

KG

11366

11888

Vol XII

Plates

1126

1128

Harvard Lunar Plates

Measures and Reductions

Mary Fowles

Volume XII

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MC 1126.

1913 Jan. 20

1. 1

Comparison Stars - Standard Coordinates.

Preliminary Reduction

	1	2	3	4
α	2.8678	55128	240938	258988
δ	4.1560	6.6914	25.4403	27.0020
$\alpha - \delta$	-1.2882	-1.1786	-1.3465	-1.1032
η	18.1825	280278	124282	34.3768
ζ	18.1630	280401	12.6430	34.6177
$\eta - \zeta$	+295	-123	-2148	-2409

$$\begin{aligned}
 \alpha - \delta &+ 1.1032 & -11024 & & -2x & & +3858 \\
 -1.2882 & = -1850 & +2009 & = & -3859 - 6 & = & -3865 & = -7 \\
 -1.1786 & = -854 & -3097 & = & -3851 - 11 & = & -3862 & = -4 \\
 -1.3465 & = -2433 & -1374 & = & -3807 - 48 & = & -3855 & = +3 \\
 -1.1032 & = & 0 & -3799 & = & -3799 - 52 & = & -3851 & = +7 \\
 16.9737 & & -2358 & & -34 & & & & = 18.2235 -
 \end{aligned}$$

$$\begin{aligned}
 \eta - \zeta &+ 11276 & & +34 & & -584 \\
 +295 & +321 & = & +576 & +57 & = & +573 & = -11 \\
 -123 & +617 & = & +494 & +84 & = & +578 & = -6 \\
 -2148 & +2698 & = & +550 & +37 & = & +587 & = +3 \\
 -2409 & +2901 & = & +492 & +103 & = & +595 & = +61 \\
 21.3420 & +1901 & & +64 & & = & 21.4801
 \end{aligned}$$

M4126

1913 Jan. 20

Comparison Stars - Standard Coordinates.

Preliminary Reduction.

	1	3	4
α	2.8678	5.5128	24.0938
δ	4.1560	6.6914	25.4403
$\alpha - \delta$	-1.2882	-1.1786	-1.3465
η	18.1825	28.0278	12.4282
ζ	18.1620	28.0401	12.6430
$\eta - \zeta$	+205	-123	-2148

$$\begin{aligned}
 \alpha - \delta &+ 1.1032 & -1.1032 & & -2 \times & & +3858 \\
 -1.2882 & = -1850 + 2009 & = & 3859 - 6 & = -3865 & = -7 \\
 -1.1786 & = -754 - 3097 & = & 3851 - 11 & = -3862 & = -4 \\
 -1.3465 & = -2433 - 1374 & = & 3807 - 48 & = -3855 & = +3 \\
 -1.1032 & = & 0 - 3799 & = & 3799 - 52 & = -3851 & = +7 \\
 10.9737 & & -2354 & & -34 & & = 18.2285
 \end{aligned}$$

$$\begin{aligned}
 \eta - \zeta &+ 1.1270 & & +34 & & -584 \\
 +205 & +321 & = & +526 + 57 & = & +583 & = -1 \\
 -123 & +617 & = & +494 + 84 & = & +578 & = -6 \\
 -2148 & +2698 & = & +550 + 37 & = & +587 & = +3 \\
 -2414 & +2901 & = & +487 + 103 & = & +590 & = +6 \\
 1.3420 & +1901 & & +64 & & & = 21.4801
 \end{aligned}$$

MC1126

Standard Coordinates - Comparison stars

2

α $14^{\text{h}} 13^{\text{m}} 14.93^{\text{s}}$

$14^{\text{h}} 14^{\text{m}} 01.71^{\text{s}}$

$\delta -14^{\circ} 29' 59''.8$

$-11^{\circ} 39' 09''.4$

J211374

1110 11 11

8P41 11 11

2P2 11 11

8P2 11 11

MC1126

2.

Standard Coordinates - Comparison stars

 $\alpha \quad 14^{\text{h}} 13^{\text{m}} 14^{\text{s}}.93$
 $\alpha \quad 14^{\text{h}} 14^{\text{m}} 01^{\text{s}}.71$
 $\delta \quad -14^{\circ} 29' 59''.8$
 $\delta \quad -11^{\circ} 39' 09''.4$

MC 1126

1913 Jan. 18.

3.

Comparison star measures

$\frac{1}{2}$	α	N	α	N
2.8				
18.2	16471	17352	12849	17341
mag	14643 51	9172 74	11520 28	8655 60
6.7	49	71	30	56
	80	46		35
	<u>18.1825</u>	<u>1825</u>	<u>2.8677</u>	<u>.8679</u>
2 - double star				
5.5	10501	13230	16698	18662
28.0	10227 25	30 30	11820 25	13529 37
mag	20	12952	30 30	38
7.9			92	60
	<u>28.0277</u>	<u>.0278</u>	<u>5.5131</u>	<u>.5126</u>
3	14774	15881	18948	16549
24.1	10498 00	10164 70	9887 90	15615 10
12.5	04	60	81	11
mag	94	85	49	55
8.6				
	<u>12.4281</u>	<u>.4282</u>	<u>24.0937</u>	<u>.0938</u>
4				
25.9	15339	17680	16714	17466
34.4	11568 67	11450 60	15699 00	8488 79
mag	70	54	60	80
7.8	30	90	06	70
	<u>34.3767</u>	<u>.3769</u>	<u>25.8987</u>	<u>.8988</u>

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3.

Comparison Star Measures.

$\frac{1}{2}$	$\frac{4}{2}$	$\frac{N}{2}$	$\frac{24}{2}$
2.8	a	a	N
18.2	16471	17352	12849
mg	1464351	917274	1152028
67	49	71	30
	80	46	35

18.182518252.86778679

2 - double star

5.5	10501	13230	16698	18662
28.0	1022725	3030	1182025	1352937
mg	20	12952	3030	38
79			92	60

28.027702785.51315126

3	14774	15881	18948	16549
24.1	1049800	1016470	988790	1561510
125	04	60	81	11
mg	94	85	49	55
8.6				

12.4281428224.09370938

4				
25.9	15339	17680	16714	17466
34.4	1156867	1145060	1569900	848879
mg	70	54	60	80
78	30	90	06	70

34.3767376925.89878988

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4

moon-measures.

$\frac{1}{16.0}$ α γ δ
 19.6 147 98 186 68
 80 83 95 153 41 48
 99 55
 00 72

19.6707.6679

$\frac{2}{15.7}$
 20.0

16063 17067
 11869 73 11288 59
 62 69
 61 60

15.5806.5791

11000 98 14849
 98 14140 40
 10284 40

15.0715.0709

9595 80 14868
 94 14482 90
 9220 85

15.0370.0382

14779 17988
 6340 50 16440 30
 51 30
 98 98

15.15521556

9798 11420 20
 9525 27 01
 45 11165

15.9734.9752

$\frac{3}{15.1}$
 21.0

$\frac{4}{15.0}$
 21.3
 min
 in
 70

$\frac{5}{15.2}$
 22.0

$\frac{6}{15.9}$
 23.0

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4

moon - measures.

L	4				
16.0	a		w	d	N
19.6	147 98		186 68		
	80 83 95		153 41 48		
	99		55		
	00		72		

19.67076679
2
 15.7
 20.0

 16063
 11869 73
 62
 61

 17067
 11288 59
 69
 60
15.58065791
3
 15.1
 21.0

 11000 98
 98
 10284

 14849
 14140 40
 40
15.07150709
4
 15.0
 21.3
 min
 76

 9595 80
 94
 9220

 14868
 14482 90
 85
15.03700382
5
 15.2
 22.0

 14779
 6340 50
 51
 98

 17988
 16440 30
 30
 98
15.15521556
6
 15.9
 23.0

 9798
 9525 27
 45

 11420 20
 01
 11165
15.97349752

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5

moon-measures

	d	N
16.0	7228	10312
23.0	7070	01
	7061	10160

d	N
---	---

23.0161.0149

	d	N
17.0	18080	14689
23.3	15315	7465
max	07	50
w	79	98
y		

23.2773.2762

9
scratch.

	d	N		d	N
17.5	18020	14715	17541	14181	
23.2	16041	6675	12651	9069	
	41	75	46	64	
	28	14	30	80	

23.1981.195917.5110.5116

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5

Moon-Measures

	d	N
16.0	7228	10312
23.0	707061	01
	70	10160

23.01610149

	d	N
17.0	18080	14689
23.3	1531598	746556
man	07	50
"	79	98

23.27732762

9
scratch.

	d	N		d	N
17.5	18020	14715	17541	14181	
23.2	1604140	667569	1265138	906961	
	41	75	46	64	
	28	14	30	80	

23.1981195917.51105116

pt.	pos. L	resid
1	210.2	+43
2	226.0	+12
3	259.8	-91
4	270.0	+31
5	289.8	-60
6	329.0	+54
7	329.8	+63
8	0.8	+36
9	16.2	-88

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Moon's Center

1913 Feb. 17.

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$y - y_0$
1	16.0000	-0.9720	-2	0.9452	3.7478	+64
2	15.5798	-1.3922	-2	1.9388	3.7429	+15
3	15.0712	-1.9008	0	3.6130	3.7301	-113
-4	15.0376	-1.9344	0	3.7419	3.7419	+5
5	15.1554	-1.8166	+1	3.2997	3.7327	-87
6	15.9743	-0.9977	+2	0.9950	3.7460	+46
7	16.0000	-0.9720	+2	0.9444	3.7470	+56
8	17.0000	+0.0280	+3	0.0008	3.7473	+59
9	17.5113	+0.5393	+3	0.2912	3.7370	-44
mean					3.7414	+1

	y	$y - y_0$	Δy	$(y - y_0)^2$	
1	19.6693	-1.6731	-10	2.8026	
2	~~20.0000~~	-1.3424	-8	1.8041	
3	21.0000	-0.3424	-2	0.1171	
4	21.3424	0.0000	0	0.0000	
5	22.0000	+0.6576	+4	0.4330	
6	23.0000	+1.6576	+10	2.7510	
7	23.0155	+1.6731	+10	2.8026	
8	23.2768	+1.9344	+12	3.7465	
9	23.1975	+1.8551	+12	3.4458	

Approximate Center

$$\begin{aligned}
 x_0 &= 16.0 & y &= 19.6693 \\
 & & & 23.0155 \\
 & & & \hline
 & & & 42.6848 \\
 \text{Mean } y & & & 21.3424 \\
 y - \text{max} & & & 23.2768 \\
 R & & & 1.9344 \\
 x - \text{min} & & & 15.0376 \\
 x_0 & & & 16.9720
 \end{aligned}$$

$$y_0 = 16.9720$$

$$y_0 = 21.3424$$

MC 1126

Morris Center

1913 Jan. 17.

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)$	
1	16.0000	-0.9720	-2	0.9452	3.7478	+64
2	15.5798	-1.3922	-2	1.9388	3.7429	+15
3	15.0712	-1.9008	0	3.6130	3.7301	-113
4	15.0376	-1.9344	0	3.7419	3.7419	+15
5	15.1554	-1.8166	+1	3.2997	3.7327	-87
6	15.9743	-0.9977	+2	0.9950	3.7460	+46
7	16.0000	-0.9720	+2	0.9444	3.7470	+56
8	17.0000	+0.0280	+3	0.0008	3.7473	+59
9	17.5113	+0.5393	+3	0.2912	3.7370	-44
				mean	3.7414	+1

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	19.6693	-1.6731	-10	2.8026
2	20.0000	-1.3424	-8	1.8041
3	21.0000	-0.3424	-2	0.1171
4	21.3424	0.0000	0	0.0000
5	22.0000	+0.6576	+4	0.4330
6	23.0000	+1.6576	+10	2.7510
7	23.0155	+1.6731	+10	2.8026
8	23.2768	+1.9344	+12	3.7465
9	23.1975	+1.8551	+12	3.4458

Approximate Center

$x = 16.0$ $y = 19.6693$
 $\quad \quad \quad 23.0155$
 $\quad \quad \quad 42.6848$
 $\quad \quad \quad \text{mean } y = 21.3424$
 $y - \text{mean } y = 23.2768$
 $R = 1.9344$
 $\text{mean } x = 15.0376$
 $x_0 = 16.9720$

$y_1 = 16.9720$
 $y_2 = 21.3424$

Formation of Normals

	at	an	bn
1	+ 1.62	- 620	- 106.8
2	+ 1.86	- 204	- 20.8
3	+ 0.65	+ 215.0	+ 38.4
4	0.00	- 96	0.0
5	- 1.20	+ 158.0	- 57.3
6	- 1.66	- 46.0	+ 76.3
7	- 1.62	- 54.4	+ 94.0
8	+ 0.06	+ 18	+ 113.8
9	+ 1.00	- 23.8	- 81.9
	+ 0.71	+ 158.6	+ 56.4

$$[aa] = +15.77 \quad [bb] = +17.90$$

$$[ac] = -9.41 \quad [bc] = +4.43 \quad [cn] = +1$$

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Center of mass
Conditional Equation

1913 Feb 17.

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	a	b	c	0		C	0 - C
1	-0.97	-1.67	+1	= +64	- 33	+14 +40 = +21	+ 43
2	-1.39	-1.34	+1	= +15	- 48	+ 11 +40 = +3	+ 12
3	-1.90	-0.34	+1	= -113	- 65	+ 3 +40 = -22	- 91
4	-1.93	+0.03	+1	= +5	- 66	+ 0 +40 = -26	+ 31
5	-1.82	+0.66	+1	= -87	- 62	+ 5 +40 = -27	- 60
6	-1.06	+1.66	+1	= +46	- 34	+ 14 +40 = -8	+ 54
7	-0.97	+1.67	+1	= +56	- 33	+ 14 +40 = -7	+ 63
8	+0.03	+1.93	+1	= +59	+ 1	+ 16 +40 = +23	+ 36
9	+0.54	+1.86	+1	= -44	+ 19	+ 15 +40 = +44	- 88

Normal Equations:

+239 - 239

Average 0 - C = 53

+ 15.77 + 0.71 - 9.41 = +159

+ 0.71 + 17.90 + 4.43 = +56

- 9.41 + 4.43 + 9.00 = +1

- 0.71 - 0.03 + 0.42 = -7

+ 9.41 + 0.42 - 5.63 = +95

+ 17.87 + 4.85 = +49

+ 4.85 + 3.37 = +96

- 4.85 - 1.32 = -13

+ 2.05 = +83

- 6.99 - 4.85 = -138

+ 10.88 = -89

+ 1.51 - 0.71 - 1.44 = -0

+ 38.00 - 17.90 - 36.35 = -4

+ 117.28 - 10.85 = +159

+ 38.71 - 3.192 = +52

- 13.17 + 10.85 = -18

+ 4.11 = +141

a = +34

MC 1126

Center of mass
Conventional Equation

1915 Feb. 17.

7

	a	b	c	0		C	0 - C
1	-0.97	-1.67	+1	= +64	-	33 + 14 + 40 = +21	+ 43
2	-1.39	-1.34	+1	= +15	-	48 + 11 + 40 = +3	+ 12
3	-1.90	-0.34	+1	= -113	-	65 + 3 + 40 = -22	- 91
4	-1.93	+0.00	+1	= +5	-	66 + 0 + 40 = -26	+ 31
5	-1.82	+0.66	+1	= -87	-	62 - 5 + 40 = -27	- 60
6	-1.00	+1.66	+1	= +46	-	34 - 14 + 40 = -8	+ 54
7	-0.97	+1.67	+1	= +56	-	33 - 14 + 40 = -7	+ 63
8	+0.03	+1.93	+1	= +59	+	1 - 16 + 40 = +23	+ 36
9	+0.54	+1.86	+1	= -44	+	19 - 15 + 40 = +44	- 88

Normal Equation

+ 239 - 239

Average 0 - C = 53

$$\begin{aligned}
 + 15.77 + 0.71 - 9.41 &= +15.9 \\
 + 0.71 + 17.90 + 4.43 &= +56 \\
 - 9.41 + 4.43 + 9.00 &= +1
 \end{aligned}$$

$$\begin{aligned}
 + 0.71 - 0.03 + 0.42 &= -7 \\
 + 9.41 + 0.42 - 5.63 &= +9.5
 \end{aligned}$$

$$\begin{aligned}
 + 17.87 + 4.85 &= +49 \\
 + 4.85 + 3.37 &= +9.6
 \end{aligned}$$

$$\begin{aligned}
 - 4.85 - 1.32 &= -13 \\
 + 2.05 &= +8.3
 \end{aligned}$$

$$C = +40.5$$

$$\begin{aligned}
 - 6.99 - 4.85 &= -13.8 \\
 + 10.88 &= -8.9
 \end{aligned}$$

$$t = -8$$

$$\begin{aligned}
 + 1.51 - 0.71 - 1.44 &= -0.64 \\
 + 38.00 - 17.90 - 36.35 &= -4.25
 \end{aligned}$$

$$\begin{aligned}
 + 17.28 &= -10.85 = +15.9 \\
 + 38.71 &= -31.92 = +5.2
 \end{aligned}$$

$$\begin{aligned}
 - 13.17 &= +10.85 = -18 \\
 + 4.11 &= +14.1
 \end{aligned}$$

$$a = +34$$

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Times etc

1913 Feb 17.

8

Exp. to stars 1911 June 7 $14^h 41^m$ - $14^h 50^m$
 " to moon $14 45$ 28.0° - $14 45$ 28.2°
 clock fast 3 15.5°

H. Sid T. $14 42$ 12.6°
 H. Long $4 44$ 31.05°
 G. Sid T. $19 26$ 43.65°
 Sid T. to moon $4 59$ 03.79°
 Interval $14 27$ 39.86°
 Reduction 2 22.15°
 G. m. T. $14 25$ 17.71°

From Naut. Alm. ~~$14^h 09^m$ 00.31° - $12^h 31^m$ 18.8°~~
 Moon 14^h ~~09^m 00.31°~~
 Motion in $1^m = 1.8736$ ~~12.687~~
 " 15.3225 ~~28.71~~
 Tabular place $14 09$ 29.02° - $12 34$ 33.2°

Moon's parallax $54' 39.0''^{\circ}$
 " semidiam $14 55.1^{\circ}$

From Naut. Alm. $14 09 00.31^{\circ}$ - $12 31 18.8^{\circ}$
 Moon 14^h 09 00.31°
 Motion in $1^m = 1.8735^{\circ}$ 12.687°
 " 25.2952° 47.39° - $5 21.0^{\circ}$
 Tabular place $14 09 47.70^{\circ}$ - $12 36 39.8^{\circ}$

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Times etc

1913 Feb 17.

8

Alt. to stars. 1911 June 7
 " moon
 clock fast

14^h 41^m
 14 45
 3

- 14^h 50^m

28.0 - 14 45 28.2
 15.5

H. Sid T.

14 42 12.6

H. hour

4 44 31.05

G. Sid T.

19 26 43.65

Sid T. in noon

4 59 03.79

Interval

14 27 39.86

Reduction

2 22.55

G. in T.

14 25 19.35

From hant. Alm.

moon 14^hmotion in 1^m = 1.8736

15.3225

Tabular place

~~14^h 09^m 00.31 - 12^h 31^m 18.8~~
~~12.687~~
~~28.71~~
~~14 09 29.02 - 12 34 33.2~~
~~2~~

Moon's parallax
 semi-diam

54' 39.0
 14 55.8

From hant. Alm.

moon 14^hmotion in 1^m = 1.8735

25.2952

Tabular place

14 09 00.31 - 12 31 18.8
 12.689
 + 47.39 - 5 21.0
 14 09 47.70 - 12 36 39.8

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1913 Feb. 25.

9

Moon's Mean Position (1911.0)

$$\begin{array}{rcl}
 x_0 = 16.9720'' & y_0 = 21.3424'' & \\
 \text{hr} = +17'' & \text{lb} = -4'' & \\
 \hline
 16.9737'' & 21.3420'' &
 \end{array}$$

From Preliminary Reduction $x = 18.2235''$ $y = 21.4801''$

$$\begin{array}{rcl}
 \text{Plate Constants} & a_p = +8 & -12 + 7 \\
 & b_p = +3 & -11 - 2 \\
 & c = -12 & +24 - 3 \\
 \hline
 & 18.2234'' & 21.4802''
 \end{array}$$

$$\begin{array}{rcl}
 z = +0.2239'' & & \\
 \log S = 9.34908 & & \\
 \log s = 9.98809'' & & \\
 \text{const} = 8.50724 & & \\
 (x-A) = 0.85375 & &
 \end{array}$$

$$\eta = -0.5199''$$

$$\begin{array}{rcl}
 \log \tan S = 9.3725'' & & \\
 S^2 = 9.8888'' & & \\
 m_1 = 6.3147'' & & \\
 m_1 = -2'' & &
 \end{array}$$

$$d-A = +2.14''$$

$$A = 14 \ 09 \ 16''$$

$$d = 14 \ 09 \ 23.14''$$

$$\begin{array}{rcl}
 \log \eta = 9.71567'' & & \\
 \text{const} = 7.33115'' & &
 \end{array}$$

$$\text{Red} = +1.59''$$

$$(d-D) = 2.38452''$$

$$x' = 14 \ 09 \ 24.73''$$

$$s-D = -4 \ 02.4''$$

$$D = -13 \ 17 \ 23''$$

$$s = -13 \ 21 \ 25.4''$$

$$\text{Red} = -12.4''$$

$$s' = -13 \ 21 \ 37.8''$$

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1913 Feb. 25. 9

moon's mean Position (1911.0).

$$\begin{array}{rcl} x_0 = 16.9720 & y_0 = 21.3424 \\ ha = +17 & lb = -4 \\ \hline 16.9737 & 21.3420 \end{array}$$

from Preliminary Reduction

$$\begin{array}{rcl} x = 17.1203 & y = 21.4801 \\ \text{Plate Constants} & a_x = +8 & +7 \\ & b_y = +3 & -2 \\ & c = -12 & -3 \\ \hline & 17.1202 & 21.4803 \end{array}$$

$$\begin{array}{l} \beta = -0.8798 \\ \log S = 9.94438^m \\ \log \delta = 9.98809 \\ \text{const} = 8.50724 \end{array}$$

$$(x-A) = 1.44905^m$$

$$d-A = -28.12$$

$$A = 14 \ 09 \ 16$$

$$d = 14 \ 08 \ 47.88$$

$$Rad = +1.59$$

$$\alpha = 14 \ 09 \ 24.73$$

$$\eta = -0.5197$$

$$\begin{array}{l} \log \tan \delta = 9.3725^m \\ \log \delta = 9.8888 \\ \eta_1 = 6.3147^m \end{array}$$

$$m_1 = -2$$

$$\eta_0 = -0.5195$$

$$\begin{array}{l} \log \eta_0 = 9.71559^m \\ \text{const} = 7.33115 \end{array}$$

$$(d-D) = 2.38444^m$$

$$d-D = -4 \ 02.3$$

$$D = -13 \ 17 \ 23$$

$$\delta = -13 \ 21 \ 25.3$$

$$Rad = -124$$

$$\delta' = -13 \ 21 \ 37.8$$

Lunar Parallax.

10

$$\begin{array}{r}
 1126 \\
 \alpha' = 14^h 09^m 24.73^s \\
 \theta = 14 \quad 42 \quad 12.6 \\
 + 32 \quad 47.87 \\
 + 8^0 \quad 11' \quad 58'' \\
 + \quad \quad 2 \quad 57 \\
 + \quad 8 \quad 09 \quad 01 \\
 \hline
 9.957.27 \\
 0.00000 \\
 0.00441 \\
 \hline
 9.96168
 \end{array}$$

$$\begin{array}{r}
 \delta = 42 \quad 28 \quad 31 \\
 - 13 \quad 21 \quad 38 \\
 \hline
 55 \quad 50 \quad 09
 \end{array}$$

$$\begin{array}{r}
 982640 \\
 820130 \\
 991773 \\
 0.17052 \\
 \hline
 8.11595
 \end{array}$$

$$S - S' = +44 \quad 53.9$$

$$S = -12 \quad 36 \quad 43.9$$

$$\text{Hantel's } S = -12 \quad 36 \quad 39.8$$

$$O - C \quad -4.1$$

$$\text{Cor. for stand. radius} \quad +0.0$$

$$O - C \quad -4.1$$

$$S'' = -13^0 \quad 21' \quad 37.8''$$

$$\pi = 54' \quad 39.0''$$

$$\begin{array}{r}
 986913 \\
 820130 \\
 915418 \\
 001061 \\
 \hline
 7.23522
 \end{array}$$

$$\alpha - \alpha' = +5' \quad 54.52$$

$$= +23.63$$

$$\alpha = 14 \quad 09 \quad 48.36$$

$$\alpha = 14 \quad 09 \quad 47.70$$

$$+0.66$$

$$+0.01$$

$$+0.67$$

$$\begin{array}{r}
 1126 \\
 \alpha = 14^{\circ} 09' 24.73'' \\
 \delta = 14^{\circ} 42' 12.6'' \\
 + 32' 47.87'' \\
 + 8'' 11' 58''
 \end{array}$$

$$+ 2' 57''$$

$$+ 8' 09' 01''$$

$$995727''$$

$$000000''$$

$$000441''$$

$$996168''$$

$$\mu = 42' 28' 31''$$

$$- 13' 21' 38''$$

$$55' 50' 09''$$

$$982640''$$

$$820130''$$

$$991773''$$

$$017052''$$

$$811595''$$

$$S - S' = +44' 53.9''$$

$$S = -12' 36' 43.9''$$

$$\text{Hauptblau } S = -12' 36' 39.8''$$

$$O - C = -4.1''$$

$$\text{Cor. for stand. radius} = +0.0''$$

$$O - C = -4.1''$$

$$S = -13^{\circ} 21' 37.8'' \quad 10$$

$$\Pi = 54' 39.0''$$

$$986913''$$

$$820130''$$

$$915408''$$

$$001061''$$

$$723522''$$

$$\alpha - \alpha' = +5' 54.52''$$

$$= +23.63''$$

$$\alpha = 14^{\circ} 09' 48.36''$$

$$\alpha = 14^{\circ} 09' 47.70''$$

$$+0.66''$$

$$+0.01''$$

$$+0.67''$$

MC1128

Comip Stars Standard Corrids

Feb. 14. 1913-16.

✓ No. 2025 mag. 7.7

2. No. 2030 mag. 6.8

RC. 14^h 50^m 40.61^s ✓14^h 52^m 29.64^s ✓

L 67 .67

Σ
Mean 14 50 40.62
Prec + 37.14 ✓14 52 29.66
+ 36.87 ✓

α(1911) 14 51 17.77 ✓

14 53 06.53

A 14 56 04 ✓

14 56 04 ✓

α-A - 4 46.23 ✓

- 2 57.47 ✓

sin(α-A) - 28621^m- 177.47^mlog " 2.45668^m2.24912^mcos δ 9.97679^m9.98058^m3° 0.94071^m0.73694^m

8° - 8.7238 ✓

- 5.4569 ✓

8₁ - 17 ✓

- 17 ✓

8 9.2745 ✓

12.5414 ✓

x 9.3256 ✓

12.7320 ✓

x-8 + 511 ✓

+ 1906 ✓

86 - 18° 31' 23.2^s ✓- 16° 57' 45.2^s ✓

L 24.0

Σ 23.7

Mean - 18 31 23.6 ✓

- 16 57 45.6 ✓

Prec - 2 41.9 ✓

- 2 40.7 ✓

S(1911) - 18 34 05.5 ✓

- 17 00 26.3 ✓

D - 18 15 15 ✓

- 18 15 15 ✓

S-D - 18 50.5 ✓

+ 1 14 48.7 ✓

tan(S-D) - 1130.5^m4489.4^mlog " 3.05327^m3.65219^m70 0.38442^m0.98334^mtan δ 9.5262^m9.4855^m8² 18814^m14739^m7₁ 84.610^m8.0128^m

70 - 2.4234 ✓

+ 9.6236 ✓

7₁ - 289 ✓

- 103 ✓

7 19.5477 ✓

31.6133 ✓

7 19.4524 ✓

31.4714 ✓

7 - 9.53 ✓

- 1419 ✓

7-7

MC1128

Comp Stars Standard Corvich

Feb. 14, 1913-16.

✓ No. 2025 mag. 7.7

2. No. 2030 mag. 6.8.

RC 14^h 50^m 40.6114^h 52^m 29.64

L 67

67

E 14 50 40.62

14 52 29.66

Mean 14 50 40.63

14 52 29.67

Proc 14 50 40.63

14 53 06.53

A(1911) 14 51 17.77

14 56 04

A 14 56 04

- 2 57.47

α-A - 4 46.23

- 177.47 m

sin(α-A) - 286.21 m

2.24912 m

log 2.45668 m

9.98058

log 9.97679

0.73694 m

3 0.94071 m

- 5.4567

3° - 87.238

- 17

3, - 17

1254.14

3 42.745

127320

3 93.256

+ 1906

α-3 + 511

- 16° 57' 45.2

36 - 18° 31' 23.2

45.5

L 24.0

46.0

E 23.7

45.6

Mean - 18 31 23.6

40.7

Proc - 18 31 41.9

26.3

S(1911) - 18 34 05.5

15.

D - 18 15 15

48.7

δ-D - 18 50.5

4489.4

tan(δ-D) - 1130.5 m

3.65219

log 3.05327 m

0.98334

log 0.38442 m

9.4855-

tan δ 9.5262 m

14739

3° 18814

8.0128 m

3, 84610 m

- 2.4234

m - 289

- 103

m 195477

31.6133

m 194524

314714

y - 953

- 1419

y-m

ML1128 Comp. Stars Standard Aords

1913 Feb. 14

17

3 No. 2041 mag. 7.0

4 No. 2050 mag. 5.9

KC 14^h 57^m 29^s 1215^h 00^m 33.9^s

L 14

.97

E 14

Mean Prec. 14 57 + 29.13

15 00 + 33.96

K(1911) 14 58 06.13

15 01 11.35

A 14 56 04

14 56 04

K-A + 2 02.13

+ 5 07.35

Sin(K-A) + 122.13

307.32

log 208682

2.48759

cos 8 997993

9.97558

E 0.57399

0.97041

W 0 + 3.7496

+ 9.3414

W 1 + 6

+ 28

W 2 21.7502

27.3442

W 2 21.9198

27.3540

W 2 21.9198

27.3540

W 2 21.9198

27.3540

W 2 21.9198

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W 2 21.9198

27.3540

W 2 21.9198

27.3540

M1128 Comp. Stars Standard Gratic

1913 Feb. 14

17

3 no. 2041 mag. 7.0

4 no. 2050 mag. 5.9

AC 14^h 57^m 29^s 12^v15^h 00^m 33^s 75^vL 14 57 29.13^v

97

E 14 57 29.13^v

96

Mean 14 57 29.13^v15 00 33.96^vS(1911) 14 58 06.13^v15 01 11.35^v

A 14 56 04

14 56 04

X-A + 2 02.13

+ 5 07.35^v

S(A-A) + 122.13

307.32^vlog... 2.08682^v2.48759^vcosδ 99.7993^v9.97558^vδ 057399^v097041^vδ₀ + 3.7496^v+ 9.3414^vδ₁ + 6^v+ 28^vδ 21.7502^v27.3448^vα 21.9198^v77.3540^vα-δ + 1696^v+ 98^vα-δ + 1696^v+ 98^vα-δ + 1696^v+ 98^vα-δ + 1696^v+ 98^vδC. - 17° 14' 19.2^v- 18° 59' 20.0^vL 19.5^v204^vE 19.8^v207^vMean - 17 14 19.5^v- 18 - 59 20.4^vS(1911) - 17 16 56.9^v- 19 01 55.7^vD - 18 15 15^v- 18 15 15^vδ-D + 58 18.1^v- 46 40.7^vtan δ-D + 34 98.4^v- 2800.9^vlog... 3.54387^v3.49730^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^vlog... 087502^v077845^v

$$\begin{array}{r} 14159 \\ 964039 \\ 39 \\ 80 \\ \hline \end{array}$$

$$\underline{.4530}$$

$$\begin{array}{r} 18060 \\ 1260107 \\ 9907 \\ 67 \\ \hline \end{array}$$

$$\underline{19.4538}$$

$$\begin{array}{r} 16854 \\ 10122 \\ 1621 \\ 71 \\ \hline \end{array}$$

$$\underline{9.3251}$$

$$\begin{array}{r} 17560 \\ 14300.00 \\ 00 \\ 76 \\ \hline \end{array}$$

$$\underline{.3265}$$

$$\begin{array}{r} 15356 \\ 1065057 \\ 50 \\ 60 \\ \hline \end{array}$$

$$\underline{31.4706}$$

$$\begin{array}{r} 17550 \\ 1227480 \\ 71 \\ 68 \\ \hline \end{array}$$

$$\underline{.4716}$$

$$\begin{array}{r} 17529 \\ 1510002 \\ 05 \\ 33 \\ \hline \end{array}$$

$$\underline{29.2428}$$

$$\begin{array}{r} 15877 \\ 832829 \\ 2029 \\ 92 \\ \hline \end{array}$$

$$\underline{2438}$$

$$\begin{array}{r} 17192 \\ 1638591 \\ 92 \\ 08 \\ \hline \end{array}$$

$$\underline{21.9196}$$

$$\begin{array}{r} 15716 \\ 653035- \\ 29 \\ 29 \\ \hline \end{array}$$

$$\underline{.9197}$$

$$\begin{array}{r} 18032 \\ 1146673 \\ 70 \\ 36 \\ \hline \end{array}$$

$$\underline{15.6564}$$

$$\begin{array}{r} 14233 \\ 1080211 \\ 0711 \\ 48 \\ \hline \end{array}$$

$$\underline{.6569}$$

$$\begin{array}{r} 18348 \\ 1189195- \\ 98 \\ 59 \\ \hline \end{array}$$

$$\underline{27.3540}$$

$$\begin{array}{r} 14946 \\ 114100209 \\ 58 \\ \hline \end{array}$$

$$\underline{.3543}$$

MC11281

Comparison Stars - Measures.

1913 Jan. 20.

18

Russian reversed

	α	ν	α	ν
1	16054	17845	16399	15230
9.4	11536	12368	9615	11970
19.4	30	67	56	77
mag	54	34	01	20
7.7				
	<u>19.4522</u>	<u>.4527</u>	<u>9.9257</u>	<u>.3255</u>
2				
12.7	16759	16351	18227	17369
31.5	12051	11078	15541	10048
mag	54	70	50	54
6.8	55	51	27	75
	<u>31.4706</u>	<u>.4722</u>	<u>12.7318</u>	<u>.7322</u>
3				
21.9	16000	15349	16149	15610
29.3	13577	7785	15349	6414
mag	74	87	50	10
7.0	94	56	40	08
	<u>29.2425</u>	<u>.2433</u>	<u>21.9201</u>	<u>.9195</u>
4				
27.4	14581	18432	15530	17088
15.6	8008	15000	9063	13550
mag	05	97	70	50
5.9	73	21	20	84
	<u>15.6571</u>	<u>.6571</u>	<u>27.3542</u>	<u>.3537</u>

MC1128.

Comparison Stars - measures.

1913 Jan. 20.

18

Russian measures

	α	ν	α	ν
✓	16054	17845	16399	15230
9.4	11536	12368	9655	11970
19.4	30	67	56	77
my	54	34	01	20
7.7				
	<u>194522</u>	<u>4527</u>	<u>99257</u>	<u>3255</u>
2				
12.7	16759	16351	18227	17369
31.5	12051	11078	15545	10048
my	54	70	50	54
0.8	55	51	27	75
	<u>314706</u>	<u>4722</u>	<u>127318</u>	<u>7322</u>
3				
21.9	16000	15349	16149	15610
29.3	13577	7785	11349	6414
my	74	87	50	10
7.0	94	56	40	08
	<u>292425</u>	<u>2433</u>	<u>219201</u>	<u>9195</u>
4				
27.4	14581	18432	15530	17088
15.6	8008	15000	9063	13550
my	05	97	70	50
5.9	73	21	20	84
	<u>156571</u>	<u>6571</u>	<u>273542</u>	<u>3537</u>

	d	N
V	17999	16344
17.0	1442930	987682
20.4	27	78
	94	38

20.3568

.3539

2
16.3
21.0

18281
10372
7570
71

15955
13850
5055
49

16.2093

.2098

3
16.0 16849
21.4 1294030
29
48

14134
802098
05-98
29

21.3916

.3877

4
15.9
22.0

17227
1582521
20
20

14338
573032
34
31

15.8596

.8600

5
15.8
22.1
min
to
x

16175
1470505
0605
75

18283
9740
3038
85

15.8530

.8549

MC1128 mmm + measures. Residuals. 1913 Jan. 20. 19

	α	δ
✓	17999	16344
7.0	14429 ₃₀	987682
20.4	27	78
	94	38

20.3568

3539

3
63
11.0

18281
10372
7570
71

15955
13850
5055
49

162093

2098

3
16.0 16849
21.4 12940₃₀
29
48

14134
8020
0548
29

21.3916

3877

4
15.9
22.0

17277
15825
20
20

14338
5730
34
32
51

15.8596

8600

5
15.8
22.1

16175
14705
0605
75

18283
9740
3038
85

15.8530

8549

McIlwain moon-measured - Rescan reversed, 1913 Jan 20.

20.

$\frac{6}{16.0}$ $\frac{4}{27.8}$ $\frac{N}{16.611}$ $\frac{d}{14.92050}$ $\frac{N}{35.50}$
 $\frac{15731}{742500}$ $\frac{1492050}{3550}$
 $\frac{36}{11}$

22.83188324

very oblique.

 $\frac{2}{16.1}$

23.0

15634

6410²⁵

29

46

16390

15610

05

80

16.0776.0783 $\frac{8}{17.0}$

23.8

14780

607776

76

77

16311

1503845

32

11

23.8701.8727 $\frac{9}{17.7}$

24.0

14769

1444046

32

46

1180098

90

14462

may

in

 $\frac{7}{24.0330}$ 24.0330.0334 $\frac{10}{18.0}$

24.0

14752

1453950

50

50

10702

0194

10478

24.0206.0221

1161128 mmm - measured - return reversed. 1913 Jan. 20.

20.

16.0	d	N	d	N
22.8	15731	16611		
	74 25	14920		
	2500	3550		
	36	11		

22.83188324

very oblique.

2	16.1	230	15634	16390
			6910	15610
			29	01-07
			46	80

16.07760783

8	17.0	14780	16311
23.8	6077	15038	45
	76	32	
	77	11	

23.87018727

9	17.7	14769	11800	98
24.0	14440	90		
max	32	1462		

24.03300334

10	18.0	14752	10702
24.0	14539	0194	
	50	10478	

24.02060221

N

1913 Feb 13.

21

Center of plates - 1128-1129-1130

α	γ	h	m	s	$^{\circ}$	$'$	$''$
9.21	19.70	14	51	18	-18	34	06
12.65	31.71	14	53	07	-17	00	26
21.84	29.44	14	58	06	-17	16	57
27.23	15.85	15	01	11	-19	01	56
41 7093	9670		163	42		31	53
17.73	24.18	14	55	56	-17	58	21
-18	-22			+8		-16	59
0.27	218	14	56	04	-18	15	15
31	465						
27	1090						
81	1308						
8.37	872						
	1013.70						

$$A = 14^{\circ} 56' 04''$$

$$D = -18^{\circ} 15' 15''$$

Preliminary Reduction (re-measures used)

$$\begin{aligned} \alpha - \bar{\alpha} &= 1164 & -22 & & +1761 \\ +513 - 2256 &= -1743 - 19 &= -1762 &= -1 \\ +1906 - 3650 &= -1744 - 25 &= -1769 &= -8 \\ +1694 - 3392 &= -1698 - 44 &= -1742 &= +19 \\ +100 - 1817 &= -1717 - 55 &= -1772 &= -11 \\ \text{sum } 17.7817 - 2565 & & -36 &= 17.6977 \end{aligned}$$

$$\begin{aligned} \gamma - \bar{\gamma} &+ 1192 & +84 & & -332 \\ -943 + 1110 &= +167 + 157 &= +324 &= -8 \\ -1422 + 1514 &= +92 + 252 &= +344 &= +12 \\ -2511 + 2609 &= +98 + 234 &= +332 &= 0 \\ -3053 + 3255 &= +202 + 125 &= +327 &= -5 \\ \text{sum } 22.1114 + 21.16 & & +177 &= 22.3075 \end{aligned}$$

1.

1913 Feb. 13.

21

Center of plates - 1128-1129-1130

α	δ	α	δ	α	δ
19.21	19.70	14 51 18	-18° 34' 06"		
12.65	31.71	14 53 07	-17 00 26		
21.84	29.44	14 58 06	-17 16 57		
27.23	15.85	15 01 11	-19 01 56		
41 70.93	96.70	163 42	31 53 25		
17.73	24.18	14 55 56	-17 58 21		
18	22	+ 8	- 16 54		
0.27	218	14 56 04	-18° 15' 15"		
31	465				
27	1090				
81	1308				
8.37	872				
	1013.70				

$$A = 14^h 56^m 04^s$$

$$D = -18^\circ 15' 15''$$

Preliminary Reduction (new measures used)

$$\begin{aligned} \alpha - 3 &= 1164 & -2\alpha & & +1761 \\ +513 - 2256 &= -1743 & -19 &= -1762 & = -1 \\ +1906 - 3650 &= -1744 & -25 &= -1769 & = -8 \\ +1694 - 3392 &= -1698 & -44 &= -1742 & = +19 \\ +100 - 1817 &= -1717 & -55 &= -1772 & = -11 \\ \text{sum } 17.7817 - 2565 & & -36 & & = 17.6977 \end{aligned}$$

$$\begin{aligned} \delta - \alpha &+ 119\alpha & +8\alpha & & -332 \\ -943 + 1110 &= +167 & +157 &= +324 & = -8 \\ -1422 + 1514 &= +92 & +252 &= +344 & = +12 \\ -2511 + 2609 &= +98 & +234 &= +332 & = 0 \\ -3053 + 3255 &= +202 & +125 &= +327 & = -5 \\ \text{sum } 22.1114 + 2116 & & +177 & & = 22.3075 \end{aligned}$$

MA 1128

Times etc

22

Exp to stars 1911 June 8 14^h 59^m to 15^h 08^m
 to moon 15 03 43.0^L 15 03 43.2^L
 clock fast 3 16.0^L

# Sid T	15	00	27.0 ^L
H. Long	14	44	31.05 ^L
G. Sid T	19	44	58.15 ^L
Sid T. m. now	5	03	0.35 ^L
Internal	14	41	57.80 ^L
Reduction		2	24.49 ^L
G. M. T	14	39	33.31 ^L

Down Nautical Alm, R A Rect.
 now 14^h 14^h 54^m 41.82^L -17° 18' 30".1^L
 motion in 1^m = 1.940^L 11.13^L
 " 39^m 55.5^L + 1 16.75^L - 7 20.3^L
 Tabular place 14 55 58.57^L -17 25 50.4^L

Moon's parallax 54' 19.7^L
 semidiam 14 49.8^L

1128

Times etc.

22

Exp. to Stars 1911 June 8 $14^h 59^m$ $\pm 15^s 08^m$
 Time - $15^h 03^m 43.0 - 15^h 03^m 43.2$
 Clock fast $3 16.0$

H Sid T.	15	00	27.0
H Hong	4	44	31.05
G. Sid T.	19	44	58.15
Sid T. in. now	5	03	0.35
Internal	14	41	57.80
Reduction		2	24.49
G. M. T.	14	39	33.31

From Nautical Alman. R. A. Rect.
 noon 14^h $14^h 54^m 41.82$ $-17^\circ 18' 30.1$
 noon $14^h 14^m 14$ 11.106
 " 39.555 $+ 1 16.79$ $- 7 20.3$
 Tabular place $14 55 58.61$ $-17 25 50.4$

Moon's parallax. $54' 19.7$
 semidiameter $14 49.9$

pt.	pos. L	resid.
1	203.8	-31
2	234.8	+55
3	247.9	-69
4	266.7	+27
5	270.0	+125
6	292.0	-95
7	297.6	-95
8	336.2	+108
9	0.0	-34
10	6.7	-9

MC 1128

1913 Feb 15.

23.

Moor's Center

	x	$x - X_0$	Δy	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$O - C$
1	17.0000	-0.7751	-1	0.6009	3.6925	+ 56
2	16.2096	-1.5655	0	2.4508	3.6898	+ 29
3	16.0000	-1.7751	0	3.1510	3.6740	- 129
4	15.8598	-1.9153	0	3.6684	3.6810	- 59
5	15.8540	-1.9211	0	3.6906	3.6906	+ 37
6	16.0000	-1.7751	0	3.1510	3.6704	- 165
7	16.0780	-1.6971	0	2.8801	3.6698	- 171
8	17.0000	-0.7751	+1	0.6006	3.7014	+ 145
9	17.7751	0.0000	+1	0.0000	3.6971	+ 102
10	18.0000	+0.2249	+1	0.0506	3.7025	+ 156

Mean 3.6869 +1

105

	y	$(y - Y_0)$	Δx	$(y - Y_0)^2$
1	20.3554	-1.7567	-16	3.0916
2	21.0000	-1.1121	-10	1.2390
3	21.3896	-0.7225	-7	0.5230
4	22.0000	-0.1121	-1	0.0126
5	22.1121	0.0000	0	0.0000
6	22.8321	+0.7200	+7	0.5194
7	23.0000	+0.8879	+8	0.7898
8	23.8714	+1.7593	+16	3.1008
9	24.0332	+1.9211	+17	3.6971
10	24.0214	+1.9093	+17	3.6519

Approximate Center

 $x = 17.0$ $y = 20.3554$ 23.8714

44.2268

mean $y = 22.1134$ $y - \text{max} = 24.0332$ $R = 1.9198$ $y - \text{min} = 15.8540$ $X_0 = 17.7738$ $x = 16.0$ $y = 21.3896$ 22.8321

44.2217

mean $y = 22.1108$ $y - \text{max} = 24.0332$ $R = 1.9224$ $x - \text{min} = 15.8540$ $X_0 = 17.7764$ Assume $\begin{cases} Y_0 = 22.1121 \\ X_0 = 17.7751 \end{cases}$

1911phaa.pro

Time	Altitude	Distance	Angle
10:00	1000	1000	1000
10:05	1000	1000	1000
10:10	1000	1000	1000
10:15	1000	1000	1000
10:20	1000	1000	1000
10:25	1000	1000	1000
10:30	1000	1000	1000
10:35	1000	1000	1000
10:40	1000	1000	1000
10:45	1000	1000	1000
10:50	1000	1000	1000
10:55	1000	1000	1000
11:00	1000	1000	1000
11:05	1000	1000	1000
11:10	1000	1000	1000
11:15	1000	1000	1000
11:20	1000	1000	1000
11:25	1000	1000	1000
11:30	1000	1000	1000
11:35	1000	1000	1000
11:40	1000	1000	1000
11:45	1000	1000	1000
11:50	1000	1000	1000
11:55	1000	1000	1000
12:00	1000	1000	1000

1911phaa.pro

Time	Altitude	Distance	Angle
12:05	1000	1000	1000
12:10	1000	1000	1000
12:15	1000	1000	1000
12:20	1000	1000	1000
12:25	1000	1000	1000
12:30	1000	1000	1000
12:35	1000	1000	1000
12:40	1000	1000	1000
12:45	1000	1000	1000
12:50	1000	1000	1000
12:55	1000	1000	1000
13:00	1000	1000	1000
13:05	1000	1000	1000
13:10	1000	1000	1000
13:15	1000	1000	1000
13:20	1000	1000	1000
13:25	1000	1000	1000
13:30	1000	1000	1000
13:35	1000	1000	1000
13:40	1000	1000	1000
13:45	1000	1000	1000
13:50	1000	1000	1000
13:55	1000	1000	1000
14:00	1000	1000	1000

1911phaa.pro

Time	Altitude	Distance	Angle
14:05	1000	1000	1000
14:10	1000	1000	1000
14:15	1000	1000	1000
14:20	1000	1000	1000
14:25	1000	1000	1000
14:30	1000	1000	1000
14:35	1000	1000	1000
14:40	1000	1000	1000
14:45	1000	1000	1000
14:50	1000	1000	1000
14:55	1000	1000	1000
15:00	1000	1000	1000
15:05	1000	1000	1000
15:10	1000	1000	1000
15:15	1000	1000	1000
15:20	1000	1000	1000
15:25	1000	1000	1000
15:30	1000	1000	1000
15:35	1000	1000	1000
15:40	1000	1000	1000
15:45	1000	1000	1000
15:50	1000	1000	1000
15:55	1000	1000	1000
16:00	1000	1000	1000

nC 1128

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23.

Moon's Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	O - C
1	17.0000	-0.7751	-1	0.6009	3.6925	+ 56
2	16.2096	-1.5655	0	2.4508	3.6898	+ 29
3	16.0000	-1.7751	0	3.1510	3.6740	- 129
4	15.8598 ^v	-1.9153 ^v	0	3.6684 ^v	3.6810 ^v	- 59
5	15.8540 ^v	-1.9211 ^v	0	3.6906 ^v	3.6906 ^v	+ 37
6	16.0000 ^v	-1.7751 ^v	0	3.1510 ^v	3.6704 ^v	- 165
7	16.0780 ^v	-1.6971 ^v	0	2.8801 ^v	3.6698 ^v	- 171
8	17.0000 ^v	-0.7751 ^v	+1	0.6006 ^v	3.7014 ^v	+ 145
9	17.7751	0.0000	+1	0.0000	3.6971	+ 102
10	18.0000	+0.2249	+1	0.0506	3.7025	+ 156
mean					3.6869	+ 1

	y	$(y - Y_0)$	Δy	$(y - Y_0)^2$
1	20.3554	-1.7567	-16	3.0916
2	21.0000	-1.1121	-10	1.2390
3	21.3896	-0.7225	-7	0.5230
4	22.0000	-0.1121	-1	0.0126
5	22.1121	0.0000	0	0.0000
6	22.8321	+0.7200	+7	0.5194
7	23.0000	+0.8879	+8	0.7898
8	23.8714	+1.7593	+16	3.1008
+9	24.0332	+1.9211	+17	3.6971
10	24.0214	+1.9093	+17	3.6519

Approximate Center

$$x = 17.0 \quad y = 20.3554$$

$$23.8714$$

$$44.2268$$

$$\text{mean } y = 22.1134$$

$$y - \text{max} = 24.0332$$

$$R = 1.9198$$

$$x - \text{min} = 15.8540$$

$$X_0 = 17.7738$$

$$x = 16.0 \quad y = 21.3896$$

$$22.8321$$

$$44.2217$$

$$\text{mean } y = 22.1108$$

$$y - \text{max} = 24.0332$$

$$R = 1.9224$$

$$x - \text{min} = 15.8540$$

$$X_0 = 17.7764$$

$$\text{Assume } \begin{cases} Y_0 = 22.1121 \\ X_0 = 17.7751 \end{cases}$$

Formation of Normals

N_0	a_b	a_n	b_n
1	+ 1.37 [✓]	- 43.6 [✓]	- 98.5 [✓]
2	+ 1.74 [✓]	- 45.5 [✓]	- 32.2 [✓]
3	+ 1.28 [✓]	+ 229.7 [✓]	+ 93.0 [✓]
4	+ 0.21 [✓]	+ 113.2 [✓]	+ 6.5 [✓]
5	0.00 [✓]	- 71.0 [✓]	0.0 [✓]
6	- 1.28 [✓]	+ 293.8 [✓]	- 118.8 [✓]
7	- 1.51 [✓]	+ 290.5 [✓]	- 152.0 [✓]
8	- 1.37 [✓]	- 113.0 [✓]	+ 255.3 [✓]
9	0.00 [✓]	0.0 [✓]	+ 196.0 [✓]
10	+ 0.42 [✓]	+ 34.3 [✓]	+ 298.0 [✓]
	+ 0.86 [✓]	+ 688.4 [✓]	+ 447.3 [✓]

$$[a_a] = +20.24^{\checkmark} \quad [b_b] = +16.63^{\checkmark}$$

$$[a_c] = -12.01^{\checkmark} \quad [b_c] = +3.50^{\checkmark}$$

$$[c_m] = +1$$

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Munro's Center.

Conditional Equations.

	a	b	c	0-c		0-c
1	-0.78	-1.76	+1 =	+56	-102 + 25 + 164 =	+87
2	-1.57	-1.11	+1 =	+29	-206 + 16 + 164 =	-26
3	-1.78	-0.72	+1 =	-129	-234 + 10 + 164 =	-60
4	-1.92	-0.11	+1 =	-59	-252 + 2 + 164 =	-86
5	-1.92	+0.00	+1 =	+37	-252 + 0 + 164 =	-88
6	-1.78	+0.72	+1 =	-165	-234 + 10 + 164 =	-80
7	-1.70	+0.89	+1 =	-171	-223 + 13 + 164 =	-72
8	-0.78	+1.76	+1 =	+145	-102 - 25 + 164 =	+37
9	0.00	+1.92	+1 =	+102	00 - 28 + 164 =	+136
10	+0.22	+1.91	+1 =	+156	+29 - 28 + 164 =	+165

Normal Equations.

$$\begin{aligned}
 +20.24^{\vee} + 0.86^{\vee} - 12.01^{\vee} &= +688^{\vee} \\
 +0.86^{\vee} + 16.63^{\vee} + 35.0^{\vee} &= +947^{\vee} \\
 -12.01^{\vee} + 35.0^{\vee} + 10.00^{\vee} &= +1^{\vee}
 \end{aligned}$$

$$\begin{aligned}
 &-327 + 315 \\
 \text{Average } (0-c) &= 64 \\
 \frac{\Delta a}{\Delta c} &= +0.604
 \end{aligned}$$

$$\begin{aligned}
 -0.86^{\vee} - 0.04^{\vee} + 0.51^{\vee} &= -29^{\vee} \\
 +12.01^{\vee} + 0.51^{\vee} - 7.14^{\vee} &= +409^{\vee}
 \end{aligned}$$

$$\begin{aligned}
 +16.59^{\vee} + 4.01^{\vee} &= +418^{\vee} \\
 +4.01^{\vee} + 28.6^{\vee} &= +410^{\vee}
 \end{aligned}$$

$$\frac{\Delta b}{\Delta c} = -0.242$$

$$\begin{aligned}
 -4.01^{\vee} - 0.97^{\vee} &= -101^{\vee} \\
 +1.89^{\vee} &= +309^{\vee}
 \end{aligned}$$

$$c = +164$$

$$\begin{aligned}
 -5.64^{\vee} - 4.01^{\vee} &= -576 \\
 +10.95^{\vee} &= -158
 \end{aligned}$$

$$b = -14$$

$$\begin{aligned}
 +29.5^{\vee} - 0.86^{\vee} - 2.46^{\vee} &= 0^{\vee} \\
 +57.05^{\vee} - 16.63^{\vee} - 47.50^{\vee} &= 5^{\vee}
 \end{aligned}$$

$$\begin{aligned}
 +232.9^{\vee} &- 14.47^{\vee} = +688^{\vee} \\
 +579.6^{\vee} &- 44.00^{\vee} = +442^{\vee}
 \end{aligned}$$

$$\begin{aligned}
 -19.05^{\vee} &+ 14.47^{\vee} = -14.5^{\vee} \\
 +4.14^{\vee} &= +543^{\vee}
 \end{aligned}$$

$$a = +13.7$$

M61.28

1913 Feb. 15.

24.

Movable Center.

Conditional Equations

	a	b	c	0-c		0-c
1	-0.78	-1.76	+1	+56	-102 + 25 + 164 = +87	-31
2	-1.57	-1.11	+1	+29	-206 + 16 + 164 = -26	+55
3	-1.78	-0.72	+1	-129	-234 + 10 + 164 = -60	-69
4	-1.92	-0.11	+1	-59	-252 + 2 + 164 = -86	+27
5	-1.92	+0.00	+1	+37	-252 + 0 + 164 = -88	+125
6	-1.78	+0.72	+1	-165	-234 - 10 + 164 = -80	-85
7	-1.70	+0.89	+1	-171	-223 - 13 + 164 = -72	-98
8	-0.78	+1.76	+1	+145	-102 - 25 + 164 = +37	+108
9	0.00	+1.92	+1	+102	00 - 28 + 164 = +136	+34
10	+0.22	+1.91	+1	+156	+29 - 28 + 164 = +165	+9

Normal Equations

-327 + 315

Averaged 0-c: 64

$$+20.24 + 0.86 - 12.01 = +6.88$$

$$+ 0.86 + 16.63 + 3.50 = +9.47$$

$$-12.01 + 3.50 + 10.00 = +1$$

$$- 0.86 - 0.04 + 0.51 = -29$$

$$+12.01 + 0.51 - 7.14 = +4.97$$

$$+ 16.59 + 4.01 = +41.8$$

$$+ 4.01 + 28.6 = +41.0$$

$$- 4.01 - 0.97 = -10.1$$

$$+ 1.89 = +30.9$$

$$c = +164$$

$$- 5.64 - 4.01 = -57.6$$

$$+ 10.95 = -15.8$$

$$b = -14$$

$$+ 29.5 - 0.86 - 2.46 = -$$

$$+ 57.05 - 16.63 - 47.50 = -$$

$$+ 23.29 - 14.47 = +68.8$$

$$+ 57.96 - 44.00 = +44.2$$

$$- 19.05 + 14.47 = -14.5$$

$$+ 4.28 = +54.3$$

$$a = +130$$

MC1128.

1913 Feb 21

25

Moon's Mean position (1911.0)

$$\begin{array}{rcl}
 Y_0 = 17.7751'' & Y_0 = 22.1121'' & \\
 \frac{1}{2}a = \frac{+66}{17.7817''} & \frac{1}{2}b = \frac{-7}{22.1114''} &
 \end{array}$$

from preliminary constants: $X = 17.6977''$ $Y = 22.3075''$
 " plate constants: a_x $+16$ -2
 b_y $+22$ $+22$
 c $+39$ -21
 $17.6978''$ $22.3074''$

$$\begin{array}{l}
 z = -0.3022'' \\
 \log \delta = 9.48029'' \\
 \cos \delta = 997768'' \\
 \text{const} = 850724'' \\
 \therefore (x-A) = 0.99537''
 \end{array}$$

$$x-A = -9.89''$$

$$A = 14.56.04''$$

$$\alpha = 14.55.54.11''$$

$$\text{Red} = +1.50''$$

$$\alpha' = 14.55.55.91''$$

$$\eta = +0.3074''$$

$$\begin{array}{l}
 \log \tan \delta = 9.4978'' \\
 \therefore \delta = 8.9600'' \\
 \therefore \eta_1 = 5.5112'' \\
 \eta_1 = -1''
 \end{array}$$

$$\eta_0 = +0.3075''$$

$$\begin{array}{l}
 \log \eta_0 = 9.48785'' \\
 \text{const} = 733115''
 \end{array}$$

$$\therefore (\delta-D) = 2.15670''$$

$$\delta-D = +2.23.4''$$

$$D = -18.15.15''$$

$$\delta = -18.12.51.6''$$

$$\text{Red} = -13.1''$$

$$\delta = -18.13.04.7''$$

MC 1128.

1913 Feb. 21

25.

Moon's Mean position (1911.0)

$$Y_0 = 17.7751$$

$$\frac{1}{2}b = \frac{+66}{17.7817}$$

$$Y_0 = 22.1121$$

$$\frac{1}{2}b = \frac{-7}{22.1114}$$

from preliminary constants $X = 17.6977$ $Y = 22.3075$ " plate constants. a_x

+20

-2

by

+22

+22

c

-39

-21

17.6980

22.3074

$$z = -0.3020$$

$$\eta = +0.3074$$

$$\log S = 9.48001m$$

$$\log \tan S = 9.4978m$$

$$\cos S = 9.97768$$

$$S^2 = 8.9600$$

$$\sin S = 8.50724$$

$$S_1 = 55.112m$$

$$(X-A) = 0.99509m$$

$$\eta_1 = -1$$

$$X-A = -9.89$$

$$\eta_0 = +0.3075$$

$$A = 14 \quad 56 \quad 04$$

$$\log \eta_0 = 9.48785$$

$$\cos S = 7.33115$$

$$A = 14 \quad 55 \quad 54.11$$

$$(S-D) = 2.15670$$

$$Red = +1.50$$

$$S-D = +2 \quad 23.4$$

$$X' = 14 \quad 55 \quad 55.91$$

$$D = -18 \quad 15 \quad 15$$

$$S = -18 \quad 12 \quad 51.6$$

$$Red = -13.1$$

$$S = -18 \quad 13 \quad 04.7$$

1128

Red. ad locum app.

$$S = -18^{\circ} 13'$$

$$H + \alpha \quad 3^h 43^m = 55^{\circ} 45'$$

$$\# \quad 12 \quad 47$$

$$\kappa \quad 14 \quad 56$$

$$G \quad 20 \quad 10$$

$$G + \kappa \quad 11 \quad 06 = +67^{\circ} 30'$$

$$L \cos(G + \kappa) \quad 9.9896m$$

$$g \quad 0.9038$$

$$\sin \quad 9.3353$$

$$\tan S \quad 9.5173m$$

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

$$8' \quad 0.8934m$$

$$g \quad 8.5803m$$

$$b \quad +0.66$$

$$g \quad -0.64$$

$$h \quad +0.18$$

$$\frac{1}{L} \quad +1.80$$

$$\log \cos S \quad 9.9777$$

$$i \quad 0.2566m$$

$$i \quad 0.2343m$$

$$L \sin S \quad 9.4950m$$

$$\cos(H + \alpha) \quad 9.7504$$

$$h \quad 1.3089$$

$$\sin \quad 9.9173$$

$$\sec S \quad 0.0223$$

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

$$h' \quad 0.5543m$$

$$h \quad 0.0724$$

$$8' \quad -7.82$$

$$h' \quad -3.58$$

$$i \quad -1.71$$

$$\frac{1}{L} \quad -13.11$$

1128

Red. ad. locum aff.

$$S = -18^{\circ} 13'$$

$$H + \alpha \quad 3 \quad 43 = 55^{\circ} 45'$$

$$H \quad 12 \quad 47$$

$$\alpha \quad 14 \quad 56$$

$$G \quad 20 \quad 10$$

$$G + \alpha \quad 11 \quad 06 = 167^{\circ} 30'$$

$$2 \cos(G + \alpha) \quad 9.9896m$$

$$g \quad 0.9038$$

$$\sin \quad 9.3353$$

$$\tan S \quad 9.5173m$$

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

$$8' \quad 08934m$$

$$8 \quad 85803m$$

$$b \quad +0.66$$

$$g \quad -0.04$$

$$h \quad +0.18$$

$$\hline T180$$

$$\log \cos S \quad 9.9777$$

$$i \quad 0.2566m$$

$$(i) \quad 0.2343m$$

$$\log \sin S \quad 9.4950m$$

$$\cos(H + \alpha) \quad 9.7504$$

$$h \quad 1.3089$$

$$\sin \quad 9.9173$$

$$\sec S \quad 0.0223$$

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

$$h' \quad 0.5543m$$

$$h \quad 0.0724$$

$$8' \quad -7.82$$

$$h' \quad -3.58$$

$$i \quad -1.71$$

$$\hline -13.11$$

1128 Lunar Parallax.

$$\alpha' = 14^{\circ} 55' 55.91''^{\vee}$$

$$\theta = 15^{\circ} 00' 27.1''^{\vee}$$

$$\alpha - \alpha' = + 4' 31.2''^{\vee}$$

$$= + 1^{\circ} 07' 48''^{\vee}$$

$$+ 25''^{\vee}$$

$$+ 1' 07' 23''^{\vee}$$

$$9.95727''^{\vee}$$

$$0.00000''^{\vee}$$

$$0.00008''^{\vee}$$

$$9.95735''^{\vee}$$

$$\gamma = 42^{\circ} 11' 29''^{\vee}$$

$$- 18^{\circ} 13' 05''^{\vee}$$

$$60^{\circ} 24' 34''^{\vee}$$

$$9.82640''^{\vee}$$

$$8.19873''^{\vee}$$

$$9.93931''^{\vee}$$

$$0.17288''^{\vee}$$

$$8.13732''^{\vee}$$

$$\delta - \delta' = + 47' 09.8''^{\vee}$$

$$\delta = -17^{\circ} 25' 54.9''^{\vee}$$

$$\alpha = 14^{\circ} 55' 59.23''^{\vee}$$

$$\text{Nautical } \delta = -17^{\circ} 25' 50.4''^{\vee}$$

$$\alpha = 14^{\circ} 55' 58.57''^{\vee}$$

$$O - C = - 4.5''^{\vee}$$

$$+ 0.66''^{\vee}$$

$$\text{Rad to stand Radin} = + 0.6''^{\vee}$$

$$- 0.11''^{\vee}$$

$$O - C = - 3.9''^{\vee}$$

$$+ 0.55''^{\vee}$$

$$\delta' = -18^{\circ} 13' 04.7''^{\vee}$$

$$\Pi = 54' 19.7''^{\vee}$$

$$9.86913''^{\vee}$$

$$8.19873''^{\vee}$$

$$8.29493''^{\vee}$$

$$0.02041''^{\vee}$$

$$6.38320''^{\vee}$$

$$\alpha - \alpha' = + 0' 49.85''^{\vee}$$

$$= + 03.32''^{\vee}$$

1128 Lunar Parallax.

$$\alpha = 14^{\circ} 55' 55.91$$

$$\delta = 15^{\circ} 00' 27.1$$

$$\alpha - \alpha' = + 4' 31.2$$

$$= + 1^{\circ} 07' 48''$$

$$+ 25$$

$$+ 1 \quad 07 \quad 23$$

$$995727$$

$$000000$$

$$000008$$

$$995735$$

$$\gamma = 42 \quad 11 \quad 29$$

$$- 18 \quad 13 \quad 05$$

$$60 \quad 24 \quad 34$$

$$982640$$

$$819873$$

$$993931$$

$$017288$$

$$813732$$

$$\delta - \delta' = + 47 \quad 09.8$$

$$\delta = -17 \quad 25' \quad 54.9$$

$$\text{Hantalan } \delta = -17 \quad 25' \quad 50.4$$

$$O - C = - 45$$

$$\text{Red Island Radon} = 08$$

$$O - C = - 39$$

$$\delta = -18^{\circ} 13' 04.7$$

$$\bar{\delta} = 54 \quad 19.7$$

$$986913$$

$$819873$$

$$829493$$

$$002041$$

$$638320$$

$$\alpha - \alpha' = + 0' 49.85$$

$$= + 03.32$$

$$\alpha = 14 \quad 55 \quad 59.23$$

$$\alpha = 14 \quad 55 \quad 58.57$$

$$+ 066$$

$$- 014$$

$$+ 055$$

[Faint, illegible handwriting]

