14.6	-14.2	-21.9	-11.4	-18.0	-17.5
-25.6	-27.6	-34.2	-21.2	+27.3	+29.3	+36.3	+22.5
-40.7	-40.9	-40.8	-40.7	+10.4	+10.4	+10.3	+10.3

c from $x - \bar{x}$ c from $y - \bar{y}$

Residuals

O - C ($x - \bar{x}$)

5	21 + 32 - 41 =	+12	+20	+8
4	17 + 26 - 41 =	+2	-15	-17
3	14 + 19 - 41 =	-8	+3	+11
2	11 + 19 - 41 =	-11	-4	+7
1	8 + 36 - 41 =	+3	-4	-7

5	26 - 34 + 10 =	+2	+19	+17	(y - \bar{y})
4	21 - 27 + 10 =	+4	-18	-22	
3	18 - 20 + 10 =	+8	+14	+6	
2	13 - 20 + 10 =	+3	+20	+17	
1	16 - 39 + 10 =	-19	-35	-16	

MC 864.

1912 Oct 14. 11

	Star	a	b	x-3	0-c	y-7
XY	⑤	32.93	+27.62	+c = +20	+8	+19
X4	4	26.88	+22.29	+c = -15	-17	-18
X4	3	22.32	+16.55	+c = +3	+11	+14
24	2	16.49	+16.16	+c = -4	+7	+20
2Y	①	12.05	+31.41	+c = -4	-7	-35

Mean Equations

$$\begin{aligned}
 27.38 + 22.15 + c &= -2.67 & +5.00 \\
 14.27 + 23.78 + c &= -4.00 & -7.50 \\
 22.49 + 29.52 + c &= +8.00 & -8.00 \\
 21.90 + 18.33 + c &= -5.33 & +5.33 \\
 13.11 - 1.63 &= +6.67 & +12.50 \\
 (0.45) \quad 0.59 + 11.19 &= +13.33 & -13.33 \\
 0.59 - 0.07 &= +0.30 & +0.56 \\
 +11.26b &= +13.03 & -13.89 \\
 b &= +1.16 & -123 \\
 13.11a &= +6.67 + 1.89 = +8.56 & = +12.50 - 200. + 10.50 \\
 a &= +0.65 & +0.80
 \end{aligned}$$

2.67	-4.00	+8.00	-5.33	+5.00	-7.50	-8.00	+5.33
-17.8	-9.3	-14.6	-14.2	-21.9	-11.4	-18.0	-17.5
-25.6	-27.6	-34.2	-21.2	+27.3	+29.3	+36.3	+22.5
-40.7	-40.9	-40.8	-40.7	+10.4	+10.4	+10.3	+10.3

c from x-3

c from y-7

Residuals

0-c (x-3)

5	21 + 32 - 41 =	+12	+20	+8
4	17 + 26 - 41 =	+2	-15	-17
3	14 + 19 - 41 =	-8	+3	+11
2	11 + 19 - 41 =	-11	-4	+7
1	8 + 36 - 41 =	+3	-4	-7

5	26 - 34 + 10 =	+2	+19	+17
4	21 - 27 + 10 =	+4	-18	-22
3	18 - 20 + 10 =	+8	+14	+6
2	13 - 20 + 10 =	+3	+20	+17
1	16 - 39 + 10 =	-19	-35	-16

(y-7)

MC 864

1912 Oct 25. 12

Seines etc.

Exp. to stars	1911. Jan 15	9 ^h 22 ^m 24 ^s	-	32 ^m 24 ^s
" " Moon		9 27 ^m 23.8 ^s	-	27 24.0 ^s
Clock				2 22.6

Howard S. T.

" " Long.

Gr. Sid. T.

Sid. T. in Moon

Sid. Interval

Reduction

Gr. m. T.

9	25	01.3 ^s
4	44	31.05 ^s
14	09	32.35 ^s
19	35	16.37 ^s
18	34	15.98 ^s
	3	02.55 ^s
18	31	13.43 ^s

From Ann Eph

Moon 18^hMotion in 1^m = 2.4467^s" " 31^m 24^s

Tabular place

R. A
9^h 06^m 55.93^s1 16 40^s9 08 12.33^s

Moon's par.

59' 13.5^s

" Semid.

16 09.8

Decl.

+21° 48'	54.1 ^s
-10.180 ^s	
-	5 17.9 ^s
+21 43	36.2 ^s

MC 864

1912 Oct 25. 12

Series etc.

Exp. to stars 1911 Jan 15 $9^h 22^m 24^s - 32^m 24^s$
 " " Moon $9^h 27^m 23.8 - 27^m 24.0$
 Clock $2 22.6$

Harvard S. T.

" Long.

Gr. Sid. T.

Sid. T. to Moon

Secd Interval

Reduction

Gr. m. T.

$9^h 25^m 01.3$
 $4^h 44^m 31.05$
 $14^h 09^m 32.35$
 $19^h 35^m 16.37$
 $18^h 34^m 15.98$
 $3^m 02.55$
 $18^h 31^m 13.43$

From Am Eph.

R. A

Decl.

Moon $18^h 9^m 06^s 55.93$ $+21^{\circ} 48' 54.1$ Motion in $1^m 2^s 4.45$ -10.180 • " " $31^m 22^s 16.48$ $- 5' 18.8$ Tabular place $9^h 08^m 12.38$ $+21^{\circ} 43' 33.3$ 36.2 Moon's par. $59' 13.5$ " Semid. $16' 09.8$

Point	Pos. \angle	Residuals
2	176.2	+26
12	167.0	-21
11	157.3	-78
1	147.2	+21
5	146.9	+71
6	111.3	-6
9	90.0	-4
7	83.7	-53
8	54.3	+23
4	332.8	+67
10	3518.2	-26
3	353.8	-24

MC 864

1912 Oct 31

13

Approximate center of Moon

$$x = 18 \quad y = 21.9935$$

$$y = 25.5430$$

$$\underline{47.5365}$$

$$\text{mean } y = 23.7682$$

$$x = 17.0 \quad y = 21.6612$$

$$\underline{25.8728}$$

$$\underline{47.5340}$$

$$\text{mean } y = 23.7670$$

$$\text{max } Y_0 = 23.7676$$

$$R = 2.1052$$

$$23.7676$$

$$y = \text{min} = 21.6612$$

$$R = 2.1064$$

$$R = 2.1058$$

$$X = \text{max} = 18.9661$$

$$R = 2.1058$$

$$\text{mean } X_0 = 16.8603$$

$$\text{center of moon } \begin{cases} X_0 = 16.8603 \\ Y_0 = 23.7676 \end{cases}$$

Point	x	$x - X$	Δx	$(x - X)^2$	$(x - X)^2 + (y - Y)^2$	$O - C$
1	18.0000	+1.1397	-0	1.2989	4.4467	+19
2	17.0000	+0.1397	-0	0.0195	4.4568	+120
3	17.0000	+0.1397	+	0.0195	4.4518	+70
4	18.0000	+1.1397	+	1.2989	4.4513	+65
5	18.0122	+1.1519	-	1.3269	4.4516	+68
6	18.8217	+1.9614	-	3.8469	4.4361	-87
7	18.9522	+2.0919	+	4.3761	4.4301	-147
8	18.5698	+1.7095	+	2.9224	4.4414	-34
9	18.9661	+2.1058	+	4.4349	4.4349	-99
10	17.1630	+0.3027	+	0.0916	4.4500	+52
11	17.8380	+0.9777	-	0.9559	4.4383	-65
12	17.3317	+0.4714	-	0.2222	4.4489	+41
13				Mean =	4.4448	+3

	y	$y - Y$	Δy	$(y - Y)^2$
1	21.9935	-1.7741	-1	3.1478
2	21.6612	-2.1064	-1	4.4373
3	25.8728	+2.1052	+1	4.4323
4	25.5430	+2.7754	+1	3.1524
5	22.0000	-1.7676	-1	3.1247
6	23.0000	-0.7676	0	0.5892
7	24.0000	+0.2324	0	0.0540
8	25.0000	+1.2324	+1	1.5190
9	23.7682	+0.0006	0	0.0000
10	25.8552	+2.0876	+1	4.3584
11	21.9016	-1.8660	-1	3.4824
12	21.7128	-2.0558	-1	4.2267

MC 864

1912 Oct 31

13

Approximate Center of Moon

$$x = 18 \quad y = 21.9935$$

$$y = 25.5430$$

$$47.5365$$

$$\text{mean } y = 23.7682$$

$$x = 17.0 \quad y = 21.6612$$

$$25.8728$$

$$47.5340$$

$$\text{mean } y = 23.7670$$

$$Y_0 = 23.7676$$

$$\text{max } Y = 25.8728$$

$$R = 21.052$$

$$23.7676$$

$$y = \text{min} = 21.6612$$

$$R = 21.064$$

$$R = 21.058$$

$$X = \text{max} = 18.9661$$

$$R = 22.1058$$

$$\text{mean } X_0 = 16.8603$$

$$\left\{ \begin{array}{l} X_0 = 16.8603 \\ Y_0 = 23.7676 \end{array} \right.$$

Point	x	$x - X$	Δx	$(x - X)^2$	$(x - X)^2 + (y - Y)^2$	$0 - \Delta$
1	18.0000	+1.1397	-0	1.2989	4.4467	+19
2	17.0000	+0.1397	-0	0.0195	4.4568	+120
3	17.0000	+0.1397	1	0.0195	4.4518	+70
4	18.0000	+1.1397	1	1.2989	4.4513	+65
5	18.0122	+1.1519	-	1.3269	4.4516	+68
6	18.8217	+1.9614	-	3.8469	4.4361	-87
7	18.9522	+2.0919	+	4.3761	4.4301	-147
8	18.5698	+1.7095	+	2.9224	4.4414	-34
9	18.9661	+2.1058	+	4.4349	4.4349	-99
10	17.1630	+0.3027	+	0.0916	4.4500	+52
11	17.8380	+0.9777	-	0.9559	4.4383	-65
12	17.3317	+0.4714	-	0.2222	4.4489	+41
13 +				mean =	4.4448	

	y	$y - Y$	Δy	$(y - Y)^2$
1	21.9935	-1.7741	-1	3.1478
2	21.6612	-2.1064	-1	4.4389
3	25.8728	+2.1052	+1	4.4323
4	25.5430	+2.7754	+1	3.1524
5	22.0000	-1.7676	-1	3.1247
6	23.0000	-0.7676	0	0.5892
7	24.0000	+0.2324	0	0.0540
8	25.0000	+1.2324	+1	1.5190
9	23.7682	+0.0006	0	0.0000
10	25.5552	+2.0876	+1	4.3584
11	21.9016	-1.8660	-1	3.4824
12	21.7128	-2.0558	-1	4.2267

Formation of normals.

No.	[aa]	[ab]	[an]	[bb]	[bn]
1	1.30	-2.02	+21.7	3.13	-33.6
2	0.02	-0.30	+16.8	4.45	-253.2
3	0.02	+0.30	+9.8	4.45	+147.7
4	1.30	+2.03	+74.1	3.17	+115.7
5	1.32	-2.04	+78.2	3.13	-120.4
6	3.84	-1.51	-170.5	0.59	+67.6
7	4.37	+0.48	-307.2	0.05	-33.8
8	2.92	+2.10	-58.1	1.51	-41.8
9	4.45	+0.00	-208.9	0.00	-0.0
10	0.09	+0.63	+15.6	4.37	+108.7
11	0.96	-1.83	-63.7	3.50	+121.6
12	0.22	-0.97	+19.3	4.24	-84.5
	20.81	-3.13	-572.9	+32.59	-6.6

$$[ac] = +13.33$$

$$[bc] = -2.91$$

$$[cn] = +3.00$$

MC864.

1912 Nov. 6.

14

Moon's Limb - Reductions

conditional Equations $\begin{matrix} a \\ b \\ c \end{matrix}$ 0 - C

1	+ 1.142	- 1.776	+ c	= +19	- 2	+ 21
2	+ 0.14	- 2.11	+ c	= +120	+ 94	+ 26
3	+ 0.14	+ 2.11	+ c	= +70	+ 94	- 24
4	+ 1.14	+ 1.78	+ c	= +65	- 2	+ 67
5	+ 1.15	- 1.77	+ c	= +68	- 3	+ 71
6	+ 1.96	- 0.77	+ c	= - 87	- 81	- 6
7	+ 2.09	+ 0.23	+ c	= - 147	- 94	- 53
8	+ 1.71	+ 1.23	+ c	= - 34	- 57	+ 23
9	+ 2.11	+ 0.00	+ c	= - 99	- 95	- 4
10	+ 0.30	+ 2.09	+ c	= +52	+ 78	- 26
11	+ 0.98	- 1.87	+ c	= - 65	+ 13	- 78
12	+ 0.47	- 2.06	+ c	= +41	+ 62	- 21

 Σ
 + 208
 - 212

normal equations

$$\begin{array}{rcl}
 +20.81 - 3.13 + 13.33 & = & -573 \\
 - 3.13 + 32.59 - 2.91 & = & -7 \\
 +13.33 - 2.91 + 12.00 & = & +3 \\
 \\
 + 3.13 - 0.47 + 7.01 & = & -86 \\
 +13.33 + 2.01 - 8.54 & = & +367
 \end{array}$$

Average 0 - C = 35

 $P.E. = 35 \times \sqrt{\frac{1}{12}} \times 0.84 = \pm 35$
 P.E. one equation.

$$\begin{array}{rcl}
 +32.12 - 0.90 & = & -93 \\
 - 0.90 + 34.6 & = & +370
 \end{array}$$

$$\frac{\Delta S}{\Delta n} = 2.11 \times +.03 = +.06$$

$$\begin{array}{rcl}
 + 0.90 - 0.03 & = & -3 \\
 + 34.3 & = & +367
 \end{array}$$

$$C = +107 \pm 19$$

$$\begin{array}{rcl}
 - 0.23 + 0.90 & = & +96 \\
 +31.89 & = & +3
 \end{array}$$

$$b = 0.1 \pm 6$$

$$\begin{array}{rcl}
 -14.81 + 3.23 - 13.33 & = & -3 \\
 + 3.23 - 0.71 + 2.91 & = & +1
 \end{array}$$

$$\begin{array}{rcl}
 + 60.0 + 0.10 & = & -576 \\
 + 0.10 + 31.88 & = & -6
 \end{array}$$

$$a = -96 \pm 14$$

$$\begin{array}{rcl}
 +216.5 - 32.59 + 138.8 & & \\
 + 213 & & + 136
 \end{array}$$

$$\frac{\Delta S}{\Delta n} = 2.11 \times -64 = -1.35$$

MCB64.

1912 Nov. 6.

14

Moon's limb - Reductions.

conditional Equations.

1	+1.14a	-1.77b+c	=	+19	-2	+21
2	+0.14	-2.11	+c	=	+120	+94 + 26
3	+0.14	+2.11	+c	=	+70	+94 - 24
4	+1.14	+1.78	+c	=	+65	-2 + 67
5	+1.15	-1.77	+c	=	+68	-3 + 71
6	+1.96	-0.77	+c	=	-87	-81 - 6
7	+2.09	+0.23	+c	=	-147	-94 - 53
8	+1.71	+1.23	+c	=	-34	-57 + 23
9	+2.11	+0.00	+c	=	-99	-95 - 4
10	+0.80	+2.09	+c	=	+52	+78 - 26
11	+0.98	-1.87	+c	=	-65	+13 - 78
12	+0.47	-2.06	+c	=	+41	+62 - 21

+208

Normal equations.

a b c

$$+20.81 - 3.13 + 13.33 = -573$$

$$- 3.13 + 32.59 - 2.91 = 7$$

$$+13.33 - 2.91 + 12.00 = +3$$

$$+ 313 - 0.47 + 7.01 = -586$$

$$-13.33 + 2.01 - 8.54 = +367$$

$$+3212 - 0.90 = -93$$

$$- 0.90 + 346 = +370$$

$$+ 0.90 - 0.03 = -3$$

$$+ 343 = +367$$

$$- 0.23 + 0.90 = +96$$

$$+ 3189 = +3$$

$$-1481 + 3.23 - 13.33 = -3$$

$$+ 323 - 0.71 + 2.91 = +1$$

$$+ 600 + 0.10 = -576$$

$$+ 0.10 + 3188 = -6$$

$$+2165 - 32.59 + 138.8$$

$$+ 213 + 136$$

Average a-c = 35

$$P.E. = 35 \times 0.04 \times 0.84 = \pm 35$$

P.E. one equation.

$$c = +10 \pm 19$$

$$b = 0.1 \pm 6$$

$$a = -96 \pm 14$$

$$\frac{48}{\Delta 2} = 2.11 \times -0.64 = -1.35$$

MC 864

1912 Nov. 14

15

$$\begin{aligned}
 X &= 16.8555 \pm 7 \\
 Y &= 23.7676 \pm 3 \\
 R &= 2.1085 \pm 5
 \end{aligned}$$

$$\begin{aligned}
 &\text{from parallax Red.} \\
 &= 16.5642 \\
 &23.7550
 \end{aligned}$$

$$\begin{aligned}
 &\text{from plate constants} \\
 &= 16.5639 \\
 &= 23.7544
 \end{aligned}$$

Reduction to standard coords. ✓

$$\begin{aligned}
 \xi &= -1.4361 \\
 \log \xi &= 0.15718m
 \end{aligned}$$

$$\xi_1 = 0$$

$$\begin{aligned}
 \xi_0 &= -1.4361 \\
 \log \xi_0 &= 0.15718m \\
 \cos \delta &= 9.96905 \\
 \cos \theta &= 8.50724
 \end{aligned}$$

$$\begin{aligned}
 \sin(\alpha - A) &= 1.68089m \\
 \sin(\alpha - A) &= -47.96
 \end{aligned}$$

$$\begin{aligned}
 \alpha - A &= -47.96 \\
 A &= 9^h 08^m 46.00
 \end{aligned}$$

$$\alpha = 9^h 07^m 58.04$$

$$\begin{aligned}
 \tan \delta &= 9.588 \\
 \log \tan \delta &= 0.314 \\
 \cos \theta &= 7.053 \\
 \log \eta_1 &= 6.955 \\
 \eta_1 &= +9
 \end{aligned}$$

$$\begin{aligned}
 \eta_0 &= +1.7535 \\
 \log \eta_0 &= 0.24390 \\
 \cos \theta &= 7.33115
 \end{aligned}$$

$$\begin{aligned}
 \log \tan(\delta - D) &= 29.1275 \\
 \tan(\delta - D) &= 818.0 \\
 \delta - D &= +13' 38.0'' \\
 D &= 21^{\circ} 08' 52''
 \end{aligned}$$

$$(1911.0) \delta = +21^{\circ} 22' 30.0''$$

71

41. 4045.51 P1

4045.51

$95022.00 - 1.2045 = 95020.7955$
 $95022.00 - 1.2045 = 95020.7955$
 $95022.00 - 1.2045 = 95020.7955$

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 $95022.00 - 1.2045 = 95020.7955$

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$95022.00 - 1.2045 = 95020.7955$
 $95022.00 - 1.2045 = 95020.7955$

$95022.00 - 1.2045 = 95020.7955$
 $95022.00 - 1.2045 = 95020.7955$

MC 864

1912 Nov. 14

15

 $X =$

$$X = 16.8555 \pm 7$$

$$Y = 23.7676 \pm 3$$

$$R = 2.1085 \pm 5$$

Reduction to Standard Coords.

$$\xi = -1.4361$$

$$\eta = +1.7544$$

$$\log \xi = 0.15718m$$

$$\tan \delta = 9.588$$

$$\xi_1 = -1.4361$$

$$\log \eta = 0.314$$

$$\xi_0 = -1.4361$$

$$\log \eta_1 = 6.955$$

$$\log \xi = 0.15718m$$

$$\eta_1 = +9$$

$$\cos \delta = 9.96905$$

$$\cos \eta = 8.50724$$

$$\eta_0 = +1.7535$$

$$\sin(A) = 1.68389m$$

$$\log \eta_0 = 0.24390$$

$$\sin(X-A) = -47.96$$

$$\cos \eta = 7.33115$$

$$X-A = -47.96$$

$$\log \tan(\delta-D) = 2.91275$$

$$A = 9^h 08^m 40.00$$

$$\tan(\delta-D) = 818.0$$

$$\delta-D = +13' 38.0"$$

$$D = 21^{\circ} 08' 52.0"$$

$$\alpha = 9^h 07^m 53.04$$

$$(1912) \delta = +21^{\circ} 22' 30.0"$$

MC 864. (1911, Jan 15, 9 $\frac{1}{2}$ hours)

1912 Nov. 25.

16

moon -

Reduction to apparent place.

$$\begin{aligned}\alpha_0 &= 9^h 07^m 58.04^s \\ G &= 15^h 59^m 59^s \\ G + \alpha_0 &= 25^h 07^m 51.30^s \\ &= (376^\circ 58')\end{aligned}$$

$$\begin{aligned}\delta &= +26^\circ 22' 30'' \\ H &= 22^h 27^m 15^s \\ H + \alpha &= 31^h 35^m 15^s \\ &= (473^\circ 49')\end{aligned}$$

$$\begin{aligned}\log i_0 &= 8.8239 & \log i_1 &= 8.8239 \\ "h &= 1.3043 & "g &= 0.8458 \\ \sin(H + \alpha) &= 9.9614 & \sin(G + H) &= 9.4651 \\ \sec \delta &= 0.0310 & \tan \delta_0 &= 9.5926 \\ \log(h) &= 0.1206 & \log(g) &= 8.7274\end{aligned}$$

$$\begin{aligned}\log h &= 1.3043 & \log g &= 0.8458 \\ \cos(H + \alpha) &= 9.6062^m & \cos(G + H) &= 9.9807 \\ \sin \delta_0 &= 9.5617 & \log(g') &= 0.8265 \\ \log(h') &= 0.4722^m\end{aligned}$$

$$\begin{aligned}\log i &= 0.5372^m \\ \cos \delta_0 &= 9.9690 \\ \log(i) &= 0.5062^m\end{aligned}$$

$$\begin{aligned}\alpha_0 &= 9^h 07^m 58.04^s \\ 1 &= - & 0.54 \\ (g) &= + & 0.05 \\ (h) &= + & 1.32 \\ \alpha &= 9^h 07^m 58.87^s\end{aligned}$$

$$\begin{aligned}\delta_0 &= +21^\circ 22' 30.0'' \\ (g') &= + & 6.7 \\ (h') &= - & 3.0 \\ (i) &= - & 3.2 \\ \delta &= +21^\circ 22' 30.5''\end{aligned}$$

$$\begin{aligned}&+ 1.37 \\ &- 0.59 \\ &0.83 \\ &+ 6.7 \\ &- 6.2\end{aligned}$$

B.S. 000501P1

(Lunar, R21, 11.11) - 11.11.11

Lunar, R21, 11.11.11

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

0.02 1.5 1.5 + 1.5
 1.5 1.5 1.5 + 1.5
 2.1 2.2 1.5 + 1.5
 (1.5 1.5 1.5)

110864. (1911 Jan 15 9^h 12^m 40^s)

1912 Nov. 14.

16

moon -

Reduction to apparent place.

$$\alpha_0 = 9^h 07^m 57.30^s$$

$$\delta_0 = 15^\circ 59' 54''$$

$$\alpha_0 = 25 07 51.30$$

$$(376^\circ 58')$$

$$\delta = +26^\circ 22' 50''$$

$$H = 22^h 27^m 18^s$$

$$H + \alpha = 31 35 15$$

$$(473^\circ 49')$$

$$\log t_s = 8.8239$$

$$h = 1.3043$$

$$\sin(H + \alpha) = 9.9614$$

$$\sec \delta = 0.0310$$

$$\log(h) = 0.1206$$

$$\log t_s = 8.8239$$

$$h = 0.8458$$

$$\sin(\delta + \alpha) = 9.4651$$

$$\tan \delta = 9.5926$$

$$\log(g) = 8.7274$$

$$\log h = 1.3043$$

$$\cos(H + \alpha) = 9.6062$$

$$\sin \delta = 9.5617$$

$$\log(h) = 0.4722$$

$$\log h = 0.8458$$

$$\cos(\delta + \alpha) = 9.9807$$

$$\log(g) = 0.8265$$

$$\alpha_0 = 9^h 07^m 57.30^s$$

$$t = - 0.54$$

$$(g) = + 0.05$$

$$(h) = + 1.32$$

$$\alpha = 9^h 07^m 58.13^s$$

$$\delta_0 = +21^\circ 22' 30.0''$$

$$(g') = + 6.7$$

$$(h') = - 3.0$$

$$(i) = - 3.2$$

$$\delta = +21^\circ 22' 30.5''$$

Lunar parallax.

$$\alpha' = 9^h 07^m 58.87^s \checkmark$$

$$\theta = 9 \quad 25 \quad 01.3 \checkmark$$

$$\delta' = +21^\circ 22' 30.5'' \checkmark$$

$$\pi = 59' 13.5'' \checkmark$$

$$\theta - \alpha' = +17^m 02.43^s \checkmark$$

$$= 4^\circ 15' 36.4'' \checkmark$$

$$\log \sec \phi = 9.86913 \checkmark$$

$$\log \sin \pi = 8.23621 \checkmark$$

$$\log \sin(\theta - \alpha') = 8.87089 \checkmark$$

$$\log \cos \delta' = 9.96905 \checkmark$$

$$\frac{1}{2}(\alpha - \alpha') = 1 \quad 44.9 \checkmark$$

$$\log \sin(\alpha - \alpha') = 7.00716 \checkmark$$

$$\alpha - \alpha' = 4^\circ 13' 51.5'' \checkmark$$

$$\alpha - \alpha' = 3' 29.8'' \checkmark$$

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

$$\log \cos(\frac{1}{2}(\alpha - \alpha')) = 0.00000 \checkmark$$

$$\log \cos(\theta - \alpha' - \frac{1}{2}(\alpha - \alpha')) = 9.99881 \checkmark$$

$$\tan \phi = 9.95846 \checkmark$$

$$= +42^\circ 15' 50.5'' \checkmark$$

$$\delta' = +21 \quad 22 \quad 30.5 \checkmark$$

$$\log \cos \delta = 9.96800 \checkmark$$

$$\log \sin(\alpha - \alpha') = 7.00823 \checkmark$$

$$\delta - \delta' = 20 \quad 53 \quad 20.0 \checkmark$$

$$\alpha - \alpha' = 3' 30.2'' \checkmark$$

$$= +14.0'' \checkmark$$

$$\log \sec \phi = 9.82640 \checkmark$$

$$\log \sin \pi = 8.23621 \checkmark$$

$$\log \sin(\phi - \delta') = 9.55213 \checkmark$$

$$\log \sin \phi = 9.82773 \checkmark$$

$$\log \sin(\delta - \delta') = 7.78701 \checkmark$$

$$\delta - \delta' = +21' 03.1'' \checkmark$$

$$\delta = +21^\circ 43' 33.5'' \checkmark \quad \alpha = 9^h 08 \quad 12.88^s \checkmark$$

$$\text{Ann Epl } \delta = +21^\circ 43' 35.2'' \checkmark \quad \alpha = 9^h 08^m 12.33^s \checkmark$$

$$O - C = -1.7(O - C) = +0.55 \checkmark$$

$$0 \quad - \quad 0.03$$

Corr to Star radius

$$\text{Final } O - C = -2.7 \quad + \quad 0.52$$

1911phae.0003

1911phae.0003

1911phae.0003

2.10×10^5 1.5×10^5 1.5×10^5
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2.10×10^5 1.5×10^5 1.5×10^5

1912 Dec. 2.

17

MC 864.

Lunar parallax.

$$\alpha' = 9^h 07^m 58^s.47$$

$$\theta = 9 \quad 25 \quad 01.3$$

$$\delta' = +21^\circ 22' 30''.3$$

$$\pi = 59' 13''.5$$

$$\theta - \alpha = +17^m 02.43''$$

$$= 4^\circ 15' 30.4''$$

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

$$\log \sin \pi = 8.23619$$

$$\log \sin(\theta - \alpha') = 8.87689$$

$$\log \cos \delta' = 9.96905$$

$$\frac{1}{2}(\alpha - \alpha') = 1 \quad 44.9$$

$$\log \sin(\alpha - \alpha') = 7.00746$$

$$\theta - \alpha - \frac{1}{2}(\alpha - \alpha') = 4^\circ 13' 51''.5$$

$$\alpha - \alpha' = 3' 29.8''$$

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

$$\log \cos(\frac{1}{2}(\alpha - \alpha')) = 0.00000$$

$$\log \cos(\theta - \alpha - \frac{1}{2}(\alpha - \alpha')) = 9.99881$$

$$\tan \gamma = 9.95846$$

$$\gamma = +2^\circ 15' 50''.5$$

$$\delta = +21 \quad 22 \quad 30.3$$

$$\log \cos \delta = 9.96800$$

$$\log \sin(\alpha - \alpha') = 7.00821$$

$$\gamma - \delta = 20 \quad 53 \quad 20.2$$

$$\alpha - \alpha' = 3' 30.4''$$

$$= 14.50''$$

$$\log \sec \phi = 9.82640$$

$$\log \sin \pi = 8.23621$$

$$\log \sin(\gamma - \delta) = 9.55213$$

$$\log \sin \gamma = 9.82773$$

$$\log \sin(\delta - \delta') = 7.78794$$

$$\delta - \delta' = 21' 03.0''$$

$$\delta = +21^\circ 43' 33''.5 \quad \alpha = 9^h 08 \quad 12.88$$

$$\text{App. Eph } \delta = +21^\circ 43' 33''.5 \quad \alpha = 9^h 08^m 12.86$$

$$O - C = + \frac{2.0(O - C)}{1.8} = + 0.63$$

$$= - 0.03$$

Corr. to star radius

$$\text{Final } O - C = -2''.7 \quad + 0''.52$$

2

2

2

Measurements of Compton Scattering



12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600

12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600

12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600

12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600
12.9600	12.9600	12.9600	12.9600

2

MC 865 measures of Comparison stars 1912 Oct. 4 21

$$\begin{array}{r}
 11 \\
 \hline
 26.4 \\
 12.8 \\
 \hline
 16.47 \\
 655054 \\
 52 \\
 53 \\
 \hline
 12.9600
 \end{array}$$

 $\frac{d}{d}$
 $\frac{v}{d}$
 $\frac{x}{d}$
 $\frac{d}{d}$

24.6	17152	15760	14658	16435
12.8	1544642	747058	882525	1225560
	48	60	25	55
	38	50	53	35
	<u>12.8293</u>	<u>12.8289</u>	<u>24.5830</u>	<u>24.5822</u>

20.2	14115	16260	16180	15722
28.1	513230	1523034	1393833	796060
	35	32	40	60
	05	50	70	12
	<u>28.1027</u>	<u>28.1027</u>	<u>20.2241</u>	<u>20.2246</u>

14.3	15635	14545	14900	14808
27.8	1313230	704244	1093540	877066
	32	36	40	70
	35	42	98	10
	<u>27.7496</u>	<u>27.7502</u>	<u>14.3961</u>	<u>14.3960</u>

49	15817	15830	15000	15886
20.8	617580	154655	691618	1396066
22.0	75	64	20	60
	10	20	02	96
	<u>22.0367</u>	<u>22.0375</u>	<u>9.8084</u>	<u>9.8074</u>

MC 865 Measures of Comparison Stars 1912 Oct. 4 21

11	2	4	d	2	x	d
26.4	16.4	4.7	12.8	16.4	4.7	12.8
	6.5	0.54		6.5	0.54	
	5.2			5.2		
	5.3			5.3		
	<u>12.9600</u>			<u>12.9600</u>		
24.6	17152	15760		14658	16435	
12.8	15446.42	7470.58		8825.25	12255.60	
	48	60		25.25	55.60	
	38	50		53	35	
	<u>12.8293</u>	<u>12.8289</u>		<u>24.5830</u>	<u>24.5822</u>	
20.2	14115	16260		16180	15722	
28.1	513230	1523034		1393833	796060	
	35	32		40	60	
	05	50		70	12	
	<u>28.1027</u>	<u>28.1027</u>		<u>20.2241</u>	<u>20.2246</u>	
14.3	15635	14545		14900	14808	
27.8	1313230	704244		1093500	877066	
	32	36		40	70	
	35	42		98	10	
	<u>27.7496</u>	<u>27.7502</u>		<u>14.3961</u>	<u>14.3960</u>	
49	15817	15830		15000	15886	
20.8	617580	1546565		691618	1396066	
22.0	75	64		20	60	
	10	20		02	96	
	<u>22.0367</u>	<u>22.0375</u>		<u>9.8084</u>	<u>9.8074</u>	

MC 865

1912 Oct 4.

22

Comparison Stars -
measures continued.

δ	α	δ	α
3.8	15070	16930	14965
16.7	1245050	954642	765852
	5550	48	52
	60	25	50
			45
	<u>16.7385</u>	<u>16.7381</u>	<u>3.7300</u>
			<u>3.7301</u>

Mean measured coordinates of Comp. Stars.

Star	α	δ
1	24.5826 ^v	12.8291 ^v
2	20.2244 ^v	28.1027 ^v
3	14.3960 ^v	27.7499 ^v
4	9.8079 ^v	22.0371 ^v
5	3.7300 ^v	16.7383 ^v

$$\begin{array}{r} 5172.7409^v \\ 14.5482 \end{array}$$

$$\begin{array}{r} 107.4572^v \\ 21.4914 \end{array}$$

$$\begin{array}{r} 34518^v \\ 31 \end{array}$$

$$\begin{array}{r} .5086^v \\ 465 \end{array}$$

$$\begin{array}{r} 34518 \\ 103554^v \\ 107.0058 \\ 1^m 47^s \end{array}$$

$$\begin{array}{r} 25430 \\ 30516 \\ 20344 \\ 236.4990^v \\ 3' 56'' \end{array}$$

$$\text{Mean R.A.} = 9^h 10^m 54^s$$

$$\text{Mean Dec.} = 21^\circ 15' 06''$$

$$\begin{array}{l} A = 9^h 09^m 07^s \\ D = 21^\circ 11' 10'' \end{array} \left. \vphantom{\begin{array}{l} A = 9^h 09^m 07^s \\ D = 21^\circ 11' 10'' \end{array}} \right\} \text{center of plate.}$$

MC 865

1912 Oct 4.

22

Comparison Stars
measures continued.

δ	N	d	N	d
3.8	15070	16930	14968	16249
16.7	12450	95464	7658	13546
	55	48	52	50
	60	25	50	45
	<u>16.7385</u>	<u>16.7381</u>	<u>3.7300</u>	<u>3.7301</u>

Mean measured coordinates of Comp. Stars

Star	x	y
1	24.5826	12.8292
2	20.2244	28.1027
3	14.3960	27.7499
4	9.8079	22.0371
5	3.7300	16.7383

$$\begin{array}{r} 5772.7409 \\ 14.5482 \end{array} \quad \begin{array}{r} 107.4572 \\ 21.4914 \end{array}$$

$$\begin{array}{r} 34518 \\ 31 \\ \hline 34518 \\ 103554 \\ 107,0058 \\ 1^m 47^s \end{array} \quad \begin{array}{r} .5086 \\ 465 \\ \hline 25430 \\ 70516 \\ 20344 \\ \hline 236,4990 \\ 3' 56'' \end{array}$$

$$\text{Mean R.A.} = 9^h 10^m 54^s \quad \text{Mean Decl. } 21^\circ 15' 06''$$

$$\quad \quad \quad - \quad 1 \quad 47 \quad \quad \quad - \quad \quad \quad 3 \quad 56$$

$$\begin{array}{l} A = 9^h 09^m 07^s \\ D = 21^\circ 11' 10'' \end{array} \quad \left. \vphantom{\begin{array}{l} A = 9^h 09^m 07^s \\ D = 21^\circ 11' 10'' \end{array}} \right\} \text{center of plate.}$$

10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7

10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7
10.7	10.7	10.7	10.7	10.7

MC 865

1912 Oct. 4.

23

Points on Moon's Limit - measured.

1/ 18.0
19.1

d

15676
1497264
7270
71

N

15830
643026
1640
7019.070619.0608

remeasured twice same result

2/ ?

19.0 15642
18.7 854040
3037
3615193
1226262
5468
83probably on
Termination18.710118.7072

3/

19.0 14946
22.9 583028
2025
3614078
1315668
7550
72probably on
phase limit22.911022.9084

4/

18.0 14260
22.5 871816
1215
5015062
1060410
0915
6222.554022.5548

26

5/ ✓

18.1
19.0

d

16960
795430
5036
56

N

16350
1533250
4052
4018.098618.1006

MC 865

1912 Oct 4

23

Points on Moon's Rim - measured.

1/18.0
19.115676
1497264
7270
71N
15830
643026
1640
2019.070619.0608 remeasured twice same result2/19.0 15642
18.7 854040
3037
3615193
1226262
5468
8318.710118.70723/19.0 14946
22.9 583028
2025
3614078
1315668
7550
7222.911022.90844/18.0 14260
22.5 871816
1215
5015062
1060410
0915
6222.554022.55485/18.1
19.016960
795430
5036
56N
16350
1533250
4052
4018.098618.0906

MC865

1912 Oct. 4

24

Points on moon's limb.

measures - continued

4 ✓

17.3

20.0

$$\begin{array}{r} d \\ 15320 \\ 775450 \\ 4040 \\ 06 \end{array}$$
17.2437

2

$$\begin{array}{r} 16250 \\ 1381210 \\ 3022 \\ 52 \end{array}$$
17.2432

7 ✓

17.1

21.0

$$\begin{array}{r} 15280 \\ 621094 \\ 0000 \\ 70 \end{array}$$
17.0931

$$\begin{array}{r} 16280 \\ 1534250 \\ 5040 \\ 70 \end{array}$$
17.0933

8 ✓

17.5

22.0

$$\begin{array}{r} 17735 \\ 1227276 \\ 9586 \\ 38 \end{array}$$
17.4545

$$\begin{array}{r} 15285 \\ 1076555 \\ 8068 \\ 80 \end{array}$$
17.4516

9 ✓

17.1

20.8

min in 2

$$\begin{array}{r} 16860 \\ 767060 \\ 7062 \\ 48 \end{array}$$
17.0817

$$\begin{array}{r} 14970 \\ 1411520 \\ 2518 \\ 58 \end{array}$$
17.0848

10 ✓

scratch on north limb.

18.5

18.9

$$\begin{array}{r} 16868 \\ 879406 \\ 0095 \\ 65 \end{array}$$
18.8066

$$\begin{array}{r} 14276 \\ 1233333 \\ 4046 \\ 75 \end{array}$$
18.8062

$$\begin{array}{r} 15547 \\ 1078090 \\ 8580 \\ 40 \end{array}$$
18.5240

$$\begin{array}{r} 16964 \\ 1172020 \\ 2222 \\ 58 \end{array}$$
18.5240

MC865

1912 Oct. 4

24

Points on moon's limb.

measures - continued

4

17.3

20.0

d

15320

775450

4040

06

17.2437

2

16250

1381210

3042

52

17.2432

7

17.1

21.0

15280

621094

0000

70

17.0931

16280

1534250

5040

70

17.0933

8

17.5

22.0

17735

1227276

9586

38

17.4545

15285

1076555

8068

80

17.4516

9

17.1

20.8

16860

767060

7062

48

17.0817

14970

1411520

2518

58

17.0848

10

scratch on north limb

15547

16964

18.5

1078000

1172020

16868

14276

8580

2222

18.9

879406

1233333

40

58

0095

4046

65

75

18.524018.524018.806618.8062

MC 865

1912 Oct 4.

25

Points on Moon's limb
 Measures - continued.

✓ scratch on south limb.

	d	y	n	d	x	n
18.4						
22.8	15430		16046	14290		14284
	766262		1379200	875046		980610
	6060		9495	4848		0912
	20		35	80		80

22.776122.775618.446418.4473

12						
19.2 (?)	14549		16929			
22.9	533541		1607794			
max	3038		7878			
in y.	20		19			
	<u>229186</u>		<u>.9154</u>			

measured Nov. 5.
 very rough edge
 prob. on termin.

13.7	16192		16458			
19.2	920410		1340210			
18.7	1717		9016			
min	84		42			
y.	<u>18.6974</u>		<u>.6951</u>			

Remeasure	for 11.		
15002	15184		
718390	1297270		
8090	6980		
80	67		

22.7798.7791

Nov. 7.

14323	14365		
879085	989001		
8485	0000		
19	60		

18.4465.4465

MC 865-

1912 Oct 4.

25

Points on moon's limb
 Measures - continued.

11 scratch on south limb.

	d	y	n	d	x
18.4	15430		16040	14290	14284
22.8	766262		1379200	875046	980610
	6060		9495	4848	0912
	20		35	80	80

227761 227756 184464 184473

	d	y	n	
19.2	114549		16929	
22.9	533541		1607794	
max	3038		7878	
in y.	20		19	

Unmeasured Nov. 5.
 very rough edge

229186 9154

	d	y	n
13	16192		16458
17.2	920410		1340210
18.7	1717		9016
min in	89		42
y.	186974		6951

MC 865.

1912 Oct 10.

26

Standard Coordinates.

Comp. Stars see pages 1-5.

Star	1	2	3
α	$9^h 05^m 14.22^s$	$9^h 07^m 48.36^s$	$9^h 11^m 01.64^s$
A	$9 09 07$	$9 9 7$	$9 9 7$
$\alpha - A$	$- 3 52.78$	$- 1 18.64$	$+ 1 54.64$
$\sin \alpha - A$	$- 232.77$	$- 78.64$	$+ 114.64$
$\log \mu$	2.36693^m	1.89564^m	2.05933^m
$\cos \delta$	9.96605^m	9.97190^m	9.97175^m
$\sin \delta$	0.84022^m	0.37478^m	0.53832^m
δ	-6.9218^m	-2.3702^m	$+3.4540^m$
δ_1	$- 22^m$	$- 3^m$	$+ 4^m$
δ	249240	203705	145456
α	245826	202244	143960
$\delta - \alpha$	$+ 3414$	$+ 1461$	$+ 1496$
δ	$+22^\circ 21' 30.5''$	$20^\circ 23' 18.9''$	$20^\circ 26' 38.6''$
δ	$21 11 10$	$21 11 10$	$21 11 10$
$\delta - \delta$	$+ 1 10 20.5$	$- 47 51.1$	$- 44 31.4$
$\tan \delta - \delta$	$+ 422.11$	$- 2871.3$	$- 2671.5$
$\log \mu$	3.62543^m	3.45807^m	3.42675^m
η_0	0.95658^m	0.78922^m	0.75790^m
$\tan \delta$	9.6142^m	9.5702^m	9.5714^m
η	1.6804^m	0.7496^m	1.0766^m
η_1	8.3480^m	7.3732^m	7.7014^m
η_0	$+9.0486^m$	-6.1549^m	-5.7266^m
η_1	$+ 223^m$	$+ 24^m$	$+ 50^m$
η	12.9291	28.1525	27.7216
$-y$	12.8291	28.1027	27.7499
$y - \eta$	$+ 1000$	$+ 498$	$- 283$

Rescan up side down - signs of x & y changed.

MC 865.

1912 Oct 10.

26

Standard Coordinates

Comp. Star pages 1-5.

Star	1	2	3
α	$9^h 05^m 14.22^s$	$9^h 07^m 48.36^s$	$9^h 11^m 01.64^s$
A	$9 09 07$	$9 9 7$	$9 9 7$
$\alpha - A$	$- 3 52.78$	$- 1 18.64$	$+ 1 54.64$
$\sin \alpha - A$	$- 232.77$	$- 78.64$	$+ 114.64$
$\log \dots$	2.36693^m	1.89564^m	2.05933^m
$\cos \delta$	9.96605^m	9.97190^m	9.97175^m
\dots	0.84022^m	0.37478^m	0.53832^m
\dots	-6.9248^m	-2.3702^m	$+3.4540^m$
\dots	$- 22^m$	$- 3^m$	$+ 4^m$
\dots	2492.24	203705^m	145456^m
\dots	24.5826^m	20.2244^m	14.3960^m
\dots	$+ 3398^m$	$+ 1461^m$	$+ 1496^m$
δ	$+22^\circ 21' 30.5''$	$20^\circ 23' 18.9''$	$20^\circ 26' 38.6''$
D	$21 11 10$	$21 11 10$	$21 11 10$
$\delta - D$	$+ 1 10 20.5''$	$- 47 51.1''$	$- 44 31.4''$
$\tan \delta - D$	$+ 422.11$	$- 2871.3$	$- 2671.5$
$\log \dots$	3.62543^m	3.45807^m	3.42673^m
\dots	0.95658^m	0.78922^m	0.75796^m
\dots	9.6142^m	9.5702^m	9.5714^m
\dots	1680.2^m	0.7496^m	1.0766^m
\dots	83480^m	7.3732^m	7.7014^m
\dots	$+9.0486^m$	-6.4534^m	-5.7266^m
\dots	$+ 223^m$	$+ 24^m$	$+ 50^m$
\dots	129291^m	281525^m	277216^m
\dots	12.8291^m	28.1027^m	27.7499^m
\dots	$+ 1988^m$	$+ 483^m$	$- 283^m$

Revan upside down signs of x & y changed.

MC 865

27

Standard Coordinates.

Star	4	5
α	9 ^h 13 ^m 32. ^s 84 ^v	9 ^h 16 ^m 55. ^s 25 ^v
A	9 09 07	29 09 07
$\alpha - A$	+ 4 25.84 ^v	+ 7 48.25 ^v
$\sin(\alpha - A)$	+ 265.82 ^v	+ 468.16 ^v
log "	2.42458 ^v	2.67039 ^v
cos δ	9.96960 ^v	9.96754 ^v
" Σ_0	0.80142 ^v	1.14517 ^v
Σ_0	+ 6.3310 + 7.9693 ^v	+ 13.9690 ^v
Σ_1	+ 6 + 13	+ 74
Σ	11.668410.0294 ^v	4.0236 ^v
x	9.8079	37300 ^v
$x - \Sigma$	+ 2215	+ 2936 ^v
δ	21° 11' 21.6 ^v	21° 52' 39.2 ^v
D	21 11 10	21 11 10
$\delta - D$	+ 11.6 ^v	+ 41 29.2 ^v
$\tan(\delta - D)$	+ 11.6 ^v	+ 2489.3 ^v
log "	1.06446 ^v	3.39607 ^v
" η_0	8.39561 ^v	0.72722 ^v
" $\tan \delta$	9.5884 ^v	9.6037 ^v
" Σ^2	1.8028	22903
" η_1	8.4446 ^v	8.9474 ^v
η_0	+ 0.0249 ^v	+ 5.3360 ^v
η_1	+ 278 ^v	+ 886 ^v
η	21.9473	16.5754 ^v
y	22.0371 ^v	16.7383 ^v
$y - \eta$	- 898 ^v	- 1629 ^v

Signs of x + y changed.

MC 865

27

Standard Coordinates.

Star	4	5
α	9 ^h 13 ^m 32. ^s 84	9 ^h 16 ^m 55. ^s 25
A	9 09 07	29 09 07
$\alpha - A$	+ 4 25.84	+ 7 48.25
$\sin(\alpha - A)$	+ 265.82	+ 468.16
log "	2.42458	2.67039
cos δ	9.96968	9.96754
" δ_0	090143	1.14517
δ_0	+ 6.33 + 0 + 7.9695	+ 13.9690
δ_1	+ 6 + 13	+ 74
δ	11.6684 10.0292	4.0236
α	9.8079	3.7300
$\alpha - \delta$	+ 2213	+ 2936
δ	21° 11' 21.6"	21° 52' 39.2"
D	21 11 10	21 11 10
$\delta - D$	+ 11.6	+ 41 29.2
$\sin(\delta - D)$	+ 11.6	+ 2489.3
log "	1.06446	3.39607
" η_0	8.39561	0.72722
" $\tan \delta$	9.5886	9.6037
" δ^2	1.6029	22903
" η_1	82449	89474
η_0	+ 0.0249	+ 5.3360
η_1	+ 176	+ 886
η	229575	165754
y	220371	16.7383
$y - \eta$	- 1796	- 1629

Signs of α & δ changed.

Preliminary Reduction

Star	$x - \xi$	+ 1274	- 5034	
1	+341.4	+1630	= +5044	= +10
2	+146.1	+3569	= +5030	- 4
3	+149.6	+3524	= +5020	- 14
4	+221.5	+2799	= +5014	- 20
5	+293.6	+2126	= +5062	+ 28
Mean	1919.36	+2643		= -19.4327 ✓

sign of x must be changed

	$y - \eta$	- 1272	- 2122	+ 2110	
1	+1000	-3122	= -2122		= -12
2	+498	-2568	= -2070		+40
3	-283	-1829	= -2112		-2
4	-898	-1246	= -2144		-34
5	-1629	-474	= -2103		+7
Mean	20.8075	-2437			= -20.8402 ✓

Conditional Equations.

X_4 1	24.58a	+12.83b	+c	= +10	-12
XY ②	2022	+28.10	+c	= -4	+40
xy ③	1440	+27.75	+c	= -14	-2
xy ④	981	+22.04	+c	= -20	-34
xy 5	3.73	+16.74	+c	= +28	+7

Normal Equations.

22.40	+20.47	+c	= +3.00	+14.00
9.31	+22.18	+c	= -2.00	-9.67
14.81	+25.96	+c	= -12.67	+1.33
14.16	+14.78	+c	= +19.00	-1.67

[+0.50]	13.09	-1.71	= +5.00	+23.67
	0.65	+11.18	= -31.67	+3.00
	0.65	-0.09	= +0.25	+1.18
		+11.27b	= -31.92	+1.82
		b	= -2.83	b = +0.16
	13.09a	= +5.00 - 4.84	= +0.16	+2.3.67 + 0.27 = +23.94
		a	= +0.01	a = +1.83

+3.0	-2.0	-12.7	+19.0	+14.0	-9.7	+1.3	-1.7
-2	-1	-1	-1	-41.0	-17.1	-27.1	-26.0
+58.0	+62.8	+73.6	+41.9	-3.3	-3.6	-42	-2.4
+60.8	+60.7	+60.8	+60.8	-30.3	-30.4	-30.0	-30.1

c from $x - \xi$ c from $y - \eta$

Preliminary Reduction.

Star	$x-s$	$y-y$	$z-z$	$w-w$
1	+3414	+1630	= +5044	= +10
2	+1461	+3569	= +5030	= -4
3	+1496	+3524	= +5020	= -14
4	+2215	+2799	= +5014	= -20
5	+2936	+2126	= +5062	= +28
Mean	191936	+2643		= 18.9545

Star	$x-s$	$y-y$	$z-z$	$w-w$
1	+1000	-3122	= -2122	= -12
2	+498	-2568	= -2070	= +40
3	-283	-1829	= -2112	= -2
4	-898	-1246	= -2144	= -34
5	-1629	-474	= -2103	= +7
Mean	208075	-2437		= 20.7748

Conditional Equations.

X_4 1	24.58a	+12.83b	+c	= +10	-12
XY ②	20.22	+28.10	+c	= -4	+40
xy ③	14.40	+27.75	+c	= -14	-2
xy ④	9.81	+22.04	+c	= -20	-34
xy 5	3.73	+16.74	+c	= +28	+7

Normal Equations.

22.40	+20.47	+c	= +3.00	+14.00
9.31	+22.18	+c	= -2.00	-9.67
14.81	+25.96	+c	= -12.67	+1.33
14.16	+14.78	+c	= +19.00	-1.67

[1.050]	13.09	-1.71	= +5.00	+23.67
	0.65	+11.18	= -31.67	+3.00
	0.65	-0.09	= +0.25	+1.18
		+11.27b	= -31.92	+1.82
		b	= -2.83	b = +0.16
	13.09a	= +5.00 - 4.84	= +0.16	+2.3.67 + 0.27 = +23.94
		a	= +0.01	a = +1.83

+3.0	-2.0	-12.7	+19.0	+14.0	-9.7	+1.3	-1.7
-2	-1	-	-	-41.0	-17.1	-27.1	-26.0
+58.0	+68.8	+73.6	+41.9	-3.3	-3.6	-4.2	-2.4
+60.8	+60.7	+60.8	+60.8	-30.3	-30.4	-30.0	-30.1

c from $x-s$ c from $y-y$

N 100 2171

24858

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0
0.1 + 0	0.002 + 0	0.001 + 0	0.001 + 0
0.1 - 0	0.002 - 0	0.001 - 0	0.001 - 0

MC 865

1912 Oct 14 29

Star	Residuals $(x - \bar{x})$						864	865 - 864
	C	O	O - C	O - C	O - C	O - C		
1	0	-36	+61 = +25	+10	-15	-7		-8
2	0	-80	+61 = -19	-4	+15	+7		+8
3	0	-79	+61 = -18	-14	+4	+11		-7
4	0	-62	+61 = -1	-20	-19	-17		-2
5	0	-47	+61 = +14	+28	+14	+8		+6

Residuals $(y - \bar{y})$

1	+45	+2	-30 = +17	-12	-29	-16	-13
2	+37	+4	-30 = +11	+40	+29	+17	+12
3	+26	+4	-30 = 0	-2	-2	+6	-8
4	+18	+4	-30 = -8	-34	-26	-22	-4
5	+7	+3	-30 = -20	+7	+27	+17	+10

Pa - 1000 21P1

209 21P1

+23-7.8		208 (2-2)		209 (2-2)		210 (2-2)		211 (2-2)	
8 -	5 -	2 -	0	2 -	0	2 -	0	2 -	0
8 +	5 +	2 +	0	2 +	0	2 +	0	2 +	0
7 -	4 -	1 -	0	1 -	0	1 -	0	1 -	0
7 +	4 +	1 +	0	1 +	0	1 +	0	1 +	0
6 -	3 -	0 -	0	0 -	0	0 -	0	0 -	0
6 +	3 +	0 +	0	0 +	0	0 +	0	0 +	0

(p-q) 21P1

8 -	5 -	2 -	0	2 -	0	2 -	0	2 -	0
8 +	5 +	2 +	0	2 +	0	2 +	0	2 +	0
7 -	4 -	1 -	0	1 -	0	1 -	0	1 -	0
7 +	4 +	1 +	0	1 +	0	1 +	0	1 +	0
6 -	3 -	0 -	0	0 -	0	0 -	0	0 -	0
6 +	3 +	0 +	0	0 +	0	0 +	0	0 +	0

MC 865

1912 Oct 14. 29

Star	Residuals, $(x - \bar{x})$							864	865 - 864
	C	0	0-C	0-C	0-C	0-C	0-C		
1	0	-36	+61 = +25	+10	-15	-7	-7	-8	
2	0	-80	+61 = -19	-4	+15	+7	+7	+8	
3	0	-79	+61 = -18	-14	+4	+11	+11	-7	
4	0	-62	+61 = -1	-20	-19	-17	-17	-2	
5	0	-47	+61 = +14	+28	+14	+8	+8	+6	

Residuals $(y - \bar{y})$								
1	+45	+2	-30 = +17	-12	-29	-16	-16	-13
2	+37	+4	-30 = +11	+40	+29	+17	+17	+12
3	+26	+4	-30 = 0	-2	-2	+6	+6	-8
4	+18	+4	-30 = -8	-34	-26	-22	-22	-4
5	+7	+3	-30 = -20	+7	+27	+17	+17	+10

+22-7.2		+22-7.2		+22-7.2		+22-7.2		+22-7.2	
8-	7-	7-	7-	7-	7-	7-	7-	7-	7-
8+	7+	7+	7+	7+	7+	7+	7+	7+	7+
7-	7+	7+	7+	7+	7+	7+	7+	7+	7+
7-	7-	7-	7-	7-	7-	7-	7-	7-	7-
6+	8+	8+	8+	8+	8+	8+	8+	8+	8+

(p-y) (m-m)

81-	81-	81-	81-	81-	81-	81-	81-
81+	81+	81+	81+	81+	81+	81+	81+
81-	81+	81-	81-	81-	81-	81-	81-
81-	81-	81-	81-	81-	81-	81-	81-
81+	81+	81+	81+	81+	81+	81+	81+

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Times etc

exp. t stars 1911 Jan. 15 $9^h 35^m 24^s - 9^h 45^m 24^s$
 " " moon $9 40 23.6 - 9 40 23.8$
 clock fast 2 22.6

H. Sid. T. $9 38 01.1$
 " Long. $4 44 31.05$
 G. Sid. T. $14 22 32.15$
 Sid. T. m. moon $19 35 16.37$
 Interval $18 47 15.78$
 Reduction $- 3 46.8$
 G. M. T. $18 44 11.10$

From Am. Eph. $R. A. Dec.$
 moon. 1911 $9^h 4^m 22.61" + 21^\circ 38' 41.5"$
 motion in 1^m $2.94 \times 5^m - 38.61" 10.256$
 " " $15.875 - 38.61" + 2 42.2$
 Tabular place $9 8 4400 + 21 41 23.7$
 Moon's parallax $59' 13.1"$
 " Semidiam. $16 09.7"$

Approximate center of moon

1912 Nov. 6.

$x = 19.0$ $y = 18.7086$
 $x = 19.0$ $y = 22.9097$
 41.6183
 mean $y = 20.8092$
 max $y = 22.9170$
 $R = 2.1078$

$x = 18.0$ $y = 19.0657$
 18.0 22.5544
 41.6201
 mean $y = 20.8100$

min $y = 18.6962$
 $R = 2.1130$

mean $R = 2.1104$
 $X = \text{mean} = 17.0832$
 $X_0 = 19.1936$

Adopt center of moon

$X_0 = 19.1936$
 $Y_0 = 20.8092$

Times etc

Exp. t stars 1911 Jan. 15 $9^h 35^m 24^s - 9^h 45^m 24^s$
 - moon $9 40 23.6 \quad 9 40 23.8$
 clock fast $2 22.6$

Sid T. $9 38 01.1$
 " Long. $4 44 31.05$
 g. Sid. T. $14 22 32.15$
 Sid T. m. moon $19 35 16.37$
 Interval $18 47 15.78$
 Reduction $- 3 46.8$
 g. m. T. $18 44 11.10$

from Amph. $R.A.$
 moon $19^h 9^m 22.61$ $Dec. + 21^\circ 38' 41.5$
 motion in $1^m 2.44 25$ 10.256
 " 15.825 $- 38.64$ $+ 2 42.2$
 Tabular place $9 8 44.00$ $+ 21 41 23.7$
 Moon's parallax $59' 13.1$
 " Schmidt. $16 09.5$

1912 Nov. 6

Approximate center of moon

$x = 19.0 \quad y = 18.7086$
 $x = 19.0 \quad y = 22.9097$
 41.6183
 mean $y = 20.8092$
 max $y = 22.9170$
 $R = 2.1078$

min $y = 18.6962$
 $R = 2.1130$

$x = 18.0 \quad y = 19.0657$
 $18.0 \quad 22.5544$
 41.6201
 mean $y = 20.8100$

mean $R = 2.1404$
 $x = \text{mean} 17.0832$
 $x_0 = 19.1936$

Adopt center of moon $\left\{ \begin{array}{l} x_0 = 19.1936 \\ y_0 = 20.8092 \end{array} \right.$

	Pos L	Resid
12	180.0	-67
3	174.8	-10
4	145.7	+194
8	124.3	-62
7	95.2	-84
9	90.0	-33
6	64.9	-17
1	34.4	+21
5	31.2	+74
10	18.8	+99
2	5.2	-134
13	0.0	+13

Moon's Run - Reduction

Point	x	$x - \bar{x}$	Δx	$(x - \bar{x})^2$	$(x - \bar{x})^2 + (y - \bar{y})^2$	$0 - c$
1	18.0000	+1.1936	0	1.4247	4.4648	+70
2	19.0000	+0.1936		0.0375	4.4504	-74
3	19.0000	+0.1936		0.0375	4.4490	-88
4	18.0000	+1.1936		1.4247	4.4707	+129
5	18.0996	+1.0940		1.1968	4.4704	+126
6	17.2434	+1.9502		3.8033	4.4581	+13
7	17.0932	+2.1004		4.4117	4.4481	-97
8	17.4530	+1.7406		3.0297	4.4470	-108
9	17.0832	+2.1104		4.4538	4.4538	-40
10	18.5240	+0.6796		0.4619	4.4735	+157
[11	18.4468	+0.7468		0.5577	4.4856	Run error circled 4.4402
12	19.1936	0.0000		0.0000	4.4432	-146
13	19.1936	0.0000		0.0000	4.4652	+74
Mean neglecting 11 =					4.4578	+6

	y	$y - \bar{y}$	Δy	$(y - \bar{y})^2$	
1	19.0657	+1.7435	+1	3.0401	4.4648 +40
2	18.7086	+2.1006	+1	4.4129	4.4504 +13
3	22.9097	-2.1005	-1	4.4125	4.4490 -88
4	22.5544	-1.7452	-1	3.0460	4.4707 +129
5	19.0000	+1.8092	+1	3.2736	4.4704 +126
6	20.0000	+0.8092	0	0.6548	4.4581 +13
7	21.0000	-0.1908	0	0.0364	4.4481 -97
8	22.0000	-1.1908	-1	1.4183	4.4470 -108
9	20.8092	0.0000	0	0.0000	4.4538 -40
10	18.8064	+2.0028	+1	4.0116	4.4735 +157
11	22.7758	-1.9666	-1	3.8679	
12	22.9170	-2.1078	-1	4.4432	
13	18.6962	+2.1130	+1	4.4652	

sign of $(x - \bar{x})$ and $(y - \bar{y})$ are
changed because run error is backwards

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Moon's limb - Reduction.

Point	z	$z - X$	Δz	$(z - X)^2$	$(z - X)^2 + (z - Y)^2$	$0 - z$
1	18.0000	+0.1926	0	1.4247	4.4648	+70
2	19.0000	+0.1936	0	0.0375	4.4504	-74
3	19.0000	+0.1936	0	0.0375	4.4490	-188
4	18.0000	+1.1936	0	1.4247	4.4707	+129
5	18.0996	+1.0940	0	1.1968	4.4704	+126
6	17.2434	+1.9502	0	3.8033	4.4581	+13
7	17.0932	+2.1004	0	4.4117	4.4481	-197
8	17.4530	+1.7406	0	3.0297	4.4470	-108
9	17.0832	+2.1104	0	4.4538	4.4538	-40
10	18.5240	+0.6796	0	0.4619	4.4735	+157
[11	18.4468	+0.7468	0	0.5577	4.4256	+4402]
12	19.1936	0.0000	0	0.0000	4.4432	-146
13	19.1936	0.0000	0	0.0000	4.4652	+74
Mean rejecting 11 =					4.4578	

	y	$y - Y$	Δy	$(y - Y)^2$
1	19.0657	+1.7435	+1	3.0401
2	18.7086	+2.1006	+1	4.4129
3	22.9097	+2.1005	+1	4.4125
4	22.5544	+1.7452	-1	3.0460
5	19.0000	+1.8092	+1	3.2736
6	20.0000	+0.8092	0	0.6548
7	21.0000	+0.1908	0	0.0364
8	22.0000	-1.1908	-1	1.4183
9	20.8092	0.0000	0	0.0000
10	18.8064	+2.0028	+1	4.0116
11	22.7758	+1.9666	-1	3.8679
12	22.9170	+2.1098	-1	4.4432
13	18.6962	+2.1130	+1	4.4652

Formation of Normal Equations.

no	[aa]	[ab]	[ac]	[bt]	[bn]
1	1.42	+ 2.07	- 83.3	3.03	- 121.8
2	0.04	+ 0.40	+ 14.0	4.41	+ 155.4
3	0.04	- 0.40	+ 16.7	4.41	- 184.8
4	1.42	- 2.07	- 153.5	3.03	+ 224.5
5	1.19	+ 1.97	- 137.3	3.28	- 228.1
6	3.80	+ 1.58	- 5.9	6.65	- 2.4
7	4.41	- 0.40	+ 203.7	0.04	+ 18.4
8	3.03	- 2.07	+ 187.9	1.42	- 128.5
9	4.45	0.00	+ 84.0	0.00	0.0
10	0.46	+ 1.36	- 106.8	4.00	- 314.0
12	0.00	- 0.00	+ 0.0	4.45	- 308.1
13	0.00	+ 0.00	+ 0.0	4.45	- 156.1
	2026	+ 2.44	+ 19.5	33.17	- 1082.3

$$[ac] = +12.43 \quad [bc] = +3.24 \quad [cn] = +6.0$$

Sum of [ac] [bc] [cn] should

be zero

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Moon's Limb - Reduction

Conditional Equations.

	a	b	c	
1	+1.19	+1.74	+1	= +70
2	+0.19	+2.10	+1	= -74
3	+0.19	-2.10	+1	= -88
4	+1.19	-1.74	+1	= +129
5	+1.09	+1.81	+1	= +126
6	+1.95	+0.81	+1	= +3
7	+2.10	-0.19	+1	= -97
8	+1.74	-1.19	+1	= -108
9	+2.11	0.00	+1	= -40
10	+0.68	+2.00	+1	= +157
12	0.00	-2.11	+1	= -146
13	0.00	+2.11	+1	= +74

Normal Equations.

a	b	c	
+20.26	+2.44	+12.43	= -20.
+2.44	+33.17	+3.24	= +1082
+12.43	+3.24	+12.00	= +6.

-2.44	-0.29	-1.50	= +2
-12.43	-1.50	-7.63	= +12

+32.88	+1.74	= +1084
+1.74	+4.37	= +18

$$\frac{\Delta s}{\Delta v} = 2.11 - 0.05 = -0.11$$

-	1.74	-	0.09	=	-	57
		+	4.28c	=	-	39

$$c = -9 \pm 31$$

$$\begin{array}{rcl} -0.69 & -1.74 & = -7 \\ +32.19 & & = +1077 \end{array}$$

$$b = +33 \pm 11$$

-12.88	-3.36	-12.43	= -6
-3.36	-0.87	-3.24	= -2

+7.38	-0.92	= -26
-0.92	+32.30	= +1080

- 0.03	+ 0.92	= + 31
+ 7.35a		= + 5

$$a = +1 \pm 24$$

$$-273a -$$

$$-166c$$

$$\frac{\Delta s}{\Delta v} = 2.11 - 0.61 = -0.28$$

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Moon's Limb - Reduction.

Conditional Equations.

	a	b	c	
1	+1.19	+1.74	+1	= +70
2	+0.19	+2.10	+1	= -74
3	+0.19	+2.10	+1	= -88
4	+1.19	+1.74	+1	= +129
5	+1.09	+1.81	+1	= +126
6	+1.95	+0.81	+1	= +3
7	+2.10	+0.19	+1	= -97
8	+1.74	+1.19	+1	= -108
9	+2.11	+0.00	+1	= -40
10	+0.68	+2.00	+1	= +157
12	0.00	+2.11	+1	= -146
13	0.00	+2.11	+1	= +74

Normal Equations.

$$\begin{array}{rcl}
 +20.26 & + & 2.44 & +12.43 & = & -20. \\
 +2.44 & + & 33.17 & +3.24 & = & +10.82 \\
 +12.43 & + & 3.24 & +12.00 & = & +6.
 \end{array}$$

$$\begin{array}{rcl}
 -2.44 & - & 0.29 & -1.50 & = & +2 \\
 -12.43 & - & 1.50 & -7.63 & = & +12
 \end{array}$$

$$\begin{array}{rcl}
 +32.88 & + & 1.74 & = & +1084 \\
 +1.74 & + & 43.7 & = & +18
 \end{array}$$

$$\begin{array}{rcl}
 -1.74 & - & 0.09 & = & -57 \\
 +42.80 & = & -39
 \end{array}$$

$$\begin{array}{rcl}
 -0.69 & - & 1.74 & = & -7 \\
 +33.19 & = & +1077
 \end{array}$$

$$\begin{array}{rcl}
 -12.88 & - & 3.36 & -12.43 & = & -6 \\
 -3.36 & - & 0.87 & -3.24 & = & -2
 \end{array}$$

$$\begin{array}{rcl}
 +7.38 & - & 0.92 & = & -26 \\
 -0.92 & + & 32.30 & = & +1080
 \end{array}$$

$$\begin{array}{rcl}
 -0.03 & + & 0.92 & = & +31 \\
 +7.35a & = & +5
 \end{array}$$

$$-273a - 166c$$

$$\frac{\Delta b}{\Delta a} = 2.11705 = 0.11$$

$$c = -9 \pm 31$$

$$b = +3 \pm 11$$

$$a = +1 \pm 24$$

$$\frac{\Delta b}{\Delta a} = 2.11705 = 0.1128$$

Residuals.

						C	O	O-C	
1	+	1	+	57	-9	=	+49	+70	+21
2	+	0	+	69	-9	=	+60	-74	-134
3	+	0	-	69	-9	=	-78	-88	-10
4	+	1	-	57	-9	=	-65	+129	+194
5	+	1	+	60	-9	=	+52	+126	+74
6	+	2	+	27	-9	=	+20	+3	-17
7	+	2	-	6	-9	=	-13	-97	-84
8	+	2	-	39	-9	=	-46	-108	-62
9	+	2		00	-9	=	-7	-40	-33
10	+	1	+	66	-9	=	+58	+157	+99
11	+					=			
12	+	0	-	70	-9	=	-79	-146	-67
13	+	0	+	70	-9	=	+61	+74	+13

-407+401 Average = 67

Parab. Eq. one 29. = ± 65

$$X_0 = -19.1936 \quad Y_0 = -20.8092 \quad R_0 = 2.1104$$

$$\frac{1}{2}a = 0 \quad +\frac{1}{2}b = +17 \quad \frac{1}{2}c = -2$$

$$X = -19.1936 \pm 12 \quad Y = -20.8075 \pm 0.6 \quad R = 2.1102 \pm 0.8$$

$$\text{From preliminary constant } X = -19.4327 \quad Y = -20.8402$$

Applying plate constants

$$\begin{array}{rcl} \alpha x & = & 0 \\ by & = & 59 \\ c & = & +61 \end{array} \quad \begin{array}{rcl} + & 35 \\ + & 3 \\ - & 36 \end{array}$$

$$X = -19.4325 \quad Y = -20.8394$$

mean position for 1911.0

$$\xi = -1.4325$$

$$\eta = +1.1606$$

$$\log \xi = 9.15610$$

$$\cos \delta = 9.96916$$

$$\text{const} = 8.50724$$

$$\tan \delta = 9.599$$

$$\log \xi^2 = 9.312$$

$$\text{const} = 7.053$$

$$\log \eta = 6.962$$

$$\log(X-A) = 1.67970$$

$$(X-A) = -47.83$$

$$A = 9^h 09^m 07^s$$

$$x = 9^h 08^m 19.17^s$$

$$\eta_1 = +9$$

$$\eta_0 = 1.1597$$

$$\log \eta_0 = 0.06435$$

$$\text{const} = 7.33115$$

$$\log(\delta-0) = 2.73320$$

$$\delta-D = +541.0 = +9^{\circ} 01.0'$$

$$D = +21^{\circ} 11' 10''$$

$$\delta = +21^{\circ} 20' 11.0''$$

Residuals

						C	O	O-C	
1	+	1	+	57	-9	=	+49	+70	+21
2	+	0	+	69	-9	=	+60	-74	-134
3	+	0	-	69	-9	=	-78	-88	-10
4	+	1	-	57	-9	=	-65	+129	+194
5	+	1	+	60	-9	=	+52	+126	+74
6	+	2	+	27	-9	=	+20	+3	-17
7	+	2	-	6	-9	=	-13	-97	-84
8	+	2	-	39	-9	=	-46	-108	-62
9	+	2		00	-9	=	-7	-40	-33
10	+	1	+	66	-9	=	+58	+157	+99
11	+					=			
12	+	0	-	70	-9	=	-79	-146	-67
13	+	0	+	70	-9	=	+61	+74	+13

-407 + 401 Average = 67

-407+401. Average = 67

Prob. 22. one 29. = ± 65

$$X_0 = 19.1936 \quad Y_0 = 20.8092 \quad R_0 = 2.1104$$

$$\frac{1}{2}a = 0 \quad \frac{1}{2}b = -17 \quad \frac{1}{4}c = -2$$

$$X = 19.1936 \pm 12 \quad Y = 20.8075 \pm 0.6 \quad R = 2.1102 \pm 0.8$$

From preliminary constant $X = 19.4327 \quad Y = -20.8402$

Applying plate constants

$ax =$	0	+	35	
$bx =$	-	59	+	3
$c =$	+	61	-	30

$$X = 18.9543 \quad Y = 20.7756$$

Mean position for 1911.0

$$\xi = -0.9543$$

$$\eta = +1.2244$$

$$\log \xi = 9.97968$$

$$\cos \delta = 9.96915$$

$$\cos t = 8.50724$$

$$\tan \delta = 9.599$$

$$\log \xi^2 = 9.960$$

$$\cos t = 7.053$$

$$\log \eta = 6.612$$

$$\log(X-A) = 1.50329$$

$$(X-A) = -31.86$$

$$A = 9^h 09^m 07^s$$

$$X = 9^h 08^m 35.14$$

$$19.17$$

$$\eta_1 = +4$$

$$\eta_0 = 1.2240$$

$$\log \eta_0 = 0.08778$$

$$\cos t = 7.33115$$

$$\log(\delta-D) = 2.75663$$

$$\delta-D = +571.0 = 9' 31.0''$$

$$D = +21' 11.10''$$

$$\delta = +21' 20' 41.0''$$

$$+21 20 47.0$$

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Reduction to App. place.

$$\begin{aligned}\alpha_0 &= 9^h 08^m 35.14^s \\ G &= 15 \quad 59 \quad 54 \\ G + \alpha &= 25 \quad 08 \quad 29.14 \\ &\quad (377^\circ 07')\end{aligned}$$

$$\begin{aligned}\delta_0 &= +21^\circ 20' 41.0'' \\ H &= 22^h 27^m 18^s \\ H + \alpha &= 31 \quad 35 \quad 53.14 \\ &\quad (473^\circ 58')\end{aligned}$$

$$\begin{aligned}\text{wgt} &= 8.8239 \\ \text{h} &= 1.3058 \\ \sin(H + \alpha) &= 9.9608 \\ \sec \delta_0 &= 0.0308 \\ &\quad \underline{0.1213}\end{aligned}$$

From page 16 Reduction to $\alpha = +0.83$
to $\delta = 10.5$

$$\begin{aligned}\alpha_0 &= 9^h 08^m 35.14^s & \delta_0 &= +21^\circ 20' 41.0'' \\ &\quad + 0.83 & & + 0.5 \\ \alpha &= 9 \quad 08 \quad 35.95 & \delta &= +21^\circ 20' 41.5'' \\ &\quad 9 \quad 08 \quad 20.00 & & + 21 \quad 20 \quad 11.3\end{aligned}$$

75.200 5.1 P1

(48.21 - 11.1 P1) 308.2 M

Production of 1100 + 11000

0.14 0.05 0.15 0.2
 0.21 0.15 0.25 0.3
 0.12 0.25 0.18 0.24
 (0.25 0.28)

0.08 0.08 0.08
 0.21 0.21 0.21
 0.15 0.15 0.15
 (0.25 0.28)

From 1100 + 11000

0.14 0.05 0.15 0.2
 0.21 0.15 0.25 0.3
 0.12 0.25 0.18 0.24
 (0.25 0.28)

0.14 0.05 0.15 0.2
 0.21 0.15 0.25 0.3
 0.12 0.25 0.18 0.24
 (0.25 0.28)

Reduction to App. place.

$$\begin{aligned} \alpha_0 &= 9^h 08^m 35.14 \\ \delta &= 15^\circ 59' 54'' \\ G + \alpha &= 21^\circ 08' 29.14 \\ &\quad (377^\circ 07') \end{aligned}$$

$$\begin{aligned} \delta_0 &= +21^\circ 20' 41.0'' \\ H &= 22^h 27^m 18.9 \\ H + \alpha &= 31^\circ 35' 53.14 \\ &\quad (473^\circ 58') \end{aligned}$$

$$\begin{aligned} \log t_0 &= 8.8239 \\ h &= 1.3058 \\ \sin(H + \alpha) &= 9.9608 \\ \sec \delta_0 &= 0.0308 \\ &\quad 0.1213 \end{aligned}$$

From page 16 Reduction $\delta - \alpha = +0.83$
 $\delta - \alpha = 10.3$

$$\begin{aligned} \alpha_0 &= 9^h 08^m 35.14 & \delta_0 &= +21^\circ 20' 41.0'' \\ &+ 0.83 & &+ 0.3 \\ \alpha &= 9^h 08^m 35.97 & \delta &= +21^\circ 20' 41.3'' \\ &20.00 & &20.11.3 \end{aligned}$$

$$\alpha' = 9^h 08^m 20.00$$

$$\theta = 9^{\circ} 38' 01.1$$

$$\delta' = +21^{\circ} 20' 11.5$$

$$\pi = 59' 13.1$$

$$\theta - \alpha' = + 29^{\circ} 41.1 +$$

$$= 7^{\circ} 25' 16.5$$

$$\frac{1}{2}(\alpha - \alpha') = 3 \ 02.2$$

$$(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = 7 \ 22 \ 14.4$$

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

$$\log \cos \frac{1}{2}(\alpha - \alpha') = 0.00000$$

$$\log \cos [(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha')] = 9.99640$$

$$\log \tan f = 9.96087$$

$$f = +42^{\circ} 25' 26.1$$

$$f - \delta' = +21 \ 20 \ 43.1$$

$$f - \delta' = 21 \ 05 \ 07.0$$

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

$$\log \sin \pi = 8.23616$$

$$\log \sin (f - \delta') = 9.55501$$

$$\log \sin f = 9.82904$$

$$\log \sin (\delta - \delta') = 7.78953$$

$$\delta - \delta' = +21' 10.4$$

$$\delta = +21 \ 41 \ 21.7$$

$$\text{true Eph } \delta = +21^{\circ} 41' 23.7$$

$$(O - C) = -7.8$$

$$\text{Corr. to stand. radius}$$

$$+ 0.1$$

$$\text{Final } O - C = -1.7$$

$$\log \cos \phi' = 9.86913$$

$$\log \sin \pi = 8.23616$$

$$\log \sin (\theta - \alpha') = 9.11714$$

$$\log \cos \delta' = 9.96914$$

$$\log \sin (\alpha - \alpha') = 7.24729$$

$$\alpha - \alpha' = 6' 04.5$$

$$\log \cos \delta = 9.96808$$

$$\sin (\alpha - \alpha') = 7.24835$$

$$\alpha - \alpha' = 6' 05.4$$

$$= +24.36$$

$$\alpha = 9 \ 08 \ 44.36$$

$$\alpha = 9^h 08^m 44.00$$

$$(O - C) = +0.36$$

$$+ 0.02$$

$$+ 0.38$$

2.51 0.5 1.5 + 0
8.51 0.5 1.5 + 0

8.51 0.5 1.5 + 0
1.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0
1.10 0.5 1.5 + 0
1.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0
1.10 0.5 1.5 + 0
1.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0

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5.10 0.5 1.5 + 0
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8.10 0.5 1.5 + 0

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8.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0

5.10 0.5 1.5 + 0
8.10 0.5 1.5 + 0

MC 865

1912 DEC. 2.

35

$$\alpha' = 9^h 08^m 34.99$$

$$\theta = 9^\circ 38' 01.1$$

$$\delta' = +21^\circ 20' 43.7$$

$$\pi = 59' 12.8$$

$$\theta - \alpha' = + 29^\circ 25' 15'' \checkmark$$

$$= 7^\circ 21' 17.2$$

$$\frac{1}{2}(\alpha - \alpha') = 3 \ 00.6$$

$$(6 - \alpha') - \frac{1}{2}(\alpha - \alpha') = 7 \ 18 \ 16.4$$

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

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.000000$$

$$\cos[(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha')] = 9.99646$$

$$\tan \phi = 9.96081$$

$$\phi = +42^\circ 25' 06.9$$

$$\delta = +21^\circ 20' 41.3$$

$$\delta - \delta' = 21 \ 04 \ 25.6$$

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

$$\sin \pi = 8.23616$$

$$\sin(\phi - \delta') = 9.55578$$

$$\sin \phi = 9.82901$$

$$\sin(\delta - \delta') = 7.78930$$

$$\delta - \delta' = 21^\circ 09.8$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\delta = +21^\circ 41' 51.7$$

$$\log \cos \phi' = 9.86913$$

$$\sin \pi = 8.23616$$

$$\sin(\theta - \alpha') = 9.10725$$

$$\cos \delta' = 9.96914$$

$$\sin(\alpha - \alpha') = 7.24337 \checkmark$$

$$\alpha - \alpha' = 6' 01.2$$

$$\log \cos \delta = 9.96808$$

$$\sin(\phi - \delta') = 7.24443$$

$$\alpha - \alpha' = 6' 02.1$$

$$= 24.14$$

$$= 24.14$$

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$$= 24.14$$

$$= 24.14$$

$$= 24.14$$

Formation of Normals.

no	ab	ac	bc	aa	bb
1	+ 2.07	+ 47.6	+ 69.7	1.42	3.04
4	- 2.07	+ 118.0	- 172.3	1.42	3.05
5	+ 1.97	+ 104.8	+ 174.0	1.20	3.27
6	+ 1.58	- 52.6	- 21.9	3.80	0.65
7	- 0.40	- 266.8	+ 24.2	4.41	0.04
8	- 2.07	- 240.0	+ 164.0	3.03	1.42
9	0.00	- 147.5	0.0	4.45	0.00
10	+ 1.36	+ 86.4	+ 254.0	0.46	4.01
	+ 2.44	- 350.1	+ 491.7	+ 20.19	+ 15.48

$$[ac] = +12.05 \quad [bc] = +1.62 \quad cn = 0$$

Formation of Minerals

No.	at	an	bx	ca	fo
1	+ 2.07	+ 47.5	+ 69.7	+ 1.4	3.02
2	+ 2.07	+ 115.0	+ 172.7	+ 1.7	3.02
3	+ 1.97	+ 104.8	+ 174.0	+ 2.0	3.17
4	+ 1.58	+ 52.6	+ 71.9	+ 3.8	0.01
5	- 0.00	+ 246.8	+ 34.2	+ 4.0	+ 0.9
6	+ 2.07	+ 240.0	+ 164.0	+ 3.8	1.42
7	- 0.00	+ 197.5	0.0	+ 2.0	0.00
10	+ 1.30	+ 36.4	+ 258.0	+ 4.0	4.01
	+ 2.44	+ 550.1	+ 441.7	+ 20.1	3.548

$$60 \times + 2.05 \quad 100 \times + 1.62 \quad 100 \times 0$$

Comparison of stars

2 Oct 12

Star				Star			
C	1494	4.8		C	1491	2.0	
W	24.1	4.1		W	24.8	2.7	
10	54	2.57		10	54	1.75	
		2.723				1.95	
		2.752				1.925	
10	54	2.57		10	54	1.95	
+		2.469		+		2.456	
10	55	2.26		10	54	5.410	
10	58	2.0		10	58	2.0	
-		3	1.772	-		3	2.592
(A)		1.9773		-		2.0527	
		2.29608m				2.31364m	
		9.95011				9.95280	
		0.79343m				0.81365m	
		7.62144				-4.6115	
		7.6				1.5	
		24.2.64				24.5123	
		24.1740				24.5639	
-3		3.24		-		3.12	

signs of x + y are changed

10	58	2.0		10	58	2.0	
		2.64				2.64	
		2.64				2.64	
10	58	2.0		10	58	2.0	
+		3	2.16	+		3	2.16
10	58	2.0		10	58	2.0	
1		9	5.6	1		9	5.6
+		0	3.88	+		0	3.88
+		3.653.2		+		3.653.2	
		3.66735				3.66735	
		0.89463				0.89463	
		9.3342				9.3342	
		1.3867				1.3867	
		7.9745				7.9745	
		4.73438				4.73438	
		7.6				7.6	
		1.01452				1.01452	
		4.8				4.8	

MC 878

Comparison stars

1912 Oct 7
1912 Oct 12.

42

I	no.	mag
C	1494	6.4
$\alpha = 24.1$	$\gamma = 14.1$	
C	10 ^h 54 ^m	27.57
L		27.63
E		27.52
Mean	10 54	27.57
Proc	+	34.69
1911(RA)	10 55	02.26
A	10 58	20
x-A	- 3	17.74 ^v
sin(x-A)	-	197.73 ^v
log "		2.29608 ^m
cos		9.99011 ^v
Σ_0		0.79343 ^m
Σ_0		-6.2149
Σ_1		- 15 ^v
Σ		24.2164 ^v
x		24.1340 ^v
x- Σ	+	824

signs of x + y are changed.

Decl			
C	+ 12° 14'	26.4	
E		26.4	
E		26.3	
Mean	+ 12° 14'	26.4	
Proc	-	3	31.6
1911	+ 12	10	54.8
D	11	9	56
S-D	+ 1	0	58.8 ^v
tan(S-D)	+	3659.2 ^v	
log		3.56338 ^v	
η_0		0.89453 ^v	
Tan δ		9.3342 ^v	
η		1.5869 ^v	
η_1		7.9745	
η_0		+ 7.8438 ^v	
η		+ 94	
η		14.1468	$\gamma = 14.0982v$
$\eta - \gamma$		+ 486	

II	no.	mag.
	1491	7.0
$\alpha = 24.5$	$\gamma = 27.8$	
C	10 ^h 54 ^m	19.57
		19.55
		19.55
	10 54	19.54
+		34.56 ^v
10	54	54.10 ^v
10	58	20
-	3	25.90 ^v
-		205.89 ^v
		2.31364 ^m
		9.99280 ^v
Σ_0		0.81368 ^m
Σ_0		-6.5115 ^v
Σ_1		- 12 ^v
Σ		24.5127
x		24.5639 ^v
x- Σ		- 512

	+ 10° 28'	00.3
		00.8
		00.3
	+ 10 28	00.5
	-	3
	+ 10 24	289
	11	9
		56
	-	45
		27.1 ^v
	-	27.27.3 ^v
		3.43573 ^m
		0.76688 ^m

	9.2641 ^v
	1.6274
	7.9449 ^v
	-5.8463
	+ 89
	27.8375
	+ 583
	$\gamma = 27.7792$

MC 878

Comparison Stars

1912 Oct 7

1912 Oct 12.

42

1	no.	mag
C	1494	6.4
$\mu = 24.1$	$\mu = 14.1$	
C	10 ^h 54 ^m	27.57
L		27.63
E		27.52
Mean	10 54	27.57
Pre	+	34.69
1911(RA)	10 55	02.26
A	10 58	20
-A	- 3	1774
$\sin(x.A)$	-	197.73
\log		229608m
\cos		999011
Σ_0		0.79343m
Σ_1		-6.2149
Σ_2		- 15
Σ		24.2164
x		24.1340
$x - \Sigma$	+	824

2	no.	mag
	1491	7.0
$\mu = 24.8$	$\mu = 27.8$	
C	10 ^h 54 ^m	17.52
		19.55
		19.55
	10 54	19.54
	+	34.56
	10 54	54.10
	10 58	20
	- 3	2590
	-	205.89
		2.31364m
		9.99280
		0.81368m
		-6.5145
		- 12
		24.5127
		24.5639
		- 512

signs of $x + y$ are changed.

Decl.			
C	+12° 14'	26.4	
L		26.4	
		26.3	
Mean	+12° 14'	26.4	
Pre	-	3	316
1911	+12° 10'	54.8	
D	11	9	56
S-D	+ 1	0	588
$\sin(S-D)$	+	3659.2	
\log		356338	
η_0		0.89453	
$\tan \delta$		9.3342	
η_1		1.5869	
η_2		7.9745	
η_0		+7.8438	
η_1		+ 44	
η_2		14.1468	$y = 14.0982$
η_3		+ 486	

	+10° 28'	0.03	
		00.8	
		00.3	
	+10 28	00.5	
	-	3	316
	+10 24	289	
	11	9	56
	-	45	271
	-	27273	
		3.43573m	
		0.76688m	
		9.2641	
		1.6274	
		7.9449	
		-5.8463	
		+ 88	
		27.8375	$y = 27.7792$
		+ 583	

MC878

Comparison stars - continued.

1912 Oct 7,

43

1912 Oct 12

31	no	mag
C	1499	7.18
$x =$	18.9	$y = 33.6$
C	10 ^N 57 ^m	20.10
L		20.14
E		20.13
Mean	10 57	20.12
Prec +		34.47
1911(RA)	10 57	54.59
A	10 58	20
$\alpha - A$	-	25.41
$\sin(\alpha - A)$	-	25.41
\log	1.40500	0.00
$\cos \delta$	9.99381	
$\sin \delta$	9.90605	
δ_0	-0.8055	
δ_1	-	3
δ	18.8058	
δ	18.9166	
$\delta - \delta_0$	-11.08	

4	no.	mag.
	1508	7.38
$x =$	10.0	$y = 25.7$
C	11 ^N 01 ^m	59.91
		59.95
		59.94
11	01	59.93
+		34.49
11	02	34.42
10	58	20.
+	4	14.42
+		254.41
		240554
		9.99239
		0.90517
		+80384
		+16
		9.9600
		9.9910
		-290

Decl.		
C	+9° 42'	39.4
L		39.4
E		39.2
Mean	+9 42	39.3
Prec	-	3
1911	+9 39	07.9
D	+11 9	56
$\delta - D$	-1 30	49.0
$\tan(\delta - D)$	-	54.50.3
\log	3.73642	
η_0	4.06757	
$\tan \delta$	9.2306	
$\sin \delta$	98.121	
η_1	50961	
η_0	-11.6835	
η_1	+	1
η	33.6834	
η	33.6813	
$\eta - \eta_0$	+	21

+10° 45'	12.1
	11.4
	11.1
+10 45	11.5
-	3
10 41	37.9
11 9	56.
-	28
-	16
	98.1
	3.22997
	0.56112
	9.2759
	1.8103
	81396
	-36402
	+138
	25.6264
	25.7120
	-256

MC878

Comparison stars - continued. 1912 Oct 7. 43
1912 Oct 12

31	no	mag	4	no	mag
C	1499	7.1		1508	7.36
L	18.9	33.6		10.0	25.7
C	10 ^N 57 ^m	20.10		11 ^N 01 ^m	59.91
L		20.14			59.95
E		20.13			59.94
Moran	10 57	20.12		11 01	59.93
Prez	+	34.47		+	34.49
M (RA)	10 57	54.59		11 02	34.42
A	10 58	20		10 58	20
X-A	-	254.1		+	4 14.42
Sm (X-A)	-	254.1		+	254.41
log	1.40500m				2.40554
" cos δ	9.99381				9.99239
" S ₀	9.90605m				2.90867
S ₀	-0.8055				+8.0384
S ₁	-	3			+ 16
S	18.8058				9.9600
2	18.9166				9.9910
2-3	-1.108				- 298

Decl.					
C	+9° 42'	39.4		+10° 45'	11.1
L		39.4			11.4
E		39.2			11.1
Moran	+9 42	39.3		+10 45	11.5
Prez	-	3 32.4		-	3 33.6
S (RA)	+9 39	06.9		10 41	37.9
D	11 9	56		11 9	56
D-D	- 1 30	49.1		-	28 18.1
Sm (D-D)	-	54 50.4		-	16 98.1
log	3.73643m				3.22997m
" η ₀	4.06758m				0.56112m
Moran	9.2306				8.2761
S ₀	9.8121				1.8193
" η ₁	5.0964				2.1398
η ₀	-11.6838				-36.402
η ₁	+	1			+ 438
η	33.6837				25.6263
" η	33.6813				25.7120
" -	+	24			- 856

M 6878

Comparison stars - continued

1912 Oct 7. 44
1912 Oct 12

$\frac{r}{c}$	no.	mag.
C	1505	8.8
$x = 12.8$		$y = 11.2$
C	112 00	26.41 ✓
L		26.55
E		26.39
Mean	11 00	26.45
Prec	+	34.64
1911(R9)	11 01	01.09
A	10 58	20
$\alpha - A$	+	2 41.09 ✓
$\sin(\alpha - A)$	+	161.09
$\log \dots$		2.20707
" $\cos \delta$		9.98946 ✓
" ξ_0		0.70377 ✓
ξ_0		+5.0556
ξ_1	+	1.7 ✓
ξ		12.9427
x		12.8305
$x - \xi$	+	1122

Decl.		
C	+12° 37'	45.4
L		44.8
E		45.1
Mean	+12° 37'	45.1
Prec	-	3 33.2
1911	+12 34	11.9
D	+11 9	56
$\delta - D$	+1 24	159 ✓
$\tan(\delta - D)$	+	.50 56.9
$\log \dots$		3.70388
" η_0		1.03503
" $\tan \delta$		9.8483
" ξ		1.4078
" η_1		7.8095
η_0		+10.8400
η_1	+	64
η		11.1536
η		11.2137
$\eta - \eta_1$	-	601

M 6878

Comparison stars continued

1912 Oct 7. 44
1912 Oct 12

S	no.	mag.
C	1505	8.8
$x = 12.8$	$y = 11.2$	
C	11 00	26.41
L		26.55
E		26.39
Mean	11 00	26.45
Prec	+	34.69
1911(R9)	11 01	01.14
A	10 58	20
x-A	+	2 41.14
ln(x-A)	+	161.14
log		2.20720
"cosδ		9.98946
" ξ_0		0.70390
ξ_0	+	5.0570
ξ_1	+	1.7
ξ		12.9412
x		12.8305
x- ξ	+	1.107

Decl.		
C	+12° 37'	45.4
L		44.8
E		45.1
Mean	+12° 37'	45.1
Prec	-	3 33.7
1911	+12 34	12.7
D	+11 9	56
S-D	+1 24	1.2
ln(S-D)	+	50.56.9
log		3.70388
" η_0		1.03503
" $\tan \delta$		9.3483
" ξ		1.4078
" η_1		2.8095
η_0	+	10.8400
η_1	+	64
η		11.1538
η		11.2137
$\eta - \eta_0$	-	60.8

MC 878

Comparison standard
measures.1912 Oct 7.
Oct 8

45

1/ d y
24.1 12735 15070
14.1 11765 6060 55
55 60
35 73

14.0978 14.0985

2/ 24.5 17240 14280
27.8 9445 12070 73
52 72
40 78

27.7793 27.7792

x d y
13430 14539
4776 75 12190 96
70 98
40 37

24.1335 24.1344

15890 14390
11528 30 8751 55
30 52
95 98

24.5637 24.5641

3/ 18.9 15878 14250
33.6 9064 11060 65
60 60
72 50

33.6814 33.6812

16088 12980
15248 54 3810 04
50 00
92 72

18.9163 18.9168

4/ 10.0 14357 16039
25.7 7242 13160 60
40 58
63 39

25.7120 25.7120

12472 12380 75 8820 16
85 14
8730

9.9908 9.9913

5/ 17628 13820
12.8 15490 5955 55
11.2 86 56
20 18

11.2137 11.2137

16908 13654
15200 5332 32
06 35
06 50

12.8295

12.8318

remeasure
gives 12.8303

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MC 878

Comparison standard.
measures.1912 Oct 7.
Oct 8

45

1	d	N	d	N
24.1	12735	15070	13430	14539
14.1	1176552	606055	477675	1319096
	55	60	70	98
	35	73	40	37
	<u>14.0978</u>	<u>14.0985</u>	<u>14.1335</u>	<u>14.1344</u>
2	d	N	d	N
24.5	17240	14280	15890	14390
27.2	944545	1207073	1152830	875155
	52	72	30	52
	40	78	95	98
	<u>27.7793</u>	<u>27.7792</u>	<u>24.5637</u>	<u>24.5641</u>
3	d	N	d	N
18.9	15878	14250	16088	12980
33.6	906455	1106065	1524854	381004
	60	60	50	00
	72	50	92	72
	<u>33.6814</u>	<u>33.6812</u>	<u>18.9163</u>	<u>18.9168</u>
4	d	N	d	N
10.0	14357	16039	12472	
25.7	724240	1316060	1238075	882016
	40	58	85	14
	65	39		8730
	<u>25.7120</u>	<u>25.7120</u>	<u>9.9908</u>	<u>9.9913</u>
5	d	N	d	N
12.8	17628	13820	16908	13654
11.2	1549092	595555	1520003	533232
	86	56	06	35
	20	18	06	50
	<u>11.2137</u>	<u>11.2137</u>	<u>12.8295</u>	<u>12.8318</u>
				remeasure
				gives <u>12.8303</u>

MC 978

1912 Oct. 8.

46

Points on Moon's limb,
measures.

	d	y	N
1/18.0			
20.2	146 45		17548
	132 84 80		8895 92
	90 78		97 88
	50		48

20.136320.1345

2/18.0	147 53	16278
23.5	99 57 74	10035 38
	57 62	30 40
	55	78

23.479223.4758

3/19.0	15750	14540
23.8	7260 50	13025 14
	45 45	19 20
	50	45

- possibly on
terminator.23.850023.8479

	d	N
4/18.3	13470	14290
20.0	11233 50	12052 40
	42 30	35 40
	70	90

18.223118.2248

5/17.4	15810	15035
21.0	8887 76	11970 72
	80 90	60 72
	20	33

17.306717.3067

MC 978

1912 Oct. 8.

46

Points on Moon's limb
measures.

1/1
18.0 d
20.7 146 45
132 84 80
90 78
50

20.1363

N
17548 790
8895 92 40 30
97 88 50 40
48 40

20.1345 1453

N
14077
12600 44
0 40 30
46

17.1476

2/ 147 53
18.0 99 57 74
23.5 57 62
55

23.4792

16278
10035 38
30 40 50 60
78 100 60

23.4758

16088
10878 60
70 75
78

17.5422

3/ 157 50
19.0 72 60 50
23.8 45 45
50

23.8500

14540 5790
13025 1470 possibly on
19 20 terminator.
45 01

23.8479 137817.1392

4/ 18.3
20.0 153 98
68 30 05
40 10
50 08

23.8542

d
13470
11233 50
42 30
70
18.2231

23.8560

N
14290
12052 40
35 20
90
18.2248

18.2248

5/ 17.4
21.0

15810
8887 76
80 90
20

17.3067

15035
11970 72
60 72
33

17.3067

MC878

1912 Oct. 8.

47

Points on Moon's limb
measured.

6.

171
220

2
14790
624042
5040
90

17.1453

2
14072
1260094
9492
66

17.1476

7/

17.6
23.0

16753
1196562
6060
65

17.5203

16088
1087868
7275
98

17.5220

8/

17.1
21.7
 $x = \text{min.}$

15790
777080
8675
01

17.1378

15040
1365050
4050
43

17.1392

9/

19.1
23.8 = max

15398
684005
2010
5408

23.8592

15525
1409376
8095
30

23.8560

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110878

1912 Oct 8.

47

Points on Moon's limb
measured.

6/11
17.1
22.0
15 105
14790
6240 05
50 40
90
140 12
12600 94
44 92
66

17.1453 17.1476

7/11
17.6
23.0
16 4 10
1578
1196 5 62
60 60
65
160 88
10878 68
7275
98

17.5203 17.5220

8/
17.1
21.7
22 min.
15790
7770 80
8675
01
15040
13650 50
40 50
43

17.1378 17.1392

9/
19.1
23.8 = max
15398
6820 05
20 10
5408
15525
14093 76
80 95
30

23.8592 23.8560

Points on moon's limb.

10 Scratch on no. side

	α	δ	α	δ
17.8	15 705	14310	14095	16542
20.3	1250014	752625	1187060	880800
	0802	2526	7070	0000
	15	15	00	50

<u>20.3202</u>	<u>20.3213</u>	<u>17.2971</u>	<u>17.7746</u>
----------------	----------------	----------------	----------------

11 Scratch on so. side

16410	15788	15710	15554
859504	1361002	1214850	912020
1000	0808	5652	1418
12	00	15	60
<u>23.7810</u>	<u>23.7816</u>	<u>18.6440</u>	<u>18.6440</u>

Point on oceanic bank

1911 Dec 7
 12.502 12.502 12.502 12.502
 12.502 12.502 12.502 12.502
 12.502 12.502 12.502 12.502
 12.502 12.502 12.502 12.502

12.502 12.502 12.502 12.502

12.502 12.502 12.502 12.502

12.502 12.502 12.502 12.502
 12.502 12.502 12.502 12.502
 12.502 12.502 12.502 12.502
 12.502 12.502 12.502 12.502

12.502 12.502 12.502 12.502

Points on moon's limb.

10 Scratch on no. side.

	d	r	d	r
17.8	15705	14310	14095	16542
20.3	1250014	752625	1187060	880800
	0802	2526	7070	0000
	15	15	00	50

20.3202 20.3215 17.7771 17.7746

11 Scratch on so. side.

16410	15788	15710	15554
859504	1361002	1214850	912020
1000	0808	5652	1418
12	00	15	60
<u>23.7810</u>	<u>23.7816</u>	<u>18.6440</u>	<u>18.6440</u>

MC 878

1912 Oct 9.

49

mean measured coörds of comp. stars.
Coördinates of center of plate

Star	x	y	R.A.	Decl.
1	24.1340	14.0982	10h 55 02	12 10 55
2	24.5639	27.7792	54 54	10 24 29
3	18.9166	33.6813	57 55	9 39 7
4	9.9910	25.7120	11 2 34	10 41 38
5	12.8305	11.2137	1 1	12 34 12
	5190.44 ^v	5112.48 ^v	51 51 26	5 30 21
	18.09	22.46	10 58 17 ^v	11 06 04 ^v
	31	22.50 ^v	+ 3 ^v	+ 3 52
	279	465	10h 58m 20s	11° 09' 56"
		232.5 ^v		
		3' 52" ^v		

A = 10h 58m 20s } coörds. of center of plate
D = 11° 09' 56"

Preliminary Reduction.

Star	x-3	+984	+22	-2248
1	+824	+1382	+2206	+48 = +2254 = +6
2	-512	+2722	+2210	+49 = +2259 = +11
3	-1108	+3801	+2193	+38 = +2231 = -17
4	-290	+2520	+2230	+20 = +2250 = +2
5	+1122	+1099	+2221	+26 = +2247 = -1
mean	-19.1885 ^v	+2137 ^v	+38 ^v	= -19.1958 ^v

	4-7	-992	-34	+1931
1	+486	-2389	-1903	-42 = -1945 = -14
2	+583	-2451	-1848	-83 = -1931 = 0
3	+21	-1873	-1852	-101 = -1953 = -22
4	-856	-989	-1845	-77 = -1922 = +9
5	-601	-1270	-1871	-34 = -1905 = +26
mean	-21.8082	-1900 ^v	-65 ^v	= -21.8116 ^v

ML 878

1904 Oct 9

49

mean measured co-ords of comp. stars.
 co-ordinates of center of plate

Star	x	y	RA.	Decl.
1	24.1340	140.982	10h 55' 02"	12 10 55
2	24.5639	27.7792	54 54	10 24 19
3	18.9166	33.6813	57 55	9 39 7
4	9.9910	25.7120	11 2 34	10 41 38
5	12.8305	11.2137	1 1	12 34 12
	<u>519044</u>	<u>5112.88</u>	<u>31 26</u>	<u>15 30 21</u>
	18.09	22.46	10 58 17	11 06 04
	31	22.50	+	3 52
	<u>2.79</u>	<u>465</u>	<u>10h 58m 20s</u>	<u>11 09 56</u>
		<u>232.5"</u>		
		3' 52"		

A = $10^h 58^m 20^s$
 D = $11^\circ 09' 56''$ } words of center of plate.

Preliminary Reduction.

Star	x-3	+1984	+2228	-2248		
1	+824	+1382	+2206	+48	+2254	+6
2	-512	+2722	+2210	+49	+2259	+11
3	-1108	+2301	+2193	+38	+2231	-17
4	-290	+2520	+2230	+20	+2250	+2
5	+1122	+1099	+2221	+26	+2247	-1
mean	19.1885	+2137	+38			19.1812

	$y - 7$	$- 992$	$- 34$	$+ 1931$		
1	$+486$	-2389	-1903	-42	-1945	-14
2	$+583$	-2451	-1848	-83	-1931	0
3	$+21$	-1873	-1852	-101	-1953	-22
4	-856	-989	-1845	-77	-1922	$+9$
5	-601	-1270	-1871	-34	-1905	$+26$
mean	21.8082	-1900	-65			21.8048

Conditional Equations.

	Star	a	b	
X _Y	2	24.56 + 27.78 + c = + 6		0
X ₄	1	24.13 + 14.10 + c = + 11		- 14
X _Y	3	18.92 + 33.68 + c = - 17		- 22
X _Y	5	12.83 + 11.21 + c = + 12		+ 26
X _Y	4	9.99 + 25.71 + c = - 1		+ 9

Normal Equations

24.34 + 20.94 + c = + 8.50	- 7.00
13.91 + 23.53 + c = - 5.33	+ 4.33
17.82 + 29.06 + c = - 4.00	- 4.33
12.48 + 12.66 + c = + 6.50	+ 6.00
+10.43 - 2.59 = + 13.83	- 11.33
- 0.66 + 16.40 = - 10.50	- 10.33
- 0.66 + 0.16 = - 0.87	+ 0.71
+ 16.24 = - 9.63	- 11.04
b = - 0.59	- 0.68
+10.43 a = + 13.83 - 1.53 = + 12.30	- 11.33 - 1.76 = - 13.09
a = + 1.18	a = - 1.25

+ 8.5	- 5.3	- 4.0	+ 6.5	- 7.0	+ 4	- 4	+ 6
- 28.7	- 16.4	- 21.0	- 21.8	+ 37.	+ 17	+ 22	+ 23
+ 12.3	+ 13.4	+ 17.2	+ 7.4	+ 14.	+ 16	+ 20	+ 8
= 8.	- 8.	- 8.	- 8.	+ 37	+ 37	+ 38	+ 37

c from (x-3)

c from (y-4)

Star	Residuals in x.	0	0 - c
2	+29 - 16 - 8 = + 5	+ 6	+ 1
1	+28 - 8 - 8 = + 12	+ 11	- 1
3	+22 - 20 - 8 = - 6	- 17	- 11
5	+15 - 7 - 8 = 0	+ 2	+ 2
4	+12 - 15 - 8 = - 11	- 1	+ 10

Star	Resids. in y.	c	0	0 - c
2	- 31 - 19 + 37 = - 13	0	0	+ 13
1	- 30 - 10 + 37 = - 3	- 14	- 14	- 11
3	- 24 - 23 + 37 = - 10	- 22	- 22	- 12
5	- 16 - 8 + 37 = + 13	+ 26	+ 26	+ 13
4	- 12 - 17 + 37 = + 8	+ 9	+ 9	+ 1

02 P1 400 S1 P1

078 014

Continued from previous page

0	1	2	3	4
0	1	2	3	4
0	1	2	3	4
0	1	2	3	4
0	1	2	3	4

Continued from previous page

00.7 -	02.8 +	02.8 +	02.8 +	02.8 +
22.4 +	22.2 -	22.2 -	22.2 -	22.2 -
88.0 -	01.8 -	01.8 -	01.8 -	01.8 -
00.2 +	02.2 +	02.2 +	02.2 +	02.2 +
02.11 -	02.81 +	02.81 +	02.81 +	02.81 +
28.01 -	02.01 -	02.01 -	02.01 -	02.01 -
17.0 +	08.0 -	08.0 -	08.0 -	08.0 -
01.11 -	02.81 -	02.81 -	02.81 -	02.81 -
24.0 -	02.0 -	02.0 -	02.0 -	02.0 -
02.11 -	02.81 +	02.81 +	02.81 +	02.81 +
02.11 -	02.81 +	02.81 +	02.81 +	02.81 +

0.7 -	2.8 +	2.8 +	2.8 +	2.8 +
22.4 +	22.2 -	22.2 -	22.2 -	22.2 -
88.0 -	01.8 -	01.8 -	01.8 -	01.8 -
00.2 +	02.2 +	02.2 +	02.2 +	02.2 +

Continued from previous page

Continued from previous page

0	1	2	3	4
0	1	2	3	4
0	1	2	3	4
0	1	2	3	4
0	1	2	3	4

0	1	2	3	4
0	1	2	3	4
0	1	2	3	4
0	1	2	3	4
0	1	2	3	4

MC 878.

1902 Oct 19. 50

Conditional Equations.

Star		a	b	
XY	2	24.56 + 27.78 + c = + 6		0
Xy	1	24.13 + 19.10 + c = + 11		- 14
xy	3	18.92 + 33.68 + c = - 17		- 22
xy	5	12.83 + 11.21 + c = + 12		+ 26
xy	4	9.99 + 25.71 + c = - 1		+ 9

Normal Equations

24.34 + 20.94 + c = + 8.50	- 7.00
13.91 + 23.53 + c = - 5.33	+ 4.33
17.82 + 29.06 + c = - 4.00	- 4.33
18.48 + 12.66 + c = + 6.50	+ 6.00
+10.43 - 2.59 = + 13.83	- 11.33
- 0.66 + 16.40 = - 10.50	- 10.33
- 0.66 + 0.16 = - 0.87	+ 0.71
+ 16.24 = - 9.63	- 11.04
b = - 0.89	- 0.68
+10.43 a = + 13.83 - 1.53 = + 12.30	- 11.33 - 1.76 = - 13.09
a = + 1.18	a = - 1.25

+ 8.5	- 5.3	- 4.0	+ 6.5	- 7.0	+ 4	- 4	+ 6
- 28.7	- 16.4	- 21.0	- 21.8	+ 37.	+ 17	+ 22	+ 23
+ 12.3	+ 13.4	+ 17.2	+ 7.4	+ 14.	+ 16	+ 20	+ 8
- 8.	- 8.	- 8.	- 8.	+ 37	+ 37	+ 38	+ 37

c from (x-3)

c from (y-4)

Star	Residuals in x.	0	0 - c
2	+29 - 16 - 8 = + 5	+ 6	+ 1
1	+28 - 8 - 8 = + 12	+ 11	- 1
3	+22 - 20 - 8 = - 6	- 17	- 11
5	+13 - 7 - 8 = 0	+ 2	+ 2
4	+12 - 15 - 8 = - 11	- 1	+ 10

Star	Residuals in y.		c	0	0 - c
2	-31	-19 + 37	= -13	0	+13
1	-30	-10 + 37	= -3	-14	-11
3	-24	-23 + 37	= -10	-22	-12
5	-16	-8 + 37	= +13	+26	+13
4	-12	-17 + 37	= +8	+9	+1

1911phae (proj)	1911phae (proj)	1911phae (proj)	1911phae (proj)
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4

1911phae (proj)	1911phae (proj)	1911phae (proj)	1911phae (proj)
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4

1911phae (proj)	1911phae (proj)	1911phae (proj)	1911phae (proj)
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4

1911phae (proj)	1911phae (proj)	1911phae (proj)	1911phae (proj)
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4

1911phae (proj)	1911phae (proj)	1911phae (proj)	1911phae (proj)
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4

J. inus etc.

Exp. to stars 1911 Jan 17 $9^h 53^m 59^s - 10^h 03^m 59^s$
 " " Moon. $9 58 59.0^v$ 59.4
 Clock fast $2 23.3^v$

H. Sid. T. $9 56 35.9^v$
 " Long. $4 44 31.05$
 G. Sid. T. $19 41 06.95^v$
 Sid. T. M. norm $19 43 09.48^v$
 Interval $18 57 57.47^v$
 Reduction $10 3 06.43^v$
 G. M. T. $18 54 51.04^v$

From Arm Eph. RA $Decl.$
 Moon $19^h 10^h 57^m 07.10^s + 11^h 40' 04.6''$
 Motion $1^m = 2.0676''$ $10.65'' + 13.975''$
 " " 5.15 $- 10.65''$ $1 12.0''$
 Tabular place $10 56 56.45^v + 11 41 16.6$

Moon's parallax $57' 31.4''$
 " semidiam. $15' 42.0''$

J. inus etc.

Exp. to stars 1911 Jan 17 $9^h 53^m 59^s - 10^h 03^m 59^s$
 " " moon. $9 58 59.0$ 59.4
 Clock fast $2 23.3$

H. sid. T. $9 56 35.9$
 " Long. $4 44 31.05$
 G. Sid. T. $14 41 06.95$
 Sid. T. M. now $19 43 09.48$
 Interval $18 57 57.47$
 Reduction $3 06.43$
 G. M. T. $18 54 51.04$

from Ann Eph. $R.A.$ $Decl.$
 Moon $19^h 10^h 57^m 07.10 + 11^{\circ} 40' 04".6$
 Motion $1^m = 20.679$ $10.65 + 13.974$
 " " 5.45 $1 12.0$
 Tabular place $10 56 56.45 + 11 41 16.6$

moon's parallax $57' 31".5$
 " semidiam. $15' 42".0$

Point	Pos. \angle	Resid.
9	180.0	+29
3	174.7	+28
11	164.6	-79
2	145.0	+8
7	125.0	+10
6	95.4	+52
8	90.0	+4
5	66.9	-94
10	43.5	+32
1	35.0	+60
4	28.0	-49

Approximate Center of Moon.

$$\begin{aligned}
 x &= 18.0 & y &= 20.1354 \\
 &\dots & y &= 23.4775 \\
 & & \hline
 & & 43.6129 \\
 \text{mean } y &= & 21.8064 \\
 y = \text{max} &= & 23.8576 \\
 R &= & 2.0512
 \end{aligned}$$

$$\begin{aligned}
 x = \text{min} &= 17.1385 \\
 R &= 2.0512 \\
 x &= 19.1897
 \end{aligned}$$

Point	x	x - X	Δx	$(x - X)^2$	$(x - X)^2 + (y - Y)^2$	O - C
1	18.0000	+1.1897	-1	1.4151	4.2080	+25
2	18.0000	+1.1897	+1	1.4156	4.2088	+33
3	19.0000	+0.1897	+2	0.0361	4.2091	+36
4	18.2240	+0.9657	+1	0.9324	4.1962	-93
5	17.3067	+1.8830	-1	3.5453	4.1957	-98
6	17.1464	+2.0433	+0	4.1750	4.2125	+70
7	17.5212	+1.6685	+1	2.7843	4.2092	+37
8	17.1385	+2.0512	0	4.2074	4.2074	+19
9	19.1897	0.0000	+2	0.0000	4.2082	+27
10	17.7758	+1.4139	-1	1.9987	4.2060	+5
11	18.6440	+0.5457	+2	0.2980	4.1990	-65
					4.2055	-4

	y	y - Y	Δy	$(y - Y)^2$
1	20.1354	+1.6710	+2	2.7929
2	23.4775	+1.6711	-2	2.7932
3	23.8490	-2.0426	-2	4.1730
4	20.0000	+1.8064	+2	3.2638
5	21.0000	+0.8064	+1	0.6504
6	22.0000	+0.1936	0	0.0375
7	23.0000	-1.1936	-1	1.4249
8	21.8064	0.0000	0	0.0000
9	23.8576	-2.0512	-2	4.2082
10	20.3208	+1.4856	+1	2.2073
11	23.7813	-1.9749	-2	3.9010

Signs of $(x - X)$ and $(y - Y)$ are
 changed because measure was
 put on up side down.

MC878

1912 Oct 31.

50

Approximate Center of Gravity

$x = 18.0$	$y = 20.1354$	$x - \bar{x} = -1.1897$	$(x - \bar{x})^2 = 1.4151$	$(x - \bar{x})(y - \bar{y}) = -4.2080$	$\bar{x} = 17.1385$	1
$y = 23.4775$	$\bar{y} = 21.8064$	$x - \bar{x} = +1.1897$	$(x - \bar{x})^2 = 1.4156$	$(x - \bar{x})(y - \bar{y}) = +4.2088$	$\bar{y} = 22.0517$	5
$\bar{x} = 18.0$	$\bar{y} = 21.8064$	$x - \bar{x} = +0.1897$	$(x - \bar{x})^2 = 0.0358$	$(x - \bar{x})(y - \bar{y}) = +0.0361$	$\bar{x} = 19.1897$	2
$y = 23.8576$	$\bar{y} = 21.8064$	$x - \bar{x} = +0.9657$	$(x - \bar{x})^2 = 0.9324$	$(x - \bar{x})(y - \bar{y}) = +0.9324$	$\bar{y} = 23.8576$	4
$R = 2.0512$	$\bar{y} = 21.8064$	$x - \bar{x} = +1.8830$	$(x - \bar{x})^2 = 3.5453$	$(x - \bar{x})(y - \bar{y}) = +1.8830$	$\bar{y} = 21.8064$	3
	$\bar{y} = 21.8064$	$x - \bar{x} = +2.0433$	$(x - \bar{x})^2 = 4.1750$	$(x - \bar{x})(y - \bar{y}) = +2.0433$	$\bar{y} = 21.8064$	2
	$\bar{y} = 21.8064$	$x - \bar{x} = +1.6685$	$(x - \bar{x})^2 = 2.7843$	$(x - \bar{x})(y - \bar{y}) = +1.6685$	$\bar{y} = 21.8064$	3
	$\bar{y} = 21.8064$	$x - \bar{x} = +2.0512$	$(x - \bar{x})^2 = 4.2074$	$(x - \bar{x})(y - \bar{y}) = +2.0512$	$\bar{y} = 21.8064$	3
	$\bar{y} = 21.8064$	$x - \bar{x} = 0.0000$	$(x - \bar{x})^2 = 0.0000$	$(x - \bar{x})(y - \bar{y}) = 0.0000$	$\bar{y} = 21.8064$	3
	$\bar{y} = 21.8064$	$x - \bar{x} = +1.4139$	$(x - \bar{x})^2 = 1.9987$	$(x - \bar{x})(y - \bar{y}) = +1.4139$	$\bar{y} = 21.8064$	3
	$\bar{y} = 21.8064$	$x - \bar{x} = +0.5457$	$(x - \bar{x})^2 = 0.2980$	$(x - \bar{x})(y - \bar{y}) = +0.5457$	$\bar{y} = 21.8064$	3

Point	x	$x - \bar{x}$	Δx	$(x - \bar{x})^2$	$(x - \bar{x})(y - \bar{y})$	$\bar{x} = 17.1385$	$\bar{y} = 21.8064$
1	18.0000	+1.1897	+1	1.4151	-4.2080	17.1385	21.8064
2	18.0000	+1.1897	+1	1.4156	+4.2088	17.1385	21.8064
3	19.0000	+0.1897	+2	0.0358	+0.0361	19.1897	21.8064
4	18.2240	+0.9657	-1	0.9324	+0.9324	18.2240	21.8064
5	17.3067	+1.8830	-1	3.5453	+1.8830	17.3067	21.8064
6	17.1464	+2.0433	+0	4.1750	+2.0433	17.1464	21.8064
7	17.5212	+1.6685	+1	2.7843	+1.6685	17.5212	21.8064
8	17.1385	+2.0512	+0	4.2074	+2.0512	17.1385	21.8064
9	19.1897	0.0000	+2	0.0000	0.0000	19.1897	21.8064
10	17.7758	+1.4139	-1	1.9987	+1.4139	17.7758	21.8064
11	18.6440	+0.5457	+2	0.2980	+0.5457	18.6440	21.8064

4.2055

	y	$y - \bar{y}$	Δy	$(y - \bar{y})^2$
1	20.1354	+1.6710	+2	2.7929
2	23.4775	+1.6711	-2	2.7932
3	23.8490	-2.0426	-2	4.1730
4	20.0000	+1.8064	+2	3.2638
5	21.0000	+0.8064	+1	0.6504
6	22.0000	+0.1936	0	0.0375
7	23.0000	-1.1936	-1	1.4249
8	21.8064	0.0000	0	0.0000
9	23.8576	-2.0512	-2	4.2082
10	20.3208	+1.4856	+1	2.2073
11	23.7813	-1.9749	-2	3.9000

Formation of normals.

No	aa	ab	an	bb	bn
1	1.42	+1.99	-29.8	2.79	-41.8
2	1.42	-1.99	-39.3	2.79	+55.1
3	0.04	-0.39	-6.8	4.16	+73.4
4	0.94	+1.76	+90.2	3.28	+168.3
5	3.53	+1.52	+184.2	0.65	+79.4
6	4.16	-0.39	-142.8	0.04	+13.3
7	2.79	-1.99	-61.8	1.42	+44.0
8	4.20	0.00	-39.0	0.00	0.0
9	0.00	-0.00	0.0	4.20	+55.4
10	1.99	+2.10	-7.0	2.22	-7.5
11	0.30	-1.08	+35.8	3.88	-128.0
	2079	+1.53	+16.3	2543	+311.6

$$[ca] = +13.14$$

$$[cb] = -3.33$$

$$[ca] = -4$$

Conditional Equations.

Point	a	b	c	
1	+ 1.19	+ 1.67	+ 1	= + 25
2	+ 1.19	- 1.67	+ 1	= + 33
3	+ 0.19	- 2.04	+ 1	= + 36
4	+ 0.97	+ 1.81	+ 1	= - 93
5	+ 1.88	+ 0.81	+ 1	= - 98
6	+ 2.04	+ 0.19	+ 1	= + 70
7	+ 1.67	- 1.19	+ 1	= + 37
8	+ 2.05	0.00	+ 1	= + 19
9	0.00	- 2.05	+ 1	= + 27
10	+ 1.41	+ 1.49	+ 1	= + 5
11	+ 0.55	+ 1.97	+ 1	= - 65

Normal Equations.

+ 2 a	- b	c	
+ 20.79	+ 1.53	+ 13.14	= + 16
+ 1.53	+ 25.43	- 3.33	= - 312
+ 13.14	- 3.33	+ 11.00	= - 4
- 1.53	- 0.11	- 0.97	= - 1
- 13.14	- 0.97	- 8.31	= - 10

$$+ 25.32 - 4.30 = - 313$$

$$- 4.30 + 2.69 = - 14$$

$$+ 4.30 - 0.73 = - 53$$

$$+ 1.96c = - 67$$

$$- 6.87 + 4.30 = - 22$$

$$+ 18.45c = - 335$$

$$- 15.70 + 3.98 - 13.14 = + 5$$

$$+ 3.98 - 1.08 + 3.33 = - 1$$

$$+ 5.09 + 5.51 = + 21$$

$$+ 5.51 + 24.35 = - 313$$

$$- 1.25 - 5.51 = + 71$$

$$+ 3.84a = + 92$$

$$- 344a$$

$$- 222c = -$$

$$\frac{\Delta x}{\Delta n} = 2.05 - 0.65 = 1.32$$

$$\frac{\Delta 8}{\Delta \omega} = 2.05 + 0.17 = + 0.35$$

$$c = - 34 \pm 28$$

$$b = - 18 \pm 9$$

$$a = + 24 \pm 20$$

Conditional Equations.

Point	a	b	c	
1	+ 1.19	+ 1.67	+ 1	= +25
2	+ 1.19	- 1.67	+ 1	= +33
3	+ 0.19	+ 2.04	+ 1	= +36
4	+ 0.97	+ 1.81	+ 1	= -93
5	+ 1.88	+ 0.81	+ 1	= -98
6	+ 2.04	+ 0.19	+ 1	= +70
7	+ 1.67	+ 1.19	+ 1	= +37
8	+ 2.05	0.00	+ 1	= +19
9	0.00	+ 2.05	+ 1	= +27
10	+ 1.41	+ 1.49	+ 1	= + 5
11	+ 0.55	+ 1.97	+ 1	= -65

Normal Equations.

+ a	- b	c	
+ 20.79	+ 1.53	+ 13.14	= + 16
+ 1.53	+ 25.43	- 3.33	= + 312
+ 13.14	- 3.33	+ 11.00	= - 4

- 1.53	- 0.11	- 0.97	= - 1
- 13.14	- 0.97	- 8.31	= - 10

+ 25.32	- 4.30	= - 313
- 4.30	+ 2.69	= - 14

+ 4.30	- 0.73	= - 53
	+ 1.966	= - 67

- 6.87	+ 4.30	= - 22
+ 18.45		= - 335

- 15.70	+ 3.98	- 13.14	= + 5
+ 3.98	- 1.08	+ 3.33	= - 1

+ 5.09	+ 5.51	= + 21
+ 5.51	+ 24.35	= - 313

- 1.25	- 5.51	= + 71
+ 3.84a		= + 92

- 344a

- 222c

$$\frac{\Delta s}{\Delta a} = 2.05 - 0.35 - 1.32$$

$$c = -34 \pm 28$$

$$b = -18 \pm 9$$

$$a = +24 \pm 20$$

25+	1+	101+	111+	1
25+	1+	101+	111+	2
25+	1+	101+	111+	3
25+	1+	101+	111+	4
25+	1+	101+	111+	5
25+	1+	101+	111+	6
25+	1+	101+	111+	7
25+	1+	101+	111+	8
25+	1+	101+	111+	9
25+	1+	101+	111+	10
25+	1+	101+	111+	11

25+	1+	101+	111+	1
25+	1+	101+	111+	2
25+	1+	101+	111+	3
25+	1+	101+	111+	4
25+	1+	101+	111+	5
25+	1+	101+	111+	6
25+	1+	101+	111+	7
25+	1+	101+	111+	8
25+	1+	101+	111+	9
25+	1+	101+	111+	10
25+	1+	101+	111+	11

25+	1+	101+	111+	1
25+	1+	101+	111+	2
25+	1+	101+	111+	3
25+	1+	101+	111+	4
25+	1+	101+	111+	5
25+	1+	101+	111+	6
25+	1+	101+	111+	7
25+	1+	101+	111+	8
25+	1+	101+	111+	9
25+	1+	101+	111+	10
25+	1+	101+	111+	11

25+	1+	101+	111+	1
25+	1+	101+	111+	2
25+	1+	101+	111+	3
25+	1+	101+	111+	4
25+	1+	101+	111+	5
25+	1+	101+	111+	6
25+	1+	101+	111+	7
25+	1+	101+	111+	8
25+	1+	101+	111+	9
25+	1+	101+	111+	10
25+	1+	101+	111+	11

Residuals.

					C	O	O - C
1	+	29	-30	-39	=	-35	+25
2	+	29	+30	-39	=	+25	+33
3	+	5	+37	-39	=	+8	+36
4	+	23	-33	-34	=	-44	-93
5	+	45	-15	-34	=	-4	-98
6	+	49	+3	-34	=	+18	+70
7	+	40	+21	-34	=	+27	+37
8	+	49	0	-34	=	+15	+19
9	+	0	+37	-34	=	+3	+27
10	+	34	-27	-34	=	-27	+5
11	+	13	+35	-34	=	+14	-65
							+218-222

Average = 40

Prob. Er. one eq = ± 39 $R_0 = 2.0512$ $\pm C = -8$ $R = 2.0504$ $X = -19.1958$ $Y = -21.8116$ $\pm C = -15$ $\pm C = +37$ $X = -19.1956$ $Y = -21.8118$

Mean position for 1911.0.

 $\bar{z} = -1.1956$ $\log \bar{z} = 0.07759$ $\cos \delta = 9.99167$ $\cos \gamma = 8.50724$ $\log (\alpha - A) = 1.57868$ $\alpha - A = 37.90$ $A = 10^h 58 20$ $\alpha = 10^h 57 42.10$ $\eta = +0.1882$ $\log \tan \delta = 9.316$ $\log \bar{z} = 0.145$ $\log \eta = 6.514$ $\log \eta_1 = +3$ $\eta_1 = +3$ $\eta_0 = +0.1879$ $\log \eta_0 = 9.27393$ $\log \eta_1 = 7.33115$ $\log (\delta - D) = 1.94278$ $\delta - D = +87.66$ $D = +11^{\circ} 09' 56''$ $\delta = +11^{\circ} 11' 23.7''$ $\delta = +11^{\circ} 11' 23.7''$

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1912 Nov. 19.

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Residuals

					C	O	O-C	
1	+	29	-30	-34	=	-35	+25	+60
2	+	29	+30	-34	=	+25	+33	+8
3	+	5	+37	-34	=	+8	+36	+28
4	+	23	-33	-34	=	-44	-93	-49
5	+	45	-15	-34	=	-4	-98	-94
6	+	49	+3	-34	=	+18	+70	+52
7	+	40	+21	-34	=	+27	+37	+10
8	+	49	0	-34	=	+15	+19	+4
9	+	0	+37	-34	=	+3	+27	+24
10	+	34	-27	-34	=	-27	+5	+32
11	+	13	+35	-34	=	+14	-65	-79

-218-22

-218-222

Average = 40

Prob. error = ± 39

R = 2.0512

 $\pm C = -8$

R = 2.0504

 $X_0 = 19.1897$ $Y_0 = 21.8064$ ± 12 ± 18 $X = 19.1885$ $Y = 21.8082$ Applying previous consts. $X = 19.1812$ $Y = 21.8048$

computed

 $\alpha = +23$ -24 $\log = -13$ -15 $\omega = -8$ $+37$ $X = 19.1814$ $Y = 21.8046$

Mean Position for 1911.0.

 $\bar{z} = -1.1814$ $\eta = +0.1954$ $\log \delta = 0.07240$ $\log \delta = 9.99167$ $\log \delta = 8.50724$ $\log \tan \delta = 9.316$ $\log \delta = 0.145$ $\log \delta = 7.053$ $\log \eta = 6.514$ $\eta = +3$ $\log A = 11.57349$ $A = 10^h 58 20$ $A = 10^h 58 20$ $\eta_0 = +0.1951$ $\log \eta_0 = 9.20026$ $\log \eta_0 = 7.33115$ $\alpha = +10^h 57^m 42.55$ $10 57 42.10$ $\log (S-D) = 1.86911$ $S-D = +74.0 + 01' 14.0$ $D = +11^{\circ} 09' 56''$ $S = +11^{\circ} 11' 10.0$ $+11 11 23.7$

MC 878 (Tan 17, 10^h)

1912 Nov. 25

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Reduction to apparent place.

$$\begin{aligned}\alpha_0 &= 10^h 57^m 42.55^s \\ \delta &= 16^\circ 05' 6'' \\ G + \alpha_0 &= 27 02 48.55 \\ &\quad (1405^\circ 42')\end{aligned}$$

$$\begin{aligned}\delta &= +11^\circ 11' 10.0'' \\ H &= 22^h 19^m 18^s \\ H + \alpha_0 &= 33 17 09.55 \\ &\quad (139^\circ 15')\end{aligned}$$

$$\begin{aligned}\log \frac{1}{r_0} &= 8.8239 & \log \frac{1}{r_s} &= 8.8239 \\ \therefore g &= 0.8483 & \therefore h &= 1.3033 \\ \therefore \sin(G+\alpha) &= 9.8547 & \sin(H+\alpha) &= 9.8148 \\ \tan \delta_0 &= 9.2961 & \sec \delta_0 &= 0.0083 \\ \log(g) &= 8.8230 & \log(h) &= 9.9503\end{aligned}$$

$$\begin{aligned}\log i &= 0.5680m \\ \therefore \cos \delta_0 &= 9.9917 \\ \therefore (i) &= 0.5597m\end{aligned}$$

$$\begin{aligned}\therefore g &= 0.8483 & \log h &= 1.3033 \\ \therefore \cos(G+\alpha) &= 9.8441 & \cos(H+\alpha) &= 9.8794m \\ \therefore (g') &= 0.6924 & \sin \delta_0 &= 9.2878 \\ & & \log(h') &= 0.4705m\end{aligned}$$

$$\begin{aligned}\alpha_0 &= 10^h 57^m 42.55^s \\ \frac{1}{r_0} &= - 0.52 \\ (g') &= + 0.07 \\ (h') &= + 0.89 \\ \alpha &= 10^h 57^m 42.99^s \\ &\quad - 45^s \\ \hline &10 57 42.54^s\end{aligned}$$

$$\begin{aligned}\delta_0 &= +11^\circ 11' 10.0'' \\ (g') &= + 4.9 \\ (h') &= - 3.0 \\ (i) &= - 3.6 \\ \delta &= +11^\circ 11' 08.3'' \\ &\quad + 13.7'' \\ \hline &+11 11 22.0''\end{aligned}$$

$$\begin{aligned}&+ 96 \\ &- 52 \\ &44\end{aligned}$$

$$\begin{aligned}&- 6.6 \\ &+ 4.9 \\ &17\end{aligned}$$

20.00000000

(0.01, 0.01) 0.00000000

0.00000000 0.00000000

0.01 11 11 + 0 22.50 01 01 01
 01 01 01 01 01 01 01 01 01
 01 01 01 01 01 01 01 01 01
 (01 01 01) (01 01 01)

0.00000000 0.00000000 0.00000000 0.00000000
 0.00000000 0.00000000 0.00000000 0.00000000
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0.00000000 0.00000000 0.00000000 0.00000000
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0.01 11 11 + 0 22.50 01 01 01
 01 01 01 01 01 01 01 01 01
 01 01 01 01 01 01 01 01 01
 01 01 01 01 01 01 01 01 01
 01 01 01 01 01 01 01 01 01
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 01 01 01 01 01 01 01 01 01
 01 01 01 01 01 01 01 01 01

M 878 (Tan 17, 10^h)

1912 Nov. 25

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Reduction to apparent place.

$$\begin{aligned} \alpha_0 &= 10^h 57^m 42.55 \\ \delta &= 16^\circ 05' 6. \\ G + \alpha &= 27.024855 \\ &\quad (405^\circ 42') \end{aligned}$$

$$\begin{aligned} \delta &= +11^\circ 11' 10.0 \\ H &= 22^h 19^m 18^s \\ &\quad 33 \quad 17 \quad 00.55 \\ &\quad (139^\circ 15') \end{aligned}$$

$$\begin{aligned} \log \frac{1}{r} &= 8.8239 & \log \frac{1}{r} &= 8.8239 \\ \log &= 0.8483 & h &= 1.3033 \\ \sin(G+H) &= 9.8547 & \sin(H+X) &= 9.8148 \\ \tan \delta &= 9.2961 & \sec \delta_0 &= 0.0083 \\ \log(g) &= 8.8230 & \log(h) &= 9.9503 \end{aligned}$$

$$\begin{aligned} \log &= 0.8483 & \log &= 1.3033 \\ \sin(G+H) &= 9.8441 & \sin(H+X) &= 9.8794 \\ (g') &= 0.6924 & \sin \delta_0 &= 9.2878 \\ & & \log(h') &= 6.4705 \end{aligned}$$

$$\begin{aligned} \alpha_0 &= 10^h 57^m 42.55 \\ f &= -0.52 \\ (g) &= +0.07 \\ (h) &= +0.89 \\ \alpha &= 10^h 57^m 40.99 \\ &\quad 10 \quad 57 \quad 42.54 \end{aligned}$$

$$\begin{aligned} \delta_0 &= +11^\circ 11' 10.0 \\ (g') &= +4.9 \\ (h') &= -3.0 \\ \delta &= +11^\circ 11' 08.8 \\ &\quad +11 \quad 11 \quad 22.0 \end{aligned}$$

0.01 11 11 + 3
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12 11 11 + 3
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22.24 53 01 0.2
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Lunar parallax

$$\begin{aligned} \alpha' &= 10^h 57^m 42.99^s \\ \delta' &= 9 \ 56 \ 35.9 \\ \ominus - \alpha' &= -1 \ 01 \ 06.6 \\ &= -15^\circ 16' 39'' \end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = - \quad 5 \ 44$$

$$(\delta - \delta') - \frac{1}{2}(\alpha - \alpha') = -15 \ 10 \ 55$$

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

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.00000$$

$$\cos(\delta - \delta') \frac{1}{2}(\alpha - \alpha') = 9.98457$$

$$\tan \gamma = 9.97270$$

$$\gamma = +43^\circ 12' 02.2$$

$$\delta = +11 \ 11 \ 22.0$$

$$\delta - \delta' = +32 \ 00 \ 40.2$$

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

$$\sin \gamma = 8.22355$$

$$\sin(\delta - \delta') = 9.72434$$

$$\sin \gamma = 9.83541$$

$$\sin(\delta - \delta') = 7.93888$$

$$\delta - \delta' = + \quad 29' 51.9''$$

$$\delta = +11 \ 41 \ 13.9$$

$$\text{App. par. } \delta = +11^\circ 41' 16.6''$$

$$O - C = -12.7$$

$$\text{Corr to stand. radius} = -0.7$$

$$\text{Final } O - C = -3.4$$

$$\begin{aligned} \delta' &= +11^\circ 11' 22.0'' \\ \pi &= 57' 31.9'' \end{aligned}$$

$$\log \rho \cos \phi' = 9.86913$$

$$\sin \pi = 8.22355$$

$$\sin(\delta - \delta') = 9.42077$$

$$\cos \delta' = 9.99167$$

$$\sin(\alpha - \alpha') = 7.51185$$

$$(\alpha - \alpha') = -11' 10.3''$$

$$\log \cos \delta = 9.99090$$

$$\sin(\alpha - \alpha') = 7.52255$$

$$\alpha - \alpha' = -11' 27.0''$$

$$= -45.80$$

$$\alpha = 10 \ 56 \ 56.74$$

$$\alpha = 10^h 56^m 56.45^s$$

$$+ \quad 0.29$$

$$+ \quad 0.17$$

$$+ \quad 0.46$$

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MC 878

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lunar parallax

$$\begin{aligned}\alpha' &= 10^h 57^m 42.9^s \\ \delta &= 9 \ 56 \ 35.9 \\ \alpha - \alpha' &= -1 \ 01 \ 06.6 \\ &= -15^\circ 16' 396.4\end{aligned}$$

$$\frac{1}{2}(\alpha - \alpha') = -5 \ 44.2$$

$$\delta - \delta' - \frac{1}{2}(\alpha - \alpha') = -15 \ 10 \ 55.2$$

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

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.00000$$

$$\cos(\delta - \delta') \frac{1}{2}(\alpha - \alpha') = 9.98457$$

$$\tan \gamma = 9.97270$$

$$\gamma = +43^\circ 12' 04.7$$

$$\delta = +11 \ 11 \ 08.3$$

$$\delta - \delta' = +32 \ 00 \ 56.4$$

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

$$\sin \gamma = 8.22356$$

$$\sin(\delta - \delta') = 9.72434$$

$$\sin \gamma = 9.83541$$

$$\sin(\delta - \delta') = 7.93889$$

$$\delta - \delta' = +29' 51.9$$

$$\delta = +11 \ 41 \ 13.9$$

$$\text{Observed } \delta = +11^\circ 41' 16.6$$

$$O - C = -16.2$$

$$\text{Corr to stand. radius} = -3.77$$

$$\text{Final } O - C = -3.4$$

$$\begin{aligned}\delta' &= +11^\circ 11' 22.0 \\ \gamma &= 57' 31.5\end{aligned}$$

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

$$\sin \gamma = 8.22356$$

$$\sin(\delta - \delta') = 9.42077$$

$$\cos \delta' = 9.99167$$

$$\sin(\alpha - \alpha') = 7.51185$$

$$(\alpha - \alpha') = -11' 10.3$$

$$\log \cos \delta = 9.99090$$

$$\sin(\alpha - \alpha') = 7.52256$$

$$\alpha - \alpha' = -11' 27.0$$

$$= -45.80$$

$$\alpha = 10 \ 56 \ 56.74$$

$$\alpha = 10^h 56^m 56.45$$

$$+ - 0.73$$

$$+ + 0.129$$

$$+ 0.46$$

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Standard of Observations. 20-10-12-13

10	55	022.4	10	54	54.1	10	57	54.5
-	3	00.7	-	3	00.7	-	0	00.1
-	1	150.73	-	1	150.73	-	0	150.73
22570.3			22570.3			22570.3		
4.00000			4.00000			4.00000		
0.75438			0.75438			0.75438		
-	50.004		-	50.004		-	50.004	
-	1.4		-	1.4		-	1.4	
12.3162			12.3162			12.3162		
12.3804			12.3804			12.3804		
+ 4.32			+ 4.32			+ 4.32		

10	54	54.1	10	54	54.1	10	57	54.5
11	5	47	11	5	47	11	5	47
-	2	78	-	2	78	-	0	78
43728.1			43728.1			43728.1		
3.57150			3.57150			3.57150		
0.90265			0.90265			0.90265		
9.2348			9.2348			9.2348		
1.5028			1.5028			1.5028		
7.8744			7.8744			7.8744		
+ 7.9012			+ 7.9012			+ 7.9012		
+ 7.4			+ 7.4			+ 7.4		
12.3097			12.3097			12.3097		
12.30213			12.30213			12.30213		
+ 3.16			+ 3.16			+ 3.16		

Standard coordinates. see pages 42-44.

	1	2	3
α	10 55 02.26	10 54 54.10	10 57 54.59
$\alpha - A$	- 3 00.74	- 3 8.90	- 0 8.41
$\sin(\alpha - A)$	- 180.73	- 188.89	- 8.41
$\log \mu$	2.25703 m	2.27621 m	0.92480 m
$\cos \delta$	9.99011	9.99280	9.99381
δ	0.75438 m	0.77625 m	9.48585 m
δ	- 5.6804	- 5.9738	- 0.2666
δ	- 14	- 10	- 1
δ	12.3182	12.0252	17.7333
δ	12.3864	11.9844	17.6421
$\delta - \delta$	+ 682	- 0408	- 912

δ	+ 12° 10' 54.8	10° 24' 28.9	9° 39' 07.0
δ	11 8 47	11 8 47	11 8 47
$\delta - \delta$	+ 1 2 7.8	- 44 18.1	- 1 29 40.0
$\tan(\delta - \delta)$	+ 3728.2	- 2658.2	- 5381.2
$\log \mu$	3.57150	3.42458 m	3.73088 m
μ	0.90265	0.75573 m	1.06203 m
$\tan \delta$	9.3342	9.2641	9.2306
δ	1.5088	1.5525	88517
μ	7.8964	7.8700	5.1357
μ	+ 7.9918	- 5.6981	- 11.5353
μ	+ 79	+ 74	0
μ	29.9997	16.3093	10.4647
μ	30.0313	16.3518	10.4631
$\mu - \mu$	+ 316	+ 425	- 16

Standard coordinates.

See pages 42-44.

	1	2	3
α	10 55 02.26	10 54 54.10	10 57 54.59
$\alpha - A$	- 3 00.74	- 3 8.90	- 0 8.41
$\sin(\alpha - A)$	- 180.73	- 188.89	- 8.41
$\log r$	2.25703 m	2.27621 m	0.92480 m
$\cos \delta$	9.99011	9.99250	9.99381
δ	0.75438 m	0.77625 m	9.42585 m
δ_0	- 5.6804	- 5.9738	- 0.2666
δ_1	- 14	- 10	- 1
δ	12.3182	12.0252	17.7333
α	12.3864	11.9844	17.6421
$\alpha - \delta$	+ 682	- 0408	- 912
δ	+ 12° 10' 54.8"	10° 24' 28.9"	9° 39' 07.0"
δ	11 8 47	11 8 47	11 8 47
$\delta - D$	+ 1 2 7.8	- 44 18.1	- 1 29 40.0
$\sin(\delta - D)$	+ 3728.2	- 2658.2	- 5381.2
$\log r$	3.57150	3.42458 m	3.73088 m
η_0	0.90265	0.75573 m	1.06203 m
$\cos \delta$	9.3342	9.2641	9.2306
δ	1.5088	1.5525	8.8517
η_1	7.8964	7.8700	5.1357
η_0	+ 7.9918	- 5.6981	- 11.5353
η_1	+ 74	+ 74	0
η	29.9997	16.3093	10.4647
η	30.0313	16.3518	10.4631
$\eta - \eta$	+ 316	+ 425	- 16

Standard Coordinates of comp. stars.
 Serpp 42-44.

α	11 ^h 02 ^m 34.42
A	10 58 03
$\alpha - A$	+ 4 31.42
$\sin(\alpha - A)$	+ 271.40
$\log \dots$	2.43361
" $\cos \delta$	9.99239 ^v
" ζ_0	0.93324
ζ_0	+ 8.5752
ζ_1	+ 18
ζ	26.5770
α	26.5496
$\alpha - \zeta$	- 274

α	11 ^h 01 ^m 01.09
A	10 58 03
$\alpha - A$	+ 2 58.09
$\sin(\alpha - A)$	+ 178.09
$\log \dots$	2.25064
" $\cos \delta$	9.98946 ^v
" ζ_0	0.74734
	[+ 5.5891]
ζ_0	+ 21
ζ	23.5912
α	23.6822
$\alpha - \zeta$	+ 910

δ	10° 41' 37.9
D	11 08 47
$\delta - D$	- 27 9.1
$\tan(\delta - D)$	- 1629.1
$\log \dots$	3.21195
" η_0	0.54310 ^m
" $\tan \delta$	9.2759 ^v
" ζ	18665
" η_1	8.1958
η_0	- 3.4922
η_1	+ 157
η	18.5235
η	18.4491
$\eta - \eta_0$	- 744

δ	12 34 11.9
D	11 08 47
$\delta - D$	+ 1 25 24.9
$\tan(\delta - D)$	+ 5126.0
$\log \dots$	3.70978
" η_0	1.04093
" $\tan \delta$	9.3482 ^v
" ζ	14947
" η_1	7.8963
η_0	+ 10.9882
η_1	+ 79
η	32.9961
η	32.9381
$\eta - \eta_0$	- 580

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1911phae.000j	1911phae.000j	1911phae.000j
1911phae.000j	1911phae.000j	1911phae.000j

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Standard Coordinates of comp. stars.
See pp 42-44.

	⁴	
α	11 ^h 02 ^m 34.42	
A	10 58 03	
$\alpha-A$	+ 4 31.42	
$\sin(\alpha-A)$	+ 271.40	
$\log "$	2.43361	
" \cos	9.99239 ^v	
\log	0.93324	
\log		
\log	+ 8.5752	
\log	+ 18	
\log	26.5770	
\log	26.5496	
\log	- 274	

	⁵	
α	11 ^h 01 ^m 01.09	
A	10 58 03	
$\alpha-A$	+ 2 58.09	
$\sin(\alpha-A)$	+ 178.09	
$\log "$	2.25064	
" \cos	9.98946 ^v	
\log	0.74734	
\log	[+ 5.5891]	
\log		
\log	+ 21	
\log	23.5912	
\log	23.6822	
\log	+ 910	

δ	10° 41' 37.9	
D	11 08 47	
$\delta-D$	- 27 9.1	
$\tan(\delta-D)$	- 1629.1	
$\log "$	3.21195	
\log	0.54310 ^m	
\log		
\log	9.2759 ^v	
\log	1.8665	
\log	8.1958	
\log		
\log	- 3.4922	
\log	+ 157	
\log	18.5235	
\log	18.4491	
\log	- 744	

δ	12 34 11.9	
D	11 08 47	
$\delta-D$	+ 1 25 24.9	
$\tan(\delta-D)$	+ 5126.0	
$\log "$	3.70978	
\log	1.04093	
\log		
\log	9.3482 ^v	
\log	1.4947	
\log	7.8963	
\log		
\log	+ 10.9882	
\log	+ 79	
\log	32.9961	
\log	32.9381	
\log	- 580	

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Oct 9.

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Comparison stars - see pp. 42-44

μ	d	N	μ	d	N
12.4	16095	13815	14150	13690	
30.0	15780 88	4140 45	800610	9820 10	
	82	35	10	22	
	75	25	45	80	
	<u>30.0211</u>	<u>30.0215</u>	<u>12.3859</u>	<u>12.3869</u>	

μ	d	N	μ	d	N
12.0	14822	15164	11760		
16.4	10705 00	8670 80	11600 02	6785 95	
	04	80	00	95	
	10	50		6640	
	<u>16.3514</u>	<u>16.3522</u>	<u>12.9841</u>	<u>11.9848</u>	

μ	d	N	μ	d	N
17.7	15790	16332	15200	14205	
10.5	11150 55	10960 60	11616 10	7778 70	
	56	55	10	70	
	76	18	80	88	
	<u>10.4629</u>	<u>10.4633</u>	<u>17.6420</u>	<u>17.6422</u>	

μ	d	N	μ	d	N
26.5	14570	14973	15755	14650	
18.5	10072 70	9454 64	11248 50	9156 60	
	78	58	50	55	
	62	70	50	56	
	<u>18.4494</u>	<u>18.4488</u>	<u>26.5496</u>	<u>26.5496</u>	

μ	d	N	μ	d	N
23.7	14760	15590	14866	14672	
32.9	5380 80	14978 68	11695 95	7858 58	
	80	70	90	65	
	60	90	78	84	
	<u>32.9380</u>	<u>32.9382</u>	<u>23.6843</u>	<u>23.6820</u>	

MC 879

1912 Oct 8.

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Comparison stars - see pp. 42-44

y		N		d		N	
12.4	16095	15815		14150		13690	
30.0	15780 88	4140 45		8006 10		9820 10	
	800	35 45		10		22 10	
	45	25		45		80	
<u>30.0311</u>		<u>30.0315</u>		<u>123859</u>		<u>123869</u>	
15029		15870		11760		67815	
12.0	14822	15164		11600		9595	
16.4	10705 60	8670 80		00		6640	
	204	80					
	10	50					
<u>16.3514</u>		<u>16.3522</u>		<u>119841</u>		<u>119848</u>	
15790		16332		15200		14205	
12.7	15790	16332		11616 10		7778 70	
10.5	11150 55	10760 60		10		88	
	56	55					
	22.67876	22.6718					
<u>10.4629</u>		<u>10.4633</u>		<u>17.6430</u>		<u>17.6423</u>	
14570		14973		15755		14650	
26.5	10072 70	9454 64		15755		14650	
	78	58		15755		14650	
18.5	62	70		50		55	
				50		56	
21.0	184494	18.4488		20.8496		26.5496	
<u>14760</u>		<u>15590</u>		<u>14866</u>		<u>14672</u>	
43.7	14760	15590		14866		14672	
32.9	5380 80	14978 68		11695 95		7858 58	
	80	70		90		65	
		90		78		84	
<u>32.9380</u>		<u>32.9382</u>		<u>23.6823</u>		<u>23.6820</u>	

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Points on moon's limb.
measures

$\frac{1}{8}$	d	y	N
19.9	14420		15720
	505372		1504552
	5270		6062
	23		20

18.936118.9335

$\frac{2}{19.}$	15028	15370
20.4	1219282	818070
	9480	7286
	26	68

20.284120.2809

$\frac{3}{19.}$	14170	13362
23.6	738575	1011512
	8078	0620
	60	62

23.678323.6751

$\frac{4}{18.3}$	d	N
20.0	15145	14815
	880555	1113518
	9842	2010
	45	20

18.368018.3696

$\frac{5}{19.6}$	14360	14098
21.0	1088685	758060
	7066	6868
	60	03

19.651719.6532

$\frac{6}{19.9}$	13380	14545
22.0	1228890	552816
	9086	3818
	10	45

19.897819.9020

MC 879

1912 Oct. 9

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Points on moon's limb.

Measures continued.

1		2		3	
18	d	15	N	13	N
19.9	14420	15720		13570	
22.0	505372	1504518		731000	
	5270	6062	052	0206	
	23	20	5270	72	
		10			
	<u>18.9361</u>	<u>18.9335</u>			
2		10.6257		<u>19.6266</u>	
19.6	15028	15370			
20.4	97219282	8180700		14505	
	9480	7286	05	550808	
	26	68	0450	0498	
			60	02	
	<u>20.2841</u>	<u>20.2809</u>			
3		12.9332		<u>19.2998</u>	
19.6	14170	13362			
23.6	738575	1011512			
	8078	0620			
	60	62			
	<u>23.6783</u>	<u>23.6751</u>			
4					
19.3	14550	14652	15145	14815	
20.0	5675240	14888055	9802	1113518	
	20	45	30	2010	
				30	
		<u>18.3680</u>		<u>18.3696</u>	
5					
19.6	14360			14098	
20.0	1088685			758060	
19.2	16414	16492	17066	156868	
20.1	6068	600563		703	
	<u>19.6517</u>			<u>19.6532</u>	
6					
19.9	1330034			14545	
22.0	1228890			552816	
	9086			3818	
	10			45	
	<u>19.8978</u>			<u>19.9020</u>	

AAC 879

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Points on Moon's limb. Measurements continued.

7
19.6
23.0

α
16200
12470 52
5270
10

ω
13570
7310 00
0406
72

19.625719.6266

8
 $\alpha = 19.9 = \text{max.}$
 $\omega = 21.9$

15260
14232 45
44 50
60

14505
550808
0498
02

ω
15447
17.8 1400521
19.9 2019
41
min 19.8569

α 19.8983
15220
663821
1520
10
.8587

19.8998

measured lim. 5
rough edge

9 scratches on north limb.

18.8	14550	14653	13482	13882
23.8	675240	1242433	1173415	564545
	5048	2440	3025	4030
	50	60	84	82

23.780223.777618.824418.8242

10 scratch on south limb.

18.8	16414	16090	14170	15470
20.1	1495856	252010	1180503	781525
	6068	1214	0205	2220
	10	90	70	70

20.145420.142418.763418.7650

1911 Oct 9

1911 Oct 9

Points on Meridian

Observations

1225	1225
1210	1210
1200	1200
1150	1150

1225	1225
------	------

1225	1225
1210	1210
1200	1200
1150	1150

1225	1225
------	------

1225

1225

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MLC 879

1912 Oct. 9. 62

Points on Moon's limb

measurements continued.

7			α	δ
19.6	12.336	35.731	16200	13570
23.0	11.924	16.551	12470.52	7310.00
	17.643	10.949	5270	04.06
	26.549	18.449	10	72
	23.632	32.930		
	319.224	81.023		
	18.43	2.15		

19.625719.6266

8			α	δ
2-19.9	max		15260	14505
4-21.9	39.5		14232.45	5502.08
			44.50	04.98
			60	02

9	α	δ	α	δ
15.447	15220	19.8983	19.8998	06.00
17.2 1400521	663821			
14.9 2019	1520			
41	10.			
19.8569	.8587			

measured Nov. 5

rough edge

49 scratches on north limb.

18.8	14550	14658	13482	13882
23.8	675240	1242433	1173415	564545
	5048	2440	3025	4030
	50	60	84	82

23.780223.777618.824418.8242

10 scratches on south limb.

18.8	16414	16690	14170	15470
20.1	1495856	752010	1180509	781525
	6068	1214	0205	2270
	10	40	70	74

20.145420.142418.763418.7650

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mean measured coords of comp. stars.
and coords of center of plate.

star	α	δ
1	12.3864 ^v	30.0313 ^v
2	11.9844 ^v	16.3518 ^v
3	17.6421 ^v	10.4631 ^v
4	26.5496 ^v	18.4491 ^v
5	23.6822 ^v	32.9381 ^v
	<u>5192.24^v</u>	<u>510823^v</u>
	18.45 ^v	21.65 ^v
	<u>31</u>	-35
	45	<u>465</u>
	<u>135</u>	175
	+13.95 ^v	210
		<u>140</u>
		-162.75 ^v = 2' 43"

Mean R.A. = $10^h 58^m 17^s$
 $- 14^s$
 $\hline 10 58 03$

see p 49

Mean Decl. = $11^\circ 06' 04''$
 $+ 2' 43''$
 $\hline 11^\circ 08' 47''$

A = $10^h 58^m 03^s$
D = $11^\circ 08' 47''$ } center of plate.

Preliminary Reduction

Star	$x - \bar{x}$	$y - \bar{y}$	x^2	y^2
	-814	+1755		
1	+682	-2441	-1759	-4
2	-408	-1324	-1732	+23
3	-912	-847	-1759	-4
4	-274	-1494	-1768	-13
5	+910	-2668	-1758	-3
Mean	17.8522 ^v	-1780 ^v		17.8497 ^v

Star	$x - \bar{x}$	$y - \bar{y}$	x^2	y^2	xy
	+802	+44			-1442
1	+316	+991	+1307	+120	+1427
2	+425	+958	+1383	+65	+1448
3	-16	+1411	+1395	+41	+1436
4	-744	+2124	+1380	+74	+1454
5	-580	+1894	+1314	+132	+1446
Mean	21.9784 ^v	+1428 ^v		+88 ^v	21.9858 ^v

1911phae.0003

1911phae.0003

Mean position of center of gravity of plate.
and center of center of plate.

Station	Height	Distance
1	1.2324	1.2324
2	1.1234	1.1234
3	1.7421	1.7421
4	1.6240	1.6240
5	1.2324	1.2324
6	1.2324	1.2324
7	1.2324	1.2324
8	1.2324	1.2324
9	1.2324	1.2324
10	1.2324	1.2324
11	1.2324	1.2324
12	1.2324	1.2324
13	1.2324	1.2324
14	1.2324	1.2324
15	1.2324	1.2324
16	1.2324	1.2324
17	1.2324	1.2324
18	1.2324	1.2324
19	1.2324	1.2324
20	1.2324	1.2324

Station	Height	Distance
1	1.2324	1.2324
2	1.1234	1.1234
3	1.7421	1.7421
4	1.6240	1.6240
5	1.2324	1.2324
6	1.2324	1.2324
7	1.2324	1.2324
8	1.2324	1.2324
9	1.2324	1.2324
10	1.2324	1.2324
11	1.2324	1.2324
12	1.2324	1.2324
13	1.2324	1.2324
14	1.2324	1.2324
15	1.2324	1.2324
16	1.2324	1.2324
17	1.2324	1.2324
18	1.2324	1.2324
19	1.2324	1.2324
20	1.2324	1.2324

A = 10° 28' 08" } Center of plate
D = 11° 08' 47"

Observing Position

Station	Height	Distance
1	1.2324	1.2324
2	1.1234	1.1234
3	1.7421	1.7421
4	1.6240	1.6240
5	1.2324	1.2324
6	1.2324	1.2324
7	1.2324	1.2324
8	1.2324	1.2324
9	1.2324	1.2324
10	1.2324	1.2324
11	1.2324	1.2324
12	1.2324	1.2324
13	1.2324	1.2324
14	1.2324	1.2324
15	1.2324	1.2324
16	1.2324	1.2324
17	1.2324	1.2324
18	1.2324	1.2324
19	1.2324	1.2324
20	1.2324	1.2324

Station	Height	Distance
1	1.2324	1.2324
2	1.1234	1.1234
3	1.7421	1.7421
4	1.6240	1.6240
5	1.2324	1.2324
6	1.2324	1.2324
7	1.2324	1.2324
8	1.2324	1.2324
9	1.2324	1.2324
10	1.2324	1.2324
11	1.2324	1.2324
12	1.2324	1.2324
13	1.2324	1.2324
14	1.2324	1.2324
15	1.2324	1.2324
16	1.2324	1.2324
17	1.2324	1.2324
18	1.2324	1.2324
19	1.2324	1.2324
20	1.2324	1.2324

mean measured coords of comp. stars.
and coords. of center of plate.

Star	x	y
1	12.3864	30.0313
2	11.9844	16.3518
3	17.6421	10.4631
4	26.5496	18.4491
5	13.6822	32.9381
	<u>59.224</u>	<u>108.23</u>
	18.43	21.65
	<u>31</u>	<u>35</u>
	45	463
	<u>135</u>	<u>175</u>
	13.95	210
		<u>140</u>

$$162.75 = 2' 43''$$

$$\text{Mean R.A.} = 10^h 58^m 17^s$$

$$\quad \quad \quad - 14^s$$

$$\hline 10 \ 58 \ 03$$

see p 49

$$\text{Mean Decl.} = 11^{\circ} 06' 04''$$

$$\quad \quad \quad + 2' 43''$$

$$\hline 11^{\circ} 08' 47''$$

$$A = 10^h 58^m 03^s$$

$$D = 11^{\circ} 08' 47'' \quad \left. \vphantom{\begin{matrix} A \\ D \end{matrix}} \right\} \text{center of plate.}$$

Preliminary Reduction

Star	x- \bar{x}	y- \bar{y}		
	-814		+1755	
1	+682	-2441	-1759	-4
2	-408	-1324	-1732	+23
3	-912	-847	-1759	-4
4	-274	-1494	-1768	-13
5	+910	-2668	-1758	-3
mean	17.8522	-1780		17.8497

Star	y- \bar{y}	+802	+44	-1442
1	+316	+991	+1307	+1427
2	+425	+958	+1383	+65
3	-16	+1411	+1395	+41
4	-744	+2124	+1380	+74
5	-580	+1894	+1314	+132
mean	21.9784	+1428	+88	

Conditional Equations

	Star	a	b	
X ₄	4	26.55 + 18.45 + c = -13		+12
X ₅	5	23.68 + 32.94 + c = -3		+4
X ₃	3	17.64 + 10.46 + c = -4		-6
X ₁	1	12.39 + 30.03 + c = -4		-15
X ₂	2	11.98 + 16.35 + c = +23		+6

Mean Equations

25.12 + 25.70 + c = -8.00	+8.00
14.00 + 18.95 + c = +5.00	-5.00
18.04 + 31.48 + c = -3.50	-5.50
18.72 + 15.09 + c = +2.00	+4.00

(-p61)	+11.12 + 6.75 = -13.00	+13.00
	-0.68 + 16.39 = -5.50	-4.50
	-0.68 - 0.41 = +0.79	-0.79
	+16.80 b = -6.29	-8.71
	b = -0.37	-0.52
	11.12a = -13.00 + 2.50 = -10.50	+13.00 + 3.51 = +16.51
	a = -0.94	a = +1.48

-8	+5	-3.5	+2.0
+24	+13	+16.9	+17.
+9	+7	+11.7	+6.
+25	+25	+25	+25

C from x = 3

Residuals in x

4	-25	-7	+25
5	-22	-12	+25
3	-17	-4	+25
1	-12	-11	+25
2	-11	-6	+25

Residuals in y

4	+39	-9	-16	= +14	+12	-2	+1	-3
5	+35	-17	-16	= +2	+4	+2	+13	-11
3	+26	-5	-16	= +5	-6	-11	-12	+1
1	+18	-16	-16	= -14	-15	-1	-11	+10
2	+18	-8	-16	= -6	+6	+12	+13	-1

+8	-5	-5	+4
-37	-21	-27	-28
+13	+10	+16	+8
-16	-16	+16	-16

C from y = 4

c	0	0-c	0-c	
-7	-13	-6	+10	-1.6
-9	-3	+6	+2	+4
+4	-4	-8	-11	+3
+2	-4	-6	-1	-5
+8	-23	+15	+1	+14

Conversion Table

Star	Star	Star	Star
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20

Conversion Table

0.00	0.00	0.00	0.00
0.01	0.01	0.01	0.01
0.02	0.02	0.02	0.02
0.03	0.03	0.03	0.03

0.04	0.04	0.04	0.04
0.05	0.05	0.05	0.05
0.06	0.06	0.06	0.06
0.07	0.07	0.07	0.07
0.08	0.08	0.08	0.08
0.09	0.09	0.09	0.09

0.10	0.10	0.10	0.10
0.11	0.11	0.11	0.11
0.12	0.12	0.12	0.12
0.13	0.13	0.13	0.13
0.14	0.14	0.14	0.14
0.15	0.15	0.15	0.15

0.16	0.16	0.16	0.16
0.17	0.17	0.17	0.17
0.18	0.18	0.18	0.18
0.19	0.19	0.19	0.19
0.20	0.20	0.20	0.20
0.21	0.21	0.21	0.21

0.22	0.22	0.22	0.22
0.23	0.23	0.23	0.23
0.24	0.24	0.24	0.24
0.25	0.25	0.25	0.25
0.26	0.26	0.26	0.26
0.27	0.27	0.27	0.27
0.28	0.28	0.28	0.28
0.29	0.29	0.29	0.29
0.30	0.30	0.30	0.30

0.31	0.31	0.31	0.31
0.32	0.32	0.32	0.32
0.33	0.33	0.33	0.33
0.34	0.34	0.34	0.34
0.35	0.35	0.35	0.35
0.36	0.36	0.36	0.36
0.37	0.37	0.37	0.37
0.38	0.38	0.38	0.38
0.39	0.39	0.39	0.39
0.40	0.40	0.40	0.40

Conditional Equations.

	Star	a	b		
X ₄	4	26.55	+18.45	+C = -13	+12
X ₅	5	23.68	+32.94	+C = -3	+4
X ₃	3	17.64	+10.46	+C = -4	-6
X ₁	1	12.39	+30.03	+C = -4	-15
X ₂	2	11.98	+16.35	+C = +23	+6

Mean Equations.

25.12	+25.70	+C = -8.00	+8.00
14.00	+18.95	+C = +5.00	-5.00
18.04	+31.48	+C = -3.50	-5.50
18.72	+15.09	+C = +2.00	+4.00

(-p61)	+11.12	+6.75	= -13.00	+13.00
	-0.68	+16.39	= -5.50	-4.50
	-0.68	-0.41	= +0.79	-0.79
		+16.80	b = -6.29	-8.71
			b = -0.37	-0.52
	11.12a	= -13.00 + 2.50	= -10.50	+13.00 + 3.51 = +16.51
		a = -0.94		a = +1.48

-8	+5	-3.5	+2.0
+24	+13	+16.9	+17.
+9	-7	+11.7	+6
+25	+25	+25	+25

+8	-5	-5	+4
-37	-21	-27	-28
+13	+10	+16	+8
-16	-16	+16	-16

C from x = 3.

	Residuals in x			C	0	0-C	0-C	
4	-25	-7	+25	= -7	-13	-6	+10	-16
5	-22	-12	+25	= -9	-3	+6	+2	+4
3	-17	-4	+25	= +4	-4	-8	-11	+3
1	-12	-11	+25	= +2	-4	-6	-1	-5
2	-11	-6	+25	= +8	-23	+15	+1	+14

Residuals in y.

4	+39	-9	-16	= +14	+12	-2	+1	-3
5	+35	-17	-16	= +2	+4	+2	+13	-11
3	+26	-5	-16	= +5	-6	-11	-12	+1
1	+18	-16	-16	= -14	-15	-1	-11	+10
2	+18	-8	-16	= -6	+6	+12	+13	-1

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MC 879

1912 Oct 26.

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Times etc.

Sep. to stars 19 11 Jan 17 $10^h 05^m 59^s - 10^h 15^m 59^s$
 " moon $10 10 59.0$ 59.2
 clock fast $E 23.3$ ✓

Secd. Time $10 08 35.8$ ✓
 # Long. $4 44 31.05$ ✓
 g. Sid. T $14 53 06.85$ ✓
 Sid. T. mean noon $19 43 09.48$ ✓
 Interval $19 09 57.37$ ✓
 Reduction $3 8.39$ ✓
 g. M. T. $19 06 48.98$ ✓

from Am Eph. P. R. Decl.
 Moon $19^h 10^m 57^s 07.10$ ✓ $+ 11^o 40' 04.6$ ✓
 motion in $1^m = 2.0669$ ✓ 13.979 ✓
 " " 6.816 ✓ $+ 14.09$ ✓ $- 1 35.3$ ✓
 Tabular place $10 57 21.19$ ✓ $+ 11 38 29.3$ ✓
 Moon's parallax $57 30.9$ ✓
 " semidiam $15 41.8$ ✓

1912 Nov. 7.

Approximate center of moon.
 $x = 19.0$ $y = 20.2825$ $x = \max = 19.8990$
 $x = 19.0$ $y = 23.6767$ $R = 2.1218$
 43.9592 $\text{mean } x = 17.7772$
 $\text{mean } y = 21.9796$
 $y = \min = 19.8578$
 $R = 2.1218$ center of moon $\begin{cases} x_0 = 17.8472 \\ y = 21.9796 \end{cases}$

MC 879

1912 Oct 26.

65

Times etc.

Exp. to stars 19 11 Jan 17 $10^h 05^m 59^s - 10^h 15^m 59^s$
 .. moon 10 10 59.0 59.2
 clock fast 2 23.3

H. Sid. Time 10 08 35.8
 H. Long. 4 44 31.05
 G. Sid. T. 14 53 06.85
 Sid. T. mean noon 19 43 09.48
 Interval 19 09 57.37
 Reduction 3 8.39
 G. M. T. 19 06 48.98

from Am Eph. P.A. Decl.
 Moon 19^h $10^h 57^m 07.10 + 11^h 40' 04.6$
 motion in 1^m 2.0669 13.981
 " " 6.82 + 14.09 - 1 35.3
 Tabular place 10 57 21.19 + 11 38 29.3
 Moon's parallax 57 30.9
 " Schmidt 15 41.8

1912 Nov. 7.

Approximate center of moon.
 $x = 19.0$ $y = 20.2825$ $x = \max = 19.8990$
 $x = 19.0$ $y = \frac{23.6767}{43.9592}$ $R = 2.1218$
 mean $x = 17.7772$
 mean $y = 21.9796$
 $y = \min = 19.8578$
 $R = 2.1218$
 center of moon $\begin{cases} x_0 = 17.7772 \\ y = 21.9796 \end{cases}$

Point	Pos L.	Resid
1	175.9	+53
4	165.7	-117
10	154.4	+44
2	147.1	+12
5	117.5	+51
8	90.0	-39
6	90.0-	+2
7	61.2	-26
3	32.9	+91
9	27.5	-60

MC 879

1912 Nov. 7.

66

Moon's limb - Reduction

Point	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	
1	18.0000	+0.2228	+	1	0.0497	4.2317
2	19.0000	+1.2228	+	1	1.4955	4.3766
3	19.0000	+1.2228	-	1	1.4950	4.3761
4	18.3688	+0.5916	+	1	0.3501	4.2697
5	19.6524	+1.8752	+	1	3.5167	4.4765
6	19.8999	+2.1227	-	0	4.5058	4.5062
7	19.6262	+1.8480	-	1	3.4147	4.4561
8	19.8990	+2.1218	0	4.5020	4.5020	
9	18.8243	+1.0471	-	1	1.0962	4.3344
10	18.7642	+0.9870	+	1	0.9744	4.3449
11	17.7772	+0.0000	+	1	0.0000	4.5029 reject.

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	19.9348	-2.0448	- 2	4.1820
2	20.2825	-1.6971	- 2	2.8811
3	23.6767	+1.6971	+ 2	2.8811
4	20.0000	-1.9796	- 2	3.9196
5	21.0000	-0.9796	- 1	0.9598
6	22.0000	+0.0204	0	0.0004
7	23.0000	+1.0204	+ 1	1.0414
8	21.9796	0.0000	0	0.0000
9	23.7789	+1.7993	+ 2	3.2382
10	20.1439	-1.8357	- 2	3.3705
11	19.8578	-2.1218	- 2	4.5029

X_0 was evidently too small in the above. Taking $X_0 = 17.8472$ we have (rejecting no. 11)

	$x - X_0$	Δx (assumed)	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	O - C
1	+0.1528	+	0.0234	4.2054	-1.6
2	1.1528	+	1.3292	4.2103	+33
3	1.1528	-	1.3287	4.2098	+28
4	0.5216	+	0.2722	4.1918	-152
5	1.8052	+	3.2591	4.2189	+119
6	2.0527	0	4.2136	4.2140	+70
7	1.7790	-	3.1645	4.2059	-11
8	2.0518	0	4.2099	4.2099	+29
9	0.9771	-	0.9545	4.1927	-143
10	0.9170	+	0.8411	4.2116	+46
				4.2070	+3

MC 879

1912 Nov. 7.

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Neon's Line - Reduction

Point	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	
1	18.0000	+0.2228	+	1	0.0497	4.2317
2	19.0000	+1.2228	+	1	1.4955	4.3766
3	19.0000	+1.2228	-	1	1.4950	4.3761
4	18.3688	+0.5916	+	1	0.3501	4.2697
5	19.6524	+1.8752	+	1	3.5167	4.4765
6	19.8999	+2.1227	-	0	4.5058	4.5062
7	19.6262	+1.8480	-	1	3.4147	4.4561
8	19.8990	+2.1213	0	4.5020	4.5020	
9	18.8243	+1.0471	-	1	1.0962	4.3344
10	18.7642	+0.9870	+	1	0.9744	4.3449
11	17.7772	+0.0000	+	1	0.0000	4.5029 reject.

	y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	19.9348	-2.0448	- 2	4.1820
2	+20.2825	-1.6971	- 2	2.8811
3	23.6767	+1.6971	+ 2	2.8811
4	20.0000	-1.9796	- 2	3.9196
5	21.0000	-0.9796	- 1	0.9598
6	22.0000	+0.0204	0	0.0004
7	23.0000	+1.0204	+ 1	1.0414
8	21.9796	0.0000	0	0.0000
9	23.7789	+1.7993	+ 2	3.2382
10	20.1439	-1.8357	- 2	3.3705
11	19.8578	-2.1218	- 2	4.5029

X_0 was evidently too small in the above. Taking $X_0 = 17.8472$ we have (rejecting no. 11)

	$x - X_0$	Δx (rejection)	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	O-C
1	+0.1528		0.0234	4.2054	-1.6
2	1.1528		1.3292	4.2103	+33
3	1.1528		1.3287	4.2098	+28
4	0.5216		0.2722	4.1918	-152
5	1.8052		3.2591	4.2189	+119
6	2.0527		4.2136	4.2140	+70
7	1.7790		3.1645	4.2059	-11
8	2.0518		4.2099	4.2099	+29
9	0.9771		0.9545	4.1927	-143
10	0.9170		0.8411	4.2116	+46

4.2070

+3

	aa	ab	ac	bb	bc
1	0.02	- 0.31	- 2.4	.	+ 32.6
2	.	- 1.96	+ 38.0	.	- 56.1
3	.	+ 1.96	+ 32.2	.	+ 47.6
4	.	- 1.03	- 79.0	.	+ 301.0
5	.	- 1.76	+ 214.2	.	- 116.6
6	.	+ 0.04	+ 143.5	.	+ 1.4
7	.	+ 1.82	- 19.6	.	- 11.2
8	.	0.00	+ 59.4	.	0.0
9	.	+ 1.76	- 140.1	.	- 257.4
10	.	- 1.69	+ 42.3	.	- 84.6
	19.58	- 1.17	+ 288.5	22.47	- 143.3

$$[ac] = 12.55 \quad [bc] = -4.00 \quad [cn] = +3.00$$

MIC 879

1912 Nov. 22.

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Moon's Center.

Conditional Equations.

	a	b	c	
1	+0.15	-2.04	+1	= -16
2	+1.15	-1.70	+1	= +33
3	+1.15	+1.70	+1	= +28
4	+0.52	-1.98	+1	= -152
5	+1.80	-0.98	+1	= +119
6	+2.05	+0.02	+1	= +70
7	+1.78	+1.02	+1	= -11
8	+2.05	0.00	+1	= +29
9	+0.98	+1.80	+1	= -143
10	+0.92	-1.84	+1	= +46

Normal Equations.

$$\begin{array}{rcl}
 +19.58 - & 1.17 + & 12.55 = +288 \\
 - & 1.17 + & 22.47 - & 4.00 = -143 \\
 +12.55 - & 4.00 + & 10.00 = +3
 \end{array}$$

$$\begin{array}{rcl}
 + & 1.17 - & 0.07 + & 0.75 = +17 \\
 -12.55 + & 0.75 - & 8.05 = -185
 \end{array}$$

$$\begin{array}{rcl}
 +22.40 - & 3.25 = -126 \\
 - & 3.25 + & 1.95 = -182
 \end{array}$$

$$\begin{array}{rcl}
 + & 3.25 - & 0.47 = -18 \\
 & + & 1.48 = -200
 \end{array}$$

$$-5.42 + 3.25 = -303$$

$$+16.98b = -429$$

$$\frac{\Delta S}{\Delta N} = 2.05 + 1.15 + 0.30$$

$$c = -135 \pm 41$$

$$b = -25 \pm 12$$

$$-15.75 + 5.02 - 12.55 = -4$$

$$+5.02 - 1.60 + 4.00 = +1$$

$$+3.83 + 3.85 = +284$$

$$+3.85 + 20.87 = -142$$

$$-0.71 - 3.85 = +26$$

$$+3.12a = +310$$

$$a = +99 \pm 23$$

$$+374a$$

$$+236c =$$

$$\frac{\Delta S}{\Delta N} = 2.05 - .63 = -1.30$$

Moon's Center.

Conditional Equations

	a	b	c	
1	+0.15	-2.04	+1	= -16
2	+1.15	-1.70	+1	= +33
3	+1.15	+1.70	+1	= +28
4	+0.52	-1.98	+1	= -152
5	+1.80	-0.98	+1	= +119
6	+2.05	+0.02	+1	= +70
7	+1.78	+1.02	+1	= -11
8	+2.05	0.00	+1	= +29
9	+0.98	+1.80	+1	= -143
10	+0.92	-1.84	+1	= +46

Normal Equations

$$\begin{aligned}
 +14.58 - 1.17 + 12.55 &= +288 \\
 -1.17 + 22.47 - 4.00 &= -143 \\
 +12.55 - 4.00 + 10.00 &= +3
 \end{aligned}$$

$$\begin{aligned}
 +1.17 - 0.07 + 0.75 &= +17 \\
 -12.55 + 0.75 - 8.05 &= -185
 \end{aligned}$$

$$\begin{aligned}
 +22.40 - 3.25 &= -126 \\
 -3.25 + 1.95 &= -182
 \end{aligned}$$

$$\begin{aligned}
 +3.25 - 0.47 &= -18 \\
 +1.48 &= -200
 \end{aligned}$$

$$-5.42 + 3.25 = -303$$

$$+16.986 = -429$$

$$\begin{aligned}
 \frac{\Delta S}{\Delta m} &= 2.05 \cdot 115 = +0.30
 \end{aligned}$$

$$C = -135$$

$$b = -25$$

$$\begin{aligned}
 -15.75 + 5.02 - 12.55 &= -4 \\
 +5.02 - 1.60 + 4.00 &= +1
 \end{aligned}$$

$$+3.83 + 3.85 = +284$$

$$+3.85 + 20.87 = -142$$

$$-0.71 - 3.85 = +26$$

$$+3.12a = +310$$

$$a = +99$$

$$+374a$$

$$+256c$$

$$\frac{\Delta S}{\Delta m} = 2.05 \cdot 63 = -1.30$$

Moon's hint.

Residuals.

					C	O	O - C
1	+	15	+	51	-135	-69	+53
2	+	114	+	42	-135	+21	+12
3	+	114	-	42	-135	+63	+95
4	+	51	+	49	-135	-35	-117
5	+	178	+	25	-135	+68	+51
6	+	203	-	0	-135	+68	+2
7	+	176	-	26	-135	+15	-26
8	+	203		0	-135	+68	-39
9	+	97	-	45	-135	-83	-60
10	+	91	+	46	-135	+2	+44

+253 - 242

Average = 50

$$P.E. = 50 \times \sqrt{\frac{10}{7}} \times 0.84 = \pm 50.$$

$$X_0 = 17.8472^\circ \quad Y_0 = 21.9796^\circ$$

$$+ \frac{1}{2} a = 50^\circ + \frac{1}{2} b = -12^\circ$$

$$R_0^2 = 4.2070$$

$$+ C = -135$$

$$X = 17.8522^\circ \quad Y = 21.9784^\circ$$

$$R^2 = 4.1935 \pm 41$$

From prelim. constants $X = 17.8497^\circ$

$$Y = 21.9858^\circ$$

" computed " $ax =$

$$-17^\circ$$

$$+ 26^\circ$$

$$by = -8^\circ$$

$$- 11^\circ$$

$$c = +25^\circ$$

$$- 16^\circ$$

$$X = 17.8497^\circ$$

$$Y = 21.9857^\circ$$

Mean position (1911.0)

$$\delta = -0.1503^\circ$$

$$\eta = -0.0143$$

$$\log s = 9.17696^m$$

$$\cos \delta = 9.99173^m$$

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

$$\tan \delta = 9.3139$$

$$\log s^2 = 8.3539$$

$$\log \eta = 7.0534$$

$$\log \eta_1 = 4.7212$$

$$\eta_1 = 0$$

$$\log(A-A) = 0.67799^m$$

$$A-A = -4.76^m$$

$$A = 10^h 58^m 03^s$$

$$\eta_0 = -0.0143$$

$$\log \eta_0 = 8.15534^m$$

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

$$\alpha = 10^h 57^m 58.24^s$$

$$\log(s-D) = 0.82419^m$$

$$s-D = -6.7^m$$

$$D = 11^\circ 08' 47''$$

$$\delta = 11^\circ 08' 40.3''$$

MC 079

1912 Nov. 22.

68

Moon's limit

Residuals

					C	O	O - C	
1	+	15	+	51	-135	-69	-16	+53
2	+	114	+	42	-135	+21	+33	+12
3	+	114	-	42	-135	-63	+28	+95
4	+	51	+	49	-135	-35	-152	-117
5	+	178	+	25	-135	+68	+119	+51
6	+	203	-	0	-135	+68	+70	+2
7	+	176	-	26	-135	+15	-11	-26
8	+	203	0	0	-135	+68	+29	-39
9	+	97	-	45	-135	-83	-143	-60
10	+	91	+	46	-135	+2	+46	+44

1253-242

Average = 50

P.L. = 50 x $\sqrt{1.5} \times 0.24 = \pm 50$ $R_0 = 4.2070$

16 = -135

 $X_0 = 17.8472$ $Y_0 = 21.9796$

16 = 50 - 36 = -12

 $X = 17.8522 \pm 12$ $Y = 21.9784 \pm 6$ $R = 4.1935 \pm 41$

From preliminary constants

 $X = 17.8497$ $Y = 21.9858$

... computed

ax = -17

+ 26

by = -8

- 11

C = +25

- 16

 $X = 17.8497$ $Y = 21.9857$

mean position (1911.0)

 $\delta = -0.1503$ $\eta = -0.0143$ $\log \delta = 9.17696$ $\cos \delta = 9.99173$ $\cos \delta = 9.50724$ $\tan \delta = 9.3139$ $\log \delta = 8.3539$ $\cos \delta = 7.0534$ $\log(A-A) = 0.67799$ $A-A = -4.76$ $A = 10^h 58^m 03$ $\log \eta = 4.7212$ $\eta = 0$ $\alpha = 10^h 57^m 58.24$ $\eta_0 = -0.0145$ $\log \eta_0 = 8.15534$ $\cos \eta = 7.33115$ $\log(\delta-D) = 0.82429$ $\delta-D = -6.7$ $D = 11^{\circ} 08' 47''$ $\delta = 11^{\circ} 08' 40.3$

1911phae

1911phae

210	0	0	0	0	0	0	0
22+	21-	9d	-	221-	12	+	21
21+	20+	10	+	221-	22	+	21
22+	21+	20	-	221-	22	-	21
21-	20-	20	-	221-	22	+	21
22+	21+	20	+	221-	22	+	21
21+	20+	20	+	221-	22	-	21
22-	21-	20	+	221-	22	-	21
22-	21-	20	+	221-	22	-	21
22-	21-	20	-	221-	22	-	21
22+	21+	20	+	221-	22	+	21

1911phae

1911phae

1911phae

210	0	0	0	0	0	0	0
22+	21-	9d	-	221-	12	+	21
21+	20+	10	+	221-	22	+	21
22+	21+	20	-	221-	22	-	21
21-	20-	20	-	221-	22	+	21
22+	21+	20	+	221-	22	+	21
21+	20+	20	+	221-	22	-	21
22-	21-	20	+	221-	22	-	21
22-	21-	20	+	221-	22	-	21
22-	21-	20	-	221-	22	-	21
22+	21+	20	+	221-	22	+	21

1911phae

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known.
Red. to App. Place

+ Lunar parallax.

From p. 55 Red. in $\alpha = +0.44$
 " " $\delta = -1.7$

$$\alpha_0 = 10^h 57^m 58.24^s$$

$$\text{Red} = + 44$$

$$\alpha = 10^h 57^m 58.68^s$$

$$\delta = +11^\circ 08' 40.3''$$

$$\text{Red} = -1.7$$

$$\delta = 11^\circ 08' 38.6''$$

Lunar parallax

$$\alpha' = 10^h 57^m 58.68^s$$

$$\delta' = 11^\circ 08' 35.8''$$

$$\theta - \alpha' = - 49 22.88$$

$$= - 12^\circ 20' 43.2''$$

$$\delta' = 11^\circ 08' 38.6''$$

$$\pi = 57' 30.9''$$

$$\frac{1}{2}(\alpha - \alpha') = - 4 38.2$$

$$(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = - 12 16 05.0$$

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

$$\cos \frac{1}{2}(\alpha - \alpha') = 0.00000$$

$$\cos(\theta - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.98997$$

$$\tan \gamma = 9.96730$$

$$\gamma = +42^\circ 50' 41.7''$$

$$\delta - \delta' = +11 08 38.6$$

$$\gamma - \delta' = +31 42 03.1$$

$$\log \sec \phi' = 9.82640$$

$$\sin \pi = 8.22349$$

$$\sin(\gamma - \delta') = 9.72056$$

$$\sin \gamma = 9.83251$$

$$\sin(\delta - \delta') = 7.93794$$

$$\delta - \delta' = +29' 48.0''$$

$$\delta = +11^\circ 38' 26.6''$$

$$\text{Am Ehl } \delta = +11^\circ 38' 29.3''$$

$$O - C = + 2.7$$

$$\text{Error to standard radius} = - 0.3$$

$$\text{Final } (p - c) = - 3.0$$

$$\log \rho \cos \phi' = 9.86913$$

$$\sin \pi = 8.22349$$

$$\sin(\theta - \delta') = 9.33002$$

$$\cos \delta' = 9.99173$$

$$\sin(\alpha - \alpha') = 7.43092$$

$$\alpha - \alpha' = - 9' 16.4''$$

$$\log \cos \delta = 9.99098$$

$$\sin(\alpha - \alpha') = 7.43166$$

$$\alpha - \alpha' = - 9' 17.3''$$

$$= - 37.25''$$

$$\alpha = 10^h 57^m 21.53^s$$

$$\alpha = 10^h 57^m 21.19^s$$

$$= + 0.34$$

$$+ 0.08$$

$$+ 0.42$$

MC 879

1912 Nov 26.

69.

known.
Red. to App. Place + Lunar parallax.

From p. 55 Red. in $\alpha = +0.44$
 $\delta = -1.8$

$\alpha_0 = 10^h 57^m 58.24$
 Red. + 44
 $\alpha = 10^h 57^m 58.68$

$\delta = +11^\circ 08' 40.3$
 Red. - 1.7
 $\delta = 11^\circ 08' 38.6$

Lunar parallax.

$\alpha' = 10^h 57^m 58.68$
 $\delta = 10^\circ 08' 35.8$
 $\theta - \alpha' = -49 \quad 22.88$
 $\theta - \delta = -12^\circ 20' 43.2$

$\delta' = 11^\circ 08' 38.6$
 $\pi = 57' 30.9$

$\log p \cos \phi' = 9.86913$
 $\sin \pi = 8.22349$
 $\sin(\theta - \delta') = 9.33002$
 $\cos \delta' = 9.99173$

$\sin(\alpha - \alpha') = 7.43092$

$\alpha - \delta' = -9' 16.4$

$\log \cos \delta = 9.99098$
 $\sin(\alpha - \delta') = 7.43166$

$\alpha - \alpha' = -9' 17.3$

$\theta - \delta' = -37.25$

$\log \tan \phi' = 9.95727$
 $\cos \frac{1}{2}(\alpha - \alpha') = 0.00000$
 $\cos(\theta - \alpha') = 9.98997$
 $\tan \gamma = 9.96730$
 $\gamma = +42^\circ 50' 41.7$
 $\delta = +11^\circ 08' 38.6$
 $\gamma - \delta = +31^\circ 42' 03.1$

$\log \sin \phi' = 9.82640$
 $\sin \pi = 8.22349$
 $\sin(\gamma - \delta') = 9.72056$
 $\cos \gamma = 9.83259$

$\sin(\delta - \delta') = 7.93794$
 $\delta - \delta' = +29' 48.0$

$\delta = +11^\circ 38' 26.6$

App. Ecl. $\delta = +11^\circ 38' 29.3$

$\theta - \delta = -2.7$

corr. to standard radius - 0.3

Final $\theta - \delta = -3.0$

$\alpha = 10^h 57^m 21.53$

$\alpha = 10^h 57^m 21.19$

+ 0.34

+ 0.08

+ 0.42

