

KG

11366

v. 889

Vol XIII



Plates.

1129

1130



Harvard Lunar Plates.

Measures and Reductions.

Mary Towler.

Volume XIII.

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1130	17.

112

20-

4-

m

m

1129	Comparison Stars Standard Cords.			1913 Feb 14.	1.
	1	2	3	4	
$x =$	8.9754	123851	21.5687	27.0000	
$y =$	9.2745	125414	21.7502	27.3442	
$x - \bar{x} =$	-2991	-1563	-1815	-3442	
$y =$	19.6174	31.6319	29.4008	15.8149	
$y - \bar{y} =$	19.5977	31.6133	29.4944	15.9619	
$y - \eta +$	697	+186	-936	-1470	

Preliminary Reduction

$x - \bar{x}$	-1174	-24	+5323	
-2991	-2296	-5287-39	-5326	= -3
-1563	-3701	-5264-63	-5327	= -4
-1815	-3440	-5255-59	-5314	= +9
-3442	-1850	-5292-32	-5324	= -1
mean 17.8599	-2573	-4.4		= 18.1305 ✓
$y - \bar{y}$	+1222	+94	-1970	
+697	+1095	+1792+177	+1969	= -1
+186	+1511	+1697+285	+1982	= +12
-936	+2632	+1696+265	+1961	= -9
-1470	+3294	+1824+142	+1966	= -4
mean 21.9936	+2179	+198		= 22.0343 ✓

Comparison with Standard Stars.				1913+14.	1.
1	2	3	4		
$x = 8.9754$	12.3851	21.5687	27.0000		
$y = 9.2745$	12.5419	21.7502	27.3442		
$x - \bar{x} = 2991$	-1563	-1815	-3442		
$y = 19.6174$	31.6319	29.4008	15.8149		
$y = 19.5977$	31.6133	29.4944	15.9619		
$y - \bar{y} = 697$	$+186$	-936	-1470		

Preliminary Reduction.

$x - \bar{x}$	-1174	-24	$+5323$	
-2991	-2296	-5287	-39	-5326
-1563	-3701	-5264	-63	-5327
-1815	-3440	-5255	-59	-5314
-3442	-1850	-5292	-32	-5324
now 17.8599	-2573	-44		-18.1305
$y - \bar{y}$	$+1222$	$+94$	-1470	
$+697$	$+1095$	$+1792$	$+177$	$+1969$
$+186$	$+1511$	$+1697$	$+285$	$+1982$
-936	$+2632$	$+1696$	$+265$	$+1961$
-1470	$+3294$	$+1824$	$+142$	-1966
now 21.9936	$+2179$	$+198$		-1966

MC1129 comp-Stars - Standard Curves

2

M6113.9 Comp. Stars - Standard Graph

2

MC1129 Comparison Stars - Measures

1913 Jan. 22.

3.

	y		x	
	d	v	d	v
1				
9.0	18168	14400	12749	955857
19.7	1199992	1056973	1250306	5457
mag.	93	70	98	9310
7.7	70	92		
	<u>19.6174</u>	<u>.6173</u>	<u>8.9753</u>	<u>.9754</u>
2				
12.4	16119	18145	16849	18180
31.6	979494	1446061	1069191	1432321
mag.	00	65	94	20
6.8	11	39	41	68
	<u>31.6318</u>	<u>.6320</u>	<u>12.3848</u>	<u>.3854</u>
3				
21.6	14570	16006	15769	16311
29.5	1056064	1001713	1145050	1062022
mag.	60	18	47	18
7.0	63	06	60	09
	<u>29.4006</u>	<u>.4010</u>	<u>21.5684</u>	<u>.5690</u>
4				
27.0	18681	15478		
15.8	1052528	1363128		
mag.	27	30		
5.9	69	71		
	<u>15.8144</u>	<u>.8154</u>	<u>27.0000</u>	

MCH29 Comparison stars - measures

1913 Jan 22.

3.

1	d	v	d	v
40	18168	14400	12749	955857
19.7	1199992	1056973	1250306	5457
mag	93	70	98	9310
7.7	70	72		

19.617461738.97539.754

12.4	16119	18145	16849	18120
31.6	979494	1446061	1069191	1432321
mag	00	65	94	20
6.8	11	39	41	68

31.6318.632012.38483.854

21.6	14570	16006	15769	16311
29.5	1056064	1001118	1145050	1062022
mag	60	mag 18	47	18
7.2	63	06	60	09

29.4006401021.56845690

27.0	18681	15478		
15.8	1052528	1363128		
mag	27	30		
5.9	69	71		

15.8144815427.0000

M
1
27
2
16
2
15
27
16
27

MC1129 - Moon - measures -

1913 Jan. 22.

4

1
 α N
 $\begin{array}{r} 120 \\ 20.3 \end{array}$ $\begin{array}{r} 15702 \\ 12950 \\ 50 \\ 92 \end{array}$ 53 $\begin{array}{r} 18221 \\ 10912 \\ 0200 \\ 11 \end{array}$

20.2748.2691

2
 $\begin{array}{r} 16.3 \\ 21.0 \end{array}$

$\begin{array}{r} 15429 \\ 756785 \\ 80 \\ 20 \end{array}$

$\begin{array}{r} 18642 \\ 1650686 \\ 99 \\ 34 \end{array}$

16.2155.2143

3 scratch.
 $\begin{array}{r} 16.4 \\ 21.3 \end{array}$ $\begin{array}{r} 13678 \\ 10695 \\ 05 \\ .69 \end{array}$ 10 $\begin{array}{r} 15869 \\ 8834 \\ 26 \\ 61 \end{array}$ 30

$\begin{array}{r} 16489 \\ 718600 \\ 85 \\ 81 \end{array}$

$\begin{array}{r} 17121 \\ 16410 \\ 10 \\ 11 \end{array}$ 15

21.2972.296716.0708.0708

4
 $\begin{array}{r} 15.9 \\ 22.0 \\ \text{min} \\ \text{in} \\ 76 \end{array}$

$\begin{array}{r} 10369 \\ 970200 \\ 9000 \end{array}$

$\begin{array}{r} 11195 \\ 8490 \\ 10531 \end{array}$

15.9328.9341

5 scratch.
 $\begin{array}{r} 16.1 \\ 22.8 \end{array}$ $\begin{array}{r} 18510 \\ 10697 \\ 99 \\ 90 \end{array}$ 90 $\begin{array}{r} 18195 \\ 16010 \\ 11 \\ 85 \end{array}$ 12

$\begin{array}{r} 18858 \\ 993031 \\ 37 \\ 50 \end{array}$

$\begin{array}{r} 15331 \\ 1424245 \\ 40 \\ 15 \end{array}$

22.7799.781816.1082.1087

1129 - Trans - measure -

1913 Jan. 22.

4

	d	N		d	N
170	15702	18221			
123	12950	10912			
	50	0200			
	53	11			
	92				

20.27482691

2
16.3
21.0

15429	18642
756785	1650686
80	99
20	39

16.21552143

3 scratch

64	13678	15869
13	10695	883430
	05	26
	69	61

16489	17121
718600	1641015
85	10
81	11

212972296716.07080708

10369	11195
970200	8490
90	10531

1593289341

5 scratch

61	18510	18195
28	10697	16010
	99	11
	90	85

18858
993031
37
50

15331
1429245
40
15

227798781816.10821087

M

16.

23.

7

17

23.

M

17

23.

M

17

23.

M

17

23.

M

17

23.

M

17

23.

M

17

23.

M

17

23.

M

17

23.

MCI129 - moon-measures

1913 Jan. 22.

5.

$\frac{d}{N}$
 16.3
 23.0

$\frac{d}{N}$
 17815
 10053 41
 41
 13
 18509
 16260 55
 68
 95-

16.22322245

$\frac{7}{17.0}$ 17442 ✓ 17262
 $\frac{23.7}{1030899}$ 14420 24
 95
 31 59

23.71337157

$\frac{8}{17.9}$ 16993 16309
 $\frac{23.9}{780590}$ 15467 58
 max 01
 82 01
 8

23.91849154

$\frac{9}{18.0}$ 15980 16319
 $\frac{23.8}{687570}$ 15386 00
 75
 74 06

23.91029081

1912g - moon - measures

1913 Jan 22

5.

$\begin{array}{r} 1 \\ 3 \\ 30 \end{array}$
 $\begin{array}{c} d \\ 4 \end{array}$
 $\begin{array}{c} N \\ 4 \end{array}$

$\begin{array}{r} d \\ 17815 \\ 1005341 \\ 41 \\ 13 \end{array}$
 $\begin{array}{c} N \\ 18509 \\ 1026055 \\ 68 \\ 95 \end{array}$

1622322245

$\begin{array}{r} 70 \\ 37 \end{array}$
 $\begin{array}{r} 17442 \\ 1030899 \\ 95 \\ 51 \end{array}$
 $\begin{array}{r} 17262 \\ 1442024 \\ 10 \\ 59 \end{array}$

2371337157

$\begin{array}{r} 19 \\ 9 \\ 24 \end{array}$
 $\begin{array}{r} 16993 \\ 780890 \\ 01 \\ 82 \end{array}$
 $\begin{array}{r} 16309 \\ 1546758 \\ 60 \\ 01 \end{array}$

2391849154

$\begin{array}{r} 10 \\ 33 \end{array}$
 $\begin{array}{r} 15980 \\ 687570 \\ 75 \\ 74 \end{array}$
 $\begin{array}{r} 10319 \\ 1538600 \\ 10 \\ 06 \end{array}$

2391029081

AAC1129

1913 Feb 15

6

Exp to stars 1911 June 8 Times etc

.. moon 15 15 22.0 - 15^h 20^m
 clock fast 3 16.0 ✓

H sid T. 15 12 06.1 ✓
 H long 4 44 31.05 ✓
 G sid T. 19 56 37.15 ✓
 Sid Tm now 5 03 00.35 ✓
 Interval 14 53 36.80 ✓
 Reduction 2 26.40 ✓
 G. M. T. 14 51 10.40 ✓

From Naut. Alm. R. A.
 Moon 15^h 14^h 56^m 38.27 ✓ - 17° 29' 37.2" ✓
 motion in 1^m = 1.9429 ✓ 11.087
 .. - 8.827 - 17.14 + 1 37.9 ✓
 Tabular place 14 56 21.13 ✓ - 17 27 59.3 ✓

Moon's parallax 54' 19.6
 .. semidiameter 14 49.8 ✓

AAC1129

1913 Feb 15.

6

Times etc
Exp. 1st ans 1911 June 8 $15^h 11^m$

.. .. moon $15 \quad 15 \quad 22.0$
clock fast $3 \quad 16.0$

$-15^h 20^m$
 $-15 \quad 15 \quad 22.2$

H sid T. $15 \quad 12 \quad 06.1$
H long $4 \quad 44 \quad 310.5$
G. sid T. $19 \quad 56 \quad 37.15$
Sid T. in moon $5 \quad 03 \quad 0.35$
Interval $14 \quad 53 \quad 36.80$
Reduction $2 \quad 26.40$
G. in T. $14 \quad 51 \quad 10.40$

From Naut. Alman.

R. A

moon 15^h $14^h 56^m 38.27$ $-17^\circ 29' 37.2$
moon in $1^m = 1.9429$ 11.087
.. .. -8.827 $-$ 17.14 $+ \quad 1 \quad 37.9$
Tabular place $14 \quad 56 \quad 21.43$ $-17 \quad 27 \quad 59.3$

moon's parallax $54' 19.6$
semidiameter $14 \quad 49.8$

pt	pos C	resid
1	206.4	+86
2	238.8	-31
3	248.8	-113
4	270.0	+128
5	294.2	-101
6	301.4	-75
7	333.6	+73
8	0.0	+68
9	4.3	-32

11C1029

1913 Feb. 14.

7

Center of Moon

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(y - y_0)^2 + (x - x_0)^2$	$O - C$
1	17.0000	-0.8571	-2	0.7349	3.7009	+ 83
2	16.2149	-1.6422	-1	2.6972	3.6854	- 72
3	16.0708	-1.7863	-1	3.1912	3.6767	- 159
-4	15.9334	-1.9237	+0	3.7006	3.7006	+ 80
5	16.1084	-1.7487	+1	3.0576	3.6791	- 135
6	16.2238	-1.6333	+1	2.6674	3.6829	- 97
7	17.0000	-0.8571	+2	3.7342	3.7026	+ 100
8	17.8571	0.0000	+2	0.0000	3.7072	+ 146
9	18.0000	+0.1429	+2	0.0204	3.6980	+ 54
mean = 3.6926						0

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.2720	-1.7212	-16	2.9660
2	21.0000	-0.9932	-9	0.9882
3	21.2970	-0.6962	-6	0.4855
4	22.0000	+0.0068	+0	0.0000
5	22.7809	+0.7877	+7	0.6215
6	23.0000	+1.0068	+9	1.0155
7	23.7145	+1.7213	+16	2.9684
8	23.9169	+1.9237	+17	3.7072
9	23.9092	+1.9160	+17	3.6776

Approximate Center

$$x = 17.0 \quad y = 20.2720$$

$$23.7145$$

$$4.39865$$

$$\text{mean } y = 21.9932$$

$$y - \text{max} = 23.9169$$

$$R = 1.9237$$

$$x - \text{min} = 15.9334$$

$$x_0 = 17.8571$$

$$x_0 = 17.8571$$

$$y_0 = 21.9932$$

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HAC 1029

1913 Feb. 14

7

Center of Moon

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(y - y_0)^2 + (x - x_0)^2$	$u - c$
1	17.0000	-0.8571	-2	0.7349	3.7009	+ 83
2	16.2149	-1.6422	-1	2.6972	3.6854	- 72
3	16.0708	-1.7863	-1	3.1912	3.6767	- 159
-4	15.9334	-1.9237	+0	3.7006	3.7006	+ 80
5	16.1084	-1.7487	+1	3.0576	3.6791	- 135
6	16.2238	-1.6333	+1	2.6674	3.6829	- 97
7	17.0000	-0.8571	+2	3.7342	3.7026	+ 100
8	17.8571	0.0000	+2	0.0000	3.7072	+ 146
9	18.0000	+0.1429	+2	0.0204	3.6980	+ 54
				mean	3.6926	

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.2720	-1.7212	-16	2.9660
2	21.0000	-0.9932	-9	0.9882
3	21.2970	-0.6962	-6	0.4855
4	22.0000	+0.0068	+0	0.0000
5	22.7809	+0.7877	+7	0.6215
6	23.0000	+1.0068	+9	1.0155
7	23.7145	+1.7213	+16	2.9684
+8	23.9169	+1.9237	+17	3.7072
9	23.9092	+1.9160	+17	3.6776

Approximate Center

$$x = 17.0 \quad y = 20.2720$$

$$23.7145$$

$$4.39865$$

$$\text{mean } y = 21.9932$$

$$y - \text{max} = 23.9169$$

$$R = 1.9237$$

$$x = \text{min} = 15.9334$$

$$x_0 = 17.8571$$

$$x_0 = 17.8571$$

$$y_0 = 21.9932$$

Formation of Normals

	ab	ac	bc
1	+ 1.48	- 71.5	- 143.0
2	+ 1.63	+ 118.0	+ 71.1
3	+ 1.25	+ 284.5	+ 111.2
4	- 0.02	- 153.5	+ 0.8
5	- 1.38	+ 236.0	- 106.8
6	- 1.64	+ 158.0	- 97.9
7	- 1.48	- 86.0	+ 172.0
8	- 0.00	- 0.0	+ 280.0
9	+ 0.27	+ 7.6	+ 103.8
	+ 0.11	+ 493.1	+ 391.2

$$[aa] = +19.80$$

$$[bb] = +16.43$$

$$[ac] = -10.31$$

$$[bc] = +3.96$$

$$[cc] = 0$$

MC1029.

1913 Feb. 14.

8

Owen's Center

Conditional Equations.

	a	b	c	0	c	0-c
1	-0.86	-1.72	+1	= +83	-49 - 15 + 61 = -3	+86
2	-1.64	-0.99	+1	= -72	-93 - 9 + 61 = -41	-31
3	-1.79	-0.70	+1	= -159	-101 - 6 + 61 = -46	-113
4	-1.92	+0.01	+1	= +80	-109 + 0 + 61 = -48	+128
5	-1.75	+0.79	+1	= -135	-99 + 7 + 61 = -31	-101
6	-1.63	+1.01	+1	= -97	-92 + 9 + 61 = -22	-75
7	-0.86	+1.72	+1	= +100	-49 + 15 + 61 = +27	+73
8	0.00	+1.92	+1	= +146	-0 + 17 + 61 = +78	+64
9	+0.14	+1.92	+1	= +54	+8 + 17 + 61 = +86	-32

Normal Equations

+355 - 352

Average (0-c) = 79

$$\begin{aligned}
 +19.80 + 0.11 - 10.31 &= +493 \\
 +0.11 + 16.43 + 396 &= +391 \\
 -10.31 + 3.96 + 900 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \frac{\Delta a}{\Delta c} &= +0.522
 \end{aligned}$$

$$\begin{aligned}
 -0.11 - 0.00 + 0.06 &= -3 \\
 +10.31 + 0.06 - 5.37 &= +257
 \end{aligned}$$

$$\begin{aligned}
 +16.43 + 4.02 &= +388 \\
 +4.02 + 3.63 &= +257
 \end{aligned}$$

$$\frac{\Delta b}{\Delta c} = -0.245$$

$$\begin{aligned}
 -4.02 - 0.98 &= -95 \\
 +2.65 &= +162
 \end{aligned}$$

$$c = +61$$

$$\begin{aligned}
 -44.5 - 4.02 &= -284 \\
 +11.98 &= +104
 \end{aligned}$$

$$b = +87 + 9 =$$

$$\begin{aligned}
 +0.29 - 0.11 - 0.25 &= 0 \\
 +42.80 - 16.43 - 37.36 &= 0
 \end{aligned}$$

$$\begin{aligned}
 +20.09 &= -10.56 = +493 \\
 +42.91 &= -33.40 = +391
 \end{aligned}$$

$$\begin{aligned}
 -13.56 &= +10.56 = -124 \\
 +6.53 &= +36.9
 \end{aligned}$$

$$a = +56.5$$

1911phae

1913 Feb. 14.

8

MC1029.

Brown's Center

Conditional Equations

	a	b	c	0		c	0-c
1	-0.86	-1.72	+1	= +83	-49	-15 + 61 = -3	+86
2	-1.64	-0.99	+1	= -72	-93	-9 + 61 = -41	-31
3	-1.79	-0.70	+1	= -159	-101	-6 + 61 = -46	-113
4	-1.92	+0.01	+1	= +80	-109	0 + 61 = -48	+128
5	-1.75	+0.79	+1	= +135	-99	7 + 61 = -31	-101
6	-1.63	+1.01	+1	= -97	-92	9 + 61 = -22	-75
7	-0.86	+1.72	+1	= +100	-49	15 + 61 = +27	+73
8	0.00	+1.92	+1	= +146	-0	17 + 61 = +78	+64
9	+0.14	+1.92	+1	= +54	+8	17 + 61 = +86	-32

+355 - 352

Average (0-c) = 79

$$+19.80 + 0.11 - 10.31 = +49.3$$

$$+ 0.11 + 16.43 + 39.6 = +39.1$$

$$-10.31 + 3.96 + 9.00 = 0$$

$$- 0.11 - 0.00 + 0.00 = - 3$$

$$+ 10.31 + 0.06 - 5.37 = +25.7$$

$$+ 16.43 + 4.02 = +38.8$$

$$+ 4.02 + 36.3 = +25.7$$

$$- 4.02 - 0.98 = - 9.5$$

$$+ 2.65 = +16.2$$

$$c = +61$$

$$- 4.95 - 4.02 = -28.4$$

$$+ 11.98 = +10.4$$

$$b = +89 + 9$$

$$+ 0.29 - 0.11 - 0.25 = 0$$

$$+ 42.80 - 16.43 - 37.36 = 0$$

$$+ 20.09 - 10.56 = +9.93$$

$$+ 42.91 - 33.40 = +39.1$$

$$- 13.56 + 10.56 = -12.4$$

$$+ 6.53 = +36.9$$

$$a = +56$$

M61129

1913 Feb. 17.

9

$$X_0 = 17.8571 \checkmark$$

$$\frac{1}{2}a = \frac{+28 \checkmark}{= 17.8599 \checkmark}$$

$$Y_0 = 21.9932 \checkmark$$

$$\frac{1}{2}b = \frac{+4 \checkmark}{= 21.9936 \checkmark}$$

From preliminary constants $X = 18.1305 \checkmark$ $Y = 22.0343 \checkmark$
 " plate constants p. 22 $a_x = +12 \checkmark$ $a_y = -15 \checkmark$
 $b_x = +9 \checkmark$ $b_y = +5 \checkmark$
 $c = -21 \checkmark$ $c = +9 \checkmark$

$$\bar{x} = +8.1305 \checkmark$$

$$\log = 9.11561 \checkmark$$

$$\log \delta = 9.97759 \checkmark$$

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

$$(x-A) = 0.63078 \checkmark$$

$$x-A = +4.27 \checkmark$$

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

$$\alpha = 14^h 56^m 08.27^s \checkmark$$

$$\text{Red} = +1.80 \checkmark$$

$$\alpha' = 14^h 56^m 10.07^s \checkmark$$

$$\eta = +0.0342 \checkmark$$

$$\log \tan \delta = 9.4978 \checkmark$$

$$\log \delta = 8.2312 \checkmark$$

$$\eta_1 = 4.7824 \checkmark$$

$$\log m_0 = 8.53403 \checkmark$$

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

$$(\delta-D) = 1.20288 \checkmark$$

$$\delta-D = +16.0 \checkmark$$

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

$$\delta = -18^{\circ} 14' 59.0'' \checkmark$$

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

$$\delta' = -18^{\circ} 15' 12.1'' \checkmark$$

1913 Feb. 17.

9

M 1129.

$$\begin{array}{r}
 X_0 = 17.8571 \\
 \frac{1}{2}a = \quad + 28 \\
 \hline
 = 17.8599
 \end{array}$$

$$\begin{array}{r}
 Y_0 = 21.9932 \\
 \frac{1}{2}b = \quad + 4 \\
 \hline
 = 21.9936
 \end{array}$$

From preliminary Constant $X = 18.1305$ $Y = 22.0343$
 plate constant p. 22 $a_x = +12$ $a_y = -15$
 $b_x = +9$ $b_y = +5$
 $c_x = -21$ $c_y = +9$

$$z = +0.1305$$

$$\log : 9.11561$$

$$\log s : 9.97759$$

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

$$(X-A) : 0.63078$$

$$X-A : T \quad 4.27$$

$$A = 14 \ 56 \ 04$$

$$X = 14^{\circ} 56' 08.27''$$

$$\text{Red} = +1.80$$

$$\alpha = 14 \ 56 \ 10.07$$

$$\eta = +0.0342$$

$$\log \tan s = 9.4978 \text{ m}$$

$$\log s^2 = 8.2312$$

$$\log \eta = 4.7824 \text{ m}$$

$$\log m_0 = 8.53403$$

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

$$(s-D) = 1.20288$$

$$s-D = + \quad 16.0$$

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

$$s = -18^{\circ} 14' 59.0''$$

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

$$s = -18 \ 15 \ 12.1$$

1129

Red ad locum app.

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

$H + \alpha$	3	43 = 55° 45'
H	12	47
α	14	56
α	20	10
$G + \alpha$	11	06 = 166° 30'

$$\begin{array}{r} l \cos S \quad 9.9776 \\ l \quad \underline{0.2566} \\ (l) \quad 0.2342 \end{array}$$

$$\begin{array}{r} l \cos(G + \alpha) \quad 9.9878 \\ \quad \quad \quad 0.9038 \\ \sin \dots \quad 9.3682 \\ \tan S \quad 9.5182 \\ \frac{1}{\sin} \quad 8.8239 \end{array}$$

$$\begin{array}{r} (g') \quad 0.8916 \\ (g) \quad 86141 \end{array}$$

$$\begin{array}{r} p \quad +0.66 \\ s \quad -0.04 \\ h \quad +1.18 \\ \hline +1.80 \end{array}$$

$$\begin{array}{r} l \sin S \quad 9.4958 \\ \cos(H + \alpha) \quad 9.7504 \\ h \quad 1.3089 \\ \sin \dots \quad 9.9173 \\ \sec S \quad 0.0224 \\ \frac{1}{\sin} \quad 8.8239 \end{array}$$

$$\begin{array}{r} (h') \quad 0.5551 \\ (h) \quad 0.0725 \end{array}$$

$$\begin{array}{r} g' \quad -7.79 \\ h' \quad -3.59 \\ i \quad \underline{-1.71} \\ -13.09 \end{array}$$

1129

Red ad locum app

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

$H + \alpha$	3	43 = 55° 45'
H	12	47
α	14	56
G	20	10
$G + \alpha$	11	06 = 166° 30'

$$\begin{aligned} L \cos S & 94776 \\ L & \underline{02566} \\ (L) & 02342 \end{aligned}$$

$$\begin{aligned} L \cos(G + \alpha) & 99878 \\ \gamma & 09038 \\ \sin \dots & 93682 \\ \tan S & 95182 \\ \frac{1}{\sin} & 88239 \end{aligned}$$

$$\begin{aligned} (8') & 08916 \\ (9) & 86141 \end{aligned}$$

$$\begin{aligned} f & +066 \\ g & -004 \\ h & +118 \\ \hline & +180 \end{aligned}$$

$$\begin{aligned} L \sin S & 94958 \\ \cos(H + \alpha) & 97504 \\ h & 13089 \\ \sin \dots & 99173 \\ \sec S & 00224 \\ \frac{1}{\sin} & 88239 \end{aligned}$$

$$\begin{aligned} (h') & 05551 \\ (h) & 00725 \end{aligned}$$

$$\begin{aligned} g' & -779 \\ h' & -359 \\ i & \underline{-171} \\ & -1309 \end{aligned}$$

Lunar Parallax.

$$\begin{array}{rcl}
 1129 & & \\
 \alpha = 14^{\circ} 56' 10.07'' & & \checkmark \\
 \delta = 15^{\circ} 12' 06.1'' & & \checkmark \\
 \theta - \alpha = + 15^{\circ} 56' 0'' & & \checkmark \\
 = + 3^{\circ} 59' 00'' & & \checkmark
 \end{array}$$

$$+ 1 28''$$

$$+ 3 57 32''$$

$$9.95727''$$

$$0.00000''$$

$$0.00104''$$

$$9.95831''$$

$$\gamma = 42 15 14''$$

$$- 18 15 12''$$

$$60 30 26''$$

9

$$9.82640''$$

$$8.19872''$$

$$9.93973''$$

$$0.17236''$$

$$8.13724''$$

$$\delta - \delta' = + 47 09.6''$$

$$\delta = -17 28 03.0''$$

$$\alpha = 14 56 21.78''$$

$$\text{Hawtalem } \delta = -17 27 59.3''$$

$$\alpha = 14 56 21.13''$$

$$0 - \alpha$$

$$- 3.7''$$

$$+ 0.65''$$

$$\text{Red to Land radius}$$

$$+ 0.5''$$

$$- 0.09''$$

$$0 - \alpha$$

$$- 3.2''$$

$$+ 0.56''$$

$$\delta' = -18^{\circ} 15' 12.1''$$

$$\Pi = 54' 19.6''$$

$$9.86913''$$

$$8.19872''$$

$$8.84177''$$

$$0.02050''$$

$$6.93012''$$

$$\alpha - \alpha' = + 2' 55.61''$$

$$= + 11.71''$$

Lunar Parallaxes

$$\begin{array}{r}
 1129 \\
 \alpha = 14^{\circ} 56' 10.07'' \\
 \delta = 15^{\circ} 12' 06.1'' \\
 0 - \alpha = + 15^{\circ} 56' 00'' \\
 = + 3^{\circ} 59' 00''
 \end{array}$$

$$+ 1 28$$

$$+ 3 57 32$$

$$9.95727$$

$$0.00000$$

$$0.00104$$

$$9.95831$$

$$f = 42 15 14$$

$$- 18 15 12$$

$$60 30 26$$

$$9.$$

$$9.82640$$

$$8.19872$$

$$9.93973$$

$$0.17236$$

$$8.13729$$

$$S - S^L = +47 09.0$$

$$S = -17 28 03.0$$

$$\alpha = 14 56 21.78$$

$$\alpha = 14 56 21.13$$

$$\text{Hantelins } S = -17 27 59.3$$

$$0 - L = -3.7$$

$$+0.65$$

$$\text{Red Island radius} = +0.5$$

$$-0.09$$

$$0 - L = -3.2$$

$$+0.56$$

$$S = -18^{\circ} 15' 12''$$

$$\text{II} = 54' 19.6''$$

$$9.86913$$

$$8.19872$$

$$8.84177$$

$$0.02050$$

$$6.93012$$

$$\alpha - \alpha' = + 2' 55.61''$$

$$= + 11.71''$$

MC1130 Preliminary Reduction 1913 Feb 14 17

Star	1	2	3	4
α	93384	128496	220150	273306
β	92745	125414	217502	273442
$\alpha - \beta$	+ 639	+ 3082	+ 2648	- 136
γ	200326	320184	297070	160740
η	195477	316133	294944	159619
$\gamma - \eta$	+ 4849	+ 4051	+ 2126	+ 1121

$$\begin{aligned}
 \alpha - \beta &= -2644 & - \alpha &= +3449 \\
 + 639 - 4086 &= -3447 & - 9 &= -3456 &= -7 \\
 + 3082 - 6532 &= -3450 & - 13 &= -3463 &= -14 \\
 + 2648 - 6061 &= -3413 & - 22 &= -3435 &= +14 \\
 - 136 - 3278 &= -3414 & - 27 &= -3441 &= +8 \\
 \text{mean } 18.6294^\circ - 4504^\circ & & - 19^\circ & & = 18.5220^\circ
 \end{aligned}$$

$$\begin{aligned}
 \gamma - \eta &= +2092 & + 74 & & - 6946 \\
 + 4849 + 1952 &= +6801 & + 140 &= +6941 &= -5 \\
 + 4051 + 2686 &= +6737 & + 224 &= +6961 &= +15 \\
 + 2126 + 4601 &= +6727 & + 208 &= +6935 &= -11 \\
 + 1121 + 5712 &= +6833 & + 113 &= +6946 &= 0 \\
 \text{mean } 22.0757^\circ + 3894^\circ & & + 154^\circ & & = 21.7859^\circ
 \end{aligned}$$

MC1130

Polarization Reduction

1913 Feb. 14

17

Star

1

2

3

4

2	93384	128496	220150	273306
3	92745	125414	217502	273442
x-3	+ 639	+ 3082	+ 2648	- 136

y	200326	320184	297070	160740
y	195477	316133	294944	159619
y-y	+ 4849	+ 4051	+ 2126	+ 1121

x-3	-2044	-x	+ 3449
+ 639-4086	= - 3447	- 9	= - 3456
+ 3082-6532	= - 3450	-13	= - 3463
+ 2648-6061	= - 3413	-22	= - 3435
- 136-3278	= - 3414	-27	= - 3441
mean 18.6294	-4504	-19	= 18.5220

y-y	+ 2092	+ 74	- 6946
+ 4849 + 1952	= + 6801	+ 140	= + 6941
+ 4051 + 2686	= + 6737	+ 224	= + 6961
+ 2126 + 4601	= + 6727	+ 208	= + 6935
+ 1121 + 5712	= + 6833	+ 113	= + 6946
mean 22.0757	+ 3894	+ 154	= 21.7859

NAC 1130.

1913 Jan. 23.

18.

Comparison Stars - means - Residual reversed.

1	d		N		d		N	
	11058		1099199		15350		16549	
9.4	1072830		9299		8725		1315251	
20.0	31		10669		17		6051	
mg					40		30	
7.7								
		<u>20.0328</u>					<u>.3389</u>	
			<u>.0325</u>		<u>9.3378</u>			
2	d		N		d		N	
	9220		99056		15010		14572	
12.8	9035		1066		1349191		607469	
32.0	3941		9720		00		67	
mg					99		77	
6.8								
		<u>32.0182</u>	<u>.0187</u>		<u>12.8486</u>		<u>.8506</u>	
3	d		N		d		N	
	15691		18476		766459		8704	
22.0	862018		1555046		60		855160	
29.7	17		50		7510		5660	
mg	82		75					
7.0								
		<u>29.7067</u>	<u>.7073</u>		<u>22.0151</u>		<u>.0148</u>	
4	d		N		d		N	
	11865		14490		16124		16930	
27.4	1113029		9092		942723		1362020	
16.1	27		13747		27		17	
mg					20		16	
5.9								
		<u>16.0736</u>	<u>.0744</u>		<u>27.3305</u>		<u>.3306</u>	

M 61130.

1913 Jan. 23.

18.

Comparison Stars measured. Results recorded.

$\frac{1}{2}$	d	N	d	N
94	11058	1099199	15350	10549
20.0	10728.0	92	8725.0	13152
mg	31	10669	17	6051
7.7			40	30
	<u>70.0328</u>	<u>0325</u>	<u>9.3378</u>	<u>3589</u>
$\frac{2}{3}$				
12.8	9220	9905.6	15010	14572
32.0	9035	10	1349191	6074
mg	3941	9720	00	6769
68			99	77
	<u>52.0182</u>	<u>0187</u>	<u>12.8486</u>	<u>8506</u>
$\frac{3}{4}$				
22.0	15691	18476	766459	8704
29.7	1620.8	1555046	60	855160
mg	17	50	7510	56
70	82	75		
	<u>29.7067</u>	<u>7073</u>	<u>12.0151</u>	<u>0148</u>
$\frac{4}{5}$				
27.4	11865	14490	16129	16930
16.1	11130.24	9092	942723	1362020
mg	27	18747	27	17
59			20	16
	<u>16.0736</u>	<u>0744</u>	<u>27.3305</u>	<u>3506</u>

MC1130.

1913 Jan 23.

19.

Moon - measures - Reseau reversed.

Scratch

4

2

	a	n
17.8	18600	15872
20.3	1503640	942018
	40	05
	00	53

20.3561.3554

	a	n
19137	16820	
1689490	905064	
85-90	51	
27	10	

17.7755.7757

3
17.1
21.0

14279
95-87
13921

11078
10685
8985-

17.0366.0392

	a	n
17.0	12001	9520
21.1	1144048	3937
	59	8978

21.0552.0554

4
16.7
22.0

17671
1475044
48
68

18500
1139386
00
89

16.7077.7099

5
16.7
22.1
min
w
26

16650
1370589
05
48

17200
1014042
40
84

16.7051.7048

6
16.9
23.0

14082
1355856
59

1206550
54
11535-

16.9476.9479

MC1130.

19135 Jan 23.

19.

Moon - measures - Results reversed.

1. $\frac{1}{2}$ $\frac{1}{4}$

	a	n
17.8	18600	15872
20.5	1503640	942018
	40	05
	00	53

20.35613554

	a	n
19137	16820	
1689470	9050	
85	5164	
77	10	

17.77557757

3
17.1
21.0

14279	11078
5387	10685
13921	8985

17.03660392

3
70 12001 9520
21.1 1149048 3937
59 8978

21.05520554

5
16.7
21.0

17671	18500
1475044	1139386
48	00
68	89

16.70777099

5
17
21.1
21.0

16650	17200
1370589	1014042
05	40
48	89

16.70517048

6
16.9
23.0

14052	1206550
1355856	5450
59	50

16.94769479

MC1130

1913 Jan. 23.

20.

Uvov-measures - Reseau reversed on plate.

λ	α	λ	α
17.0			
23.1	10000	11025	16
	904536	35	
	40	10052	

23.0960.0973

λ		
18.0	1130084	10933
23.9	75	983937
	10181	25

23.8895.8901

λ	
18.6	
24.0	
max	<u>24.0000</u>

λ	
19.0	954735
23.9	38
	9131

23.9591

10000
956070
65

.9565possibly on phase
limb.

1911phae

1913 Jan 23

20

1911phae - Russian reversed in plate

2

17.0

d

w

d

w

23.1

10000

1102516

904536

3216

40

10052

23.09600973

2

18.0

1130084

10933

75

983937

23.9

10181

25137

23.88958901

2

18.6

24.0

max

24.0000

2

2

10

19.0

954735

10000

23.9

38

956070

9131

6570

23.95919565possibly on flare
limb.

MC1030

Times etc

1913 Feb. 15

21

Eph. Stars 1911 June 8. 15^h 21^m - 15^h 30^m
 " " Moon 15 25 53.0 - 15 25 53.2 ✓
 clock fast 3 16.0 ✓

H. Sid. T. 15 22 37.1 ✓
 H. long 4 44 31.05 ✓
 G. Sid. T. 20 07 08.15 ✓
 Sid. T. in noon 5 03 00.35 ✓
 Interval 15 04 07.80 ✓
 Reduction 2 48.12 ✓
 G. M. T. 15 01 39.68 ✓

True Hank. Alm R. A. Decl.
 Moon 15^h = -14 56 38.27 ✓ -17 29 37.2 ✓
 Moon 1^m = 1.9424 ✓
 1.661 + 3.23 ✓ 1.081 ✓ - 18.4 ✓
 Tabular place 14 56 41.50 ✓ -17 29 55.6 ✓

Moon's parallax 54' 19.5 ✓
 Semi-diam 14 49.8 ✓

MC1030

Transits etc.

1913 Feb. 15.

21

Egypt Stars 1911 June 8 15^h 21^m - 15^h 30^m
 " moon 15 25 53.0 - 15 25 53.2
 clock fast 3 16.0

H. Sid. T. 15 22 57.1
 H. long 4 44 31.05
 G. Sid. T. 20 07 08.15
 Sid. T. in moon 5 03 0.35
 Interval 15 04 07.80
 Reduction 2 28.12
 G. in T. 15 01 39.68

Lower Rank. Alm R. A. Decl.
 moon 15^h : 14 56 38.27 - 17 29 37.2
 motion in 1^m = 1.9424 11.081
 1.661 + 3.23 - 18.4
 Tabular place 14 56 41.50 - 17 29 55.6

moon's parallax. 54' 19.5
 " semi-diam 14 49.8

Plates 1128-1129-1130

1913 Feb 15 22

Plate Constants

1129

1130

a	b	c	$x-3$	$y-n$	$x-3$	$y-n$	$x-3$	$y-n$
+ 9.27	+ 19.55	+ 1	- 1	- 8	- 3	- 1	- 7	- 5
+ 12.54	+ 31.61	+ 1	- 8	+ 12	- 4	+ 12	- 14	+ 15
+ 21.75	+ 29.49	+ 1	+ 2.0	+ 0	+ 9	- 9	+ 14	- 11
+ 27.34	+ 15.96	+ 1	- 1.0	+ 5	- 1	- 4	+ 8	0

mean equations

+ 10.90	+ 25.58	+ 1	- 4.50	+ 2.00	- 3.50	+ 5.50	- 10.50	+ 5.00
+ 24.54	+ 22.73	+ 1	+ 5.00	+ 2.50	+ 4.00	- 6.50	+ 11.00	- 5.50
+ 18.30	+ 17.76	+ 1	- 5.50	- 6.50	- 2.00	- 2.50	+ 0.50	- 2.50
+ 17.14	+ 30.55	+ 1	+ 6.00	+ 6.00	+ 2.50	+ 1.50	0.00	+ 2.00

- 13.64	+ 2.85	=	- 9.50	+ 4.50	- 7.50	+ 12.00	- 21.50	+ 10.50
+ 1.16	- 12.79	=	- 11.50	- 12.50	- 4.50	- 4.00	+ 0.50	- 4.50

- 1.16	+ 0.24	=	- 0.81	+ 0.38	- 0.64	+ 1.02	- 1.83	+ 0.89
- 12.55		=	- 12.31	- 12.12	- 5.14	- 2.98	- 1.33	- 3.61

$$b = +0.98 + 0.97 + 0.41 + 0.24 + 0.11 + 0.29$$

$$a = +0.90 - 0.13 + 0.64 - 0.83 + 1.60 - 0.71$$

- 3.5	+ 4.0	- 2.0	+ 2.5	+ 5.5	- 6.5	- 2.5	+ 1.5
- 6.9	- 15.6	- 11.7	- 10.9	+ 19.9	+ 20.4	+ 15.3	+ 14.3
- 10.5	- 9.3	- 7.3	- 12.5	- 6.1	- 5.4	- 4.2	- 7.3
- 20.9	- 20.9	- 21.0	- 20.9	+ 8.5	+ 8.5	+ 8.5	+ 8.5
c for ($x-3$)				c for ($y-n$)			

- 10.5	+ 11.0	+ 0.5	0.0	+ 5.0	- 5.5	- 2.5	+ 2.0
- 12.4	- 39.2	- 29.2	- 27.4	+ 7.7	+ 17.4	+ 13.0	+ 12.2
- 2.7	- 2.4	- 1.9	- 3.2	- 7.4	- 6.5	- 5.1	- 8.8
- 30.6	- 30.6	- 30.6	- 30.6	+ 5.3	+ 5.4	+ 5.4	+ 5.4
c for ($x-3$)				c for ($y-n$)			

- 4.5	+ 5.0	- 5.5	+ 6.0	+ 2.0	- 2.5	- 6.5	+ 6.0
- 9.8	- 22.2	- 16.5	- 15.4	+ 1.4	+ 3.1	+ 2.3	+ 2.2
- 25.1	- 22.3	- 17.5	- 30.0	- 24.7	- 22.0	- 17.2	- 29.5
- 39.4	- 39.5	- 39.5	- 39.4	- 21.3	- 21.4	- 21.4	- 21.3
c for ($x-3$)							

Plates 1128-1129-1130.

1913 Feb. 15. 22

Plate Constants

1129

1130

a	b	c	x-3	y-7	x-3	y-7	x-3	y-7
+ 9.27 + 19.55 + 1:	- 1	- 8	- 3	- 1	- 7	- 5		
+ 12.54 + 31.61 + 1:	- 8	- 12	- 4	+ 12	- 14	+ 15		
+ 21.75 + 29.49 + 1:	+ 20	+ 0	+ 9	- 9	+ 14	- 11		
+ 27.34 + 15.96 + 1:	- 10	- 5	- 1	- 4	+ 8	0		

mean Equations

+ 10.90 + 25.58 + 1:	- 4.50	+ 2.00	- 3.50	+ 5.50	- 10.50	+ 5.00		
+ 24.54 + 22.73 + 1:	+ 5.00	+ 2.50	+ 4.00	- 6.50	+ 11.00	- 5.50		
+ 18.30 + 17.76 + 1:	- 5.50	- 6.50	- 2.00	- 2.50	+ 0.50	- 2.50		
+ 17.14 + 30.55 + 1:	+ 6.00	+ 6.00	+ 2.50	+ 1.50	0.00	+ 2.00		

- 13.64 + 2.85	=	- 9.50	+ 4.50	- 7.50	+ 12.00	- 21.50	+ 10.50	
+ 1.16 - 12.74	=	- 11.50	- 12.50	- 4.50	- 4.00	+ 0.50	- 4.50	

- 1.16 + 0.24	=	- 0.81	+ 0.38	- 0.64	+ 1.02	- 1.83	+ 0.89	
- 12.55	=	- 12.31	- 12.12	- 5.14	- 2.98	- 1.33	- 3.61	
b:	+ 0.98	+ 0.97	+ 0.41	+ 0.24	+ 0.11	+ 0.29		
a:	+ 0.90	+ 0.13		- 0.83	+ 1.60	- 0.71		

- 3.5	+ 4.0	- 2.0	+ 2.5	+ 5.5	- 6.5	- 2.5	+ 1.5	
- 2.9	- 15.6	- 11.7	- 10.9	+ 9.1	+ 20.4	+ 15.2	+ 14.3	
- 10.5	- 9.3	- 7.3	- 12.5	- 6.1	- 5.4	- 4.2	- 7.3	
- 20.4	- 20.9	- 21.0	- 20.9	+ 8.5	+ 8.5	+ 8.5	+ 8.5	
C for (x-3)				C for (y-7)				

- 10.5	+ 11.0	+ 0.5	0.0	+ 5.0	- 5.5	- 2.5	+ 2.0	
- 12.4	- 39.2	- 29.2	- 27.4	+ 7.7	+ 17.4	- 13.0	+ 12.6	
- 2.7	- 2.4	- 1.9	- 3.2	- 7.4	- 6.5	- 5.1	- 8.8	
- 30.6	- 30.6	- 30.6	- 30.6	+ 5.3	+ 5.4	+ 5.4	+ 5.4	
C for (x-3)				C for (y-7)				

- 4.5	+ 5.0	- 5.5	+ 6.0	+ 2.0	- 2.5	- 4.5	+ 6.0	
- 9.8	- 22.2	- 16.5	- 15.4	+ 1.4	+ 3.1	+ 2.3	+ 2.2	
- 25.1	- 22.3	- 17.5	- 30.0	- 24.7	- 22.0	- 17.2	- 29.5	
- 39.4	- 39.5	- 39.5	- 39.4	- 21.3	- 21.4	- 21.4	- 21.3	
C for (x-3)								

1913 Feb. 17.

23

Residuals

Plate 1129

	L	B	O-C	
+ 6 + 8 - 21 = -	7	-3	+ 4	} resid in x
+ 8 + 13 - 21 =	6	-4	- 4	
+ 14 + 12 - 21 = +	5	+9	+ 4	
+ 17 + 7 - 21 = +	3	-1	- 4	

	L	B		
- 8 + 5 + 8 = + 5	-1		- 6	} resid in y
- 10 + 8 + 8 = + 6	+12		+ 6	
- 18 + 7 + 8 = - 3	-9		- 6	
- 23 + 4 + 8 = -11	-4		+ 7	

Plate 1130

+ 15 + 2 - 31 = - 14	- 7	+ 9	} resid in x
+ 20 + 3 - 31 = - 8	-14	- 6	
+ 35 + 3 - 31 = + 7	+14	+ 6	
+ 44 + 2 - 31 = + 15	+ 8	- 7	

- 7 + 6 + 5 = + 4	- 5	- 9	} resid in y
- 9 + 9 + 5 = + 5	+15	+10	
- 15 + 9 + 5 = - 1	-11	-10	
- 19 + 5 + 5 = - 9	0	+ 9	

Plate 1128

+ 8 + 19 - 39 = - 12	- 1	+ 11	} resid in x
+ 11 + 31 - 39 = + 3	- 8	- 11	
+ 20 + 29 - 39 = + 10	+20	+ 10	
+ 25 + 16 - 39 = + 2	-10	- 12	

	L			
$-1 + 19 - 21 =$	-3	-8	-5	} resid in y.
$-2 + 31 - 21 =$	$+8$	$+12$	$+4$	
$-3 + 28 - 21 =$	$+4$	0	-4	
$-4 + 15 - 21 =$	-10	-5	$+5$	

1913 + 16 . 17.

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Residuals

Plate 1129

	C	O	O-C	
+ 6 + 8 - 21 =	- 7	- 3	+ 4	} resid in 26
+ 8 + 13 - 21 =	0	- 4	- 4	
+ 14 + 12 - 21 =	+ 5	+ 9	+ 4	
+ 17 + 7 - 21 =	+ 3	- 1	- 4	
- 8 + 5 + 8 =	+ 5	- 1	- 6	} resid in 4
- 10 + 8 + 8 =	+ 6	+ 12	+ 6	
- 18 + 7 + 8 =	- 3	+ 9	- 6	
- 23 + 4 + 8 =	- 11	- 4	+ 7	

Plate 1130

+ 15 + 2 - 31 =	- 14	- 7	+ 9	} resid in 26
+ 20 + 3 - 31 =	- 8	- 14	- 6	
+ 35 + 3 - 31 =	+ 7	+ 14	+ 6	
+ 44 + 2 - 31 =	+ 15	+ 8	- 7	
- 7 + 6 + 5 =	+ 4	- 5	- 9	} resid in 4
- 9 + 9 + 5 =	+ 5	+ 15	+ 10	
- 15 + 9 + 5 =	- 1	- 11	- 10	
- 19 + 5 + 5 =	- 9	0	+ 9	

Plate 1128

+ 8 + 19 - 39 =	- 12	- 1	+ 11	} resid in 26
+ 11 + 31 - 39 =	+ 3	- 8	- 11	
+ 20 + 29 - 39 =	+ 10	+ 20	+ 10	
+ 25 + 16 - 39 =	+ 2	- 10	- 12	
- 1 + 19 - 21 =	- 3	- 8	- 5	} resid in 4
- 2 + 31 - 21 =	+ 8	+ 12	+ 4	
- 3 + 28 - 21 =	+ 4	0	- 4	
- 4 + 15 - 21 =	- 10	- 5	+ 5	

pt.	pos. L	resid.
1	206.4	-19
2	236.0	-21
3	238.0	+38
4	267.7	-15
5	270.0	+83
6	298.8	-122
7	302.0	+32
8	340.9	-25
9	0.0	+146
10	11.1	-91

MC1030

1913 Feb. 15.

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Moon's Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$0 - C$
1	17.7756	-0.8534	-3	0.7288	3.6934	-6
2	17.0379	-1.5911	-2	2.5323	3.6922	-18
3	17.0000	-1.6290	-2	2.6543	3.6980	+40
4	16.7088	-1.9202	-0	3.6872	3.6920	-20
-5	16.7050 ^v	-1.9240 ^v	0	3.7018 ^v	3.7018 ^v	+78
6	16.9478 ^v	-1.6812 ^v	+2	2.8258 ^v	3.6810 ^v	-130
7	17.0000	-1.6290	+2	2.6530	3.6964	+24
8	18.0000	-0.6290	+3	0.3952	3.6912	-28
9	18.6290 ^v	0.0000 ^v	+3	0.0000 ^v	3.7087 ^v	+147
10	19.0000 ^v	+0.3710 ^v	+3	0.1378 ^v	3.6854 ^v	-86
Mean					3.6940	+1

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.3558	-1.7202	-16	2.9646
2	21.0000	-1.0760	-10	1.1599
3	21.0553	-1.0207	-9	1.0437
4	22.0000	-0.0760	-1	0.0058
5	22.0760 ^v	0.0000 ^v	0	0.0000 ^v
6	23.0000 ^v	+0.9240 ^v	+8	0.8552 ^v
7	23.0966	+1.0206	+09	1.0434
8	23.8898 ^v	+1.8138 ^v	+17	3.2966 ^v
+9	24.0000 ^v	+1.9240 ^v	+18	3.7087 ^v
10	23.9578 ^v	+1.8818 ^v	+17	3.5476 ^v

Approximate Center

$$x = 17.0 \quad y = 21.0553$$

$$23.0966$$

$$44.1519$$

$$\text{mean } y = 22.0760$$

$$y - \text{max} = 24.0000$$

$$R = 1.9240$$

$$x - \text{min} = 16.7050$$

$$x_0 = 18.6290$$

$$\left. \begin{array}{l} x_0 = 18.6290 \\ y_0 = 22.0760 \end{array} \right\}$$

MC1430

1913 Feb. 15.

24.

main Center.

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$O - C$
1	17.7756	-0.8534	-3	0.7288	3.6934	-6
2	17.0379	-1.5911	-2	2.5323	3.6922	-18
3	17.0000	-1.6290	-2	2.6543	3.6980	+40
4	16.7088	-1.9202	-0	3.6872	3.6920	-20
-5	16.7050	-1.9240	0	3.7018	3.7018	+78
6	16.9478	-1.6812	+2	2.8258	3.6810	-130
7	17.0000	-1.6290	+2	2.6530	3.6964	+24
8	18.0000	-0.6290	+3	0.3952	3.6912	-28
9	18.6290	0.0000	+3	0.0000	3.7087	+147
10	19.0000	+0.3710	+3	0.1378	3.6854	-86
mean					3.6940	+1

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.3558	-1.7202	-16	2.9646
2	21.0000	-1.0760	-10	1.1599
3	21.0553	-1.0207	-9	1.0437
4	22.0000	-0.0760	-1	0.0058
5	22.0760	0.0000	0	0.0000
6	23.0000	+0.9240	+8	0.8552
7	23.0966	+1.0206	+09	1.0434
8	23.8898	+1.8138	+17	3.2960
+9	24.0000	+1.9240	+18	3.7087
10	23.9578	+1.8818	+17	3.5476

Approximate Center.

$$x = 17.0 \quad y = 21.0553$$

$$23.0966$$

$$44.1519$$

$$\text{mean } y = 22.0760$$

$$y - \text{mean} = 24.0000$$

$$R = 1.9240$$

$$x - \text{mean} = 16.7050$$

$$x_0 = 18.6290$$

$$\left. \begin{array}{l} x_0 = 18.6290 \\ y_0 = 22.0760 \end{array} \right\}$$

Formation of normals.

No	ab	an	bn
1	+ 1.46 +	5.1 +	10.3
2	+ 1.72 +	28.6 +	19.4
3	+ 1.66 -	65.2 -	40.8
4	+ 0.15 +	38.4 +	16
5	0.00 -	149.8 +	0.0
6	- 1.55 +	218.5 -	119.5
7	- 1.66 -	39.1 +	24.5
8	- 1.14 +	17.6 -	50.6
9	0.00	0.0 +	282.0
10	+ 0.70 -	31.8 -	161.5
	+ 1.34 +	22.3 -	34.6

$$[aa] = +19.32 \quad [bh] = +17.62$$

$$[ac] = -11.48 \quad [bc] = +3.65$$

$$[cn] = +1$$

MC 1130

1913 Feb 15

25

Moon's Center
Conditional Equations

	a	b	c	0	c	0-c
1	-0.85	-1.72	+1	= -6	- 7 + 9 + 11 = + 13	- 19
2	-1.59	-1.08	+1	= -18	- 13 + 5 + 11 = + 3	- 21
3	-1.63	-1.02	+1	= +40	- 14 + 5 + 11 = + 2	+ 38
4	-1.92	-0.08	+1	= -20	- 16 + 0 + 11 = - 5	- 15
5	-1.92	+0.00	+1	= +78	- 16 - 0 + 11 = - 5	+ 83
6	-1.68	+0.92	+1	= -130	- 14 - 5 + 11 = - 8	- 122
7	-1.63	+1.02	+1	= +24	- 14 - 5 + 11 = - 8	+ 32
8	-0.63	+1.81	+1	= -28	- 5 - 9 + 11 = - 3	- 25
9	0.00	+1.92	+1	= +147	0 - 10 + 11 = + 1	+ 146
10	+0.37	+1.88	+1	= -86	+ 3 - 9 + 11 = + 5	- 91

normal Equations

$$\begin{aligned}
 + 19.32 + 1.34 - 11.48 &= +22 \\
 + 1.34 + 17.62 + 3.65 &= -35 \\
 - 11.48 + 3.65 + 10.00 &= +1
 \end{aligned}$$

$$\begin{aligned}
 - 1.34 - 0.04 + 0.80 &= -2 \\
 + 11.48 + 0.80 - 6.82 &= +13
 \end{aligned}$$

$$\begin{aligned}
 + 17.53 + 4.45 &= -37 \\
 + 4.45 + 3.18 &= +14
 \end{aligned}$$

$$\begin{aligned}
 - 4.45 - 1.13 &= +9 \\
 + 2.05 &= +23
 \end{aligned}$$

$$\begin{aligned}
 - 6.23 - 4.45 &= -20 \\
 + 11.30 &= -57
 \end{aligned}$$

$$\begin{aligned}
 + 4.20 - 1.34 - 3.67 &= -0 \\
 + 55.45 - 17.62 - 48.30 &= -5
 \end{aligned}$$

$$\begin{aligned}
 + 23.52 &= -1515 = +22 \\
 + 56.79 &= -44.65 = -40
 \end{aligned}$$

$$\begin{aligned}
 - 19.25 &= +15.15 = +14 \\
 + 4.27 &= +36
 \end{aligned}$$

$$+ 299 - 293$$

$$\text{Average } (0-c) = 59$$

$$\frac{\Delta a}{\Delta c} = +0.612$$

$$\frac{\Delta b}{\Delta c} = -0.254$$

$$c = +11$$

$$b = -5$$

$$a = +8$$

ML 1130.

1913 Feb. 15.

25.

Moon's Center Conditional Equations

	a	b	c	0		c	0-c
1	-0.85	-1.72	+1	= -6	-	7+9+11 = +13	-19
2	-1.59	-1.08	+1	= -18	-	13+5+11 = +3	-21
3	-1.63	-1.02	+1	= +40	-	14+5+11 = +2	+38
4	-1.92	-0.08	+1	= -20	-	16+0+11 = -5	-15
5	-1.92	+0.00	+1	= +78	-	16-0+11 = -5	+83
6	-1.68	+0.92	+1	= -130	-	14-5+11 = -8	-122
7	-1.63	+1.02	+1	= +24	-	14-5+11 = -8	+32
8	-0.63	+1.81	+1	= -28	-	5-9+11 = -3	-25
9	0.00	+1.92	+1	= +147		0-10+11 = +1	+146
10	+0.37	+1.88	+1	= -86	+	3-9+11 = +5	-91

+294-293

Average (0-6) = 59

normal Equations

$$\begin{aligned}
 +19.32 + 1.34 - 11.48 &= +22 \\
 +1.34 + 17.62 + 3.65 &= -35 \\
 -11.48 + 3.65 + 10.00 &= +1
 \end{aligned}$$

$$\begin{aligned}
 -1.34 - 0.09 + 0.80 &= -2 \\
 +11.48 + 0.80 - 6.82 &= +13
 \end{aligned}$$

$$+17.53 + 4.45 = -37$$

$$+4.45 + 3.18 = +14$$

$$\begin{aligned}
 -4.45 - 1.13 &= +9 \\
 +2.05 &= +23
 \end{aligned}$$

$$c = +11$$

$$-6.23 - 4.45 = -20$$

$$+11.30 = -57$$

$$b = -5$$

$$+420 - 1.34 - 3.67 = -0$$

$$+55.45 - 17.62 - 48.30 = -5$$

$$+23.52 - 15.15 = +22$$

$$+56.79 - 44.65 = -40$$

$$-19.25 + 15.15 = +14$$

$$+4.27 = +36$$

$$a = +8$$

1913 Feb. 17.

26.

Plate 1130 -

$$\begin{array}{r} X_0 = 18.6290 \checkmark \\ \frac{1}{2}a \quad + 4 \\ \hline 18.6294 \checkmark \end{array}$$

$$\begin{array}{r} Y_0 = 22.0760 \checkmark \\ \frac{1}{2}b \quad - 3 \\ \hline 22.0757 \checkmark \end{array}$$

from preliminary Reduction

$X = 18.5220 \checkmark$	$Y = 21.7859 \checkmark$
Plate Constants	
$\Delta x = +30$	-13
$\Delta y = +2$	$+6$
$\Delta z = -31$	$+5$
$\hline 18.5221 \checkmark$	$\hline 21.7857 \checkmark$

$$\xi = +0.5221 \checkmark$$

$$\log = 9.71775 \checkmark$$

$$\cos \delta = 9.97750 \checkmark$$

$$\sin \delta = 8.50724 \checkmark$$

$$(\alpha - A) = 1.23301 \checkmark$$

$$\alpha - A = + 17.10 \checkmark$$

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

$$\alpha = 14^h \quad 56^m \quad 21.10^s \checkmark$$

$$\text{Red.} = + 1.80 \checkmark$$

$$\alpha' = 14 \quad 56 \quad 22.90 \checkmark$$

$$\eta = -0.2143 \checkmark$$

$$\log \tan \delta = 9.4978 \checkmark$$

$$\delta = 9.4355 \checkmark$$

$$\eta_1 = 5.9867 \checkmark$$

$$\eta_1 = - 1 \checkmark$$

$$\eta_0 = -0.2142 \checkmark$$

$$\log = 9.33082 \checkmark$$

$$\sin \delta = 7.33115 \checkmark$$

$$(\delta - D) = 1.99967 \checkmark$$

$$\delta - D = - 1 \quad 39.9 \checkmark$$

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

$$\delta = -18^\circ \quad 16' \quad 54.9'' \checkmark$$

$$\text{Red.} = - 13.1 \checkmark$$

$$\delta' = -18 \quad 17 \quad 08.0 \checkmark$$

1913 Feb. 17.

26.

Plate 1130 -

$$\begin{array}{r} X_0 = 18.6290 \\ \frac{1}{2}a \quad + 4 \\ \hline 18.6294 \end{array}$$

$$\begin{array}{r} Y_0 = 22.0760 \\ \frac{1}{2}b \quad - 3 \\ \hline 22.0757 \end{array}$$

From preliminary Reduction

X	= 18.5220	Y	= 21.7859
ap	+ 30		- 13
by	+ 2		+ 6
c	- 31		+ 5
	<hr/> 18.5221		<hr/> 21.7857

$$\bar{z} = +0.5221$$

$$\log = 9.71775$$

$$\cos \delta = 9.97750$$

$$\sin \delta = 8.50724$$

$$(X-A) = 1.23301$$

$$\lambda - A = + 17.10$$

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

$$\lambda = 14^h \quad 56^m \quad 21.10^s$$

$$\text{Red.} = + 1.80$$

$$\lambda' = 14 \quad 56 \quad 22.90$$

$$\eta = -0.2143$$

$$\log \tan \delta = 9.49782$$

$$\delta = 9.4355$$

$$\eta = 5.98672$$

$$\eta_1 = - 1$$

$$\eta_0 = -0.2142$$

$$\log = 9.330822$$

$$\sin \delta = 7.33115$$

$$(G-D) = 1.999672$$

$$\delta - D = - 1 \quad 39.9$$

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

$$\delta = -18^\circ \quad 16' \quad 54.9''$$

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

$$\delta = -18 \quad 17 \quad 08.0$$

11 30 *human Parallax.*
 $\alpha = 14^h 56^m 22.90^s$
 $\theta = 15 \quad 22 \quad 37.1^s$
 $+ \quad 26 \quad 14.2^s$
 $= + \quad 6^h 33' 33''$

$$\delta = -18^\circ 17' 08''.0$$

$$\pi = 54' 19''.5$$

$$+ \quad 2 \quad 24^s$$

$$+ \quad 6 \quad 31 \quad 09^s$$

$$\begin{array}{r} 9.95727^s \\ 0.00000^s \\ \hline 0.00282^s \\ 9.96009^s \end{array}$$

$$\begin{array}{r} 9.86913^s \\ 8.19870^s \\ 9.05778^s \\ \hline 0.02058^s \\ 7.14619^s \end{array}$$

$$\alpha' - \alpha = +4' 48''.81$$

$$= +19'.25^s$$

$$\begin{array}{r} \gamma = 42 \quad 22 \quad 1.6^s \\ 18 \quad 17 \quad 08^s \\ 60 \quad 39 \quad 24^s \end{array}$$

$$\begin{array}{r} 9.82640^s \\ 8.19870^s \\ 9.94037^s \\ \hline 0.17138^s \\ 8.13685^s \end{array}$$

$$\delta - \delta' = +47 \quad 06.8^s$$

$$S = -17 \quad 30 \quad 01.2^s \quad \alpha = 14 \quad 56 \quad 42.15^s$$

$$\text{Nautical Almanac } \delta = -17 \quad 29 \quad 55.6^s \quad \alpha = 14 \quad 56 \quad 41.50^s$$

$$O - C \quad -5.6^s \quad +0.65^s$$

$$\text{Red stand radius} \quad -0.0^s \quad -0.01^s$$

$$O - C \quad -5.6^s \quad +0.64^s$$

1130 human Parallax

$$\alpha = 14^{\circ} 56' 22.90''$$

$$\theta = 15' 22'' 37.1''$$

$$+ 26' 14.2''$$

$$+ 6^{\circ} 33' 33''$$

$$+ 2' 24''$$

$$+ 6' 31' 09''$$

$$995727$$

$$000000$$

$$000282$$

$$996009$$

$$\gamma = 42' 22'' 1.6''$$

$$18' 17'' 08''$$

$$60' 39'' 24''$$

$$982640$$

$$819870$$

$$994037$$

$$017138$$

$$813685$$

$$\delta - \delta' = +47' 06.8''$$

$$\delta = -17' 30'' 01.2'' \quad \alpha = 14' 56' 42.15''$$

$$\text{Neutralium } \delta = -17' 29'' 55.6'' \quad \alpha = 14' 56' 41.50''$$

$$O-C \quad -5.6'' \quad +0.65''$$

$$\text{Red Tandradium} \quad +0.0'' \quad -0.04''$$

$$O-C \quad -5.6'' \quad +0.64''$$

$$\delta = -18^{\circ} 17' 08'' 0$$

$$\pi = 54' 19'' 5$$

$$986913$$

$$819870$$

$$905778$$

$$002058$$

$$714619$$

$$\alpha' - \alpha = +4' 48.81''$$

$$= +19' 25''$$

