

KG

11366

6.896



Volume XX

Harvard Lunar
Plates



No.

1318

1319

1320 1331

1911phae pro.
PRINCETON UNIVERSITY OBSERVATORY
PRINCETON, N. J.
U. S. A.

Harvard Lunar Plates

Measures and Reductions.

Mary Fowler.

Volume XX.

Plate No.	Date	Page.
1318	1911 Oct 9	1
1319	1911 Oct 9	13
1331	1911 Oct 13	

C
L
E
m
P
A
n-
si
h

C
L
E
m
P
A
n-
si
h

C
L
E
m
P
A
n-
si
h

Cape no. 391 mag. 9.0				Cape no. 391 mag. 6.5				Cape no. 398 mag. 5.8			
C	2	35	09.10	2	38	44.10	2	39	02.22		
L			1.5			1.6			2.4		
E			1.6			0.9			2.2		
mean	2	35	09.14	2	38	44.12	2	39	02.23		
prec			+36.32			+36.76			+36.29		
X	2	35	45.46	2	39	20.88	2	39	38.52		
A	2	40	00	2	40	00	2	40	00		
A-A	-	4	14.54	-	0	39.12	-	0	21.48		
sin(A-A)	-		2.54.53	-		39.12	-		21.48		
log			2.40574			1.59240			1.33203		
cos			9.98432			9.97969			9.98508		
50			0.89730			0.07933			9.82435		
30			-7.8940			-1.2004			-0.6673		
21			21			3			1		
3			10.1039			16.7993			17.3326		
X			10.2026			16.9310			17.4226		
X-3			+987			+1317			+900		
C+15	15		25.8	+17	20	26.6	+14	53	18.9		
L			26.2			26.8			18.8		
E			25.1			27.0			18.4		
mean	15	15	25.7	+17	20	26.8	+14	53	18.7		
prec			+55.7			+49.2			+49.1		
S+15	18		17.4	+17	23	16.0	+14	56	07.8		
D+16	13		51	16	13	51	+16	13	51		
S-D	-	55	33.6	+1	09	25.0	-	1	17		
tan(S-D)	-		33.33.9			416.56	-		46.640		
log			3.52296			3.61968			3.66876		
50			0.85411			0.95083			0.99991		
tan S			9.4372			9.4957			9.4261		
30			17.946			0.1587			9.6487		
21			8.2852			6.7078			6.1282		
50			-7.1468			+8.9296			-9.9980		
21			+1.93			5			1		
3			14.8725			30.9301			12.0021		
4			14.8686			30.9124			11.9862		
4-3			3.0			1.77			1.59		

1			2			3		
Cape No. 391 mag. 9.0			Cape No. 391 mag. 6.5			Cape No. 398		
C	2	35 09.10	2	38 44.10	2	39 02.22		
L		.15		.16		.16		
b		1.6		.09		.22		
mean	2	35 09.14	2	38 44.12	2	39 02.23		
rec		+ 36.32		+ 36.76		+ 36.29		
X	2	35 45.46	2	39 20.88	2	39 58.52		
A	2	40 00	2	40 00	2	40 00		
A-A	-	4 14.54	-	0 39.12	-	0 21.48		
sin(A)	-	254.53	-	39.12	-	21.48		
log...		2.40574 ^m		1.59240 ^m		1.33203 ^m		
cos S		9.98432		9.97969		9.98508 ^m		
S ₀		0.89730 ^m		0.07933 ^m		9.82435 ^m		
S ₀	-	7.8940	-	1.2004	-	0.6673		
S ₁	-	21	-	3	-	1		
S		10.1039		16.7993		17.3326		
X		10.2026		16.9310		17.4226		
X-S		+ 987		+ 1317		+ 900		
C+15	15	25.8	+17	20 26.6	+14	53 18.9		
L		26.2		26.8		18.8		
		25.1		27.0		18.4		
mean	15	25.7	+17	20 26.8	+14	53 18.7		
rec		+ 2 45.7		+ 2 49.2		+ 2 49.1		
S+15	18	11.9	+17	27 16.0	+14	56 07.8		
D+16	13	51	16	13 51	+16	13 51		
b-D	-	55 33.6	+ 1	09 25.0	- 1	17 43.2		
sin(b-D)	-	3333.9	+ 4	165.6	- 4	664.0		
log...		3.52294 ^m		3.61968		3.66876 ^m		
η ₀		0.85499 ^m		0.95083		0.99991 ^m		
tan S		9.4372		9.4957		9.4261		
S ²		17946		0 1587		9.6487		
η ₁		8.2852		67078		6.1282		
η ₀	-	7.1597	+ 8.9296		- 9.9980			
η ₁	+	193	+	5	+	1		
η		14.8596		30.9301		12.0021		
η		14.8686		30.9124		11.9862		
η-S		+ 90	-	177	-	159		

Cape no. 410 mag. 6.0

C 2 42 55.62
 L 59
 E 60
 mean 2 42 55.60
 P.M.C. + 36.92
 A 2 43 32.52
 A 2 40 00
 A-A + 3 32.52
 sin(A-A) + 212.51
 log... 2.32738
 ...cos 9.97842
 ...S. 0.81304
 ... + 6.5019
 ... + 34
 ... 24.5053
 ... 246465
 ... + 1412

C + 17.52 020
 L 022
 E 01.6
 mean + 17.52 01.9
 P.M.C. + 2 46.7
 S + 17.54 48.6
 D + 16 13 51
 S-D + 1 40 57.6
 tan(S-D) + 6059.4
 log... 3.78243
 ... 2.11358
 ... 9.5095
 ... 16261
 ... 8.1890
 ... + 12.9891
 ... + 155
 ... 35.0046
 ... 34.9719
 ... - 327

Cape no. 417 mag. 5.5

2 45 58.21
 20
 22
 2 45 58.21
 + 36.37
 2 46 34.58
 2 40 00
 + 6 34.58
 + 394.53
 2.59608
 9.98551
 1.08883
 + 12.2697
 + 87
 30.2784
 30.3694
 + 910

+ 14 40 12.15
 11.91
 12.09
 + 14 40 12.0
 + 2 44.6
 + 14 42 56.6
 + 16 13 51
 - 1 30 54.4
 - 5455.7
 3.73685
 1.06800
 9.4193
 21777
 86504
 - 11.6950
 + 447
 10.3497
 10.3040
 - 457

⁴
 Cape m. 410 m. g. 6.0
 C 2 42 55 62
 L 59
 E 60
 mean 2 42 55 60
 Prec + 36.92
 A 2 45 32.52
 H 2 40 00
 A-A + 3 32.52
 sin(A-A) 7 21 2.51
 log 2.32738
 cos 9 97 842
 S 0.81304
 3. + 6.5019
 3. + 34
 3 24.5053
 2 246465
 A-3 + 1412

C + 17 52 02.0
 L 022
 E 016
 mean + 17 52 019
 Prec + 2 46.7
 S + 17 54 78.6
 D + 16 13 51
 S-D + 1 40 57.6
 sin(S-D) 1 60 59.4
 log 3.78243
 cos 2 11 358
 tan S 9 5095
 S 16261
 H 8.1890
 3. + 12.9891
 3. + 155
 3 35.0046
 2 349719
 A-3 - 327

⁵
 Cape m. 417. m. g. 55
 2 45 58 21
 20
 22
 2 45 58 21
 + 36.37
 2 46 34 58
 2 40 00
 + 6 34.58
 + 394.53
 2.59608
 9 98 551
 1.08883
 + 12.2697
 + 87
 30 2784
 30 3694
 + 910

+ 14 40 12.15
 11.91
 12.09
 + 14 40 12.0
 + 2 44.6
 + 14 42 56.6
 + 16 13 51
 - 1 30 54.4
 - 5455.7
 3.73685
 1.06800
 9 4193
 21777
 86504
 - 11.6950
 + 447
 10.3497
 10.3040
 - 457

1913 Mar. 31.

3.

MC/318

Comparison Stars - Measures.

2c

	d.	N	d	N
10.2	14826	14540	15610	13611
14.9	612842	1322925	762821	1158185
mag	4040	25	35	77
9.0	20	25	02	98
	<u>14.8683</u>	<u>.8688</u>	<u>10.2024</u>	<u>.2027</u>
2				
16.9	18094	16591	17565	18600
30.9	896660	1571520	1686764	927076
mag	60	10	67	70
6.5	.84	95	51	90
	<u>30.9123</u>	<u>.9124</u>	<u>16.9302</u>	<u>.9319</u>
3				
17.4	1016060	11163	17010	14992
12.0	66	1103030	1123031	10756540
mag	10023	30	28	60
5.8			10	86
	<u>11.9863</u>	<u>.9861</u>	<u>17.4220</u>	<u>.4232</u>
4				
24.7	1038180	12998	18683	117740
34.9	89	1271820	15142	1126670
mag	10100	20	39	68
6.0			73	34
	<u>34.9717</u>	<u>.9721</u>	<u>24.6462</u>	<u>.6468</u>
5				
30.3	17371	18852	18280	14485
10.3	1433130	1188580	1196977	1078189
mag	1918	75	65	80
5.5	50	38	75	69
	<u>10.3041</u>	<u>.3038</u>	<u>30.3693</u>	<u>30.3696</u>

1913 Mar 31

3

MC/318 Comparison Stars - Measures.

	d	N	d	N
1	14826	14540	15610	13611
10.2	612842	1322925	762821	1158185
14.9	4040	25	35	77
mg	20	25	02	98
90	14.8683	8688	102024	2027
2				
16.9	18094	16591	17565	18600
30.9	896660	1571520	1686764	927076
mg	60	10	67	70
65	84	95	51	90
	30.9123	9124	16.9302	9319
3				
174	1016060	11163	17010	14994
120	66	1103020	1123031	10786540
mg	10023	30	28	60
58			10	86
	11.9863	9861	174220	4232
4				
247	1038180	12998	18683	117740
34.9	89	1271820	1514241	1126670
mg	10100	20	39	68
60			73	34
	34.9717	9721	24.6262	6468
5				
303	17371	18852	18280	14485
103	1433130	1188580	119.6977	1078189
mg	1918	75	65	80
11	50	38	75	69
	10.3041	3038	30.3693	303696

1913 Mar 31.

4

1AC1318

Moon-Measures

d

y

N

d

x

N

$$\begin{array}{r} 1 \\ 18.5 \\ 20.0 \end{array}$$

15835

17125

11260

11690

62

9501

25

25

18.543054302

16459

14090

19.0

9775

10742

20.7

8180

4840

59

66

20.6680.66743

19.1

21.0

15600

14510

6711

13365

20

6551

90

93

19.1126.11484

19.2

21.6

max

x

14549

14530

6223

12812

30

1319

44

26

19.1686.17145

19.1

22.0

17487

18520

8664

17305

62

0610

67

14

19.1198.12126

19.0

22.3

16049

16011

12441

954860

7055

70

51

05

22.359535527

18.5

23.0

16718

14950

12298

9330

10

1528

02

50

18.5595.5626

1913 Mar 31.

4

191318

Moon-Measures

d

y

N

d

x

N

$$\begin{array}{r} 1 \\ 18.5 \\ 20.0 \end{array}$$

15-835-

17125-

11260 59

11690 01

62

95-01

25-

25-

1854305430

2	16459	14090
140	9775	10742
207	8180	4840
	59	66
	<u>206680</u>	<u>6674</u>

$$\begin{array}{r} 3 \\ 19.1 \\ 21.0 \end{array}$$

15600

14510

6711 20

13365 51

20

65-51

90

93

19.11261148

$$\begin{array}{r} 4 \\ 19.2 \\ 21.6 \\ \text{max} \\ \bar{x} \end{array}$$

14549

14530

6223 40

12812 19

30

1319

44

26

19.16861714

$$\begin{array}{r} 5 \\ 19.1 \\ 22.0 \end{array}$$

14477

18520

8664 72

17305 10

62

06

67

14

19.11981212

6	19.0	16049	16011
223	12444	954860	
	70	70	
	51	05	
	<u>223595</u>	<u>3552</u>	

$$\begin{array}{r} 7 \\ 18.5 \\ 22.0 \end{array}$$

16718

14959

12298 10

9330 28

10

50

2

18.55955626

1913 Mar 31

5

111318 Moon-Measures

	d	y	n	d	n
<u>8</u>	18198		19150		
18.0	1413030		1319092		
23.4	22		85		
	95		44		
	<u>23.4070</u>		<u>.4042</u>		

<u>9</u>	18268		18070		
17.8	1204030		1430209		
23.5	30		10		
max	68		75		
	<u>23.6265</u>		<u>.6235</u>		

<u>10</u>	17286		18067		
17.0	1105857		1429901		
23.5	50		00		
	86		70		
	<u>23.6231</u>		<u>.6232</u>		

<u>11</u>	Scratch				
16.6	16320		17030		15835
23.5	1056280		1274256		1189095
	89		46		90
	14		32		39
	<u>23.5739</u>		<u>.5717</u>		<u>16.6055</u>
					16572
					10490
					85
					67
					<u>.6052</u>

Times etc.

Epist. Stars 1911 Oct 9	1 ^h 48 ^m	- 2 ^h 00
moon	1 54	23.1 - 1 54 23.3
clock slow	0	42.0
G Sid T	1	51 052
H Long	4	44 3105
G Sid 1	6	39 3625
Sid T in room	13	07 5679
Interval	17	31 3951
Reduction	2	5229
G in T.	17	28 4722

From Hunt Alm	R A	Decl
moon 17 ^h	2 37	4797 + 16 29 594
moon in 1 ^m = 2 2788		13 926
28.787	+ 1	0560 + 6 409
Tabular place	2 38	5357 + 16 36 403

moon phase	59	157
moon distance	16	10051
moon phase	59	157
moon distance	16	10051
moon phase	59	157
moon distance	16	10051

1913 Mar 31

5

1101318

Moon - Measured

	d	h	m	s		d	h	m	s
8	18	19	8		19	15	0		
18.0	14	13	30	30	13	19	09	2	
234		22				85	92		
		95				44			
	23	40	70			40	42		

9	18	26	8		18	07	0		
17.8	12	04	03	30	14	30	20	9	
235		30				10			
17.8		68				75			
	23	62	65			62	35		

10	17	28	6		18	06	7		
17.0	11	05	57		14	29	90	1	
235		50				00			
		86				70			
	23	62	31			62	32		

11 scratch

16.6	16	32	0		17	03	0		
235	10	56	28	80	12	74	25	6	
		89	80			46			
		14				32			
	23	57	39			57	17		

15835	16572
1189095	1049085
90	85
39	67
16.6055	60.52

Times etc.

Expto Star 1911 Oct 9	1 ^h 48 ^m						
" Moon	1	54	23.1				
clock slow		0	42.0				
# Sid T	1	55	05.2				
# Long	4	44	31.0				
G Sid T	6	39	36.2				
Sid T in Moon	13	67	56.7				
Interval	17	31	39.5				
Reduction		2	52.2				
G. M. T.	17	28	47.2				

From Naut Alman.

		RA		Decl			
Moon 17 ^h	2	37	47.97	+16	29	59.4	
Motion in 1 ^m = 22788"							
" 28.787"		+1	05.60		+6	40.9	
Tabular place	2	38	53.57	+16	36	40.3	

Moon's age
Moon's parallax
Semi-diameter

17 days
59' 15.2"
16 10.3"

Center of Plate.

x	y		R.A.		Decl.
10.20	14.87	+2	35	45	+15 18 11
16.93	30.91		39	21	+17 23 16
17.42	11.99		39	39	+14 56 08
24.65	34.97		43	33	+17 54 49
30.37	10.30		46	35	+14 42 57
5 99.57	103.04		202	173	+30 15 21
19.91	20.61	+2	40	59	+16 03 04
1.8	-22.		-	59	+10 47
191	1.39	+2	40	00	+16 13 51
31	4.65				
191	69.5				
573	844				
59.21	556				
	647.35				

$$A = 2^h 40^m 00^s$$

$$D = +16^\circ 13' 51''$$

Preliminary Reduction.

$x - 3$	$-20\frac{1}{2}x$	$-x$	-670
1 +987	-304	= +683	-10 = +673 = +3
2 +1317	-633	= +684	-17 = +667 = -3
4 +1412	-716	= +696	-23 = +673 = +3
5 +910	-211	= +699	-30 = +669 = -1
moon 17.0632	-441	-17	= 1695.04
			= 17.0174

	$+20\frac{1}{2}x$	$-x$	-160
1 -39	+209	= +170	-7 = +163 = +3
2 -177	+347	= +170	-15 = +155 = -5
4 -327	+505	= +178	-17 = +161 = +1
5 -457	+622	= +165	-5 = +160 = 0
moon 21.5107	+350	-11	= 21.5286

Tables $a = -0.4$ $e = -1.3$ $a - e = +0.9$ $b + a = +0.0$
 clb $a = +1.1$ $e = +0.3$ $a - e = +0.8$ $b + a = +0.1$

Center of Plate

x	y	R.A.	Decl.
10.40	14.87	+2 35 45	+15 18 11
16.93	30.91	39 21	+17 23 16
17.42	11.99	39 39	+14 56 08
24.65	34.97	43 33	+17 54 49
30.37	10.30	46 35	+14 42 57
99.57	103.04	202 173	+30 15 21
19.91	20.61	+2 40 59	+16 03 09
18	-2.2	- 59	+10 47
19.1	1.39	+2 40 00	+16 13 51
31	+6.1		
19.1	6.5		
57.3	24.4		
59.21	5.6		
	647.35		

$$A = 2^h 40^m 00^s$$

$$D = +16^\circ 13' 51''$$

Tie line many Reduction

x - 3	-20.4	-2	-670
1 +987 - 304	+683 - 10	+673	+3
2 +1317 - 633	+684 - 17	+667	-3
4 +1412 - 716	+696 - 23	+673	+3
5 +910 - 211	+699 - 30	+669	-1
17.0632 - 441	-17		+1671.04
			+1701.74
	+20.4	-14	-160
1 -39 +209	+170 - 7	+163	+3
2 -177 +347	+170 - 15	+155	-5
4 -327 +505	+178 - 17	+161	+1
5 -957 - 622	+165 - 5	+160	0
21.5107 +350	-11		+2152.6

	nos. L.	resid.
1	135.3	+68
2	113.6	-34
3	104.0	-1
4	90.0	-268] <i>2nd</i>
5	76.6	+61
6	66.4	+25
7	45.3	-37
8	26.5	+21
9	0.0	+52
10	8.4	+15
11	12.3	-47

Moon's Center

			$(x-x_0)^2 + (y-y_0)^2$	$0-c$
1	18.5430 + 1.4856	2.2070	4.4946	+182
2	19.0000 + 1.9426	3.7737	4.4874	+110
3	19.1137 + 2.0563	4.2283	4.4908	+144
+4	19.1700 + 2.1126	4.4631	4.4631 ^{2x}	-133
5	19.1205 + 2.0631	4.2564	4.4936	+172
6	19.0000 + 1.9426	3.7737	4.4875	+111
7	18.5610 + 1.5036	2.2608	4.4740	-24
8	18.0000 + 0.9426	0.8885	4.4720	-44
9	17.0574 0.0000	0.0000	4.4635	-129
10	17.0000 - 0.0574	0.0032	4.4591	-173
11	16.6068 - 0.4506	0.2030	4.4486	-278
		Mean	4.4764	+4

Δy

1	20.0000 - 1.5124 - 1	2.2876
2	20.6677 - 0.8447 - 1	0.7137
3	21.0000 - 0.5124 - 0	0.2625
4	21.5124 0.0000 0	0.0000
5	22.0000 + 0.4876 + 0	0.2372
6	22.3572 + 0.8448 + 1	0.7138
7	23.0000 + 1.4876 + 1	2.2132
+8	23.4056 + 1.8932 + 1	3.5845
+9	23.6250 + 2.1126 + 1	4.4635
10	23.6232 + 2.1108 + 1	4.4559
11	23.5728 + 2.0604 + 1	4.2456

Approximate Center

$$x = 19.0 \quad y = 20.6677$$

$$\begin{array}{r} 22.3572 \\ \hline 43.0249 \end{array}$$

$$\text{mean} = 21.5124$$

$$y \text{ max} = 23.6250$$

$$\begin{array}{r} 21.126 \end{array}$$

$$x = \text{max} = 19.1700$$

$$\text{mean } y = 17.0574$$

$$\text{Center} \begin{cases} x_0 = 17.0574 \\ y_0 = 21.5124 \end{cases}$$

Morris Center

$(x-x_0)^2 + (y-y_0)^2$

0-6

1	18.5430 + 1.4856	2.2070	4.4946	+182
2	19.0000 + 1.9426	3.7737	4.4874	+110
3	19.1137 + 2.0563	4.2283	4.4908	+144
4	19.1700 + 2.1126	4.4631	4.4631	-133
5	19.1205 + 2.0631	4.2564	4.4936	+172
6	19.0000 + 1.9426	3.7737	4.4875	+111
7	18.5610 + 1.5036	2.2608	4.4790	-24
8	18.0000 + 0.9426	0.8885	4.4720	-44
9	17.0574 0.0000	0.0000	4.4635	-129
10	17.0300 - 0.0574	0.0032	4.4591	-173
11	16.6068 - 0.4506	0.2030	4.4486	-278
Mean			4.4764	+4

0.9

1	20.0000 - 1.5124 - 1	2.2876
2	20.6677 - 0.8447 - 1	0.7137
3	21.0000 - 0.5124 - 0	0.2625
4	21.5124 0.0000 0	0.0000
5	22.0000 + 0.4876 + 0	0.2372
6	22.3572 + 0.8448 + 1	0.7138
7	23.0000 + 1.4876 + 1	2.2132
8	23.4656 + 1.8932 + 1	3.5845
9	23.6250 + 2.1126 + 1	4.4635
10	23.6232 + 2.1108 + 1	4.4559
11	23.5728 + 2.0604 + 1	4.2456

Approximate Center

$$x = 19.0 \quad y = 20.6677$$

$$22.3572$$

$$43.0249$$

mean = 21.5124

y max = 23.6250

2.1126

x max = 19.1700

mean y = 17.0574

$$\text{Center} \begin{cases} X_0 = 17.0574 \\ Y_0 = 21.5124 \end{cases}$$

Formation of Normals

1	- 22.5	+ 271.5	- 275.0
2	- 1.63	+ 213.5	- 92.5
3	- 1.05	+ 296.0	- 73.4
4	+ 0.00	- 70.0	- 0.6
5	+ 1.01	+ 355.2	+ 84.1
6	+ 1.63	+ 215.3	+ 93.1
7	+ 22.4	- 36.1	- 35.8
8	+ 1.78	- 41.4	- 63.2
9	+ 0.00	- 0.0	- 272.5
10	- 0.13	+ 10.4	- 365.0
11	- 0.93	+ 125.0	- 573.0
	+ 0.67	+ 1339.4	- 1593.2

$$[aa] = +23.83 \quad [ac] = +12.48$$

$$[bb] = +23.18 \quad [bc] = +8.13 \quad [cc] = +4$$

Corrected solution giving (4) half wt.

$$+22.71 + 1339 + 8 + 2196 = + 3543$$

$$a = +156.0$$

$$+22.71 + 0.67 + 12.48 = +13.39$$

$$+0.67 + 23.18 + 8.13 = +15.93$$

$$+12.48 + 8.13 + 10.50 = +4$$

$$- 0.67 - 0.02 - 0.37 = - 3.9$$

$$- 12.48 - 0.37 - 6.85 = - 73.5$$

$$+23.16 + 7.76 = -163.2$$

$$+ 7.76 + 3.65 = - 73.1$$

$$- 7.76 - 2.61 = + 54.8$$

$$+ 10.4 = - 183$$

$$c = -176$$

$$- 16.50 - 7.76 = +115.7$$

$$+ 6.66 = - 75$$

$$b = -11.3$$

1318

1913 May 10.

8

Moon's Center - Conditional Equations

	a	b	c	0	c	0-c
1	+1.49	-1.51	+1	= +182	+172+51-109 = +114	+68
2	+1.94	-0.84	+1	= +110	+224+29-109 = +144	-34
3	+2.06	-0.58	+1	= +144	+237+17-109 = +145	1
4	+2.06	+0.00	+1	= -66	+122-0-54 = +68	-134
5	+2.06	+0.49	+1	= +172	+237-17-109 = +111	+61
6	+1.94	+0.84	+1	= +111	+224-29-109 = +86	+25
7	+1.50	+1.49	+1	= -24	+173-51-109 = +13	-37
8	+0.94	+1.89	+1	= -44	+104-64-109 = -65	+21
9	0.00	+2.11	+1	= -129	0-72-109 = -181	+52
10	-0.06	+2.11	+1	= -173	-7-72-109 = -188	+15
11	-0.45	+2.06	+1	= -278	-52-70-109 = -231	-47

Normal Equations

$$\begin{aligned}
 +23.83 + 0.67 + 12.48 &= +1339 \\
 +0.67 + 23.18 + 8.13 &= -1593 \\
 +12.48 + 8.13 + 10.50 &= +4
 \end{aligned}$$

Average = 47

$$\frac{\Delta a}{\Delta n} = -1.09$$

$$\begin{aligned}
 -0.67 - 0.02 - 0.35 &= -38 \\
 -12.48 - 0.35 - 6.53 &= -200
 \end{aligned}$$

$$+23.16 + 7.78 = -1631$$

$$+7.78 + 3.97 = -696$$

$$-7.78 - 262 = +549$$

$$+1.35 = -147$$

$$\frac{\Delta y}{\Delta n} = -0.71$$

$$c = -109$$

$$-1529 - 798 = +1360$$

$$+7.96 = -271$$

$$b = -34$$

$$-103 - 0.67 - 0.865 = 0$$

$$-35.58 - 23.18 - 29.94 = -11$$

$$+22.80 + 11.61 = +1339$$

$$-34.94 - 21.87 = -1604$$

$$-14.60 - 11.61 = -855$$

$$+4.20 = +489$$

$$a = +115$$

1913 May 10.

8

Moon's Centre - Conditional Equations

	a	b	c	0	C	0-C
1	+1.49	-1.51	+1	+1.82	+172+51-109 = +114	+68
2	+1.94	-0.84	+1	+1.10	+224+29-109 = +144	-34
3	+2.06	-0.58	+1	+1.44	+237+17-109 = +145	-1
4	+1.06	+0.00	+1	-66	+122-0-54 = +68	-134
5	+2.06	+0.49	+1	+1.72	+237-17-109 = +111	+61
6	+1.94	+0.84	+1	+1.17	+224-29-109 = +86	+25
7	+1.50	+1.49	+1	-24	+173-51-109 = +13	-37
8	+0.94	+1.89	+1	-44	+104-64-109 = -65	+21
9	0.00	+2.11	+1	-229	0-72-109 = -181	+52
10	-0.06	+2.11	+1	-173	-7-72-109 = -188	+15
11	-0.45	+2.06	+1	-278	-52-70-109 = -231	-47

Normal Equations

$$\begin{aligned}
 +23.836 &+ 0.67 + 12.48 = +1339 \\
 +0.67 &+ 23.18 + 8.13 = -1593 \\
 +12.48 &+ 8.13 + 10.50 = +4
 \end{aligned}$$

-253+242

Average = 47

$$\begin{aligned}
 -0.67 &- 0.02 - 0.35 = -38 \\
 -12.48 &- 0.35 - 6.53 = -900
 \end{aligned}$$

$$+23.16 + 7.78 = -1631$$

$$+7.78 + 2.97 = -696$$

$$-7.78 - 262 = +549$$

$$+1.35 = -147$$

$$C = -109$$

$$-1520 - 798 = +1360$$

$$+7.96 = -271$$

$$b = -34$$

$$-103 - 0.67 - 0.865 = 0$$

$$-35.58 - 23.18 - 29.94 = -11$$

$$+22.80 + 11.61 = +1339$$

$$-34.91 - 21.87 = -1604$$

$$-14.60 - 11.61 = -855$$

$$+4.20 = +484$$

$$a = +115$$

$$x = 1318 \quad y = 2$$

$$x = 1319 \quad y = 2$$

9

$$\begin{aligned} +1010 + 1487 + 1 &= +8 \\ +1680 + 3093 + 1 &= -3 \\ +2451 + 3500 + 1 &= +3 \\ +3028 + 1035 + 1 &= -1 \end{aligned}$$

$$\begin{aligned} +3 \\ -5 \\ +1 \\ 0 \end{aligned}$$

$$\begin{aligned} -2 &+3 \\ -1 &-4 \\ +1 &+10 \\ +1 &-11 \end{aligned}$$

$$\begin{aligned} +13.45 + 22.90 + 1 &= 0.00 & -1.00 & -1.50 & -0.50 \\ +27.39 + 22.68 + 1 &= +1.00 & +0.50 & +1.00 & -0.50 \\ +20.19 + 12.61 + 1 &= +1.00 & +1.50 & -0.50 & -4.00 \\ +20.65 + 32.96 + 1 &= 0.00 & -2.00 & 0.00 & +3.00 \end{aligned}$$

$$\begin{aligned} -1394 + 022 &= -1.00 & -1.50 & -2.50 & +0.00 \\ -0.46 - 2035 &= +1.00 & +3.50 & -0.50 & -7.00 \end{aligned}$$

$$\begin{aligned} +0.46 - 0.01 &= +0.03 & +0.05 & +0.08 & +0.00 \\ -2036 &= +1.03 & +3.55 & -0.42 & -7.00 \\ b = -0.05 & & -0.17 & +0.02 & +0.34 \\ a = +0.07 & & +0.10 & +0.18 & +0.01 \end{aligned}$$

$$\begin{array}{cccc|cccc} 0.0 & +1.0 & +1.0 & 0.0 & -1.0 & +0.5 & +1.5 & -2.0 \\ -0.9 & -1.9 & -1.4 & -1.4 & -1.3 & -2.7 & -2.0 & -2.1 \\ +0.7 & +1.1 & +0.6 & +1.6 & +3.9 & +3.9 & +2.1 & +5.6 \\ C = +0.2 & +0.2 & +0.2 & +0.2 & +1.6 & +1.7 & +1.6 & +1.5 \end{array}$$

$$\begin{array}{cccc|cccc} -1.5 & +1.0 & -0.5 & 0.0 & -0.5 & -0.5 & -4.0 & +3.0 \\ -2.4 & -4.9 & -3.6 & -3.7 & -0.1 & -0.3 & -0.2 & -0.2 \\ -0.4 & -0.4 & -0.2 & -0.6 & -7.8 & -7.7 & -4.3 & -11.2 \\ C = -4.3 & -4.3 & -4.3 & -4.3 & -8.4 & -8.5 & -8.5 & -8.4 \end{array}$$

Residuals

$$\begin{aligned} +1 - 1 &= 0 & +3 & +3 \\ +1 - 2 &= -1 & -3 & -2 \\ +2 - 2 &= 0 & +3 & +3 \\ +2 - 1 &= +1 & -3 & -2 \end{aligned}$$

$$\begin{aligned} +2 &0 & -4 &= -2 & -2 & 0 \\ +3 &0 & -4 &= -1 & -1 & 0 \\ +4 &0 & +4 &= 0 & +1 & +1 \\ +5 &0 & -4 &= +1 & +1 & 0 \end{aligned}$$

$$\begin{aligned} +1 - 3 + 2 &= 0 & +3 & +3 \\ +2 - 5 + 2 &= -1 & -5 & -4 \\ +2 - 6 + 2 &= -2 & +1 & +3 \\ +3 - 2 + 2 &= +3 & 0 & -3 \end{aligned}$$

$$\begin{aligned} +5 - 0 - 8 &= -3 & +3 & +6 \\ +10 - 0 - 8 &= +2 & -4 & -6 \\ +12 &0 - 8 &= +4 & +10 & +6 \\ +3 &0 - 8 &= -5 & -11 & -6 \end{aligned}$$

$$\begin{aligned}
 +1010 + 1487 + 1 &= +3 \\
 +1680 + 3093 + 1 &= -3 \\
 +2451 + 3500 + 1 &= +3 \\
 +3028 + 1035 + 1 &= -1
 \end{aligned}$$

$$\begin{aligned}
 +3 & & -2 & & +3 \\
 -5 & & -1 & & -4 \\
 +1 & & +1 & & +10 \\
 0 & & +1 & & -11
 \end{aligned}$$

$$\begin{aligned}
 +13.45 + 22.90 + 1 &= 000 & -1.00 & & -1.50 & & -0.50 \\
 +27.39 + 22.68 + 1 &= +1.00 & +0.50 & & +1.00 & & -0.50 \\
 +20.19 + 12.61 + 1 &= +1.00 & +1.50 & & -0.50 & & -4.00 \\
 +20.65 + 32.96 + 1 &= 000 & -2.00 & & 0.00 & & +3.00
 \end{aligned}$$

$$\begin{aligned}
 -13.94 + 0.22 &= -1.00 & -1.50 & & -2.50 & & +0.00 \\
 -0.46 - 20.35 &= +1.00 & +3.50 & & -0.50 & & -7.00
 \end{aligned}$$

$$\begin{aligned}
 +0.46 - 0.01 &= +0.03 & +0.05 & & +0.08 & & +0.00 \\
 -20.36 &= +1.03 & +3.55 & & -0.42 & & -7.00 \\
 b &= -0.05 & -0.17 & & +0.02 & & +0.34 \\
 a &= +0.07 & +0.10 & & +0.18 & & +0.01
 \end{aligned}$$

$$\begin{array}{cccc|cccc}
 0.0 & +1.0 & +1.0 & 0.0 & -1.0 & +0.5 & +1.5 & -2.0 \\
 -0.9 & -1.9 & -1.4 & -1.4 & -1.3 & -2.7 & -2.0 & -2.1 \\
 +0.1 & +1.1 & +0.6 & +1.6 & +3.9 & +3.9 & +2.1 & +5.6 \\
 C = +0.2 & +0.2 & +0.2 & +0.2 & +1.6 & +1.7 & +1.6 & +1.5
 \end{array}$$

$$\begin{array}{cccc|cccc}
 -1.5 & +1.0 & -0.5 & 0.0 & -0.5 & -0.5 & -4.0 & +3.0 \\
 -2.4 & -4.9 & -3.6 & -3.7 & -0.1 & -0.3 & -0.2 & -0.2 \\
 -0.4 & -0.4 & -0.2 & -0.6 & -7.4 & -7.7 & -4.3 & -11.2 \\
 C = -4.3 & -4.3 & -4.3 & -4.3 & -8.4 & -8.5 & -8.5 & -8.4
 \end{array}$$

Residuals

$$\begin{array}{ccc}
 +1 - 1 = 0 & +3 & +3 \\
 +1 - 2 = -1 & -3 & -2 \\
 +2 - 2 = 0 & +3 & +3 \\
 +2 - 1 = +1 & -3 & -2
 \end{array}$$

$$\begin{array}{ccc}
 +1 - 3 + 2 = 0 & +3 & +3 \\
 +2 - 5 + 2 = -1 & -5 & -4 \\
 +2 - 6 + 2 = -2 & +1 & +3 \\
 +3 - 2 + 2 = +3 & 0 & -3
 \end{array}$$

$$\begin{array}{ccc}
 +2 & 0 & -4 = -2 & -2 & 0 \\
 +3 & 0 & -4 = -1 & -1 & 0 \\
 +4 & 0 & -4 = 0 & +1 & +1 \\
 +5 & 0 & -4 = +1 & +1 & 0
 \end{array}$$

$$\begin{array}{ccc}
 +5 & 0 & -8 = -3 & +3 & +6 \\
 +10 & 0 & -8 = +2 & -4 & -6 \\
 +12 & 0 & -8 = +4 & +10 & +6 \\
 +3 & 0 & -8 = -5 & -11 & -6
 \end{array}$$

MC1318 Moon's Mean Position (1911.0)

$$\begin{array}{rcl} X_0 = 17.0574'' & Y_0 = 21.5124'' & \\ \frac{1}{2}a = +58'' & \frac{1}{2}b = -17'' & \\ \hline 17.0632'' & 21.5107'' & \end{array}$$

From Preliminary Constant $X = 16.9504''$ $Y = 21.5286''$
 " Plate constant $ax = +1$ $+2$
 $by = -1$ -4
 $c = 0$ $+2$

$$\begin{array}{l} \delta = -1.0496'' \\ \log \delta = 0.02103'' \\ \cos \delta = 9.98247'' \\ \text{const.} = 4.50724'' \end{array}$$

$$(X-A) = 1.53132''$$

$$A - A = \delta \quad 33.99''$$

$$H = 2^h 40^m 00.5''$$

$$d_0 = 2^h 39^m 26.01''$$

$$\text{Red} = +3.00''$$

$$\alpha = 2^h 39^m 29.01''$$

$$m = -0.4714''$$

$$\log \tan \delta = 9.4641''$$

$$\delta^2 = 0.0421''$$

$$\eta_1 = 6.5596''$$

$$\eta_1 = +4''$$

$$\eta_0 = -0.4718''$$

$$\log \eta_0 = 9.67376''$$

$$\text{const.} = 7.33115''$$

$$(S-D) = 2.34261''$$

$$S-D = -3.401''$$

$$D = +16 \quad 13 \quad 51''$$

$$S_0 = +16 \quad 10 \quad 10.9''$$

$$\text{Red} = +19.6''$$

$$S = +16 \quad 10 \quad 30.5''$$

M61318 moons (mean Position (1911.0))

$$\begin{array}{rcl}
 X_0 & = & 17.0574 \\
 Y_0 & = & 21.5124 \\
 \Delta\alpha & = & +58 \\
 \Delta\delta & = & -17 \\
 \hline
 & & 17.0632 \qquad 21.5107
 \end{array}$$

$$\begin{array}{rcl}
 \text{from Preliminary Constant} & X = & 16.9504 \quad Y = 21.5286 \\
 \text{Plate Constant} & \alpha = & +1 \quad +2 \\
 & \beta = & -1 \quad -4 \\
 & \gamma = & 0 \quad +2
 \end{array}$$

$$\begin{array}{rcl}
 S & = & -1.0496 \\
 \log S & = & 0.02103 \text{ m} \\
 \cos S & = & 998247 \\
 \text{const} & = & 950729 \\
 (X-A) & = & 1.53132 \text{ m} \\
 \log \gamma_0 & = & 9.4641 \\
 \gamma_1 & = & 0.0421 \\
 \gamma_2 & = & 6.5596 \\
 \gamma_3 & = & +4
 \end{array}$$

$$\begin{array}{rcl}
 X-A & = & X \quad 3399 \\
 H & = & 2^h 40^m 00^s \\
 \log \gamma_0 & = & 9.67376 \text{ m} \\
 \text{const} & = & 733115
 \end{array}$$

$$\begin{array}{rcl}
 d_0 & = & 2^h 39^m 26.01 \\
 (S-D) & = & 2.34261 \text{ m}
 \end{array}$$

$$\begin{array}{rcl}
 \text{Red} & = & +300 \\
 S-D & = & -340.1
 \end{array}$$

$$\begin{array}{rcl}
 \alpha & = & 2 \quad 39 \quad 29.01 \\
 D & = & +16 \quad 13 \quad 51
 \end{array}$$

$$S_0 = +16 \quad 10 \quad 10.9$$

$$\text{Red} = +196$$

$$S = +16 \quad 10 \quad 30.5$$

1318

Red ad locum app.

10

$$S_0 = +16^\circ 10' 10''.9$$

$$H + \alpha \quad 7 \quad 31 = 112^\circ 45'$$

$$H \quad 4 \quad 51$$

$$\alpha \quad 2 \quad 40$$

$$G \quad 21 \quad 37$$

$$G + \alpha \quad 0 \quad 17 = 4^\circ 15'$$

$$l \cos(G + \alpha) \quad 9.9988$$

$$g \quad 1.1522$$

$$\sin \quad 8.8699$$

$$\tan S \quad 9.4622$$

$$l_0 - \quad 8.8239$$

$$(g') \quad 1.1510$$

$$(g) \quad 8.3082$$

$$l \quad +1.77$$

$$g \quad +0.02$$

$$h \quad +1.21$$

$$+3.00 \checkmark$$

$$l \cos S \quad 9.9825$$

$$i \quad 0.8937$$

$$(i) \quad 0.8762$$

$$l \sin S \quad 9.4447$$

$$\cos(H + \alpha) \quad 9.5874 \sim$$

$$h \quad 1.2761$$

$$\sin \quad 9.9648$$

$$\sec S \quad 0.0175$$

$$l_0 - \quad 8.8239$$

$$(h') \quad 0.3082 \sim$$

$$(h) \quad 0.0823$$

$$g' \quad +14.16$$

$$h' \quad -2.03$$

$$i \quad +7.52$$

$$+19.65 \checkmark$$

1318

Red: a de Lumin app.

$$S_0 = +16^{\circ} 10' 10''$$

$$H + \alpha \quad 7^h \quad 31 = 112^{\circ} 45'$$

$$H \quad 4 \quad 51$$

$$\alpha \quad 2 \quad 40$$

$$G \quad 21 \quad 37$$

$$G + \alpha \quad 0 \quad 17 = 4^{\circ} 15'$$

$$1 \cos(G + \alpha) \quad 99988$$

$$g \quad 11522$$

$$\sin \quad 88699$$

$$\tan S \quad 94622$$

$$t_s \quad 88239$$

$$(g') \quad 11510$$

$$(g) \quad 83082$$

$$h \quad +1.77$$

$$g \quad +0.02$$

$$h \quad +1.21$$

$$+3.00$$

$$1 \cos S \quad 99825$$

$$i \quad 08937$$

$$(i) \quad 08762$$

$$1 \sin S \quad 94447$$

$$\cos(H + \alpha) \quad 95874$$

$$h \quad 12761$$

$$\sin \quad 99648$$

$$\sec S \quad 00175$$

$$t_s \quad 88239$$

$$(h') \quad 0.3082$$

$$(h) \quad 0.0823$$

$$g' \quad +14.16$$

$$h' \quad -2.03$$

$$i \quad +7.52$$

$$+19.65$$

1318 Lunar Parallax

$$\begin{array}{r} \alpha' = 2^h 39^m 29.01 \\ \delta = 1 \quad 55 \quad 05.2 \\ - \quad 44 \quad 23.8 \\ - \quad 11^{\circ} \quad 08' \quad 57'' \end{array}$$

$$- \quad 4 \quad 25$$

$$- \quad 11 \quad 04 \quad 32$$

$$\begin{array}{r} 995727 \\ 0.00000 \\ 0.00809 \\ \hline 996536 \end{array}$$

$$\gamma = 42 \quad 43 \quad 09$$

$$+ 16 \quad 10 \quad 30$$

$$26 \quad 32 \quad 39$$

$$\begin{array}{r} 982640 \\ 823642 \\ 965016 \\ 016853 \\ \hline 788151 \end{array}$$

$$\delta - \delta' = + 26 \quad 10.2$$

$$\delta = + 16 \quad 36 \quad 40.6$$

$$\text{Hartshorn } \delta = + 16 \quad 36 \quad 40.3$$

$$0 - c \quad + 0.3$$

$$\text{Red. to stand. n.} \quad + 0.8$$

$$0 - c \quad + 1.1$$

$$\delta' = + 16^{\circ} 10' 30.5''$$

$$\pi = 59' 15.2''$$

$$\begin{array}{r} 986913 \\ 823642 \\ 928445 \\ 001852 \\ \hline 740852 \end{array}$$

$$\alpha - \alpha' = + 8 \quad 48.38$$

$$= - 35.23$$

$$\alpha = 2 \quad 38 \quad 53.78$$

$$\alpha = 2 \quad 38 \quad 53.57$$

$$+ 0.21$$

$$+ 0.08$$

$$+ 0.29$$

1318 Human Parallax

$$\begin{aligned} \alpha &= 2^h 39^m 29^s.01 \\ \delta &= 1^{\circ} 55' 05.2'' \\ &= 44' 23.8'' \\ &= 11^{\circ} 06' 57'' \end{aligned}$$

$$- 4' 25''$$

$$- 11' 04' 32''$$

$$\begin{array}{r} 995727 \\ 000000 \\ 000809 \\ \hline 996536 \end{array}$$

$$y = 42' 43'' 89$$

$$- 16' 10'' 30$$

$$- 26' 32'' 39$$

$$\begin{array}{r} 982640 \\ 823642 \\ 965016 \\ 016853 \\ \hline 788151 \end{array}$$

$$S - S' = +26' 10.2''$$

$$S = +16' 36' 40.6''$$

$$\text{Havtalmus } S = +16' 36' 40.3''$$

$$O - C = +0.3''$$

$$\text{Red. to stand n.} = -0.8''$$

$$O - C = +1.1''$$

$$S = +16^{\circ} 10' 30.5''$$

$$\Pi = 59' 15.2''$$

$$\begin{array}{r} 986913 \\ 823642 \\ 928445 \\ 001552 \\ \hline 740852 \end{array}$$

$$\alpha - \alpha' = +8' 48.38''$$

$$= -35.28''$$

$$\alpha = 2^h 38^m 53.78^s$$

$$\alpha = 2^h 38^m 53.57^s$$

$$+0.21''$$

$$+0.08''$$

$$+0.26''$$

MC1319

Comparison Stars - Measures

1913 May. 19

113

		y		x	
1	a	n	a	n	
14.6	16338	18895	16748	18606	
14.9	745356	17778	13089	12256	
	50	8074	7981	6054	
	32	97	50	00	
	<u>14.8880</u>	<u>.8882</u>	<u>7.6334</u>	<u>.6345</u>	
2	15697	14603	15822	15626	
16.6	707070	1323030	10990	1045441	
30.8	68	30	9190	46	
	87	20	11	38	
	<u>30.8620</u>	<u>.8624</u>	<u>16.5173</u>	<u>.5185</u>	
3	16625	15142	17991	16078	
24.3	814848	1360905	1068982	1334950	
39.8	50	05	79	51	
	10	53	72	70	
	<u>34.8464</u>	<u>.8461</u>	<u>24.2706</u>	<u>.2726</u>	
5	16219	17655	18107	17782	
29.8	1494350	893031	1561021	1020006	
10.1	48	31	1020	08	
mag	98	57	00	70	
5.5	<u>10.1270</u>	<u>.1274</u>	<u>29.7510</u>	<u>.7568</u>	

Remeasure

17448	16958
149638079	937280
8093	80
48	40
<u>29.7531</u>	<u>.7567</u>

100021
100021
00
2000

100021
100021
00
2000

100021
100021
00
2000

100021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

000021
100021
00
2000

MC 1319

Companion Stars - Measures

1913 May 19

13

	α	δ	α	δ
1 46 149	16338 745356 50 32 <u>148880</u>	18895 17778 8074 97 <u>8882</u>	16748 1308981 79 50 <u>76334</u>	18606 12256 6054 00 <u>6345</u>
2 166 30.8	15697 707070 68 87 <u>308620</u>	14603 1323030 30 20 <u>8624</u>	15822 10990 9190 11 <u>165173</u>	15626 1045441 46 38 <u>5185</u>
4 243 34.8	16625 814848 50 10 <u>348464</u>	15142 1360905 05 53 <u>8461</u>	17991 1068982 79 72 <u>242706</u>	16078 1334950 51 70 <u>2726</u>
5 298 101 mag 5.1	16219 1494350 48 98 <u>101270</u>	17655 893031 31 57 <u>1274</u>	18107 1561021 1020 00 <u>297510</u>	17782 1020006 08 70 <u>7568</u>

Remeasure

17448 149638079 8093 48 <u>297531</u>	16958 937280 80 40 <u>7567</u>
---	--

MC 1317 moon measures.

1913 May 19.

$\frac{1}{2}$ $\frac{1}{2}$
 $\frac{19.0}{20.7}$ d $\frac{1}{2}$ $\frac{1}{2}$
 18162 18910
 1049891 16610
 8591 2716
 68 27
 20.7676 7704

$\frac{3}{19.3}$
 $\frac{21.7}{max}$
 $\frac{2}{2}$

 $\frac{3}{3}$ scratch

$\frac{19.2}{22.5}$ 15702 15316
 1064035 1037669
 45 62
 08 22
 22.5065 $.5050$

$\frac{5}{19.0}$
 $\frac{23.0}{2}$

$\frac{5}{150}$ 15283 18950
 238 674841 1749604
 40 08
 91 54
 238547 8552

 $\frac{3}{3}$ scratch

$\frac{17.5}{24.0}$ 664248 10060
 50 993038
 6528 40
 24.0119
 23.9881 9876

 d $\frac{1}{2}$ $\frac{1}{2}$

17932 16370
 1115657 1312028
 60 3128
 30 72
 193226 3246

16618 17511
 898979 1513930
 78 36
 20 11
 19.2363 2376

936047 14246
 6045 1408084
 9190 78
 790163 $.0165$

15522 14611
 1027580 984050
 78 50
 18 15
 17.4758 4766

MC 1319 Moon - measures.

1913 May 19.

1/

d	v
19.0	18910
207	16610
14162	2716
1049891	27
8591	27
68	7704
207676	

2/

19.3

217

moon

2.

3 scratch

15702	15316
22.1064035	1037669
45	62
08	22
22.5065	5050

4/

19.0

230

5/

15283	18950
214.674841	1749604
40	08
91	54
238547	8552

6 scratch

664248	10060
40	993038
50	40
6528	
24.0119	
23.9881	9876

d v

17932

1115657

60

30

143226

16370

1312023

3123

72

3246

16618

898979

78

20

192363

17511

1513930

36

11

2376

936047

6045

9190

230163

14246

1408084

78

0165

15522

1027580

78

18

17.4758

14611

984050

50

15

4766

MC1319

Moon. Measures

1913 May 19

δ	d^H	N	d^2	N
17.0	666950	11026		
24.0	69	1095662		
	6595	56		

<u>23.9932</u>	<u>.9932</u>
----------------	--------------

 δ scraheen

23.9	724040	12547	18270	17210
16.7	2652	1188992	1506160	1042530
	6585	1098	69	30
			70	02

<u>23.9345</u>	<u>9350</u>	<u>16.6793</u>	<u>.6777</u>
----------------	-------------	----------------	--------------

 δ - should be first remeasure gives practically same.

16.6	16958	18516	17680	19478
20.3	1359798	1187783	1414660	1300000
	88	81	5161	91
	68	34	90	92

<u>20.3367</u>	<u>.3352</u>	<u>18.6470</u>	<u>.6490</u>
----------------	--------------	----------------	--------------

 $y = \max = 24,0000$
 δ not to be used in solution.

$x=19.0$	1341516
	30
	13210
	23.0210

01571

01571

08

50

5570

01571

01571

08

50

5570

01571

01571

08

50

5570

01571

01571

08

50

5570

01571

01571

10

50

01571

01571

01571

10

50

01571

01571

01571

10

50

01571

01571

01571

10

50

01571

9

18

20

10

MC1319

moon. measures

1913 May 19

d^1
 d^2
 d^3
 d^4
 d^5
 d^6
 d^7
 d^8
 d^9
 d^{10}
 d^{11}
 d^{12}
 d^{13}
 d^{14}
 d^{15}
 d^{16}
 d^{17}
 d^{18}
 d^{19}
 d^{20}
 d^{21}
 d^{22}
 d^{23}
 d^{24}
 d^{25}
 d^{26}
 d^{27}
 d^{28}
 d^{29}
 d^{30}
 d^{31}
 d^{32}
 d^{33}
 d^{34}
 d^{35}
 d^{36}
 d^{37}
 d^{38}
 d^{39}
 d^{40}
 d^{41}
 d^{42}
 d^{43}
 d^{44}
 d^{45}
 d^{46}
 d^{47}
 d^{48}
 d^{49}
 d^{50}
 d^{51}
 d^{52}
 d^{53}
 d^{54}
 d^{55}
 d^{56}
 d^{57}
 d^{58}
 d^{59}
 d^{60}
 d^{61}
 d^{62}
 d^{63}
 d^{64}
 d^{65}
 d^{66}
 d^{67}
 d^{68}
 d^{69}
 d^{70}
 d^{71}
 d^{72}
 d^{73}
 d^{74}
 d^{75}
 d^{76}
 d^{77}
 d^{78}
 d^{79}
 d^{80}
 d^{81}
 d^{82}
 d^{83}
 d^{84}
 d^{85}
 d^{86}
 d^{87}
 d^{88}
 d^{89}
 d^{90}
 d^{91}
 d^{92}
 d^{93}
 d^{94}
 d^{95}
 d^{96}
 d^{97}
 d^{98}
 d^{99}
 d^{100}

23.9932

9932

8 scratch

d^1
 d^2
 d^3
 d^4
 d^5
 d^6
 d^7
 d^8
 d^9
 d^{10}
 d^{11}
 d^{12}
 d^{13}
 d^{14}
 d^{15}
 d^{16}
 d^{17}
 d^{18}
 d^{19}
 d^{20}
 d^{21}
 d^{22}
 d^{23}
 d^{24}
 d^{25}
 d^{26}
 d^{27}
 d^{28}
 d^{29}
 d^{30}
 d^{31}
 d^{32}
 d^{33}
 d^{34}
 d^{35}
 d^{36}
 d^{37}
 d^{38}
 d^{39}
 d^{40}
 d^{41}
 d^{42}
 d^{43}
 d^{44}
 d^{45}
 d^{46}
 d^{47}
 d^{48}
 d^{49}
 d^{50}
 d^{51}
 d^{52}
 d^{53}
 d^{54}
 d^{55}
 d^{56}
 d^{57}
 d^{58}
 d^{59}
 d^{60}
 d^{61}
 d^{62}
 d^{63}
 d^{64}
 d^{65}
 d^{66}
 d^{67}
 d^{68}
 d^{69}
 d^{70}
 d^{71}
 d^{72}
 d^{73}
 d^{74}
 d^{75}
 d^{76}
 d^{77}
 d^{78}
 d^{79}
 d^{80}
 d^{81}
 d^{82}
 d^{83}
 d^{84}
 d^{85}
 d^{86}
 d^{87}
 d^{88}
 d^{89}
 d^{90}
 d^{91}
 d^{92}
 d^{93}
 d^{94}
 d^{95}
 d^{96}
 d^{97}
 d^{98}
 d^{99}
 d^{100}

23.9345

9350

18270

17210

1506160

1042530

69

30

70

02

16.6793

6777

9 - should be first remeasure gives fraction

16.6 16958

18516

17680

19478

20.3 1359798

1187783

1414660

1300000

88

81

5161

91

68

39

90

92

20.3367

3352

18.6470

6490

$y = \max = 24,0000$
 $y = \min = 24,0000$

10 not to be used in calculation

1341516

30

13210

23.0210

MC1319

1913 May 20

Preliminary Reduction

x	9.6340	16.5179	24.2716	29.7549 (mean)
3	10.1039	16.7993	24.5053	30.2784
x-3	-4.699	-2.814	-2.337	-5.235

y	14.8881	30.8622	34.8462	10.1272
m	14.8725	30.9301	35.0046	10.3497
y-m	+1.56	-6.79	-1.584	-2.225

x-3	-1.1724	-x	+6.456
1	-4.699 - 1.749 = -6.448	-1.0	-6.458 = -2
2	-2.814 - 3.626 = -6.440	-1.7	-6.457 = -1
4	-2.337 - 4.094 = -6.431	-2.4	-6.455 = +1
5	-5.235 - 1.190 = -6.425	-3.0	-6.455 = +1
mean	17.2158 - 25.73 =	-1.7	= 17.6024

y-3	+1.18x	+y	-1.305
1	+1.56 + 1.137 = +1.293	+1.5	+1.308 = +3
2	-6.79 + 1.949 = +1.270	+3.1	+1.301 = -4
4	-1.584 + 2.864 = +1.280	+3.5	+1.315 = +10
5	-2.225 + 3.511 = +1.286	+1.0	+1.296 = -11
mean	21.8942 + 20.31 =	+2.2	= 21.9690

Tables a - -0.4 x2 = -1.3 a - x2 + 0.9 b+a = 0.0
 Obs a = +1.2 x = -0.7 a - x = +1.9 b+a = -0.5

Times etc

Left Stars 1911 Dec 9	2 ^h	02 ^m	- 2 ^h	14 ^m
clock slow	2	08	183	- 2 08 185
	0	00	420	
H Sid T	2	09	00.4	
H Long	4	44	31.05	
G Sid T	6	53	31.45	
Sid T 2 noon	13	07	56.74	
Interval	17	45	34.71	
Reduction		2	54.57	
G in T	17	42	40.4	

From Naut Alm	R	Q	Decl
noon 18 ^h	2 ^h	40 ^m	04 ^s 50 - 16° 43' 53.6
noon 17 ^h	2	28 28	13 872
- 17 336		- 39 56	- 4 004
Tabular place	2	39	25 24 + 16 39 53.3
Moon's parallax		59'	15.4
semidiam		16	10.3

MG1319

1913 May 20

Preliminary Reductions

x	96340	165879	242716	29.7549		
3	10.1039	167993	245053	30.2784		
-3	-4699	-2814	-2337	-5235		
4	148881	308622	348462	10.1272		
	148725	309301	350046	10.3497		
	+156	-679	-1584	-2225		
x-3	-11724	-20	51	+6456		
1	-4699	-1749	-6448	-10	-6458	-2
2	-2814	-3626	-6440	-12	-6457	-1
4	-2337	-4094	-6431	-24	-6455	+1
5	-5235	-1190	-6425	-30	-6455	+1
17	2158	-2573	-17			17.6024
4-3	+1182	+4			-1305	
1	+156	+1137	+1293	+15	+130805	+3
2	-679	+1949	+1230	+31	+1301	-4
4	-1584	+2869	+1280	+35	+1315	+10
5	-2225	+3511	+1286	+10	+1296	-11
21	8942	-2031	+22			219690

Times etc.
 Expt to stars 1911 Oct 9 2^h 02^m - 2^h 14^m
 moon 2 08 18.3^v - 2 08 18.5^v
 clock slow 0 00 42.0

H Sid T. 2 09 00.4^v
 H Long. 4 44 31.05^v
 G Sid F. 6 53 31.95^v
 Sid T. 2 noon 13 07 56.74^v
 Interval 17 45 34.71^v
 Reduction 2 54.57^v
 G. M. T. 17 42 40.14^v

From Naut Alman. R. A. Decl.
 Moon 18^h 2^h 40^m 04.80^v - 16° 43' 53.6^v
 Motion in 1^m 2.2828^v 13.872^v
 " " - 17.331^v - 39.56^v - 4 00.4^v
 Tabular place 2 39 25.24^v + 16 39 53.2^v
 Moon's parallax 59' 15.4^v
 " semi-diameter 16 10.3^v

hrs 4.
 1 { 137.0 + 252) int.
 2 122.3 - 58
 3 90.0 - 129
 4 73.2 + 36
 5 58.4 + 94
 6 21.8 + 44
 7 7.0 - 44
 8 354.9 - 34
 9 345.2 - 30

Moon's Center

	x	$x - x_0$	$(x - x_0)^2$	R^2	$0 - L$
1	18.6480	+1.4294	2.0432	4.4740	+1.28
2	19.0000	+1.7814	3.1734	4.4415	-6.9
3	19.3236	+2.1050	4.4310	4.4310	-1.74
4	19.2370	+2.0184	4.0739	4.4470	-1.4
5	19.0164	+1.7978	3.2321	4.4533	+4.9
6	18.0000	+0.7814	0.6106	4.4526	+4.2
7	17.4762	+0.2576	0.0664	4.4466	-1.8
8	17.0900	-0.2186	0.0478	4.4502	+1.8
9	18.6785	-0.5401	0.2917	4.4525	+4.1
			Mean: 4.4484		+3

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.3360	-1.5590	-1.24308	
2	20.7690	-1.1260	-1.12681	
3	21.8950	0.0000	0.00000	
4	23.5058	+0.6108	+0.3731	
5	23.0000	+1.1050	+1.2212	
6	23.8550	+1.9600	+1.38420	
7	23.9878	+2.0928	+1.43802	
8	23.9932	+2.0982	+1.44024	
9	23.9348	+2.0398	+1.41608	

Approximate Center

$$x = 19.0 \quad y = 20.7690$$

$$23.0210$$

$$43.7900$$

$$\text{mean } y = 21.8950$$

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

$$R = 2.1050$$

$$x - \text{max} = 19.3236$$

$$\text{mean } x = 17.2186$$

Assumed Center

$$x = 17.2186$$

$$y = 21.8950$$

1. The first part of the paper is devoted to a discussion of the general properties of the system. It is shown that the system is a typical example of a "normal" system, and that the observed properties are in good agreement with the theoretical predictions.

2. The second part of the paper is devoted to a detailed discussion of the properties of the system. It is shown that the system is a typical example of a "normal" system, and that the observed properties are in good agreement with the theoretical predictions.

3. The third part of the paper is devoted to a discussion of the properties of the system. It is shown that the system is a typical example of a "normal" system, and that the observed properties are in good agreement with the theoretical predictions.

4. The fourth part of the paper is devoted to a discussion of the properties of the system. It is shown that the system is a typical example of a "normal" system, and that the observed properties are in good agreement with the theoretical predictions.

Moons Center

	x		$(x - x_0)^2$		y^2		$0 - y$
1	18.6480	+ 1.5274	20.432	4.4740	²⁰	+ 1.28	
2	19.0000	+ 1.7814	31.734	4.4415		- 6.9	
3	19.3236	+ 2.1150	44.380	4.4380		- 1.74	
4	19.2370	+ 2.0184	40.739	4.4470		- 1.4	
5	19.0164	+ 1.7978	32.321	4.4533		+ 4.9	
6	18.0000	+ 0.7814	0.6106	4.4526		+ 4.2	
7	17.4762	+ 0.2576	0.0664	4.4466		+ 1.8	
8	17.0000	- 0.2186	0.0478	4.4502		+ 1.8	
9	18.6745	- 0.5401	0.2917	4.4525		+ 4.1	
			mean: 4.4484			+ 3	

	y		$y - y_0$		Δy		$(y - y_0)^2$
1	20.3350	- 1.5590	- 1.24304				
2	20.7690	- 1.1260	- 1.12681				
3	21.8950	- 0.0000	- 0.00000				
4	22.5058	+ 0.6108	+ 0.3731				
5	23.0000	+ 1.1050	+ 1.12212				
6	23.8550	+ 1.9600	+ 3.8420				
7	23.9878	+ 2.0928	+ 4.3802				
8	23.9982	+ 2.0982	+ 4.4024				
9	23.9348	+ 2.0398	+ 4.1608				

Approximate Center

$x = 19.0$ $y = 20.7690$
 $\underline{23.0210}$
 43.7900
 mean $y = 21.8950$
 y - max = 24.0000
 $R = 2.1050$
 x - max = 19.3236
 mean $x = 17.2186$

Circular Center $\left\{ \begin{array}{l} x = 17.2186 \\ y = 21.8950 \end{array} \right.$

Formation of Normals

	ab	an	bn
1	-0.56	+91.4	-99.8
2	-2.01	-123.0	+77.7
3	+0.00	-866.2	-00
4	+123	-282	-85
5	+198	+880	+54.2
6	+153	+328	+82.4
7	+054	+46	-37.7
8	-046	+39	+37.8
9	-110	-222	+83.6
	+1.15	-335.9	+189.7

$$[ac] = +8.70 \quad [aa] = +1.695$$

$$[ba] = +8.00 \quad [bb] = +20.86 \quad [cn] = +3$$

1319

Moore's Center
Conditional Equations

$C = +72$

$$\begin{array}{r} -13.65 - 7.41 = -323 \\ + 7.18 = -160 \end{array}$$

$$q = 1 \frac{56}{125}$$

1319

Minimum Center Concluding Equation

0 - C

1	+0.71 - 0.78 + $\frac{1}{2}$ = +1.28	-46 + 12 + 36 = +2	+1.26
2	+1.78 - 1.13 + 1 = -69	-100 + 17 + 72 = -11	-58
3	+2.10 + 0.00 + 1 = -1.74	-117 - 0 + 72 = -45	-1.29
4	+2.02 + 0.61 + 1 = -14	-113 - 9 + 72 = -50	+36
5	+1.80 + 1.10 + 1 = +49	-100 - 17 + 72 = -45	+94
6	+0.78 + 1.96 + 1 = +42	-44 - 30 + 72 = -2	+44
7	+0.26 + 2.09 + 1 = -18	-14 - 32 + 72 = +26	-44
8	-0.22 + 2.10 + 1 = +18	+12 - 32 + 72 = +52	-34
9	-0.54 + 2.04 + 1 = +41	+30 - 31 + 72 = +71	-30

+300 = 295

Average = 76

Normal Equations

$$\begin{aligned}
 &+16.95 + 1.15 + 8.70 = -336 \\
 &+ 1.15 + 20.86 + 8.00 = +190 \\
 &+ 8.70 + 8.00 + 8.50 = +3 \\
 &- 1.15 - 0.08 - 0.59 = +23 \\
 &- 8.70 - 0.59 - 4.42 = +172\frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 &+ 20.78 + 7.41 = +213 \\
 &+ 7.41 + 4.03 = +17.5 \\
 &- 7.41 - 26.5 = -76 \\
 &+ 1.38 = +199
 \end{aligned}$$

C = +74.3

$$\begin{aligned}
 &- 1.368 - 7.41 = -323 \\
 &+ 7.13 = -169
 \end{aligned}$$

L = -1.57

$$\begin{aligned}
 &- 1.25 - 1.15 - 1.22 = - \\
 &- 22.70 - 20.86 - 22.11 = -8
 \end{aligned}$$

$$\begin{aligned}
 &+ 15.70 + 7.48 = -336 \\
 &- 21.55 - 14.15 = +182
 \end{aligned}$$

$$\begin{aligned}
 &- 11.40 - 7.48 = +96 \\
 &+ 4.30 = -240
 \end{aligned}$$

a = -56

Red ad *Winn* *aph*

$$S = +16^{\circ} 14'$$

$$H + x \quad 7 \quad 31 = 112^{\circ} 45'$$

$$H \quad 4 \quad 51$$

$$x \quad 2 \quad 40$$

$$G \quad 21 \quad 37$$

$$G + x \quad 0 \quad 17 = 4^{\circ} 15'$$

$$\log \cos(H+x) \quad 9.9988$$

$$g \quad 1.1522$$

$$\sin \quad 8.8699$$

$$\tan S \quad 9.4641$$

$$8.8239$$

$$8' \quad 1.1510$$

$$8 \quad 8.3101$$

$$\begin{array}{r} f \quad +1.77 \\ 8 \quad +0.02 \\ h \quad +1.21 \\ \hline +3.00 \end{array}$$

$$\log S \quad 9.9823$$

$$0.8937$$

$$16 \quad 0.8760$$

$$\log S \quad 9.4965$$

$$\cos(H+x) \quad 9.5874$$

$$h \quad 1.2761$$

$$\sin \quad 9.9648$$

$$\sec S \quad 0.0177$$

$$H \quad 8.8239$$

$$h' \quad 0.3100$$

$$h \quad 0.0825$$

$$\begin{array}{r} 8' \quad +19.16 \\ 2 \quad -2.04 \\ i \quad +7.52 \\ \hline +19.64 \end{array}$$

$$\begin{array}{r} x_0 = 27.2186 \\ \hline \frac{1}{10} a = \frac{-28}{172158} \end{array} \quad \begin{array}{r} y_0 = 21.8950 \\ \hline \frac{1}{10} b = \frac{-8}{218942} \end{array}$$

$$M = -0.3977$$

$\log 5 = 9.59956^{\circ}$

9.98235 ✓

A - 24000 ✓

Red - + 3.00 ✓

$x = 23950.12$ ✓

$$\eta = -0.031 \text{ f}^2$$

log Tan S: 9.4898 9.4639

$$m_1 = 5.7423$$

0 7 4 1 6 1 3 5 1²

Real = 196

8' + 16 13 56.0

Red ad locum aph

$$\delta = +16^{\circ} 14'$$

$$H + \alpha \quad 7 \quad 31 = 112^{\circ} 45'$$

$$H \quad 4 \quad 51$$

$$\alpha \quad 2 \quad 40$$

$$\alpha \quad 21 \quad 37$$

$$\alpha + \alpha \quad 0 \quad 17 = 4^{\circ} 15'$$

$$\cos(H + \alpha) \quad 9.9988$$

$$g \quad 1.1522$$

$$\sin \dots \quad 8.8699$$

$$\tan \delta \quad 9.4641$$

$$8.8239$$

$$g' \quad 1.1510$$

$$g \quad 8.3101$$

$$f \quad +1.77$$

$$g \quad +0.02$$

$$h \quad +1.21$$

$$+3.00$$

$$\cos \delta \quad 9.9823$$

$$i \quad 0.8937$$

$$(i) \quad 0.8760$$

$$\cos \delta \quad 9.4465$$

$$\cos(H + \alpha) \quad 9.5874$$

$$h \quad 1.2761$$

$$\sin \dots \quad 9.9648$$

$$\sec \delta \quad 0.0177$$

$$f \quad 8.8239$$

$$h' \quad 0.3100$$

$$h \quad 0.0825$$

$$g' \quad +19.16$$

$$g \quad -2.04$$

$$i \quad +7.52$$

$$+19.64$$

change mean position
in table

1461319 Mean Position (1911.0)

$$\begin{array}{r}
 X_0 = 27.2186 \quad Y_0 = 21.8950 \\
 \hline
 \text{Red} = -28 \quad \text{Blue} = 8 \\
 \hline
 172158 \quad 218942
 \end{array}$$

From Preliminary Red
Plate constant

$$\begin{array}{r}
 X = 176024 \quad Y = 21969 \\
 \hline
 \text{ax} = +3 \\
 \text{by} = 0 \\
 \text{c} = -4 \\
 \hline
 176023 \quad 21968
 \end{array}$$

$$S = -0.3977$$

$$\log S = 9.59956m$$

$$\log S = 9.98235$$

$$\log S = 8.50724$$

$$(S-A) = 1.10997m$$

$$(S-A) = -12.88$$

$$A = 240.00$$

$$X_0 = 23947.12$$

$$\text{Red} = +3.00$$

$$X = 23950.12$$

$$m = -0.0311$$

$$\log \tan S = 9.4898$$

$$S^2 = 9.1991$$

$$m_0 = 5.7423$$

$$m_1 = +1$$

$$m_0 = -0.0312$$

$$\log m_0 = 8.49415m$$

$$\log m_0 = 7.33115$$

$$(S-D) = 1.16300m$$

$$S-D = -146$$

$$D = +16 \quad 13 \quad 51$$

$$S_0 = +16'' \quad 13 \quad 36.4 \checkmark$$

$$\text{Red} = +196$$

$$S = +16 \quad 13 \quad 56.0$$

1317

Human Parallax

$$\begin{aligned}
 \alpha' &= 2^{\text{h}} 39^{\text{m}} 50.12^{\text{s}} \\
 \theta &= 2 \quad 09 \quad 00.4 \\
 \theta - \alpha' &= -30 \quad 49.7 \\
 &= -7^{\circ} 42' 26'' \\
 &= -3 \quad 04 \\
 &= -7 \quad 39 \quad 22
 \end{aligned}$$

$$\begin{aligned}
 9.95727 \\
 0.00000 \\
 0.00388 \\
 \hline
 9.96115
 \end{aligned}$$

$$y = 42 \quad 26 \quad 26$$

$$16 \quad 13 \quad 56$$

$$26 \quad 12 \quad 30$$

$$\begin{aligned}
 9.82640 \\
 8.23644 \\
 9.64506 \\
 0.17087 \\
 \hline
 7.87877
 \end{aligned}$$

$$S - S' = +26 \quad 00.3$$

$$S = +16 \quad 39 \quad 56.3$$

$$\alpha = 2 \quad 39 \quad 25.57$$

$$\text{Wavelength } S = +16 \quad 39 \quad 53.2$$

$$\alpha = 2 \quad 39 \quad 25.24$$

$$O - C \quad + \quad 31$$

$$+ 0.33$$

$$\text{Red. to standard} \quad - \quad 0.2$$

$$- 0.01$$

$$O - C \quad + \quad 29$$

$$+ 0.32$$

$$S = +16^{\circ} 13' 56.0$$

$$\pi = 59' 15.4$$

$$\begin{aligned}
 9.86913 \\
 8.23644 \\
 9.12747 \\
 0.01864 \\
 \hline
 7.25168
 \end{aligned}$$

$$\delta - \alpha' = -6' 08.22$$

$$= -24.55$$

1 21 9 human Parallax

$$\begin{array}{r}
 \gamma' = 2 \quad 39 \quad 50.12 \\
 \theta = 2 \quad 09 \quad 00.4 \\
 \theta - \gamma' = -30 \quad 49.7 \\
 \quad \quad -7 \quad 48' \quad 26'' \\
 \quad \quad - \quad \quad 3 \quad 04 \\
 \quad \quad -7 \quad 39 \quad 22
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 \hline
 0.00369 \\
 9.96096
 \end{array}$$

$$\gamma = 42 \quad 25.42$$

$$16 \quad 13 \quad 56$$

$$26 \quad 11 \quad 46$$

$$\begin{array}{r}
 982640 \\
 823644 \\
 964488 \\
 \hline
 017021 \\
 787863
 \end{array}$$

$$S - \delta = +25 \quad 59.8$$

$$S = +16 \quad 39 \quad 55.8$$

$$x = 2 \quad 39 \quad 25.57$$

$$\text{Antares } S = +16 \quad 39 \quad 53.3$$

$$x = 2 \quad 39 \quad 25.25$$

$$O - C \quad \quad \quad + 2.5$$

$$+ 0.32$$

$$\text{Red. to stand. r.} \quad \quad \quad - 0.2$$

$$- 0.01$$

$$O - C \quad \quad \quad + 2.3$$

$$+ 0.31$$

$$S = +16 \quad 13' \quad 56''$$

$$\gamma = 59' \quad 15''.4$$

$$\begin{array}{r}
 986913 \\
 823644 \\
 9112747 \\
 \hline
 001864 \\
 725168
 \end{array}$$

$$\delta - \gamma = -6' \quad 08''.22$$

$$= -24.55$$

1913 May 24.

Comp. Stars measures.

	α	δ	μ	ν	α	δ	μ	ν
1	16567			16608	14948			16609
2	13135	33		10034	7185	75		14348
	32			3030	8080			50
	51			08	40			08
	<u>20.3429</u>			<u>3423</u>	<u>9.2238</u>			<u>2260</u>
3	18244			17231	18668			18330
4	11049	54		14442	11170	73		15809
	51			40	69			08
	50			33	74			32
	<u>9.7197</u>			<u>7209</u>	<u>15.2499</u>			<u>2523</u>
5	17770			16031	16470			16200
6	15170	70		8641	14542	48		8098
	76			3236	45			60
	65			41	58			92
	<u>27.2597</u>			<u>2598</u>	<u>128.8077</u>			<u>8098</u>

1912 May 24.

Comp. Stars measures

	α	δ	μ	ν	α	δ	μ	ν
1								
92	16567			16608	14948			16609
94	13135			10034	7155	75		14348
	32	33		30	80	80		30
	51			08	40			08
	<u>203429</u>			<u>3423</u>	<u>92238</u>			<u>2260</u>
152	18244			17231	18665			18330
97	11049	54		14442	11170	73		15809
	51			40	69			08
	50			33	74			32
	<u>97197</u>			<u>7209</u>	<u>152499</u>			<u>2523</u>
173	17770			16031	16470			16200
	15170	70		8641	14542			8098
	76			32	45	48		00
	65			41	58			92
	<u>272597</u>			<u>2598</u>	<u>1288077</u>			<u>8098</u>

moon measures.

1913 May 24

d 4 n
hand front
to measure.

a n
15852 18561
1063581 1377020
5861 5540
49 57
18.4809 .4813

3 scratch

18.8 18109 16598 16020 17555
20.2 16260 60 845855 1400000 958892
50 60 00 94
10 00 25 59
20.1852 .1858 18.7979 .7967

3
19.0 17639 15598
20.4 14200 05- 903042
00 30
40 00
20.3437 .3435

4
19.5 17720 16348
21.0 1255546 1148088
41 89
10 48
19.4832 .4862

5
19.7 17702 15371
21.7 1466660 838070
58 74
06 67
29.6957 .6994

6
19.2 16703 15376
22.0 1364142 843019
40 30
09 76
29.6935 .6950

1918 May 24

4

185-
200

hard front
to measure

15852
1063581
5861
49
84809

$$\begin{array}{r} 18561 \\ 1377020 \\ 5540 \\ 57 \\ 4813 \end{array}$$

3.5 cratons

$$\begin{array}{r} 188 \\ - 22 \\ \hline 166 \\ 50 \\ 10 \\ \hline 201852 \end{array}$$

16598
845855
60
00
1858

$$\begin{array}{r} 16000 \\ 140000 \\ 00 \\ 25 \\ \hline 187979 \end{array}$$

17555
9588
9492
59
7967

12

$$\begin{array}{r} 190 \\ 204 \\ \hline 17639 \\ 142000 \\ \hline 00 \\ 40 \\ \hline 203437 \end{array}$$
$$\begin{array}{r} 15 \overline{) 98} \\ 90 \\ \underline{30} \\ 30 \\ \underline{00} \\ 3435 \end{array}$$
$$\begin{array}{r} 17720 \\ 1255546 \\ \quad 41 \\ \quad 10 \\ \hline 9.4832 \end{array}$$
$$\begin{array}{r} 16348 \\ 1148088 \\ 89 \\ 45 \\ \hline 4862 \end{array}$$

4
17.8
21.0

5

197

217

1

6

17702
1466660
58
06
1.6957

15371
838070
74
67
6994

$$\begin{array}{r} 16703 \\ 1364142 \\ 40 \\ 09 \\ \hline 96935 \end{array}$$
$$\begin{array}{r} 15376 \\ 8430 \\ 3019 \\ 76 \\ \hline 6950 \end{array}$$

moon measures.

1913 May 24

	d	n	a	n
2			15700	14405
19.5			964626	10460
23.0			3630	55-60
			02	00
			<u>19.3934</u>	<u>.3945</u>

8	18650	18870
19.0	1377071	13743
23.5	7092	45-45
	57	70
	<u>23.4874</u>	<u>.4874</u>
9	12822	11920
18.0	1418	11850
24.0	12740	6047
	<u>23.9922</u>	<u>.9932</u>

maxing - about 24.0080

moon measures:

1913 May 24

$$\begin{array}{r} 2 \\ 19.5 \\ 230 \end{array}$$

$$\begin{array}{r} 15700 \\ 904626 \\ 3630 \\ 02 \\ \hline 19.3934 \end{array}$$

$$\begin{array}{r} 14405 \\ 10460 \\ 55-60 \\ 00 \\ \hline 3945 \end{array}$$

$$\begin{array}{r} 18650 \\ 1377071 \\ 7092 \\ 57 \\ \hline 234874 \end{array}$$

$$\begin{array}{r} 18870 \\ 13743 \\ 45-45 \\ 70 \\ \hline 4874 \end{array}$$

$$\begin{array}{r} 12822 \\ 1418 \\ 12740 \\ \hline 239922 \end{array}$$

$$\begin{array}{r} 11920 \\ 11850 \\ 6047 \\ \hline 9932 \end{array}$$

max - 7. about 240080

Center of Plate

x	y	R. a	Decl.
9.22	20.54	6 ^h 50 ^m 23 ^s	+27° 24' 10"
15.25	9.72	53 58	+26 02 09
28.81	27.26	7 01 50	+28 18 52
3 53.28	57.32	16 6 11	21 45 11
17.76	19.11	6 ^h 55 ^m 24 ^s	+27 15 04
-1.8	2.2	+ 7	5 22 28
0.24	2.84	6 55 31	+27 37 32
31	465		
29	1348		
72			
7.4			

$$A = 6^h 55^m 31^s$$

$$D = +27^\circ 37' 32''$$

Preliminary Reduction - Plate Constants

$x = 5 - 837$	$+1.7x$	$- .74$	$+1468$
$+204 - 1688 = -1484$	$+10 = -1474$	$-14 = -1488$	$= 0$
$-692 - 807 = -1499$	$+17 = -1482$	$-6 = -1488$	0
$+762 - 2263 = -1501$	$+32 = -1469$	$-19 = -1488$	0
$175761 - 1834$	$+19$		$= 175434$

$y = 7 + 84x$	$+ y$	$+462$	$- .24$	-1161
$+386 +775 = +1161$	-20	$+1181 - 4 = +1185$	-4	$+1181 = 0$
$-115 +1281 = +1166$	$+10$	$+1176 - 7 = +1183$	-2	$+1181 = 0$
$-1213 +2420 = +1149$	$+27$	$+1174 +13 = +1187$	-6	$+1181 = 0$
$219161 +1484$	$+18$			219482

from Tables $b+d = 0.0$ $a = -1.1$ $c = -0.8$
 obs. $b+d = -0.8$ $a = -0.9$ $c = -0.9$

Standard Coordinates									
MC 1331	1	Cape no. 994 mag 7.0				no. 999 mag 6.3	no. 1015 mag 6.2		
		6 ^h 49 ^m	41.66	6 ^h 53 ^m	17.52	7 ^h 01 ^m	08.63		
			72		53		62		
			66		53		62		
Mean	6	49	41.68	6	53	17.53	7	01	08.62
Prece			+41.24			+40.76			+41.44
α	6	50	22.92	6	53	58.29	7	01	50.06
δ	6	55	31	6	55	31	6	55	31
$K-A$	-	5	08.08	-	1	32.71	+	6	19.06
$\sin(K-A)$			-30805			-92.71			+37901
$\log \mu$			2.48862 ^m			1.96713 ^m			2.57865 ^m
$\cos \delta$			9.94832			9.95353			9.94466
$\sin \delta$			0.94418 ^m			0.42790 ^m			1.03055 ^m
δ_0	-	8.7938		-	2.6786		+	10.7288	
δ_1	-	17		-	11		+	38	
δ_2		9.2045			15.3203			28.7326	
δ_3		9.2249			15.2511			28.8088	
34	70-3		+204		-692			+762	
C	+27°	24'	47.2 ^v	+26°	02'	59.7 ^v	+28°	19'	50.7 ^v
L			47.8 ^v			59.7			50.1
E			47.55		03	00.2			51.6
Mean	+27	24	47.5	+26	02	59.9 ^v	+28	19	50.8
Prece			-47.8			-51.3 ^v			-58.5 ^v
δ	+27	23	59.7	+26	02	08.6 ^v	+28	18	52.3
δ	+27	37	32	+27	37	32	+27	37	32
$\delta-D$	-	13	32.3	-	1	35.234 ^v	+	41	20.3 ^v
$\tan(\delta-D)$			-842.3			-57249 ^v			+2480.4
$\log \mu$			2.90972 ^m			3.75777 ^m			3.39452 ^v
$\log \mu_0$			0.24087 ^m			1.08892 ^m			0.72567 ^v
$\tan \delta$			9.7147			9.6889 ^v			9.7314 ^v
δ_2			18883			08558 ^v			20611
δ_1			8.6564			7.5981 ^v			8.8459 ^v
η_0	-	1.7413		-	12.2722 ^v		+	5.3170 ^v	
η_1	+	453		+	40 ^v		+	701	
η		20.3040			9.7318 ^v			27.3871 ^v	
η		20.3426			9.7203 ^v			27.2598 ^v	
$\eta-m$			+386		-115 ^v			-1273 ^v	

Center of Plate

x	y	R. m	Decl.
9.22	20.54	6 ^h 50 ^m 23 ^s	+27° 24' 10"
15.25	9.72	53 58	+26 02 09
28.81	27.26	7 01 50	+28 18 52
3 53.28	57.32	166 11	+21 45 11
17.76	19.11	6 ^h 55 24	+27 15 04
-18	-22	+ 7	+ 22 28
0.24	2.89	6 55 31	+27 37 32
31	-465		
24	1348		
72			
7.44			

$$A = 6^h 55^m 31^s$$

$$D = +27^{\circ} 37' 32''$$

Preliminary Reduction - Plate Constants

x - 5 - 834	+1.15x	- .74	+1488
+204 = 7688	-1484 +10 = -1474	-14 = -1488	= 0
-692 = 807	-1499 +17 = -1482	-6 = -1488	= 0
+762 = 2263	-1501 +32 = -1469	-19 = -1488	= 0
17.57.61 = 1879	+19	-35	= 17.5434

y - 7 + 84x	+ y	+ .46x	- .24	- 1181
+386 +775 = +1161	+20 = +1181	+4 = +1185	-4 = +1181	= 0
-115 +1281 = +1166	+10 = +1176	+7 = +1183	-2 = +1181	= 0
-1273 +2420 = +1147	+27 = +1174	+13 = +1187	-6 = +1181	= 0
21.91.61 +1484	+18			= 21.948

from Tables $b+d = 0.0$ $a = -1.1$ $e = -0.8$
 obser. $b+d = -0.8$ $a = -0.9$ $e = -0.9$

No. 994 mag 7.0			No. 999 mag 6.3			No. 1015 mag 6.2			
C	6	49	41.66	6	53	17.52	7	01	08.63
L			72			53			62
E			66			53			62
mean	6	49	41.68	6	53	17.53	7	01	08.62
Pre			+41.24			+40.76			+41.44
A	6	50	22.92	6	53	58.29	7	01	50.06
A	6	55	31	6	55	31	6	55	31
x-A	-	5	08.08	-	1	32.71	+	6	19.06
sin(x-A)			-308.05			-92.71			+379.01
log...			2.48862			1.96713			2.57865
cos			9.74832			9.95353			9.94466
30			0.94418			0.42790			103055
30			-8.7938			-2.6786			+10.7288
30			-			11			38
30			9.2045			15.3203			28.7326
30			9.2249			15.2511			28.8088
20-3			+204	-692			+762		
C	+27	24	47.2	+26	02	59.7	+28	19	50.7
L			47.8			59.7			50.1
E			47.55			03 00.2			51.6
mean	+27	24	47.5	+26	02	59.9	+28	19	50.8
Pre			-47.8			-51.3			-58.5
S	+27	24	59.7	+26	02	08.6	+28	18	52.3
D	+27	37	32	+27	37	32	+27	37	32
-D	-	13	32.3	-1	35	23.4	+	41	20.3
tan(S-D)			-8623			-57249			+24804
log...			2.90972			3.75777			3.39452
no			0.24087			1.08892			0.72567
tan S			9.7147			9.6889			9.7314
30			18883			08558			20611
30			8.6564			7.5981			8.8459
no	-		1.7473	-		12.2722	+		5.3170
30	+		453	+		40	+		701
30			20.3040			9.7318			27.3871
30			20.3426			9.7203			27.2598
1-30			+386			-115			-1273

Times etc.

sp. testam	1911 Oct 13	6 ^h 12 ^m	-	6 ^h 24 ^m
... .. moon		6 17 50.0	-	6 17 50.4
clock slow		0 42.3		
H Sid T.		6 18 32.5		

G.M.T. 21 35 + 77.2

Tabular place 1 3552 1 303
6 54 45.61 + 27 52 20.5

Moon parallel 59' 18.1

MC1331

1913 May 26

Morph. Center

x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$O - C$
1	18.4811 + 0.8760	0.7674	4.4365	+ 3.08
2	18.7973 + 0.1922	1.4214	4.4143	+ 8.6
3	19.0000 + 1.3949	1.9457	4.4166	+ 10.9
4	19.4846 + 1.8795	3.5325	4.3706	- 3.51
5	19.6976 + 2.0925	4.3786	4.3786	- 2.71
6	19.6942 + 2.0891	4.3643	4.3715	- 3.42
7	19.3940 + 1.7889	3.2001	4.3763	- 2.94
8	19.0000 + 1.3949	1.9457	4.4166	+ 10.9
9	18.0000 + 0.3949	0.1559	4.4706	+ 6.49

mean 4.4057

y	$y - Y_0$	$(y - Y_0)^2$
1	20.0000 - 1.9155	3.6691
2	20.1855 - 1.7300	2.9929
3	20.3436 - 1.5719	2.4709
4	21.0000 - 0.9155	0.8381
5	21.9155 0.0000	0.0000
6	22.0000 + 0.0845	0.0072
7	23.0000 + 1.0845	1.1762
8	23.4874 + 1.5719	2.4709
9	23.9927 + 2.0772	4.3147

Approximate Center

$$x = 19.0 \quad y = 20.3436$$

$$\underline{23.4874}$$

$$4.38310$$

$$\text{mean } y = 21.9155$$

$$y - \text{max} = \underline{24.0080}$$

$$R = 2.0925$$

$$x - \text{max} = 19.6976$$

$$\text{mean } x = 17.6051$$

$$\text{Center } \begin{cases} X_0 = 17.6051 \\ Y_0 = 21.9155 \end{cases}$$

Times etc.

Exp. testar 1911 Oct 13	6 ^h 12 ^m	6 ^h 24 ^m
" moon	6 ^h 17	50.0 ^v - 16 17 50.4 ^v
clock slow	0	42.3 ^v
H. Sid T.	6 ^h 18	32.5 ^v
H. hour	4 ^h 44	31.0 ^v
G. Sid T.	11 ^h 03	03.5 ^v
Sid T. in moon	1 ^h 3	23 42.9 ^v
Interval	21 ^h 39	20.5 ^v
Reduction	3	32.8 ^v
G. h. T.	21 ^h 35	47.7 ^v

From hand Alm	R. A.	Decl.
moon 21 ^m	6 ^h 53	10.09 +27 53 40.8 ^v
motion in 1 ^m	2.6685 ^v	2.242 ^v
35.7953 ^v	+ 1	35.52 ^v
Tabular place	6 ^h 54	45.61 ^v +27 52 20.5 ^v

Moon's parallax 59' 18"^v
 " semi-diameter 16' 11"^v

M61331

1913 May 20.

Moon's Center

	x	$x - X_0$	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$O - C$
1	184811	+0.8760	0.7674	4.4365	+308
2	187973	+1.1922	1.4214	4.4143	+86
3	190000	+1.3949	1.9457	4.4166	+109
4	194846	+1.8795	3.5325	4.3706	-351
5	196976	+2.0925	4.3786	4.3786	-271
6	196942	+2.0891	4.3643	4.3715	-342
7	193940	+1.7889	3.2001	4.3763	-294
8	190000	+1.3949	1.9457	4.4166	+109
9	180000	+0.3949	0.1559	4.4706	+649
mean 4.4057					

	y	$y - Y_0$	$(y - Y_0)^2$
1	200000	-1.9155	3.6691
2	201855	-1.7300	2.9929
3	203436	-1.5719	2.4709
4	210000	-0.9155	0.8381
5	219155	0.0000	0.0000
6	220000	+0.0845	0.0072
7	230000	+1.0845	1.1762
8	234874	+1.5719	2.4709
9	239927	+2.0772	4.3147

Approximate Center

$$x = 19.0 \quad y = 20.3436$$

$$\begin{array}{r} 234874 \\ \hline \end{array}$$

$$\begin{array}{r} 438310 \\ \hline \end{array}$$

$$\text{mean } y = 21.9155$$

$$\begin{array}{r} 240080 \\ \hline \end{array}$$

$$R = 2.0925$$

$$x = \text{max} = 19.6976$$

$$\text{mean } x = 17.6051$$

$$\text{Center } \begin{cases} X_0 = 17.6051 \\ Y_0 = 21.9155 \end{cases}$$

Formation of Normals

	ab	ac	bc
1	-1.68 + 269.8	-590.0	
2	-206 + 102.5	-148.8	
3	-209 + 152.0	-171.5	
4	-1.72 - 658.0	+321.2	
5	+0.00 - 566.3	0.0	
6	+0.18 - 714.3	-28.9	
7	+1.93 - 525.0	-319.2	
8	+209 + 152.0	+171.5	
9	+0.20 + 64.0	+336.0	
10	-3.15 -1723.3	-429.7	

$$[ae] = +12.90$$

$$[ac] = +21.63$$

$$[bc] = -2.35$$

$$[H] = +15.78$$

$$[CN] = -3.22$$

MC1331 Moon's Center

1913 May 28

Conditional Equations.

$$1. + 0.88 - 1.92 + 1 = + 308$$

$$2. + 1.19 - 1.73 + 1 = + 86$$

$$3. + 1.39 - 1.57 + 1 = + 109$$

$$4. + 1.88 - 0.92 + 1 = - 351$$

$$5. + 2.09 + 0.00 + 1 = - 271$$

$$6. + 2.09 + 0.08 + 1 = - 342$$

$$7. + 1.79 + 1.08 + 1 = - 294$$

$$8. + 1.39 + 1.57 + 1 = + 109$$

$$9. + 0.20 + 1.04 + 1 = + 324$$

Normal Equations.

a

b

c

$$+ 21.63 - 3.15 + 12.90 = - 17.23$$

$$- 3.15 + 15.78 - 235 = - 430$$

$$+ 12.90 - 235 + 850 = - 322$$

$$+ 3.15 - 0.96 + 1.88 = - 251$$

$$- 12.90 + 1.88 - 7.69 = + 1028$$

$$+ 15.32 - 0.47 = - 681$$

$$- 0.47 + 0.81 = + 706$$

$$+ 0.47 - 0.014 = - 21$$

$$+ 0.796 = + 685$$

$$c = + 860$$

$$- 0.27 + 0.47 = + 410$$

$$+ 15.05 = - 271$$

$$b = - 18$$

$$- 17.30 + 3.15 - 11.40 = + 432$$

$$+ 86.60 - 15.78 + 57.08 = - 2162$$

$$+ 4.33 + 1.50 = - 1291$$

$$+ 83.45 + 54.73 = - 2592$$

$$- 2.29 - 1.50 = + 71$$

$$+ 2.04 = - 1220$$

$$a = - 599$$

1
2
3
4
5
6
7
8
9

M1331 Moon's Center

1913 May 27

Conditional Equations

$$\begin{aligned}
 1 & + 0.88 - 1.92 + 1 = + 308 \\
 2 & + 1.19 - 1.73 + 1 = + 86 \\
 3 & + 1.39 - 1.57 + 1 = + 109 \\
 4 & + 1.88 - 0.92 + 1 = - 351 \\
 5 & + 2.09 + 0.00 + 1 = - 271 \\
 6 & + 2.09 + 0.08 + 1 = - 342 \\
 7 & + 1.79 + 1.08 + 1 = - 294 \\
 8 & + 1.39 + 1.57 + 1 = + 109 \\
 9 & + 0.20 + 1.04 + 1 = + 324
 \end{aligned}$$

Normal Equations

$$\begin{aligned}
 a & & b & & c \\
 + 23.63 - 31.5 + 12.90 & = - 1723 \\
 - 31.5 + 15.78 - 23.5 & = - 430 \\
 + 12.90 - 23.5 + 8.50 & = - 322 \\
 + 31.5 - 0.46 + 1.88 & = - 251 \\
 - 12.90 + 1.88 - 7.69 & = + 1028
 \end{aligned}$$

$$\begin{aligned}
 + 15.32 - 0.47 & = - 681 \\
 - 0.47 + 0.81 & = + 706 \\
 + 0.47 - 0.01 & = - 21 \\
 + 0.796 & + 685
 \end{aligned}$$

$$c = + 860$$

$$\begin{aligned}
 - 0.27 + 0.47 & = + 410 \\
 + 15.05 & = - 271
 \end{aligned}$$

$$b = - 18$$

$$\begin{aligned}
 - 17.30 + 31.5 - 11.40 & = + 432 \\
 + 86.60 - 15.78 + 57.08 & = - 2162
 \end{aligned}$$

$$\begin{aligned}
 + 433 & & + 1.50 & = - 1291 \\
 + 8345 & & + 54.73 & = - 2592
 \end{aligned}$$

$$\begin{aligned}
 - 229 & & - 1.50 & = + 71 \\
 + 204 & & & = - 1220
 \end{aligned}$$

$$a = - 599$$

Formation of Normals.

	ab	ac	bc
1	- 1.74 -	66.1 +	139.8
2	- 2.12 -	125.0 +	176.2
3	- 2.24 +	64.1 -	70.7
4	- 1.75 -	204.3 +	98.0
5	+ 0.00 +	237.5 +	0.0
6	+ 0.18 +	84.7 +	34
7	+ 1.97 -	132.8 -	79.4
8	+ 2.24 +	145.5 +	160.5
9	+ 0.88 +	22.0 +	108.0
	- 2.58 +	25.6 +	535.8

$$ac = +13.37 \quad (aa) = +22.51$$

$$(bc) = -1.31 \quad (bb) = -17.94$$

$$(ca) = -4$$

	pos. L.	resid.
1	154.3	-7
2	144.3	-46
3	137.0	+92
4	115.9	-91
5	90.0	+96
6	87.7	+11
7	58.8	-117
8	43.0	+51
9	11.8	+5

Moon's Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$y - c$
1	18.4811	+0.9060	0.8208	4.4865	- 73
2	18.7973	+1.2222	1.4938	4.4836	- 102
3	19.0000	+1.4249	2.0303	4.4983	+ 45
4	19.4847	+1.9096	3.6466	4.4831	- 107
5	19.6976	+2.1225	4.5050	4.5050	+ 112
6	19.6942	+2.1191	4.4906	4.4978	+ 40
7	19.3946	+1.8189	3.3084	4.4865	- 73
8	19.0000	+1.4249	2.0303	4.5040	+ 102
9	18.0000	+0.4249	0.1805	4.4990	+ 52
			mean	4.4938	- 4

	y	$y - y_0$	$(y - y_0)^2$
1	20.0000	-1.9146	3.6657
2	20.1855	-1.7291	2.9898
3	20.3436	-1.5770	2.4680
4	21.0000	-0.9146	0.8365
5	21.9146	0.0000	0.0000
6	22.0000	+0.0854	0.0072
7	23.0000	+1.0854	1.1781
8	23.4874	+1.5728	2.4737
9	23.9927	+2.0781	4.3185

Approximate Center

$$\begin{cases} x_0 = 17.5751 \\ y_0 = 21.9146 \end{cases}$$

Moons Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	184811	+09060	08208	44865	-73
2	187973	+12222	14938	44836	-102
3	190000	+14249	20303	44983	+43
4	194847	+19096	36466	44831	-107
5	296976	+21225	45050	45050	+112
6	296942	+21191	44906	44978	+40
7	193946	+18189	33084	44865	-73
8	290000	+14249	20303	45040	+102
9	180000	+04249	01805	44990	+52
		mean	44938	-4	

	y	$y - y_0$	$(y - y_0)^2$
1	200000	-19146	36657
2	201855	-17291	29898
3	203936	-15770	24680
4	210000	-09146	08365
5	299146	00000	00000
6	220000	+00854	00072
7	230000	+10854	11781
8	234874	+15728	24737
9	239927	+20781	43185

Approximate Center

$$\begin{cases} x_0 = 175751 \\ y_0 = 219146 \end{cases}$$

MC1331

Morrison's Center.

1913 May 27.

Conditional Equations

Q

O-C

1	+ 0.91	- 1.91	+ 1.00	- 73	+ 18	- 59	- 25	= - 66	- 7
2	+ 1.22	- 1.73	+ 1.00	- 102	+ 23	- 54	- 25	= - 56	- 46
3	+ 1.42	- 1.57	+ 1.00	+ 45	+ 27	- 49	- 25	= - 47	+ 92
4	+ 1.91	- 0.91	+ 1.00	- 107	+ 37	- 28	- 25	= - 16	- 91
5	+ 2.12	+ 0.00	+ 1.00	+ 112	+ 41	+ 0	- 25	= + 16	+ 96
6	+ 2.12	+ 0.09	+ 1.00	+ 40	+ 41	+ 3	- 25	= + 19	+ 11
7	+ 1.82	+ 1.09	+ 1.00	- 73	+ 35	+ 34	- 25	= + 44	- 117
8	+ 1.42	+ 1.57	+ 1.00	+ 102	+ 27	+ 49	- 25	= + 51	+ 51
9	+ 0.42	+ 2.08	+ 1.00	+ 52	+ 8	+ 64	- 25	= + 47	+ 5

Normal Equations.

-261 + 255

Average = 57

$$\begin{array}{rcl}
 + 22.51 - & 2.58 + & 13.37 = + 26 \\
 - 2.58 + & 17.94 - & 1.31 = + 536 \\
 + 13.37 - & 1.31 + & 9.00 = - 4
 \end{array}$$

$$\frac{\Delta x}{\Delta z} = -1.26$$

$$\begin{array}{rcl}
 + 2.58 - & 0.30 + & 1.53 = + 3 \\
 - 13.37 + & 1.53 - & 7.95 = - 15
 \end{array}$$

$$\begin{array}{rcl}
 + 17.64 + & 0.22 = & + 539 \\
 + 0.22 + & 1.05 = & - 19
 \end{array}$$

$$\frac{\Delta y}{\Delta z} = -0.03$$

$$\begin{array}{rcl}
 - 0.22 - & 0.00 = & - 7 \\
 + & 1.05 = & - 26
 \end{array}$$

$$c = -25$$

$$\begin{array}{rcl}
 - 0.05 - & 0.22 = & + 4 \\
 + 17.59 & = & + 543
 \end{array}$$

$$b = +31$$

$$\begin{array}{rcl}
 - 26.32 + & 2.58 - & 17.75 = + 8 \\
 + 183.00 - & 17.94 + & 123.40 = - 55
 \end{array}$$

$$\begin{array}{rcl}
 - 3.81 & - 4.38 = & + 34 \\
 + 180.42 & + 1220.9 = & + 481
 \end{array}$$

$$\begin{array}{rcl}
 + 64.6 & + 438 = & + 17 \\
 + 265 & = & + 51
 \end{array}$$

$$a = +19$$

1331)

Red. ad down ahp

 $\delta = +27^\circ 37' - 1.00$
 $H + \alpha \quad 11 \quad 29 \quad 172^\circ 15'$
 $H \quad 4 \quad 34 \quad \cos S \quad 99475$
 $\alpha \quad 6 \quad 55 \quad i \quad -08836$
 $G \quad 21 \quad 42 \quad (1) \quad 08311$
 $G + \alpha \quad 4 \quad 37 \quad 69^\circ 15' \quad \cos S \quad 96661$
 $\cos(H + \alpha) \quad 99960$
 $\cos(F + \alpha) \quad 95494 \quad h \quad 12778$
 $g \quad 11584 \quad \sin \quad 91298$
 $\sin \quad 99709 \quad \sec \delta \quad 0.0525$
 $\tan S \quad 97186 \quad \frac{1}{\sin} \quad 88239$
 $t_s \quad 88239$
 $\left(\begin{smallmatrix} 8' \\ 9' \end{smallmatrix} \right) \quad 07078 \quad a' \quad 09399$
 $\quad 96718 \quad a \quad 92840$
 $\rho \quad +182 \quad 8' \quad +510$
 $\epsilon \quad +047 \quad a' \quad -871$
 $\quad +1019 \quad i \quad +678$
 $\quad +248 \quad \quad +317$

VIC 1331

Morrison's Center

1913 May 27.

Conditional Equations

Q

O-C

1	+ 0.91 - 1.91 + 1.00 - 7.3	+ 1.8 - 5.9 - 2.5 = - 6.6	- 7
2	+ 1.22 - 1.73 + 1.00 - 1.02	+ 2.3 - 5.4 - 2.5 = - 5.6	- 4.6
3	+ 1.42 - 1.57 + 1.00 + 4.5	+ 2.7 - 4.9 - 2.5 = - 4.7	+ 9.2
4	+ 1.91 - 0.91 + 1.00 - 1.07	+ 3.7 - 2.8 - 2.5 = - 1.6	- 9.1
5	+ 2.12 + 0.00 + 1.00 + 1.12	+ 4.1 + 0 - 2.5 = + 1.6	+ 9.6
6	+ 2.12 + 0.09 + 1.00 - 4.0	+ 4.1 + 3 - 2.5 = + 1.9	+ 1.1
7	+ 1.82 - 1.09 + 1.00 - 7.3	+ 3.5 + 3.4 - 2.5 = + 4.4	- 1.17
8	+ 1.42 + 1.57 + 1.00 + 1.02	+ 2.7 + 4.9 - 2.5 = + 5.1	+ 5.1
9	+ 0.42 + 2.08 + 1.00 + 5.2	+ 8 + 6.4 - 2.5 = + 4.7	+ 5.0

Normal Equations

- 26.1 + 25.5

Average = 5.7

$$\begin{aligned}
 + 22.51 - 2.58 + 13.37 &= + 26 \\
 - 2.58 + 1.794 - 1.31 &= + 5.36 \\
 + 13.37 - 1.31 + 9.00 &= - 4
 \end{aligned}$$

$$\begin{aligned}
 + 2.58 - 0.30 + 1.53 &= + 3 \\
 - 13.37 + 1.53 - 7.95 &= - 1.5
 \end{aligned}$$

$$+ 1.7.64 + 0.22 = + 5.39$$

$$+ 0.22 + 1.05 = - 1.9$$

$$- 0.22 - 0.00 = - 7$$

$$+ 1.05 = - 2.6$$

$$C = - 2.5$$

$$- 0.05 - 0.22 = + 4$$

$$+ 1.7.59 + 5.43$$

$$b = + 3.1$$

$$- 26.32 + 2.58 - 1.7.75 = + 8$$

$$+ 18.3.00 - 1.7.94 + 12.3.40 = - 5.5$$

$$- 3.81 - 4.38 = + 3.4$$

$$+ 18.0.42 + 12.2.09 = + 4.81$$

$$+ 6.46 + 4.38 = + 1.7$$

$$+ 2.65 = + 5.1$$

$$a = + 1.9$$

1331

Red. ad locum ahh

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

$$H + \alpha \quad 11^{\circ} 29' = 172^{\circ} 15'$$

$$H \quad 4 \quad 34$$

$$\alpha \quad 6 \quad 55$$

$$G \quad 21 \quad 42$$

$$G + \alpha \quad 4 \quad 37 = 69^{\circ} 15'$$

$$l \cos(G + \alpha) \quad 9.5494^{\circ}$$

$$g \quad 1.1584$$

$$\sin \quad 9.9709$$

$$\tan S \quad 9.7186$$

$$to \quad 8.8239$$

$$(g') \quad 0.7078$$

$$(g) \quad 9.6718$$

$$p \quad +1.82$$

$$e \quad +0.47$$

$$L \quad +0.19$$

$$+2.48^{\circ}$$

$$l \cos S \quad 9.9475^{\circ}$$

$$i \quad 0.8836$$

$$(i) \quad 0.8311$$

$$l \sin S \quad 9.6661$$

$$l \cos(H + \alpha) \quad 9.9960^{\circ}$$

$$h \quad 1.2778$$

$$\sin \quad 9.1298$$

$$\sec S \quad 0.0525$$

$$\frac{1}{15} \quad 8.8239$$

$$(h') \quad 0.9399^{\circ}$$

$$(h) \quad 9.2840$$

$$g' \quad +5.10^{\circ}$$

$$a' \quad -871$$

$$i \quad +678$$

$$+3.17^{\circ}$$

MG 1331

1913 May 27

Moon's Mean Position (1911.0)

$$\begin{array}{rcl}
 X_0 & = & 17.5751 \\
 \alpha & = & +10 \\
 \hline
 & & 17.5761
 \end{array}
 \qquad
 \begin{array}{rcl}
 Y_0 & = & 21.9146 \\
 \delta & = & +15 \\
 \hline
 & & 21.9161
 \end{array}$$

From Plate constants $X = 17.5434$ $Y = 21.9482$

$$\begin{array}{rcl}
 z & = & -0.4566 \\
 \log S & = & 9.65954 \\
 \log S & = & 9.94746 \\
 \log S & = & 8.50724 \\
 (X-A) & = & 1.20484 \\
 \eta & = & -0.0518 \\
 \log \tan S & = & 9.7118 \\
 S & = & 9.3191 \\
 \eta_1 & = & 6.0843 \\
 \eta_1 & = & +1
 \end{array}$$

$$X-A = 16.03 \quad \eta_0 = -0.0519$$

$$\begin{array}{rcl}
 A & = & 6.5531 \\
 X_0 & = & 6.5514.97 \\
 \log \eta_0 & = & 8.71517 \\
 \log \eta_0 & = & 7.33115
 \end{array}$$

$$Red = +24.8 \quad (S-D) = 1.38402$$

$$X' = 6.5517.45 \quad S-D = 24.2$$

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

$$S_0 = +27 \quad 37 \quad 07.8$$

$$Red = +32$$

$$S' = +27 \quad 37 \quad 11.0$$

1331 Linear Parallax

$$\alpha' = 6^{\circ} 55' 17.45''$$

$$\delta = 6^{\circ} 18' 32.5''$$

$$\alpha - \alpha' = -36^{\circ} 44.95''$$

$$-9^{\circ} 11' 14''$$

$$-3^{\circ} 58'$$

$$9^{\circ} 07' 16''$$

$$9.95727$$

$$0.00090$$

$$0.00553$$

$$9.96280$$

$$\gamma = 42^{\circ} 33' 00''$$

$$2.7^{\circ} 37' 14''$$

$$14^{\circ} 55' 49''$$

$$9.82640$$

$$8.23677$$

$$9.41102$$

$$0.16990$$

$$7.64409$$

$$S - \delta = 71.5^{\circ} 08.9'$$

$$S = +27^{\circ} 52' 19.9''$$

$$\alpha = 6^{\circ} 54' 45.76''$$

$$\text{Hart Alue } S = +27^{\circ} 52' 20.5''$$

$$\alpha = 6^{\circ} 54' 45.61''$$

$$O - C = -0.6$$

$$+0.15$$

$$\text{Red \& Land n.} = +0.1$$

$$+0.17$$

$$O - C = -0.5$$

$$+0.32$$

M161331

1913 May 27.

Moons Mean Position (1911.0)

$$\begin{array}{r}
 X_0 = 17.5751 \\
 \text{ap} = \quad + 1.0 \\
 \hline
 17.5761
 \end{array}$$

$$\begin{array}{r}
 Y_0 = 21.9146 \\
 \text{br} = \quad + 1.5 \\
 \hline
 21.9161
 \end{array}$$

From Plate constant $X = 17.5434$ $Y = 21.9482$

$$\bar{z} = -0.4566$$

$$\eta = -0.0518$$

$$\log S = 9.65954 \text{ m}$$

$$\text{WSS} = 9.94746$$

$$\text{WSS} = 8.50724$$

$$\log \tan S = 9.7118$$

$$S = 9.3191$$

$$\eta_1 = 6.0843$$

$$\eta_1 = +1$$

$$(X-A) = 1.20484 \text{ m}$$

$$X-A = 1.603 \quad \eta_0 = -0.0519$$

$$A = 6.5531$$

$$X_0 = 6.5514.97$$

$$\log \eta_0 = 8.71517 \text{ m}$$

$$\text{WSS} = 7.33115$$

$$\text{Red} = 2.48 \dots (S-D) = 1.38402 \text{ m}$$

$$X = 6.551745 \quad S-D = 24.2$$

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

$$S_0 = +27 \quad 37 \quad 078$$

$$\text{Red} = +32$$

$$S = +27 \quad 37 \quad 11.0$$

1331

Lunar Parallax

$$\begin{aligned}
 \delta' &= 6^{\circ} 55' 17.45'' \\
 \delta &= 6^{\circ} 18' 32.5'' \\
 \theta - \alpha &= -36^{\circ} 44.95'' \\
 &= -9^{\circ} 11' 14'' \\
 &= -3^{\circ} 58'' \\
 &= -9^{\circ} 07' 16''
 \end{aligned}$$

$$\begin{aligned}
 9.95727 \\
 0.00000 \\
 \hline
 0.00553 \\
 9.96280
 \end{aligned}$$

$$\begin{aligned}
 \gamma &= 42^{\circ} 33' 00'' \\
 &= 27^{\circ} 37' 11'' \\
 &= 14^{\circ} 55' 49''
 \end{aligned}$$

$$\begin{aligned}
 9.82640 \\
 8.23677 \\
 9.41102 \\
 \hline
 0.16990 \\
 7.64409
 \end{aligned}$$

$$\delta - \delta' = +15^{\circ} 08.9''$$

$$\delta = +27^{\circ} 52' 19.9''$$

$$\text{Naut Alman } \delta = +27^{\circ} 52' 20.5''$$

$$0 - c = -0.6''$$

$$\text{Red to stand n.} = +0.1''$$

$$0 - c = -0.5''$$

$$\delta' = +27^{\circ} 37' 11.0''$$

$$\pi = 59' 18.1''$$

$$\begin{aligned}
 9.86913 \\
 8.23677 \\
 9.20320 \\
 \hline
 0.05355 \\
 7.36265
 \end{aligned}$$

$$\alpha - \alpha' = -7' 55.42''$$

$$= -31.69''$$

$$\alpha = 6^{\circ} 54' 45.76''$$

$$\alpha = 6^{\circ} 54' 45.61''$$

$$+0.15''$$

$$+0.17''$$

$$+0.32''$$

