

KG

11366

11946

LXIX



3377

Small text line, likely a library or archival note.

3385

3384

Harvard Sunar Plates

Measures and Reductions

Wary Fowler

Plate No.	Date	Page
3377	1913 May 12	1
3385	1913 May 14	10
3384	1913 June 14 May	21

1
11
2

2
11
1

3
24
30

4
24
17

5
2
3

337.7 4 stars measured

Apr. 23

1

a	1	2
1	18589	19111
11.2	10860	1687670
22.8	56	61
	12	26
	<u>22.7749</u>	<u>7753</u>

a	2	3
1	18586	20055
	10889	1768579
	90857	8079
	38	51
	<u>11.2355</u>	<u>2373</u>

2	1	2
15.8	17010	18220
14.3	14149	1068589
	50	89
	14	30
	<u>14.2463</u>	<u>2460</u>

2	1	2
15.8	17011	18615
14.3	1516063	1045951
	61	52
	11	26
	<u>15.8150</u>	<u>8120</u>

3	1	2
24.6	15240	17450
34.7	788380	1483030
	83	35
	50	58
	<u>34.7365</u>	<u>7380</u>

3	1	2
24.6	16034	19256
34.7	1156967	1341506
	68	11
	39	60
	<u>24.5832</u>	<u>5847</u>

4	1	2
25.9	15162	17039
17.5	922932	1297780
	29	85
	70	54
	<u>17.5937</u>	<u>5936</u>

4	1	2
25.9	10121	12611
17.5	975960	1915
	61	12
		25
	<u>25.9639</u>	<u>9642</u>

5	1	2
26.4	13805	16885
30.3	1071009	997070
	11	70
	16	90
	<u>30.3098</u>	<u>3082</u>

5	1	2
26.4	15646	18030
30.3	915145	1452130
	48	31
	56	22
	<u>26.3496</u>	<u>3500</u>

Grade 4.

3377 4 beam measure

Apr 23

1 15559 19111
112 10860 1687670
228 56 61
18 26
22.7749 7753

1 15526 20055
10889 1768579
9081 809
38 51
11.2355 2373

158 17010 18220
143 1414945 1068589
50 89
14 30
14.2463 2460

17011 18615
1516063 1045951
61 52
11 26
15.8150 8170

3 15290 17450
246 788380 1483030
347 83 35-30
50 58
34.7365 7380

16034 19256
1186967 1341506
68 11
39 60
24.5832 5847

4 15162 17039
219 922952 1297280
171 25 85
70 54
17.5937 5936

10121 12611
975960 1711
6160 12257
25.9639 9642

5 13805 16885
264 1071009 997070
303 11 70
16 90
30.3098 3082

15646 18030
915145 1452130
48 31
56 22
26.3496 3500

Grade 4.

3377 moon-measures.

	α	γ	δ	ϵ	ζ
1 scratch					
w.6	19526	19766	19918	15769	
19.6	1318180	1614622	1557675	1012532	
	71	09	70	38	
	27	74	21	71	
	<u>19.6350</u>	<u>16347</u>	<u>20.5655</u>	<u>.5638</u>	

2
w.1
20.0

19909	16799
1117971	1554857
79	50
21	20
<u>20.1256</u>	<u>.1250</u>

3	18515
200	1700105
20.2	93
	29
	<u>20.1517</u>

16181
764952
31
97
<u>.1449</u>

remeasure(3)	
α	ϵ
.1506	.1459

4
19.6
21.0

19371	17678
1553010	1150101
1821	06
63	91
<u>19.6152</u>	<u>.6183</u>

5
19.6
21.4
mi
in
 α

18330	17726
1405071	11965
70	6071
45	33
<u>19.5738</u>	<u>.5765</u>

6
19.7
22.0

18309	18760
14950	1212920
5853	30
30	71
<u>19.6638</u>	<u>.6641</u>

3377 *lunar - measures*

	<i>d</i>	<i>n</i>	<i>d</i>	<i>n</i>
✓ scratch				
wt	19526	19766	19918	15769
196	1318180	1618622	1557675	1612532
	71	09	70	38
	27	74	21	71
	<u>19.6350</u>	<u>6347</u>	<u>20.5655</u>	<u>5638</u>

2
201
200

19909	16799
1117571	1554557
79	50
21	20
<u>20.1256</u>	<u>1250</u>

3	18515	16181
200	1700105	764952
202	93	31
	29	97
	<u>20.1517</u>	<u>1449</u>

<i>measure (31)</i>	
<i>d</i>	<i>n</i>
<u>1506</u>	<u>1459</u>

4
196
21.0

19371	17678
1553010	1150191
1821	06
63	91
<u>19.6152</u>	<u>6183</u>

5
19.6
21.4
mm
w
x

18330	17726
1405071	1196571
70	6071
45	33
<u>19.5738</u>	<u>5765</u>

6
19.7
22.0

18309	18760
1495053	1212920
58	30
30	71
<u>19.6638</u>	<u>6641</u>

3377 moon-measures.

α	δ	α	δ
2	16791	16601	
20.0	996150	1344140	
22.6	70	38	40
	05	10	
	<u>22.6841</u>	<u>6836</u>	

8
20.4
23.0

18275	19208
1122608	1622992
0929	28
81	12
<u>20.2936</u>	<u>2982</u>

9	14778	19444
21.0	1079594	1344839
23.5	81	45
	80	52
	<u>23.3988</u>	<u>3995</u>

10	14752	19890
21.6	963910	15010
23.5	4939	15-14
max	70	01
ing	<u>23.5118</u>	<u>5118</u>

3377 known measures

d 4 w d 76 w

2	16791	16601
200	996150	1344140
226	70	3840
	05	10
	<u>22.6841</u>	<u>6836</u>

8
204
230

18275
1122608
0929
81

20.2936

19
19208
1622922
28
12

2982

9	14778	19444
210	1079594	1344839
235	81	45
	80	52
	<u>23.3988</u>	<u>3995</u>

10	14752	19890
216	963910	15010
235	4939	1114
max	70	01
8	<u>23.1118</u>	<u>5118</u>

B 377 Times etc

Exh. stan 1913 May 12	12 ^h	22 ^m	✓	- 12 ^h	34 ^m	✓
" " known	12	27	478	- 12	27	482
clockfast		01	350	✓		
H. Sid T.	12	26	130	✓	$\theta - \alpha = +3^{\circ} 07''$	
H. hor.	4	44	31.05	✓		
G. Sid T.	17	10	44.05	✓		
Sid T. M. known	3	18	35.92	✓		
Internal	13	52	08.13	✓		
Reduction		2	16.33	✓		
G. M. T.	13	49	51.80	✓		

Franklin Ave		R. A.		Decl.	
known 14 ^h	9 ^h	19 ^m	58 ^s 10 ^o	+ 19°	26' 15"
known in 23167			12.820		
" -10.1367			- 2348	+ 2	10.0
Tabular place	9	19	34.62	+ 19	28 25.1

moon's age 7 days.

$$934 = 11.0$$

$$967.4 = 11.5$$

parallax	59' 04.64
semidiam	1.6 07.4
R	967.4
Augmentation	+ 11.5
Transdiction (4)	- 0.8
R	978.4
R	2097.3
(1+a) R	2096.5
R ²	4395.3

$$a = -4.2$$

B 377 Times etc
 Elevation 1913 May 12 12° 22" - 12° 34"
 Moon 12 27 478 - 12 27 482
 Cloudfast 01 350

H Sid T 12 26 130 6 - 2 - +3° 07"
 H hour 4 44 3105
 G Sid T 17 10 4405
 Sid T H hour 3 18 3592
 Internal 13 52 0813
 Reduction 2 1633
 G Sid T 13 49 5180

Franklin Ave R A. Neel.
 Moon 14° 9' 19" 58° 10' + 19° 26' 15"
 Moon 15° 2' 31.67 12820
 -10.1367 - 2348 + 2 100
 Tabular place 9 19 3462 + 19 28 251

lunar age 7 days.

934-110
 9674-114
 parallax 59' 04" 64
 semidiam 16 07 4
 R 9674
 Augmentation +11.4
 Transducer (*) - 08
 R 9784
 R 20973
 a = -42 (1+a)R 20965
 R² 43953

Preliminary

	- 72 y		+ 42		- 7560
+ 9158	- 1640	= + 7518	+ 45	= + 7563	= + 3
+ 8534	- 1025	= + 7509	+ 63	= + 7572	= + 12
+ 9942	- 2501	= + 7441	+ 98	= + 7539	= - 21
+ 8728	- 1267	= + 7461	+ 104	= + 7565	= + 5
+ 9638	- 2183	= + 7755	+ 105	= + 7560	= 0

	+ 702		+ 24		- 308
- 528	+ 786	= + 258	+ 45	= + 304	= - 4
- 818	+ 1107	= + 291	+ 28	= + 319	= + 11
- 1465	+ 1721	= + 256	+ 69	= + 325	= + 17
- 1578	+ 1817	= + 239	+ 35	= + 274	= - 34
- 1588	+ 1844	= + 256	+ 61	= + 317	= + 9

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Plate constants

	1	2	3	4	5
x	11.2364	15.8160	24.5840	25.9640	26.3498
y	10.3206	14.9626	23.5898	25.0912	25.3860
x-5	+9158	+8534	+9942	+8728	+9638
y	22.7751	14.2462	34.7372	17.5936	30.3090
y	22.8279	14.3278	34.8837	17.7514	30.4678
y-2	-528	-816	-1465	-1578	-1588

$$\begin{array}{rcl}
 x-3 & -70.94 & +4.2x \\
 +9158 & -1615 & +7543 + 47 = +7590 = 0 \\
 +8534 & -1010 & +7524 + 66 = +7590 = 0 \\
 +9942 & -2463 & +7479 + 103 = +7582 = -8 \\
 +8728 & -1247 & +7481 + 109 = +7590 = 0 \\
 +9638 & -2149 & +7489 + 111 = +7600 = +10 \\
 21.6710 & -1518 & +91 = 20.7693
 \end{array}$$

$$\begin{array}{rcl}
 y-2 & +71.5x & +0.64 \\
 -528 & +803 & +275 + 14 = +289 = -17 \\
 -816 & +1131 & +315 + 9 = +324 = +18 \\
 -1465 & +1758 & +293 + 21 = +314 = +8 \\
 -1578 & +1856 & +278 + 11 = +289 = -17 \\
 -1588 & +1884 & +296 + 18 = +314 = +8 \\
 21.4151 & +1549 & +13 = 21.5407
 \end{array}$$

$$\begin{array}{l}
 \text{Tables } a = -0.7 \quad e = -0.7 \quad a - e = 0.0 \quad b + d = -2.9 \\
 \text{Obs } a = -4.2 \quad e = -0.6 \quad a - e = -3.6 \quad b + d = -0.6
 \end{array}$$

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Plate constant

	1	2	3	4	5
x	112364	158160	245840	259640	263498
y	103206	149626	235898	250912	253860
x-y	+9158	+8534	+9942	+8728	+9638
y	227751	142462	347372	175936	303090
x	228279	143278	348837	177514	304678
y-x	-528	-816	-1465	-1578	-1588

$$\begin{array}{rcl}
 x-3 & -7094 & +4.22 \\
 +9158 & -1615 & +7543 + 47 = +7590 = 0 \\
 +8534 & -1010 & +7524 + 66 = +7590 = 0 \\
 +9942 & -2463 & +7479 + 103 = +7582 = -8 \\
 +8728 & -1247 & +7481 + 109 = +7590 = 0 \\
 +9638 & -2149 & +7489 + 111 = +7600 = +10 \\
 21.6710 & -1518 & +91 = 20.7693
 \end{array}$$

$$\begin{array}{rcl}
 y-x & +7152 & +0.64 \\
 -528 & +803 & +2754 + 14 = +289 = -17 \\
 -816 & +1131 & +315 + 9 = +324 = +18 \\
 -1465 & +1758 & +293 + 21 = +314 = +8 \\
 -1578 & +1856 & +278 + 11 = +289 = -17 \\
 -1588 & +1884 & +296 + 18 = +314 = +8 \\
 21.4151 & +1549 & +13 = 21.5407
 \end{array}$$

$$\begin{array}{l}
 \text{Tables } a = -0.7 \quad e = -0.7 \quad a-e = 0.0 \quad b+d = -2.9 \\
 \text{Obs } a = -4.2 \quad e = -0.6 \quad a-e = -3.6 \quad b+d = -0.6
 \end{array}$$

	p	$p-c$		
1	148.0	131.4	- 1.9	+ 2.1
2	132.5	115.9	- 2.3	+ 2.1
3	127.2	110.6	- 2.4	+ 1.7
4	101.5	84.9	- 2.5	- 0.4
5	90.0	73.4	- 2.4	- 1.4
6	73.8	57.2	- 2.1	- 2.6
7	52.8	36.2	- 1.5	- 3.8
8	41.0	24.4	- 1.0	- 4.3
9	18.7	2.1	- 0.1	- 4.7
10	0.0	343.4	+ 0.7	- 4.5

$$\lambda = -2.52$$

$$\beta = -4.72$$

$$c = 16.6$$

	p	$p-c$	$\lambda \sin(p-c)$	$\beta \cos(p-c)$	Ω	Component Hayne		Ω	$\Omega - c$
1	212.0	195.4	+ 0.7	+ 4.5	-3.5	+0.9	+83	-5	-88
2	227.5	210.9	+ 1.3	+ 4.1	-2.5	-0.1	-9	-22	-13
3	232.8	216.2	+ 1.5	+ 3.8	-2.0	+0.2	+18	+31	+13
4	258.5	241.9	+ 2.2	+ 2.2	+0.3	-0.3	-28	-28	0
5	270.0	253.4	+ 2.4	+ 1.4	+1.3	+1.1	+101	-29	-130
6	286.2	269.6	+ 2.5	+ 0.0	+2.8	-2.0	-184	-260	-76
7	307.2	290.6	+ 2.4	- 1.7	+4.4	+0.3	+28	+51	+23
8	319.0	302.4	+ 2.1	- 2.5	+4.9	+0.3	+28	+6	-22
9	341.3	324.7	+ 1.5	- 3.9	+5.7	-0.8	-74	-94	-20
10	0.0	343.4	+ 0.7	- 4.5	+5.5	+0.4	+37	+7	-30

	Old $\Omega - c$	Hayne	New $\Omega - c$
1	+26	+83	-57
2	+2	-9	+11
3	+53	+18	+35
4	-21	-28	+7
5	-29	+101	-130
6	-270	-184	-86
7	+29	+28	+1
8	+33	+28	+5
9	-128	-74	-54
10	-29	+37	-66

3377 Inverse Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 (y - y_0)^2$	$\Delta^2 c$
1	20.5646	-1.1064	-5	1.2252	4.3979	+26
2	20.1253	-1.5457	-4	2.3904	4.3955	+2
3	20.0000	-1.6710	-4	2.7936	4.4006	+53
4	19.6168	-2.0542	-1	4.2201	4.3932	-21
5	19.5752	-2.0958	0	4.3924	4.3924	-29
6	19.6640	-2.0070	+2	4.0272	4.3683	-270
7	20.0000	-1.6710	+4	2.7909	4.3982	+29
8	20.2959	-1.3751	+5	1.8895	4.3986	+33
9	21.0000	-0.6710	+6	0.4494	4.3825	-128
10	21.6710	0.0000	+6	0.0000	4.3924	-29

$$\text{Comp } R = 4.3953$$

	y	$y - y_0$	$(y - y_0)^2$
1	19.6348	-1.7812	3.1727
2	20.0000	-1.4160	2.0051
3	20.1483	-1.2677	1.6070
4	21.0000	-0.4160	0.1731
5	21.4160	0.0000	0.0000
6	22.0000	+0.5840	0.3411
7	22.6838	+1.2678	1.6073
8	23.0000	+1.5840	2.5091
9	23.3992	+1.9832	3.9331
10	23.5118	+2.0958	4.3924

Approx Center

$$x = 20.0 \quad y = 20.1483$$

$$22.6838$$

$$4.28321$$

$$y_0 = 21.4160$$

$$y - \text{max} = 23.5118$$

$$R = 2.0958$$

$$x - \text{min} = 19.5752$$

$$x_0 = 21.6710$$

$$\text{Center } \begin{cases} x_0 = 21.6710 \\ y_0 = 21.4160 \end{cases}$$

3377 Inverse Center

	x	$x - X_0$	Δx	$(x - X_0)^2$	$(x - X_0)(y - Y_0)$	$y - Y_0$
1	20.5646	-1.1064	-5	1.2252	4.3979	+2.6
2	20.1253	-1.5457	-4	2.3904	4.3955	+2
3	20.0000	-1.6710	-4	2.7936	4.4006	+5.3
4	19.6158	-2.0542	-1	4.2201	4.3932	-2.1
5	19.5752	-2.0958	0	4.3924	4.3924	-2.9
6	19.6640	-2.0070	+2	4.0272	4.3683	-2.70
7	20.0000	-1.6710	+4	2.7909	4.3982	+2.9
8	20.2959	-1.3751	+5	1.8895	4.3986	+3.3
9	21.0000	-0.6710	+6	0.4494	4.3825	-1.29
10	21.6710	0.0000	+6	0.0000	4.3924	-2.9

Comp K: 4.3753

	y	$y - Y_0$	$(y - Y_0)^2$
1	19.6348	-1.7812	3.1727
2	20.0000	-1.4160	2.0051
3	20.1483	-1.2677	1.6070
4	21.0000	-0.4160	0.1731
5	21.4160	0.0000	0.0000
6	22.0000	+0.5840	0.3411
7	22.6838	+1.2678	1.6073
8	23.0000	+1.5840	2.5091
9	23.3992	+1.9832	3.9331
10	23.5119	+2.0958	4.3924

Approx Center

$$x = 20.0 \quad y = 20.1483$$

$$22.6838$$

$$4.29321$$

$$Y_0 = 21.4160$$

$$y_{\text{max}} = 23.5118$$

$$10 = 2.0958$$

$$x_{\text{min}} = 19.5752$$

$$x_0 = 21.6710$$

$$\text{Center } \begin{cases} X_0 = 21.6710 \\ Y_0 = 21.4160 \end{cases}$$

Formation of Normal

	at	for	bu	an	
1	+ 1.98	- 28.9	- 46.3	+ 63.3	+ 101.5
2	+ 2.20	- 3.1	- 2.8	- 17.1	- 15.6
3	+ 2.12	- 88.5	- 67.4	- 58.5	- 44.5
4	+ 0.86	+ 43.0	+ 8.8	- 14.3	- 2.9
5	- 0.00	+ 61.0	- 0.0	+ 273.0	- 0.0
6				+ 172.9	- 49.9
7	- 2.12	- 48.5	+ 36.9	- 1.7	+ 1.3
8	- 2.18	- 45.5	+ 52.2	- 6.9	+ 7.9
9	- 1.32	+ 85.8	- 253.5	+ 36.2	- 106.9
10	+ 0.00	- 0.0	- 61.0	- 0.0	- 138.7
	+ 1.54	- 24.7	- 333.1	+ 446.9	- 247.8
	- 1.17				
	+ 0.37	giving (6) full wt.			

Residuals

	O	C	O - C
1	- 57	- 21 + 23 = + 2	- 59
2	+ 11	- 29 + 18 = - 11	+ 22
3	+ 35	- 31 + 16 = - 15	+ 50
4	+ 7	- 38 + 5 = - 33	+ 40
5	- 130	- 39 - 0 = - 39	- 91
6	- 86	- 38 - 7 = - 45	- 41
7	+ 1	- 31 - 16 = - 47	+ 48
8	+ 5	- 26 - 20 = - 46	+ 51
9	- 54	- 13 - 26 = - 39	- 15
10	- 66	+ 0 - 27 = - 27	- 39
			+ 211 - 245
			Average = 46

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Moon's Center Conditional Equations

	a	b	0	c	0-c
1	-1.11	-1.78	+26	+31	-5
2	-1.55	-1.42	+2	+24	-22
3	-1.67	-1.27	+53	+22	+31
4	-2.05	-0.42	-21	+7	-28
5	-2.10	+0.00	-29	-0	-29
[6	-2.01	+0.58	-270]	-10	-260]
7	-1.67	+1.27	+29	-22	+51
8	+1.38	+1.58	+33	-27	+6
9	-0.67	+1.98	-128	-34	-94
10	+0.00	+2.10	-29	-36	+7
					+95-178=
					Average = 30

Normal Equations

$$\begin{aligned}
 +20.03 + 1.54 &= -25 \\
 +1.54 + 1940 &= -333 \\
 -1.54 - 0.12 &= +2 \\
 +19.28 &= -331
 \end{aligned}$$

$$b = -17.2$$

$$+20.03 = -25 + 26 = +1$$

$$a = 0.0$$

Using (b) - with Haynes correction

$$\begin{aligned}
 +24.18 + 0.37 &= +44.7 \\
 +0.37 + 19.74 &= -24.8 \\
 -0.37 - 0.00 &= -7 \\
 +19.74 &= -25.5
 \end{aligned}$$

$$b = -12.9$$

$$+24.18 = +44.7 + 5 = +49.2$$

$$a = +18.7$$

Arch measured = 148° Average = -9.2

$$\frac{pc}{n} = 0.15 \quad - \frac{9.2}{10} = -0.61 \quad \Delta n = -0.7$$

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Moon's Center

Conditional Equations

	a	b	c	0	c	0-c
1	-1.11	-1.78	+26		+31	-5
2	-1.55	-1.42	+2		+24	-22
3	-1.67	-1.27	+13		+26	+31
4	-2.05	-0.42	-21		+7	-28
5	-2.10	+0.00	-29		-0	-29
6	-2.01	+0.58	-270		-10	
7	-1.67	+1.27	+29		-22	+51
8	+1.38	+1.58	+33		-27	+6
9	-0.67	+1.48	-128		-34	-94
10	+0.00	+2.10	-29		-36	+7

+95-178:

Average = 30

Normal Equations

$$+20.03 + 1.54 = -25$$

$$+ 1.54 + 19.40 = -333$$

$$- 1.54 - 0.12 = +2$$

$$+ 19.28 = -331$$

$$+20.03 = -25 + 26 = +1$$

$$b = 17.2$$

$$a =$$

Arc measured = 148° Average = -9.2

$$\frac{pc}{\pi} = 0.15$$

$$- \frac{9.2}{15} = -0.61$$

$$\Delta z = -0.7$$

Red. ad locum app.

$$S = +19^{\circ} 00' 33''$$

$$H + \alpha \quad 23^h 40^m = 355^{\circ}$$

$$H \quad 14 \quad 23$$

$$\alpha \quad 9 \quad 17$$

$$G \quad 20 \quad 28$$

$$\alpha + \alpha \quad 5 \quad 45 = 86^{\circ} 15'$$

$$\text{lews } S \quad 9.9756$$

$$i \quad 0.7028^m$$

$$(i) \quad 0.6784^m$$

$$\text{lews}(G + \alpha) \quad 8.8156$$

$$g \quad 1.0529$$

$$\sin \quad 9.9991$$

$$\tan S \quad 9.5372$$

$$8.8239$$

$$g' \quad 9.8685$$

$$g \quad 9.4131$$

$$\text{lews } S \quad 9.5128$$

$$\text{ws}(H + \alpha) \quad 9.9983$$

$$h \quad 1.2975$$

$$\sin \quad 8.9403^m$$

$$\sec S \quad 0.0244$$

$$h \quad 8.8239$$

$$h' \quad 0.8086$$

$$h \quad 9.0861^m$$

$$g \quad +4.03$$

$$g \quad +0.26$$

$$h \quad -0.12$$

$$\hline +1.17 \checkmark$$

$$g' = +0.74$$

$$h' = +6.44$$

$$i = -4.77$$

$$\hline +2.41 \checkmark$$

$$\begin{array}{r} 215.7 \\ 150 \\ \hline 65.7 \end{array}$$

Innovis Mean Position (1913.0)

$$X_0 = 21.6710^\circ$$

$$Y_0 = 21.4160^\circ$$

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

$$\text{true} = -9^\circ$$

$$\text{Mean} (21.6719)$$

$$21.4151^\circ$$

$$(21.4154)$$

$$\text{Template Constants } X = 20.7693^\circ$$

$$(20.7702)$$

$$Y = 21.5407^\circ$$

$$(21.5410)$$

$$\bar{z} = +2.7693^\circ$$

$$(+2.7702)$$

$$\eta = -0.4593^\circ$$

$$(-0.4590)$$

$$\log \bar{z} = 0.44237^\circ$$

$$(44251)$$

$$\log \tan \delta = 9.5370^\circ$$

$$\log \cos \delta = 9.97566^\circ$$

$$\log \sec \delta = 0.8847^\circ$$

$$8.50724^\circ$$

$$7.0534^\circ$$

$$7.4751^\circ$$

$$1.95947^\circ$$

$$(195961)$$

$$\eta_1 = +30^\circ$$

$$\alpha - \alpha' = +131.09^\circ$$

$$(31.12)$$

$$\eta_0 = -0.4623^\circ$$

$$(-0.4620)$$

$$A = 91547^\circ$$

$$\log \eta_0 = 9.66492^\circ$$

$$(6649)$$

$$\alpha_0 = 91718.09^\circ$$

$$(18.12)$$

$$7.33115^\circ$$

$$\text{Red} = +1.17^\circ$$

$$2.33377^\circ$$

$$(233399)$$

$$\alpha = 91719.26^\circ$$

$$(19.29)$$

$$S-D = -335.7^\circ$$

$$(355)$$

$$D = +190409^\circ$$

$$S_0 = +190033.3^\circ$$

$$(335)$$

$$\text{Red} = +24^\circ$$

$$S' = +190035.7^\circ$$

$$(35.9)$$

3377

8

Known Mean Position (1913.0)

$$X_0 = 21.6710$$

$$Y_0 = 21.4160$$

$$u = 0$$

$$v = -9$$

$$21.4151$$

$$\text{Iron Plate Constant } X = 20.7693 \quad Y = 21.5407$$

$$\bar{x} = +2.7693$$

$$\eta = -0.4593$$

$$\log 3 = 0.44237$$

$$\log \tan 5 = 9.5370$$

$$\log \cos 5 = 9.97566$$

$$3 = 6.8847$$

$$8.50724$$

$$10.534$$

$$1.95947$$

$$7.4751$$

$$X - X_0 = +1.3109$$

$$\eta_1 = +30$$

$$A = 9.1547$$

$$\eta_0 = -0.4623$$

$$X_0 = 9.1718.09$$

$$\log \eta_0 = 9.66492$$

$$7.33115$$

$$\text{Red} = +1.17$$

$$2.33377$$

$$X = 9.1719.26$$

$$S - D = -3.35.7$$

$$D = +19.04.09$$

$$S_0 = +19.00.33.3$$

$$\text{Red} = +2.9$$

$$S = +19.00.35.7$$

3377 Lunar Parallax.

$$\begin{aligned} \alpha' &= 9 \quad 17 \quad 19 \quad 26 \quad (19 \quad 29) \\ \theta &= 12 \quad 26 \quad 13.0 \\ \delta - \alpha' &= +3 \quad 08 \quad 53.74 \\ &= + \quad 47^{\circ} \quad 13' \quad 26'' \end{aligned}$$

$$S' = +19^{\circ} \quad 00' \quad 35.7 \quad (35.9)$$

$$\pi = 59' \quad 04.64$$

$$\begin{aligned} &+ \quad \quad \quad 17 \quad 01 \\ &+ \quad 46 \quad 56 \quad 25 \end{aligned}$$

$$\begin{aligned} &9.86913 \\ &8.23513 \\ &9.86570 \\ &\underline{0.02558} \\ &7.99554 \end{aligned}$$

$$\begin{aligned} &9957.27 \\ &999999 \\ &\underline{016573} \\ &0.12299 \end{aligned}$$

$$\alpha - \alpha' = +34' \quad 01.62$$

$$= +2^{\circ} \quad 16.11$$

$$\begin{aligned} \gamma &= 53^{\circ} \quad 00' \quad 23'' \\ &19 \quad 00 \quad 36 \\ &33 \quad 59 \quad 47 \end{aligned}$$

$$\begin{aligned} &9.82640 \\ &8.23513 \\ &974752 \\ &\underline{009762} \\ &7.90667 \end{aligned}$$

$$S - S' = +27 \quad 43.8$$

$$S = +19 \quad 28 \quad 19.5 \quad (19.7)$$

$$\text{Haukaleu } \delta = +19 \quad 28 \quad 25.1$$

$$\alpha = 9 \quad 19 \quad 35.37 \quad (35.40)$$

$$\alpha = 9 \quad 19 \quad 34.62$$

$$\delta - \alpha = -56$$

$$\text{With Hayn's Correction: } (-5.4)$$

$$\begin{aligned} &+0.75 \\ &(+0.78) \end{aligned}$$

3377

Lunar Parallaxes

9

 $\alpha = 9 \quad 17 \quad 19.26$ $\delta = +19^\circ 00' 35.7$ $\delta = 12 \quad 26 \quad 13.0$ $\delta - \alpha = 13 \quad 08 \quad 53.74$ $\delta = 59' 04.69$ $+ 47' 13' 26''$ $+ 17' 01''$ $+ 46 \quad 56 \quad 25$

9.86913

8.23513

9.86570

0.02558

7.99554

9.95727

9.99999

0.16573

0.12299

 $\alpha - \alpha = +34 \quad 01.62$ $= +2 \quad 16.11$ $\delta = 53^\circ 00' 23''$

19 00 36

33 59 47

9.82640

8.23513

9.74752

0.09762

7.90667

 $\delta - \delta = +27 \quad 43.8$ $\delta = +19 \quad 28 \quad 19.5$ $\alpha = 9 \quad 19 \quad 35.37$ Hankel's $\delta = +19 \quad 28 \quad 25.1$ $\alpha = 9 \quad 19 \quad 34.62$ $\delta - \alpha = -56$ $+0.75$

30.5
16.6

3385

Starm Measures

- 1914 April 28

10

	d	n	d	n
1	14948	17766	15894	17959
45	8525	14171	1016175	1364340
176	27	79	7480	41
	36	60	80	42
	<u>17.6417</u>	<u>.6411</u>	<u>4.4288</u>	<u>4310</u>
2	19508	15251	14431	17353
299	11790	1294038	1310000	865960
327	87	33	00	60
	79	40	14	37
	<u>32.7697</u>	<u>7688</u>	<u>29.8671</u>	<u>8681</u>
3	18328	16850	18225	17551
309	10490	1467870	1733138	841920
168	8581	70	36	11
	02	45	92	36
	<u>16.7822</u>	<u>.7825</u>	<u>30.9113</u>	<u>9120</u>

Grade $2\frac{1}{2}$

9

3285

Stars measured

1919 April 28

10

	d	v	d	v
1	14948	17766	15894	17959
45	8525	14171	1016175	1364340
176	27	79	7480	41
	36	60	80	42
	<u>17.6417</u>	<u>6411</u>	<u>44288</u>	<u>4310</u>
3	19508	15251	14431	17353
299	11790	1294038	1310000	865960
327	8788	33	00	60
	79	40	14	37
	<u>32.7697</u>	<u>7688</u>	<u>29.8671</u>	<u>8681</u>
3	18328	16850	18225	17551
309	10490	1467875	17331	841920
168	8581	70	3638	11
	02	45	92	36
	<u>16.7822</u>	<u>7825</u>	<u>30.9113</u>	<u>9120</u>

Grade 2 1/2

9

3385

Moon Measures

a

y

w

a

w

w

1 scratch

19.5 14370

18.1 13709

1108

180661

18409

907875

84

0670

17010

1189092

81

98

194884

19445

1455748

5048

30

48862 16100

19.0 1063039

18.6 3539

90

185460

19685

1512421

21

75

54423

18.7

19.0

16414

1388991

80

04

187476

15630

81375

39

21

74814

18.6

19.8

min

in

20

16400

1225961

60

91

185864

17070

1117991

91

66

58815

18.6

20.0

15391

1133514

2136

80

185938

17075

1110000

01

60

59666

19.0

21.1

10829

1021026

2286

210610

1103019

2919

10385

0641

3385

Moon measures

on 11

a

y

x

a

u

v

1 scratch

19.5 14370

18409

17010

19445

18.1 13709

907875

1189092

1415748

1108

84

81

50

180661067019488448862 16100

19685

190 1063039

1112421

186 35

21

90

75

18546054423

187

110

4

186

198

min

u

x

5

186

200

16424

15630

1388991

813751

80

39

04

21

1874767481

16400

17070

1225961

1117991

60

91

91

66

1858645881

15391

17075

1133514

1110000

2130

01

80

60

18593859666

190

211

10829

1103019

1021026

2919

2216

10385

2106100641

8
20
21
m
6
9
21.
21.

3385

moon-measures

12

d

y

n

d

n

n

n

7

20.0 19511

16156

21.7 11545-28

1413438

29

48

95

14

21.79647984

8

135-2411

12075

20.8

0413

11244

21.9 12701

4943

max

y 21.91889170

9 scratch

21.2 20059

17552

1939✓

18030

21.8 11555-75

16041

1167161

1572229

7070

3539

60

2629

40

51

61

21

21.8475848721.23012302

3385

Moon-Measures

212

a

y

n

d

u

v

7

200 19511

16156

217 11545²⁸

1413438

29

48

95

14

21.796479648 1352411 12075

208

0413

11244

219 12701

4943

under

9 21.918891709 scratch

21.2 20059

17552

19371

18030

21.8 11555⁷⁵

16041

1167161

1572229

7070

3539

60

2629

40

51

61

21

21.8475846721.23012302

3385

Times etc.

May 13

Exp. to Sun 1913 May 14 12^h 39^m ✓ - 12^h 51^m ✓
 " Moon 12 44 30.6 ✓ 12 44 30.8 ✓
 clock fast 1 37.9 ✓

H. Sid. T. 12 42 52.8 ✓ 0-4 = +1^h 39^m
 H. long 4 44 31.05 ✓
 G. Sid. T. 17 27 23.85 ✓
 Sid. T. M. Moon 3 26 29.03 ✓
 Interval 14 00 54.82 ✓
 Reduction 2 17.76 ✓
 G. M. T. 13 58 37.06 ✓

from Kant Alm. R. A. Decl.
 Moon 14^h 11^h 06^m 00^s 81 + 7° 25' 51" 8
 correction = 2.1267 ✓ 16.593 ✓
 " - 1.3823 ✓ - 2.94 ✓ + 23.1 ✓
 Tabular place 11 05 57.87 + 7 26 14.9

Moon's age 9 days.

934 = 11.9 ✓
 974 = 13.0

" parallax 59' 29" 84 ✓
 " semidiameter 16 14.2 ✓
 K 974.2 ✓
 Augmentation + 13.0 ✓
 Irradiation (1/2) - 0.6 ✓
 R 986.6 ✓
 R 2114.9 ✓
 (1+a) R 2115.4 ✓
 R² 4474.9 ✓

a = +2.5

3385

Tammes etc.

GV 13.

Exp. Est. Jan 1913 May 14 $12^{\circ} 39''$ $-12^{\circ} 51''$
 " Moon $12^{\circ} 44'$ 30.6 $-12^{\circ} 44'$ 30.8
 clock fast 1 37.9

H. Lid. $12^{\circ} 42'$ 52.8 $0-2-+1^{\circ} 36''$
 H. long $4^{\circ} 44'$ 31.05
 G. Lid. $17^{\circ} 27'$ 23.85
 Sid. T. Moon $3^{\circ} 26'$ 29.03
 Inclined $14^{\circ} 00'$ 54.82
 Reduction 2 17.76
 G. M. T. $13^{\circ} 58'$ 37.06

Transit Alt. R. A. Decl.
 Moon 14° $11^{\circ} 06'$ $00^{\circ} 81'$ $+7^{\circ} 25' 51'' 8$
 Moon 14° 2.1267 16.593
 -13823 -294 $+23.1$
 Tabular place $11^{\circ} 05'$ 57.87 $+7^{\circ} 26'$ 14.9

Moon's age 9 days

parallax $59' 29'' 84$
 sec. diam 16 142
 $939 \cdot 11.9$ R 979.2
 $979 \cdot 11.9$ R $+13.0$
 Augmentation -0.6
 Irradiation (2) R 986.6
 R 2.1149
 $a = +2.5$ $(1+a) R$ 2.1154
 R^2 4.4749

3385

Plate Constants

14

x	y	R.A.			Decl.		
44299	176414	10 ^h	56 ^m	14 ^s	+6 ^d	34'	09"
298676	327692	11	09	31	8	32	14
309116	167824	11	10	03	6	28	01
3 6521	67.19	132	75	48	120	94	24
2174	22.40	11	05	16	+7	11	28
-18	-22	-	1	56	-	3	07
374	40	11	03	20	+7	08	21
31	465						
116 ^s	187"						

Center of } $A = 11^h 03^m 20^s$
 plate } $D = +7^\circ 08' 21''$

$$\begin{array}{rclcl}
 2-3 & -23.54 & & -2.5x & +84 \\
 +841 & -915 = - & 74 & -11 = -85 & = -1 \\
 +760 & -770 = - & 10 & -75 = -85 & = -1 \\
 +388 & -394 = - & 6 & -77 = -83 & = +1 \\
 20.7016^v & -465^v & & -52^v & = 20.6583^v
 \end{array}$$

$$\begin{array}{rclcl}
 4-m & +25x & & -0.5y & -265 \\
 +163 & +111 = +274 & -9 & +265 & = 0 \\
 -466 & +747 = +281 & -16 & +265 & = 0 \\
 -499 & +773 = +274 & -8 & +266 & = +1 \\
 19.8018^v & +578^v & & -10^v & = 19.8261^v
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Tables } a: +0.9 & x = -1.1 & a-x = +2.0 & t+a = -1.4 \\
 \text{Obs } a: +2.5 & x = +0.5 & a-x = +2.0 & t+a = -1.5
 \end{array}$$

3385

Plate Constant

14

x	y	R.A.			Decl.		
44299	176414	10 ^h	56 ^m	14 ^s	+6 ^h	34'	09"
298676	327692	11	09	31	8	32	19
309116	167824	11	10	03	6	28	01
3 6521	67.19	132	75	48	120	94	24
2174	22.40	11	05	16	+7	11	28
18	2	-	1	56	-	3	07
374	40	11	03	20	+7	08	21
31	405						
116	187						

Center of } $A = 11^h 03^m 20^s$
 plate } $D = +7^h 08' 21''$

$$\begin{array}{rclcl}
 2-3 & -2354 & & -252 & +84 \\
 +341 & -915 & - & 74 & -11 & -85 & = & -1 \\
 +760 & -770 & - & 10 & -75 & -85 & = & -1 \\
 +388 & -394 & - & 6 & -77 & -83 & = & +1 \\
 207016 & -465 & & -52 & & & = & 206583
 \end{array}$$

$$\begin{array}{rclcl}
 4-m & +252 & & -0.54 & & -265 \\
 +163 & +111 & = & +274 & -9 & +265 & = & 0 \\
 -466 & +747 & = & +281 & -16 & +265 & = & 0 \\
 -499 & +773 & = & +274 & -8 & +266 & = & +1 \\
 198018 & +578 & & -10 & & & = & 198261
 \end{array}$$

Tables a: +0.9 $x = -11$ $a - z = +20$ $t + a = -14$
 obs a: +2.5 $x = +0.5$ $a - z = +20$ $t + a = -15$

4980 1/5
3033

3385 Standard Coordinates

15

Cape No. 1496 mag 5.1				Cape No. 1524 mag 5.1				Cape No. 1527 mag 8.0			
\angle	10 ^h	55 ^m	33.84	11 ^h	08 ^m	50.08		11 ^h	09 ^m	22.40	
L			83			14				48	
ϵ			83			08				35	
mean	10	55	33.83	11	08	50.10		11	09	22.41	
Prece		+	40.42		+	40.52			+	40.37	
α	10	56	14.25	11	09	30.62		11	10	02.78	
A	11	03	20	11	03	20		11	03	20	
$\alpha - A$	-	7	05.75	+	6	10.62		+	6	42.78	
$\sin(\alpha - A)$		-	425.68		+	370.58			+	402.72	
log μ	2	62908	m	2	56889			2	60500		
" μ_1	9	99714		9	99517			9	99723		
" μ_0	1	13346	m	1	07130			1	10947		
μ_0	-	13.5975		+	11.7842			+	12.8668		
μ_1	-	67		+	74			+	60		
μ		4.3958			29.7916				30.8928		
α		4.4299			29.8676				30.9116		
$\alpha - \mu$	+	341		+	760				+	388	
C	+6°	38'	19.3	+8°	36'	28.6		+6°	32'	14.5	
L			19.8			28.9				15.1	
ϵ			19.3			28.5				15.1	
mean	+6	38	19.5	+8	36	28.7		+6	32	14.9	
Prece		-4	10.5		-4	14.2			-4	14.4	
δ	+6	34	09.0	+8	32	14.5		+6	28	00.5	
D	+7	08	21	+7	08	21		+7	08	21	
$\delta - D$	-	34	12.0	+1	23	53.5		-	40	20.5	
$\tan(\delta - D)$		-	20521		+	50345			-	2420.6	
log μ	3	31220	m	3	70196			3	38392	m	
" μ_0	0	64335	m	1	03311			0	71507	m	
" μ_1	9	0613		9	1764			9	0544		
" μ_2	2	2669		2	1426			2	2189		
" μ_3	8	3816		8	3724			8	3267		
μ_0	-	4.3990		+	10.7922			-	5.1889		
" μ_1	+	241		+	236			+	212		
" μ_2	1	7.6251		3	2.8158			1	6.8323		
" μ_3	1	7.6414		3	2.7692			1	6.7824		
$\mu - \mu_0$	+	163		-	466			-	499		

3385 Standard Coordinates

15

Cape No. 1496 right			Cape No. 1524 right			Cape No. 1527 right		
C	10 ^h 55 ^m 33 ^s 84		11 ^h 08 ^m 50 ^s 08			11 ^h 09 ^m 22 ^s 40		
L		83		19			48	
B		83		08			35	
mean	10 55 33 83		11 08 50 10			11 09 22 41		
Pre		+ 40.42		+ 40.52			+ 40.37	
x	10 56 14 25		11 09 30 62			11 10 02 78		
A	11 03 20		11 03 20			11 03 20		
x-A	- 7 05 75		+ 6 10 62			+ 6 42 78		
tan(A)	- 4 25 68		+ 3 70 58			+ 4 02 72		
log	2 629 08		2 568 89			2 605 00		
log	9 997 14		9 995 17			9 997 23		
\log	1 133 46		1 071 30			1 109 47		
\log	- 1 359 75		+ 1 178 42			+ 1 286 68		
\log	- 67		+ 74			+ 60		
\log	4 395 8		2 979 16			3 087 28		
x	4 429 9		2 986 76			3 091 16		
2- \log	+ 341		+ 760			+ 388		
C	+ 6° 38' 19.3		+ 8° 36' 28.6			+ 6° 32' 14.5		
L		19.8		28.9			15.1	
B		19.3		28.5			15.1	
mean	+ 6 38 19.5		+ 8 36 28.7			+ 6 32 14.9		
Pre	- 4 10.5		- 4 14.2			- 4 14.4		
S	+ 6 34 09.0		+ 8 32 14.5			+ 6 28 00.5		
D	+ 7 08 21		+ 7 08 21			+ 7 08 21		
S-D	- 34 12.0		+ 1 23 53.5			- 40 20.5		
tan(A)	- 20 52.1		+ 50 34.5			- 24 20.6		
log	3.312 20		3.701 96			3.383 92		
\log	0 643 35		1 033 11			0 715 07		
\log	9.061 3		9.176 4			9.054 4		
\log	2 266 9		2 142 6			2 218 9		
\log	8 381 6		8 372 4			8 326 7		
\log	- 4.399 0		+ 10.792 2			- 5.188 9		
\log	+ 241		+ 236			+ 213		
\log	1 762 51		3 281 58			1 683 23		
\log	1 764 14		3 276 92			1 678 24		
\log	+ 163		- 466			- 499		

	p	$p-c$	$\lambda \sin(p-c)$	$\beta \cos(p-c)$
1	145.0	123.7	-0.5	+1.1
2	126.5	105.2	-0.5	+0.5
3	112.7	91.4	-0.6	+0.0
4	90.0	68.7	-0.5	-0.7
5	84.6	63.3	-0.5	-0.9
6	53.5	32.2	-0.3	-1.6
7	20.0	358.7	+0.0	-1.9
8	00	338.7	+0.2	-1.8
9	345.5	324.2	+0.3	-1.5

$$\lambda = -0.56$$

$$\beta = -1.90$$

$$c = 21.3$$

	p	$p-c$	$\lambda \sin(p-c)$	$\beta \cos(p-c)$	Ω	Corr from Haydn	Ω	$\Omega - c$
1	215.0	193.7	+0.1	+1.8	-1.4	+1.4	+129	+90
2	233.5	212.2	+0.3	+1.6	-1.0	-0.1	-9	+1
3	247.3	226.0	+0.4	+1.3	-0.6	-0.8	-74	-137
4	270.0	248.7	+0.5	+0.7	+0.1	+0.4	+37	-41
5	275.4	254.1	+0.5	+0.5	+0.3	+0.7	+64	+14
6	306.5	285.2	+0.5	-0.5	+1.3	-0.1	-9	+95
7	340.0	318.7	+0.4	-1.4	+21	0.0	0	+1
8	00	338.7	+0.2	-1.8	+23	-0.1	-9	+38
9	14.5	353.2	+0.1	-1.9	+23	-0.1	-9	-69

	old $\Omega - c$	Haydn	new $\Omega - c$
1	+142	+129	+13
2	+55	-9	+64
3	-102	-74	-28
4	-25	+37	-62
5	+25	+64	-39
6	+77	-9	+86
7	-43	0	-43
8	-13	-9	-4
9	-123	-9	-114

3385

Moon's Center

16

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$o - c$
1	19.4885	-1.2135	-3	1.4733	4.4891	+142
2	19.0000	-1.7020	-3	2.8978	4.4804	+55
3	18.7478	-1.9542	-2	3.8197	4.4647	-102
-4	18.5872	-2.1148	0	4.4724	4.4724	-25
5	18.5952	-2.1068	0	4.4386	4.4774	+25
6	19.0000	-1.7020	+3	2.8958	4.4826	+77
7	20.0000	0.7020	+4	0.4922	4.4706	-43
8	20.7020	0.0000	+4	0.0000	4.4736	-13
9	21.2302	+0.5282	+4	0.2794	4.4626	-123

Comp R² 4.4749

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	18.0666	-1.7364	-2	3.0158
2	18.5451	-1.2579	-1	1.5826
3	19.0000	-0.8030	-1	0.6450
4	19.8030	0.0000	0	0.0000
5	20.0000	+0.1970	0	0.0388
6	21.0626	+1.2596	+1	1.5868
7	21.7974	+1.9944	+2	3.9784
+8	21.9179	+2.1149	+2	4.4736
9	21.8481	+2.0451	+2	4.1832

Approx Center

$$x = 19.0 \quad y = 18.5451$$

$$21.0626$$

$$39.6077$$

$$y_0 = 19.8038$$

$$y_{\text{max}} = 21.9179$$

$$R = 2.1141$$

$$x_{\text{min}} = 18.5872$$

$$x_0 = 20.7013$$

$$\text{Center} \left\{ \begin{array}{l} x_0 = 20.7020 \\ y_0 = 19.8030 \end{array} \right.$$

3385

Lunar Center

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	19.4885	-1.2135	-3	1.4733	4.4891	+142
2	19.0000	-1.7020	-3	2.8978	4.4804	+55
3	18.7478	-1.9542	-2	3.8197	4.4647	-102
4	18.5872	-2.1148	0	4.4724	4.4724	-25
5	18.5952	-2.1068	0	4.4386	4.4774	+25
6	19.0000	-1.7020	+3	2.8958	4.4826	+77
7	20.0000	0.7020	+4	0.4922	4.4706	-43
8	20.7020	0.0000	+4	0.0000	4.4736	-13
9	21.2302	+0.5282	+4	0.2794	4.4626	-123

Compl R² 4.4749

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	18.0666	-1.7364	-2	3.0158
2	18.5451	-1.2579	-1	1.5826
3	19.0000	-0.8030	-1	0.6450
4	19.8030	0.0000	0	0.0000
5	20.0000	+0.1970	0	0.0388
6	21.0626	+1.2596	+1	1.5868
7	21.7974	+1.9944	+2	3.9784
8	21.9179	+2.1149	+2	4.4736
9	21.8481	+2.0451	+2	4.1832

Approx Center

$$x = 19.0 \quad y = 18.5451$$

$$\underline{21.0626}$$

$$3.96077$$

$$y_0 = 19.8038$$

$$y - \text{max} = 21.9179$$

$$R = 21.141$$

$$x - \text{min} = 18.5872$$

$$x_0 = 20.7013$$

$$\text{Center} \left\{ \begin{array}{l} x_0 = 20.7020 \\ y_0 = 19.8030 \end{array} \right.$$

Formation of hornals.

with dayn even

	ab	an	bn	an	bn
1	+ 2.10	- 171.9	- 247.0	- 15.7	- 22.6
2	+ 2.14	- 93.5	- 69.4	- 108.9	- 80.5
3	+ 1.56	+ 199.0	+ 81.5	+ 54.6	+ 22.4
4	- 0.00	+ 52.7	- 0.0	+ 131.0	- 0.0
5	- 0.41	- 52.7	+ 5.0	+ 82.4	- 7.8
6	- 2.14	- 131.0	+ 97.0	- 146.2	+ 108.4
7	- 1.39	+ 30.1	- 85.5	+ 30.1	- 85.5
8	+ 0.00	- 0.0	- 27.4	- 0.0	- 8.4
9	+ 1.09	- 65.2	- 252.0	- 60.4	- 233.8
	+ 2.95	- 232.5	- 497.8	- 33.1	- 307.8

	0	c	0 - c
1	+ 13	- 1 + 28 = + 27	- 14
2	+ 64	- 1 + 20 = + 19	+ 45
3	- 28	- 1 + 13 = + 12	- 40
4	- 62	- 1 - 0 = - 1	- 61
5	- 29	- 1 - 3 = - 4	- 35
6	+ 86	- 1 - 20 = - 21	+ 107
7	- 43	- 0 - 32 = - 32	- 11
8	- 4	+ 0 - 34 = - 34	+ 30
9	914	+ 0 - 33 = - 33	- 81
			+ 182 - 242
			average = 45

33 85

Moon's Center Conditional Equations

6 17

	a	b	0	c	0-c
1	-1.21	-1.74	= +142	+19 + 43 = +52	+90
2	-1.70	-1.26	= +55	+13 + 31 = +44	+11
3	-1.95	-0.80	= -102	+15 + 20 = +35	-137
4	-2.11	+0.00	= -25	+16 - 0 = +16	-41
5	-2.11	+0.20	= +25	+16 - 5 = +11	+14
6	-1.70	+1.26	= +77	+13 - 31 = -18	+95
7	-0.70	+1.99	= -43	+5 - 49 = -44	+1
8	+0.00	+2.11	= -13	-0 - 51 = -51	+38
9	+0.53	+2.05	= -123	-4 - 50 = -54	-69
					+249 - 247

Average 55

Normal Equations

$$\begin{aligned}
 +20.77 + 2.95 &= -232 \\
 +2.95 + 19.50 &= -498 \\
 -2.95 - 0.42 &= +33 \\
 +19.08 &= -465
 \end{aligned}$$

$$b = -24.4$$

$$+20.77 = -232 + 72 = -160$$

$$a = -7.8$$

Normals with Hay's corrections

$$\begin{aligned}
 +20.77 + 2.95 &= -33 \\
 +2.95 + 19.50 &= -308 \\
 -2.95 - 0.42 &= +5 \\
 +19.08 &= -303
 \end{aligned}$$

$$b = -15.9$$

$$+20.77 = -33 + 47 = +14$$

$$a = +0.7$$

$$\text{Arc measured} = 164^\circ \quad \text{Average } 0-c = 0$$

3385

Moons Center

17

Conditional Equations

	a	b	0	c	0-c
1	-1.21	-1.74	= +1.42	+1.9 + 4.3 = +5.2	+9.0
2	-1.70	-1.26	= +5.5	+1.3 + 3.1 = +4.4	+1.1
3	-1.95	-0.80	= -1.02	+1.5 + 2.0 = +3.5	-1.37
4	-2.11	+0.00	= -2.5	+1.6 - 0 = +1.6	-4.1
5	-2.11	+0.20	= +2.5	+1.6 - 5 = +1.1	+1.4
6	-1.70	+1.26	= +7.7	+1.3 - 3.1 = -1.8	+9.5
7	-0.70	+1.99	= -4.3	+5 - 4.9 = -4.4	+1
8	+0.00	+2.11	= -1.3	-0 - 5.1 = -5.1	+3.4
9	+0.53	+2.05	= -1.23	-4 - 5.0 = -5.4	-6.9
					+2.49 - 2.47

Normal Equations

$$\begin{aligned}
 +20.77 + 29.5 &= -232 \\
 +29.5 + 19.50 &= -498 \\
 -29.5 - 0.42 &= +33 \\
 +19.08 &= -465
 \end{aligned}$$

$$b = -244$$

$$+20.77 = -232 + 72 = -160$$

$$a = -7.8$$

Normals with Hough's corrections

$$\begin{aligned}
 +20.77 + 29.5 &= -33 \\
 +29.5 + 19.50 &= -308 \\
 -29.5 - 0.42 &= +5 \\
 +19.08 &= -303
 \end{aligned}$$

$$b = -159$$

$$+20.77 = -33 + 97 = +64$$

$$a = +0.7$$

Am measured = 1.64° Average 0-c = 0

3385 Moon's Mean Position (1913.0)

$$X_0 = 20.7020^\circ \quad Y_0 = 19.8030^\circ$$

$$\frac{1}{2}a = \frac{-4}{20.7016} \quad \frac{1}{2}b = \frac{-12}{19.8018}$$

$$\text{Haupt} = 20.7020$$

$$19.8022$$

$$\text{From Plate Constants } X = 20.6583^\circ \quad Y = 19.8265^\circ$$

$$\xi = +2.6582^\circ$$

$$\eta = -2.1734^\circ$$

$$\log \xi = 0.4246^\circ$$

$$\cos \xi = 9.99688^\circ$$

$$8.50724$$

$$(\alpha - A) = 1.92045^\circ$$

$$\alpha - A = +1.2328^\circ$$

$$A = 11.0320^\circ$$

$$\alpha_0 = 11.044328^\circ$$

$$\text{Red} = +1.59^\circ$$

$$\alpha' = 11.044487^\circ$$

$$\log \tan \delta = 9.0840^\circ$$

$$0.8492^\circ$$

$$7.0534^\circ$$

$$6.9866^\circ$$

$$\eta_1 = +1.0^\circ$$

$$\eta_0 = -2.1749^\circ$$

$$\log \eta_1 = 0.33744^\circ$$

$$7.3311^\circ$$

$$(\delta - 1) = 3.00624^\circ$$

$$\delta - 1 = -16.545^\circ$$

$$D = +7.0821^\circ$$

$$S_0 = +6.51265^\circ$$

$$\text{Red} = -7.1^\circ$$

$$\delta' = +6.51194^\circ$$

3385 Unknown Mean Position (1913.0)

$$X_0 = 207020 \quad Y_0 = 198030$$

$$\mu_{\alpha} = -4 \quad \mu_{\delta} = -12$$

$$207016 \quad 198018$$

$$207020 \quad 198022$$

$$\text{From Plate Constant } X = 20658^{\frac{3}{2}} \quad Y = 19826^{\frac{5}{2}}$$

$$\xi = +2658^{\frac{3}{2}}$$

$$\eta = -2173^{\frac{5}{2}}$$

$$\log S = 0.4246^{\frac{7}{2}}$$

$$\log \tan S = 9.9968^{\frac{5}{2}}$$

$$8.50724$$

$$\log \tan S = 9.0840$$

$$0.8492$$

$$7.0534$$

$$6.9866$$

$$(2-k) = 1.9204^{\frac{5}{2}}$$

$$\alpha - A = +12328$$

$$A = 110320$$

$$\alpha = 11044328$$

$$\text{Red} = +159$$

$$\alpha' = 11044487$$

$$\eta = +10$$

$$\eta_0 = -2174^{\frac{5}{2}}$$

$$\log \eta = 0.3374^{\frac{36}{2}}$$

$$7.3311^{\frac{5}{2}}$$

$$(S-1) = 3.0062^{\frac{21}{2}}$$

$$S-1 = -1654^{\frac{5}{2}}$$

$$D = +70821$$

$$S_0 = +65126^{\frac{5}{2}}$$

$$\text{Red} = -71$$

$$\delta' = +65119^{\frac{4}{2}}$$

3385 Red. ad locum app.

19

$$\delta_0 = +6^\circ 51' 26''$$

$$H + \alpha \quad 1^h 21^m = 20^\circ 15'$$

$$H \quad 14 \quad 16$$

$$\alpha \quad 11 \quad 05$$

$$G \quad 20 \quad 29$$

$$G + \alpha \quad 7 \quad 34 = 143^\circ 30'$$

$$\begin{array}{r} \text{long cos } S \\ \hline 9.9969 \\ 0.6839 \text{ m} \\ \hline 0.6803 \text{ m} \end{array}$$

$$l \cos(G + \alpha) \quad 9.6007^m$$

$$S \quad 1.0564$$

$$\sin \dots \quad 9.9624$$

$$\tan S \quad 9.0802$$

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

$$\begin{array}{r} S' \\ S \\ \hline 0.6571 \text{ m} \\ 89229 \end{array}$$

$$\begin{array}{r} h \\ S' \\ S \\ \hline +1.05 \\ +0.08 \\ +0.46 \\ \hline +1.59^h \end{array}$$

$$\sin S \quad 9.0770^v$$

$$\cos(H + \alpha) \quad 9.9723^v$$

$$h \quad 1.2987$$

$$\sin \dots \quad 9.5392$$

$$\cos S \quad 0.0031$$

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

$$\begin{array}{r} h' \\ h \\ \hline 0.3480^v \\ 9.6649 \end{array}$$

$$\begin{array}{r} S' \\ S' \\ S \\ \hline -4.54^v \\ +223^v \\ \hline -4.79 \\ -7.10^v \end{array}$$

6

3385 Red and brown app

$$S_0 = +6^\circ 51' 26''$$

$$H + \alpha \quad 1^\circ 21' = 20^\circ 15'$$

$$H \quad 14 \quad 16$$

$$\alpha \quad 11 \quad 05$$

$$G \quad 20 \quad 29$$

$$G + \alpha \quad 7 \quad 34 = 143^\circ 30'$$

$$l \cos(G + \alpha) \quad 9.6007 \sim$$

$$S \quad 1.0564$$

$$\sin \quad 9.9629$$

$$\tan S \quad 9.0802$$

$$\frac{S}{H} \quad 8.8239$$

$$\frac{S}{G} \quad 0.6571 \sim$$

$$\frac{S}{G} \quad 9.7229$$

$$f \quad +1.05$$

$$S' \quad +0.08$$

$$h \quad +0.46$$

$$\quad \quad \quad +1.59 \checkmark$$

$$\log \cos \quad 9.9969$$

$$\quad \quad \quad 0.6834 \sim$$

$$(L) \quad 0.6803 \sim$$

$$\sin S \quad 9.0770$$

$$\cos(H + \alpha) \quad 9.9723$$

$$h \quad 1.2987$$

$$\sin \quad 9.5392$$

$$\cos S \quad 0.0031$$

$$\frac{S}{h} \quad 8.8239$$

$$L' \quad 0.3480$$

$$h \quad 9.6649$$

$$\frac{S}{h} \quad -4.54$$

$$\frac{S}{h} \quad +2.23$$

$$i \quad -4.79$$

$$\quad \quad \quad -7.10 \checkmark$$

6

3385

Lunar Parallax.

20

$$\begin{aligned} \alpha' &= 11^{\circ} 04' 44.87'' \\ G &= 12 \quad 42 \quad 52.8 \\ \theta - \alpha &= +1 \quad 38 \quad 08.0 \\ &= + \quad 24^{\circ} 32' 00'' \end{aligned}$$

$$+ \quad \quad \quad 9 \quad 13''$$

$$+ \quad 24 \quad 22 \quad 47''$$

$$995727''$$

$$0.00000''$$

$$004057''$$

$$\hline 999784''$$

$$\gamma = 44 \quad 51 \quad 26.5''$$

$$6 \quad 51 \quad 19.5''$$

$$38 \quad 00 \quad 07.2''$$

$$982640''$$

$$823820''$$

$$978936''$$

$$015160''$$

$$\hline 800556''$$

$$S - S' = +34 \quad 49.3''$$

$$S = +7 \quad 26 \quad 08.7''$$

$$\text{Hankalen } S = +7 \quad 26 \quad 14.9''$$

$$O - C$$

$$- 6.2''$$

$$+ 0.72''$$

$$S' = +6^{\circ} 51' 19.4''$$

$$\pi = 59' 29.84''$$

$$9.86913''$$

$$8.23820''$$

$$9.61828''$$

$$0.00367''$$

$$\hline 7.72928''$$

$$\alpha - \alpha' = +18' 25.85''$$

$$= + 1^{\text{m}} 13.72''$$

$$\alpha = 11 \quad 05 \quad 58.59''$$

$$\alpha = 11 \quad 05 \quad 57.87''$$

This is corrected for Haug's correction

3 385

Human Parallax

W

$$\alpha = 11^{\circ} 04' 44.87''$$

$$\delta = 12^{\circ} 42' 52.8''$$

$$\delta' = +6^{\circ} 51' 19.4''$$

$$3-\alpha = +1^{\circ} 38' 08.0''$$

$$\pi = 5.9' 29.84''$$

$$+ 24^{\circ} 32' 00''$$

$$+ 9' 13''$$

$$= 24^{\circ} 22' 47''$$

$$986913$$

$$823820$$

$$961828$$

$$\underline{000367}$$

$$772928$$

$$995727$$

$$000000$$

$$\underline{004057}$$

$$999784$$

$$9-\alpha = +18' 25.87''$$

$$= + 1^{\circ} 13.72''$$

$$\mu = 44' 51'' 26.5''$$

$$6' 51'' 19.3''$$

$$38' 00'' 07.2''$$

$$9.52640$$

$$823820$$

$$9.78936$$

$$\underline{015160}$$

$$800556$$

$$S-S' = +34' 49.3''$$

$$S = +7' 26'' 08.7''$$

$$\alpha = 11^{\circ} 05' 58.59''$$

$$\text{Hankel's } S = +7' 26'' 14.9''$$

$$\alpha = 11^{\circ} 05' 57.87''$$

$$O-C = -6.2''$$

$$+0.72''$$

This is corrected for Haynes

6

32

32
16

1914 May 1st

2

15-780
996760
60
00

5824

8880
7472
85-46

9671

$$\begin{array}{r} 9598 \\ 925148 \\ 40 \end{array}$$

. 0 6 5 - 2

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22

1914 May 1st

$$\begin{array}{r} 15780 \\ 9967 \\ 60 \\ 90 \end{array}$$

58 24

8880
7472
8546

9671

9898
921148
40

50

69

3384 moon-measures

22

$\begin{array}{r} 1 \\ 20.0 \\ 17.9 \end{array}$
 $\begin{array}{r} 1223045- \\ 29 \\ 11872 \end{array}$
 $\begin{array}{r} 10341 \\ 991915- \\ 0915- \end{array}$

17.9637.95732 scratch

$\begin{array}{r} 19.5 \\ 184 \end{array}$
 $\begin{array}{r} 16972 \\ 1264959 \\ 62 \\ 90 \\ 18.4322 \end{array}$
 $\begin{array}{r} 14578 \\ 891920 \\ 20 \\ 89 \\ .4335- \end{array}$

$\begin{array}{r} 17670 \\ 12838 \\ 3941 \\ 81 \\ 19.5-164 \end{array}$

$\begin{array}{r} 16410 \\ 1126045- \\ 6145- \\ 30 \\ .5163 \end{array}$

$\begin{array}{r} 3 \\ 19.2 \\ 19.0 \end{array}$

$\begin{array}{r} 165-39 \\ 870183 \\ 99 \\ 40 \\ 19.2154 \end{array}$

$\begin{array}{r} 17430 \\ 1526060 \\ 60 \\ 45- \\ 2173 \end{array}$

$\begin{array}{r} 4 \\ 19.1 \\ 19.7 \\ 19.1 \\ 20.0 \end{array}$

$\begin{array}{r} 165-18 \\ 7400 \\ 9964 \\ 40 \\ 19.0863 \end{array}$

$\begin{array}{r} 17433 \\ 1654046 \\ 4446 \\ 53 \\ 10892 \end{array}$

$\begin{array}{r} 5 \\ 19.1 \\ 20.0 \end{array}$

$\begin{array}{r} 16517 \\ 761912 \\ 0812 \\ 49 \\ 19.1067 \end{array}$

$\begin{array}{r} 17449 \\ 1635252 \\ 4952 \\ 63 \\ 1049 \end{array}$

$\begin{array}{r} 6 \\ 19.6 \\ 21.0 \end{array}$

$\begin{array}{r} 15495 \\ 1076041 \\ 4641 \\ 10 \\ 19.5247 \end{array}$

$\begin{array}{r} 18465 \\ 1317989 \\ 7989 \\ 72 \\ 5286 \end{array}$

20

3384 *lunar - measure*

22

$$\begin{array}{r}
 \text{L} \quad 1223045 - 10341 \\
 200 \quad 29 \quad 99.1915 \\
 179 \quad 11872 \quad 0915
 \end{array}$$

$$\underline{17.9637}$$

$$\underline{9573}$$

2 scratch

$$\begin{array}{r}
 195 \quad 16972 \quad 14578 \\
 184 \quad 1264959 \quad 891920 \\
 \quad 62 \quad 20 \\
 \quad 90 \quad 89 \\
 \underline{184322} \quad \underline{4335}
 \end{array}$$

$$\begin{array}{r}
 17670 \\
 12838 \quad 41 \\
 \quad 39 \\
 \quad 81 \\
 \underline{195164}
 \end{array}$$

$$\begin{array}{r}
 16410 \\
 11260 \quad +5 \\
 \quad 61 \\
 \quad 30 \\
 \underline{5163}
 \end{array}$$

$$\begin{array}{r}
 3 \\
 192 \\
 190
 \end{array}$$

$$\begin{array}{r}
 16539 \\
 870183 \\
 \quad 99 \\
 \quad 40 \\
 \underline{192154}
 \end{array}$$

$$\begin{array}{r}
 17439 \\
 1526060 \\
 \quad 60 \\
 \quad 45 \\
 \underline{2173}
 \end{array}$$

$$\begin{array}{r}
 4 \\
 191 \\
 197 \\
 \text{mm} \\
 \text{m} \\
 \text{m}
 \end{array}$$

$$\begin{array}{r}
 16518 \\
 7400 \\
 \quad 9909 \\
 \quad 40 \\
 \underline{190863}
 \end{array}$$

$$\begin{array}{r}
 17433 \\
 1654046 \\
 \quad 44 \\
 \quad 53 \\
 \underline{10892}
 \end{array}$$

$$\begin{array}{r}
 5 \\
 191 \\
 200
 \end{array}$$

$$\begin{array}{r}
 16517 \\
 761912 \\
 \quad 08 \\
 \quad 49 \\
 \underline{191067}
 \end{array}$$

$$\begin{array}{r}
 17449 \\
 1635252 \\
 \quad 49 \\
 \quad 63 \\
 \underline{1049}
 \end{array}$$

$$\begin{array}{r}
 6 \\
 196 \\
 200
 \end{array}$$

$$\begin{array}{r}
 154915 \\
 1076041 \\
 \quad 46 \\
 \quad 10 \\
 \underline{195247}
 \end{array}$$

$$\begin{array}{r}
 18465 \\
 1317989 \\
 \quad 79 \\
 \quad 72 \\
 \underline{5256}
 \end{array}$$

50

3384 moon decreases

23

<u>7</u>	20416	17487
20.0	1590400	11990
215	00	8781
	28	04
	<u>21.4521</u>	<u>4490</u>

<u>8</u>	19421	18496
21.0	1118168	1677050
217	78	50
max	21	10
in		
y	<u>21.8245</u>	<u>8258</u>

9 scratch

21.8	19421	19195	18380	20789
20.7	1217168	1644150	1676771	1182829
	71	58	73	20
	39	10	85	12
	<u>21.7264</u>	<u>7251</u>	<u>21.8389</u>	<u>8383</u>

image of moon rather blurry.

2

3384

Moon distances

23

1	20416	17487
20.0	1090400	1199081
20.5	00	87
	28	04
	<u>20.4521</u>	<u>4490</u>

21.4	19421	18496
21.7	1118168	1677050
was	78	10
	21	10
8	<u>21.8245</u>	<u>5258</u>

9 scratch

21.8	19421	19195	18380	20789
20.7	1217168	1644150	1676771	1182829
	71	18	73	2029
	39	10	85	12
	<u>21.7264</u>	<u>725.1</u>	<u>218389</u>	<u>8383</u>

Image of moon rather blurry.

29

3384 *Trinis etc.* 24.
 Sept 1913 May 14 12 24^m ✓ - 12 36^m ✓
 - - - - - 12 30 19.7^v - 12 30 19.9^v
 clock lost 1 37.9^v

Sid 12 28 41.9^v $\theta - \alpha' = +1'' 23''$
 H. long 4 44 31.05^v
 G. Sid 17 13 12.95^v
 Sid in moon 3 26 29.03^v
 Internal 13 46 43.92^v
 Red. 2 15.44^v
 G. in T. 13 44 28.48^v

Surhaut Allen R-A local.
 moon 14" 11" 06^m 00.81^v + 7° 25' 51" 8^v
 motion 2.1270 16.588
 - - - 15.5253^v - 33.02^v + 4 17.5
 Tabular place 11 05 27.79^v + 7 30 09.3

moon's age 9 days

$$984 = 12.1$$

$$974 = 13.2$$

$$\alpha = +1.9$$

parallax 59' 29.77^v
 semi-dia 16 14.2^v
 R 974.2^v
 Augmentation +13.2^v
 Irradiation (3) -0.7^v
 R 986.7^v
 R 2115.1^v
 (1 + α) R 2115.5^v
 R² 4475.3^v

3384 *Trinities etc* 24.
 1913 May 14 12^h 24^m - 12^h 36^m
 - 12 30 197 - 12 30 199
 clock lost - 1 379

A Sid 12 28 419 $\Theta - \alpha - +1^{\circ} 23'$
 Whong 4 44 3105
 G Sid 17 13 1295
 Sid: in room 3 26 2903
 Tentative 13 46 4392
 Reel 2 1544
 to in 13 49 2848

Surmountable R.A. Reel
 hours 14^h 11^h 06^m 00^s 81 + 7^h 25^m 51^s 8
 minutes 2 1270 16588
 - 15,5253 - 3302 + 4 175
 Tabular place 11 05 2779 + 7 30 893

known age 9 days

panels 59 2977
 penicillin 16 142
 $q + 4 = 12.1$ R 9742
 $174 132$ Augmentation +132
 Terrestrial 131 - 07
 R 9867
 R 21151
 $a = +1.9$ $11 \pm a/R$ 2.1155
 R^2 44753

3384 Plate constants

25

	1	2	3
x	5.5815	30.9668	32.0644
y	4.3958	29.7916	30.8728
$x - y$	+1.1857	+1.1752	+1.1916
y	16.9612	32.1778	16.1932
x	17.6251	32.8158	16.8323
$y - x$	-.6639	-.6380	-.6391

$$\begin{array}{rclcl}
 2-3 & +10.24 & -1.9x & -1.2020 & \\
 +1.1857 + 17.3 & = +12030 & -11 & = +12019 & = -1 \\
 +1.1752 + 32.8 & = +12080 & -59 & = +12021 & = +1 \\
 +1.1916 + 16.5 & = +12081 & -61 & = +12020 & = 0 \\
 21.2028 + 201 & & -40 & & = 20.0169
 \end{array}$$

$$\begin{array}{rclcl}
 y - x & -9.4x & -1.34 & +6713 & \\
 -6639 - 52 & = -6691 & -22 & = -6713 & = 0 \\
 -6380 - 291 & = -6671 & -42 & = -6713 & = 0 \\
 -6391 - 301 & = -6692 & -21 & = -6713 & = 0 \\
 19.7088 - 199 & & -26 & & = 20.3576
 \end{array}$$

Tables $a = +1.0$ $e = -1.0$ $a - e = +2.0$ $b + d = -1.4$
 Obs $a = +1.9$ $e = +1.3$ $a - e = +0.6$ $b + a = -0.8$

3884 Plate Constants

	1	2	3
2	5.5815	30.9668	320644
3	4.3958	29.7916	308728
2-3	+1.1857	+1.1752	+1.1916
4	16.9612	32.1778	161932
2	17.6251	32.8158	168323
4-2	-6639	-6380	-6391

$$\begin{array}{rcl}
 2-3 & +1.024 & -1.92 & -1.2020 \\
 +1.1857 + 17.3 & +1.2030 & -11 & +1.2019 & -1 \\
 +1.1752 + 32.8 & +1.2080 & -59 & +1.2021 & +1 \\
 +1.1916 + 16.5 & +1.2081 & -61 & +1.2020 & 0 \\
 21.2028 + 201 & & -40 & & = 200169
 \end{array}$$

$$\begin{array}{rcl}
 4-2 & -9.42 & -1.34 & +1.713 \\
 -6639 - 52 & -6691 & -22 & -6713 & = 0 \\
 -6380 - 291 & -6671 & -42 & -6713 & = 0 \\
 -6391 - 301 & -6692 & -21 & -6713 & = 0 \\
 19.7088 - 199 & & -26 & & = 203576
 \end{array}$$

Tables $a = +1.0$ $e = -1.0$ $a - e = +2.0$ $b + d = -1.4$
 Obs $a = +1.9$ $e = +1.3$ $a - e = +0.6$ $b + a = -0.8$

	p	$p-c$	$\lambda \sin(p-c)$	$\beta \cos(p-c)$
1	145.2	123.9	-0.5	+1.1
2	127.0	105.7	-0.5	+0.5
3	109.5	88.2	-0.6	-0.0
4	90.0	68.7	-0.5	-0.7
5	82.0	60.7	-0.5	-0.9
6	52.4	31.1	-0.3	-1.6
7	34.8	13.5	-0.1	-1.8
8	0.0	338.7	+0.2	-1.9
9	342.7	321.4	+0.4	-1.5

$$\lambda = -0.56$$

$$\beta = -1.90$$

$$c = 21.3$$

	p	$p-c$	$\lambda \sin(p-c)$	$\beta \cos(p-c)$	Ω	Corr. from Hays		Ω	$\Omega - c$
1	214.8	193.5	+0.1	+1.8	-1.4	+1.5	+138	+293	+155
2	233.0	211.7	+0.3	+1.6	-1.0	-0.2	-18	-21	-3
3	250.5	229.2	+0.4	+1.2	-0.5	-0.6	-55	-266	-211
4	270.0	248.7	+0.5	+0.7	+0.1	+0.4	+37	-19	-56
5	278.0	256.7	+0.5	+0.4	+0.4	-0.1	-9	+70	+79
6	307.6	286.3	+0.5	-0.5	+1.3	+0.1	+9	+16	+7
7	325.2	303.9	+0.5	-1.1	+1.9	+0.4	+37	-46	-83
8	0.0	338.7	+0.2	-1.8	+2.3	-0.1	-9	+52	+61
9	17.3	356.0	+0.0	-1.9	+2.2	-0.1	-9	-13	-4

$\Omega - c$	Hays	new $\Omega - c$
1 + 297	+ 138	+ 159
2 + 50	- 18	+ 68
3 - 139	- 55	- 84
4 + 157	+ 37	+ 120
5 + 261	- 9	+ 270
6 + 227	+ 9	+ 218
7 + 251	+ 37	+ 214
8 + 170	- 9	+ 179
9 + 47	- 9	+ 56

338A, known center.

26

X	$y - X_0$	Δx	$(x - X_0)^2$	$(\sum x_0)^2 + (y - Y_0)^2$	$0 - C$
1	20.0000 - 1.2070	-3	1.4576	4.5050 + 297	
2	19.5164 - 1.6906	-2	2.8558	4.4803 + 50	
3	19.2164 - 1.9906	-1	3.9629	4.4614 - 139	
4	19.0878 - 2.1192	0	4.4910	4.4910 + 157	
5	19.1058 - 2.1012	+0	4.4150	4.5014 + 261	
6	19.5266 - 1.6804	+2	2.8231	4.4980 + 227	
7	20.0000 - 1.2070	+3	1.4561	4.5004 + 251	
8	21.2070 0.0000	+3	0.0000	4.4923 + 170	
9	21.8386 + 0.6316	+3	0.3992	4.4800 + 47	

Comp R^2 4.4753

y	$y - Y_0$	Δy	$(y - Y_0)^2$
1	17.9605 - 1.7455	-2	3.0474
2	18.4328 - 1.2732	-2	1.6215
3	19.0000 - 0.7060	-1	0.4985
4	19.7060 0.0000	0	0.0000
5	20.0000 + 0.2940	+0	0.0864
6	21.0000 + 1.2940	+2	1.6749
7	21.4506 + 1.7446	+2	3.0443
8	21.8252 + 2.1192	+3	4.4923
9	21.7258 + 2.0198	+3	4.0808

Approx. Center

$$x = 20.0 \quad y = 17.9605$$

$$21.4506$$

$$394111$$

$$Y_0 = 19.7056$$

$$y_{\text{max}} = 21.8252$$

$$R = 21196$$

$$x_{\text{min}} = 19.0878$$

$$X = 21.2074$$

$$\text{Center } \begin{cases} X_0 = 21.2070 \\ Y_0 = 19.7060 \end{cases}$$

3384

Linear Center

26

x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - 6$
1	200000 - 12070	-3	14576	45050 + 297	
2	195164 - 16906	-2	28588	44803 + 50	
3	192164 - 19906	-1	39629	44614 + 139	
4	190878 - 21192	0	44910	44910 + 157	
5	191058 - 21012	+0	44150	45014 + 261	
6	195266 - 16804	+2	28231	44980 + 227	
7	200000 - 12070	+3	14561	45004 + 251	
8	212070 000000	-3	00000	44923 + 170	
9	218386 + 06316	+3	03992	44800 + 47	

Comp R^2 4.4753

y	$y - y_0$	Δy	$(y - y_0)^2$
1	179605 - 17455	-2	30474
2	184328 - 12732	-2	16215
3	190000 - 07060	-1	04985
4	197060 00000	0	00000
5	200000 + 02940	-0	00864
6	210000 + 12940	+2	16749
7	214506 - 17446	+2	30443
8	218252 + 21192	-3	44923
9	217258 + 20198	-3	40808

Approx. Center

$$x = 20.0 \quad y = 179605$$

$$214506$$

$$394111$$

$$y_0 = 197056$$

$$y_{\text{max}} = 218252$$

$$R = 21196$$

$$y_{\text{min}} = 190878$$

$$x = 212074$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 212070 \\ y_0 = 197060 \end{array} \right.$$

Formation of Journals

with Hagn (0-c)

	ab	an	bn	abc	bn
1	+ 2.12	- 359.0	- 520.0	- 192.4	- 278.2
2	+ 2.14	- 84.5	- 63.5	- 115.0	- 86.5
3	+ 2.41	+ 276.5	+ 98.8	+ 167.1	+ 59.6
4	- 0.00	- 333.0	+ 0.0	- 254.5	+ 0.0
5	- 0.61	- 548.0	+ 75.7	- 567.0	+ 78.4
6	- 2.16	- 381.5	+ 393.0	- 366.2	+ 281.0
7	- 2.10	- 303.5	+ 437.0	- 259.0	+ 372.5
8	+ 0.00	+ 0.0	+ 360.0	+ 0.0	+ 379.8
9	+ 1.27	+ 29.5	+ 95.0	+ 35.3	+ 113.2
	+ 2.07	- 1703.5	+ 876.0	- 1551.7	+ 919.8

	0	C	0-C
1	+ 15-9	+ 93 - 101 = - 8	+ 167
2	+ 68	+ 129 - 74 = + 55	+ 13
3	- 84	+ 15-2 - 41 = + 101	- 195
4	+ 120	+ 162 + 0 = + 162	- 42
5	+ 270	+ 160 + 17 = + 177	+ 93
6	+ 218	+ 128 + 75 = + 203	+ 15
7	+ 214	+ 93 + 101 = + 194	+ 20
8	+ 179	+ 0 + 123 = + 123	+ 56
9	+ 56	- 48 + 117 = + 69	- 13

+364-250

Average = 68

3384

Lubbock's Center

27

Conditional Equations

	a	b	0	c	0 - c
1	-1.21	-1.75	= +297	+101 - 97 = +4	+293
2	-1.69	-1.27	= +50	+141 - 70 = +71	-21
3	-1.99	-0.71	= -139	+166 - 39 = +127	-266
4	-2.12	+0.00	= +157	+176 - 0 = +176	-19
5	-2.10	+0.29	= +261	+175 - 16 = +191	+70
6	-1.68	+1.29	= +227	+140 - 71 = +69	+16
7	-1.21	+1.74	= +251	+101 - 96 = +5	-46
8	+0.00	+2.12	= +170	- 0 + 118 = +118	+52
9	+0.63	+2.02	= +47	- 52 + 112 = +60	-13
					+431 - 365

Average = 88

Normal equations

$$+21.86 + 2.07 = -170.4$$

$$+ 2.07 + 18.55 = +87.6$$

$$- 2.07 - 0.20 = +1.61$$

$$+ 18.35 = +103.7$$

$$b = +55.5$$

$$+21.86 = -170.4 - 117 = -182.1$$

$$a = -83.3$$

Normal with Hayn's Correction

$$+21.86 + 2.07 = -155.2$$

$$+ 2.07 + 18.55 = +92.0$$

$$- 2.07 - 0.20 = +1.47$$

$$+ 18.35 = +106.7$$

$$b = +58.0$$

$$+21.86 = -155.2 - 120 = -167.2$$

$$a = -76.5$$

Arc measured = 162° Average (0 - c) = $+7.3$

$$\frac{pc}{m} = 0.21$$

$$\frac{+7.3}{.21} = +0.35 \Delta m = +0.4$$

3384

Lunar Center

27

Conditional Equations

	a	b	0	c	0 - c
1	-1.21	-1.75	+29.7	+101 - 97 = +4	+29.3
2	-1.69	-1.27	+50	+141 - 70 = +71	-21
3	-1.99	-0.71	-139	+166 - 39 = +127	-26.6
4	-2.12	+0.00	+15.7	+176 - 0 = +176	-19
5	-2.10	+0.29	+26.1	+175 - 16 = +159	+70
6	-1.68	+1.29	+22.7	+140 - 71 = +69	+16
7	-1.21	+1.74	+25.1	+101 - 96 = +5	-46
8	+0.00	+2.12	+1.70	0 - 118 = -118	+52
9	+0.63	+2.02	+4.7	-52 - 112 = -164	-13

+ 431 - 365

Average = 88

Normal equations

$$+21.86a + 207b = -1704$$

$$+207a + 1855b = +876$$

$$-207 - 0.20 = +1.61$$

$$+18.35 = +1037$$

$$b = +55.5$$

$$+21.86 = -1704 - 117 = -1821$$

$$a = -83.3$$

Normal with Hayn's Correction

$$+21.86a + 207b = -1552$$

$$+207a + 1855b = +920$$

$$-207 - 0.20 = +1.47$$

$$+18.35 = +1067$$

$$b = +58.0$$

$$+21.86 = -1552 - 120 = -1672$$

$$a = -76.5$$

Arc measured = 162° Average (0 - c) = +7.3

$$\frac{pc}{m} = 0.21$$

$$+ \frac{7.3}{.21} = +0.35 \Delta m = +0.4$$

3384 Moon's Mean Position (1913.0)

$$X_0 = 212070 \quad 197060$$

$$\text{cor} = -42 \quad 26 + 28$$

$$212028 \quad 197088$$

$$\text{mean} = 212032 \quad 197089$$

$$\text{From Plate Constants } X = 20.0169^{\circ} \quad Y = 20.3572^{\circ}$$

$$z = +20169^{\circ}$$

$$\bar{z} = -16424^{\circ}$$

$$\log 3 = 0.30472^{\circ}$$

$$\cos 5 = 999682$$

$$8.50724$$

$$(z - 4) = 180065^{\circ}$$

$$\log \tan 5 = 90891$$

$$0.6093$$

$$70534$$

$$67518$$

$$(a - 4) + 103.19^{\circ}$$

$$\eta_1 = +6^{\circ}$$

$$A = 110320^{\circ}$$

$$\eta_0 = -16439^{\circ}$$

$$X_0 = 110423 + 9^{\circ}$$

$$\log \eta_0 = 0.21564^{\circ}$$

$$733115$$

$$\text{Red} = 1.59$$

$$288446^{\circ}$$

$$\alpha' = 110424.72^{\circ}$$

$$(\delta - D) = -1246.4^{\circ}$$

$$D = +70821^{\circ}$$

$$S_0 = +65534.6$$

$$\text{Red} = -7.0^{\circ}$$

$$\delta' = +65527.6^{\circ}$$

3364 known mean position (1913.0)

$$X_0 = 212070 \quad 197060$$

$$w = -42 \quad b = +28$$

$$212028 \quad 197088$$

$$\text{comp. } 212032 \quad 197089$$

$$\text{True Plate Constant } X = 20.0167 \quad Y = 20.3576$$

$$Z = +20173$$

$$\bar{M} = -1.6429$$

$$\log Z = 0.30477$$

$$\log S = 9.99682$$

$$8.50724$$

$$(X-A) = 180073$$

$$\log \tan \delta = 9.0891$$

$$0.6093$$

$$7.0536$$

$$6.7518$$

$$X-A = +10379$$

$$\eta = +6$$

$$A = 110320$$

$$\eta = -1.6429$$

$$X = 11042379$$

$$\log \eta = 0.21564$$

$$7.33115$$

$$\log \mu = 1.59$$

$$2.88446$$

$$X = 11042479$$

$$(S-D) = -12464$$

$$D = +70821$$

$$S_0 = +65534.6$$

$$P_{\text{true}} = -70$$

$$\delta' = +65527.6$$

3384 Red. ad locum ahp.

 $\delta: +6^{\circ}55'34.5''$

$$H + \alpha \quad 1 \quad 20.5 = 20^{\circ}$$

$$H \quad 14 \quad 16.2$$

$$K \quad 11 \quad 04.3$$

$$G \quad 20 \quad 29.2$$

$$G + \alpha \quad 7 \quad 33.5 = 113^{\circ}20'$$

$$l \cos(G + \alpha) \quad 9.5978^m$$

$$g \quad 1.0564$$

$$\sin \quad 9.9629$$

$$\tan \delta \quad 9.0845$$

$$8.8239$$

$$g' \quad 0.6542^m$$

$$8.9277$$

$$b \quad +1.05$$

$$+0.08$$

$$+0.46$$

$$+1.59^v$$

$$l \cos \delta \quad 9.9968$$

$$i \quad 0.6838^m$$

$$(i) \quad 0.6806^m$$

$$l \sin \delta \quad 9.0813^v$$

$$\cos(H + \alpha) \quad 9.9730^v$$

$$h \quad 1.2987$$

$$\sin \quad 9.5340$$

$$\sec \delta \quad 0.0032$$

$$8.8239$$

$$h' \quad 0.3530^v$$

$$h \quad 9.6598$$

$$g' \quad -4.51^v$$

$$+2.26^v$$

$$-4.79$$

$$-7.04^v$$

3384 Red. ad. even - alt

5 + 6° 55' 34.5"

H + x 1 20.5 : 20°

H 14 162

x 11 043

G 20 292

G + x 7 335 : 113° W

less(G+x) 95978m

8 10564

sum 99629

less 90845

88279

8' 06542m

8 89277

8 + 105

+ 008

+ 046

+ 159

less 5 99968

i 0.6838m

(i) 06806m

less 5 90813

less(H+x) 99730

L 12987

sum 95340

less 00032

95308

L 03530

L 96598

8' -451

L -226

1 -979

-704

3384 Lunar Parallax.

$$\alpha = 11^{\circ} 04' 24.78''$$

$$\delta = 12^{\circ} 28' 41.9''$$

$$\alpha - \alpha' = +1^{\circ} 24' 17.1''$$

$$= +21^{\circ} 04' 16''$$

$$+ 7' 59''$$

$$+ 20' 56' 17''$$

$$9.95727''$$

$$9.00000''$$

$$0.02966''$$

$$9.98693''$$

$$\delta = 44^{\circ} 08' 17''$$

$$6' 55' 27''$$

$$37' 12' 50''$$

$$9.82646''$$

$$8.23820''$$

$$9.78160''$$

$$0.15714''$$

$$8.00334''$$

$$\delta - \delta' = +34' 38.6''$$

$$\delta = +7' 30' 06.2''$$

$$\text{Hantken } \delta = +7' 30' 09.3''$$

$$O - C$$

$$-3.7''$$

$$\delta' = +6^{\circ} 55' 27.6''$$

$$H = 59' 29.8''$$

$$9.86913''$$

$$8.23820''$$

$$9.55573''$$

$$0.00373''$$

$$7.66679''$$

$$\alpha - \alpha' = +15' 57.67''$$

$$= +1^{\circ} 03.84''$$

$$\alpha = 11^{\circ} 05' 28.6''$$

$$\alpha = 11^{\circ} 05' 27.79''$$

$$+0.84''$$

Hayn's correction applied.

3384

Linear Parallax

$$\alpha = 11^{\circ} 04' 24.7''$$

$$\delta = 12^{\circ} 28' 41.9''$$

$$\delta - \delta' = +1^{\circ} 24' 17.1''$$

$$+ 21^{\circ} 04' 16''$$

$$+ 7^{\circ} 59'$$

$$+ 20^{\circ} 56' 17''$$

$$995727$$

$$000000$$

$$002966$$

$$998693$$

$$\delta = 44^{\circ} 08' 17''$$

$$6^{\circ} 55' 27''$$

$$37^{\circ} 12' 50''$$

$$982640$$

$$823820$$

$$978160$$

$$015714$$

$$800334$$

$$\delta - \delta' = +34^{\circ} 38.6''$$

$$\delta = +7^{\circ} 30' 06.2''$$

$$\text{Hartmann } \delta = +7^{\circ} 30' 09.3''$$

$$0 - c$$

$$-3.2$$

$$\delta = +6^{\circ} 55' 27.6''$$

$$\delta = 59' 29.8''$$

$$986913$$

$$823820$$

$$955573$$

$$000373$$

$$766679$$

$$\alpha - \alpha' = +15^{\circ} 57' 6.7''$$

$$+ 1^{\circ} 03.84''$$

$$\alpha = 11^{\circ} 05' 28.6''$$

$$\alpha = 11^{\circ} 05' 27.79''$$

$$+0.92''$$

Hayns correction applied

