

KG

11366

v. 925

Vol. XLIX



Plate

1973

1974



Harvard Lunar Plates

Measures and Reductions

Marginalia.

Volume XLIX

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1
10.
232
23
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23
14

1973 Slans measures.

1913 Dec. 3

1.

	d	n		d	n
1	18310	14148		17785	15130
10.5	1537175-	6990		1346870.	943031
23.3	75	9991		60	2831
	20	54		05	18
	23.2939	2841		10.5671	5693
2	should be 2839				
23.0	18100	19445		10159	12592
24.8	1003631	1753135-		5757	1231010
	40	30		9865	10
	09	52			
	24.8071	8086		23.0293	0282
3					
23.1	10969	12220		9321	10709
14.1	1027073	2119		1919	975762
	73	11520		8376	51
	14.0697	0700		23.0944	0952

Grade 3

1973 Stars

1913 Dec 3

18310	14148
105 1537175	6990
233 75	9991
20	54
73.2939	2841

17785	15130
13468	9430
6070	2831
05	18
10.5671	5693

230 18100	19445
248 10036	1753135
40	30
09	52
248071	8086

10159	12592
5757	12310
9865	10
130293	0282

231 10969	12220
141 10270	2119
73	11520
14.0697	0700

9321	10709
1919	9757
8376	5162
230944	0952

Grade 3

1973 Moon - Measures.

2

	d	4	v	d x	v
1	19471		16675		
10.0	1119085		14990		
167	97		75-65		
	80		85		
	<u>16.8287</u>		<u>.8293</u>		

2 Scratch

19.4	18788	17141
17.4	1496570	10968
	70	6157
	96	50
	<u>19.3823</u>	<u>.3816</u>

18470	15841
1229091	1202039
91	1539
79	50
<u>19.3815</u>	<u>.3819</u>

3
19.5
18.2
may
in
56

18340	15881
1395360	1025458
61	56
50	83
<u>19.5614</u>	<u>.5626</u>

4
19.4
19.0

17268	15939
1136879	1184150
75-79	41
76	50
<u>19.4101</u>	<u>.4099</u>

5

19.0	16900	15256
19.6	1085055	1129197
	51	87
	02	62
	<u>19.6049</u>	<u>.6034</u>

6

18.4
20.0

16271	14800
1070913	10390
18	9291
70	00
<u>18.4443</u>	<u>.4409</u>

1973 Moon - Maximas.

2

$\frac{1}{190}$ 19471 16675
 1119085- 1497065-
 167 97 75-65
 80 85-
168287 8293

2 Scratch

154 18788 117141
 174 1496570 10968
 70 6157
 96 50
173823 3816

18470 15841
 1229091 1202039
 91 1539
 79 50
193815 3819

3

19.5 18340 15881
 18.2 1395360 1025458
 max 61 56
 76 50 83
195614 5626

4

194 17268 15939
 190 1136879 1184150
 71-77 41
 76 50
194101 4099

5

190 16900 15216
 196 1085055- 1129197
 51 8797
 02 62
196049 6034

6

19.4 16271 14800
 20.0 1070913 10390
 18 9291
 70 00
184443 4409

1973 Moon-Measures.

3

	α	δ	α	δ	α
2	15679		19529		
18.0	1417181		1100918		
20.2	7181		2018		
	86		28		
	<u>20,1506</u>		<u>1,1488</u>		

8	15695	19489
17.8	1380900	1140919
20.2	9800	10
max	08	01
u		
y	<u>20,1896</u>	<u>1984</u>

9	11639	1390498
17.0	1067559	96
20.1	60	12891
	<u>20,0974</u>	<u>1,008</u>

possibly a
terminator

1977 known measures

3

	α	δ	μ	μ
7	15679		19529	
18.0	141718		1100918	
22	71		2018	
	86		28	
	<u>20.1506</u>		<u>.1488</u>	

8	15695	19489
17.3	13809	11409
20.2	9800	1019
max	08	01
"	08	01
8	<u>20.1896</u>	<u>.1914</u>

9	11639	13909
17.0	1067159	9698
20.1	609	12891
	<u>20.0974</u>	<u>.1008</u>

possibly a
terminator

1973 Times etc. 9

Sept 12 Aug. 30, 23^h 05^m - 23^h 17^m

known 23 10 40.0 - 23 10 40.4

clock slow 1 02.3

H Sid. T. 23 11 42.5 ✓

Nhong 4 44 31.05 ✓

A Sid. T. 27 56 13.55 ✓

Sid. T. known 10 33 14.17 ✓

Interval 17 22 59.38 ✓

Reduction 2 50.87 ✓

G.M.T. 17 20 08.51 $\theta - \alpha = -1^{\circ} 44' 33''$

From hant Allen

known 17^h 05^m 38.00 ✓

motion = 1.8470 ✓

20.1418 ✓

Tabular place 0 56 15.20 ✓

Realt. 11 52.8 ✓

14.590 ✓

+ 37.20 ✓

+ 4 53.9 ✓

+ 6 16 46.7 ✓

known age 18 days.

parallel 55' 28.6 ✓

semicircle 15' 08.6 ✓

R 908.6 ✓

Augmentation + 10.8 ✓

Irradiation (3) - 0.7 ✓

R 918.7 ✓

R 1.9693 ✓

(1+a) R 1.9686 ✓

R² 3.8754 ✓

934 = 11.45 ✓

908.6 = 10.8 ✓

a = -3.4

1973 Taurus etc.

Exp. Tel. 1912 Aug. 30, 23 ^h 05 ^m	-23 ^h 17 ^m
moon	23 10 40.0 - 23 10 40.4
clock slow	1 0 23
H fuel T.	23 11 42.5
H. temp.	4 44 31.05
A. S. T.	27 56 13.55
Sid. T. in hour	10 33 14.17
Interval	17 22 59.38
Reduction	2 50.87
Calc. T.	17 20 08.51 6 - d - - 1 ^h 44 ^m 33 ^s

From hand clock	R. L.	Real.
moon 17 ^h	0 ^h 55 ^m 38.00	+ 6 11 52.8
moon 17 ^h - 1.8470		14.590
20.1418	+ 37.20	+ 4 53.9
Tabular place	0 56 15.20	+ 6 16 46.9

known angle	18 days.
parallel	55° 28' 6"
semi-declination	15 08 6
934 - 11.45	R 908 6
9086 - 10.8	+ 10.8
Amputation	- 0.7
7. reduction (3)	918.7
R	1.9693
(1 + a) R	1.9686
R ²	3.8754
a = 3.4	

1973

Plate constants.

5

α	δ	P.A.	Decl.
10.5682	23.2840	0 53 46 + 6	22 08
23.0288	24.8078	1 00 15 + 6	34 35
23.0948	14.0698	1 00 19 + 5	11 06
3 56.69	62.16	12 53 80	18 07 49
18.90	20.72	0 58 07 + 6	02 36
-78	-22	- 28 + 9	57
.90	1.28	0 57 39 + 6	12 33
31	465		
27.9	597"		
	-9' 57"		
		$A = 0^h 57^m 39^s$	
		$D = +6^\circ 12' 33''$	

$$\begin{array}{rclcl}
 x-3 & -59.44 & +3.4x & +1042 & \\
 +305 & -1883 & = -1078 + 36 & = -1042 & = 0 \\
 +354 & -1474 & = -1120 + 78 & = -1042 & = 0 \\
 -284 & -836 & = -1120 + 78 & = -1042 & = 0 \\
 17.4-996 & -1082 & +60 & & = 17.6016 \checkmark
 \end{array}$$

$$\begin{array}{rclcl}
 y-4 & +5882 & +2.5y & -1118 & \\
 +438 & +621 & = +1059 + 58 & = +1117 & = -1 \\
 -298 & +1354 & = +1056 + 62 & = +1118 & = 0 \\
 -274 & +1358 & = +1084 + 35 & = +1119 & = +1 \\
 18.2211 & +1035 & +46 & & = 18.2174 \checkmark
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Tables} & a = -0.5 & e = -3.0 & a-e = +2.2 & b+a = +2.0 \\
 \text{Obs} & a = -3.4 & e = -2.5 & a-e = -9 & b+a = +0.6
 \end{array}$$

1973

Plate constants

α	η	RG	Decl.
10.5682	23.2840	0 53 46 + 6	22 08
23.0288	24.8078	1 00 15 + 6	34 35
23.0948	14.0698	1 00 19 + 5	11 06
3 56.69	6216	2 53 80	18 07 49
18.90	20.72	0 58 07 + 6	02 36
-78	-22	- 28	+ 9 17
40	128	0 57 39 + 6	12 33
31	465		
279	597		
	9.57		

$$A = 0^h 57^m 39^s$$

$$D = +6^\circ 12' 33''$$

$$\begin{aligned}
 2-3 & -59.44 & +34x & +1042 \\
 +205 & -1383 = -1078 & +36 = -1042 & = 0 \\
 +354 & -1474 = -1120 & +78 = -1042 & = 0 \\
 -284 & -836 = -1120 & +78 = -1042 & = 0 \\
 17.5-996 & -1082 & +60 & = 17.6016
 \end{aligned}$$

$$\begin{aligned}
 4-3 & +588x & +2.54 & -1118 \\
 +438 & +621 = +1059 & +58 = +1117 & = -1 \\
 -298 & +1354 = +1056 & +62 = +1118 & = 0 \\
 -274 & +1358 = +1084 & +35 = +1119 & = +1 \\
 18.2211 & +1035 & +46 & = 18.2174
 \end{aligned}$$

$$\begin{aligned}
 \text{Tables } a & = -0.8 & b & = -3.0 & a-b & = +2.2 & b+a & = +2.0 \\
 \text{Obs. } a & = -3.4 & c & = -2.5 & a-c & = -0.9 & b+c & = +0.6
 \end{aligned}$$

1973 Standard Coordinates

Cape No. 124 mag 6.9			Cape No. 141 mag 7.8			Cape No. 142 mag 6.2		
C	0 ^h 53 ^m 08. ^s 19 ^v		0 ^h 59 ^m 37. ^s 80 ^v			0 ^h 59 ^m 41. ^s 70 ^v		
L		21		86			71	
E		22		92			68	
mean	0 53 08.21 ^v		0 59 37.86			0 59 41.70		
Prec	+	37.29 ^v	+	37.45 ^v		+	37.25 ^v	
A	0 53 45.50 ^v		1 00 15.31			1 00 18.95		
A	0 57 39		0 57 39			0 57 39		
K-A	-	3 53.50 ^v	+	2 36.31		+	2 39.95 ^v	
Sub(K-A)		-23.349 ^v	+	156.31		+	159.95 ^v	
log ₁₀	2.36827 ^v		2.19399			2.20398		
cos	9.99781 ^v		9.99713			9.99822		
Σ ₀	0.87282 ^v		0.69836			0.70944		
Σ ₁	-7.4613 ^v		+4.9930			+5.1220		
Σ ₂	-	10 ^v	+	4		+	12	
Σ ₃	10.5377 ^v		22.9934			23.1232		
Σ ₄	10.5682 ^v		23.0288			23.0948		
Σ ₅	+	305 ^v	+	354		-	284	

C + 6°	18'	14".0	+ 6°	30'	43".8	+ 5°	07'	12".8
L		14.7			44.3			13.6
E		14.7			43.5			13.2
mean + 6	18	14.5	+ 6	30	43.9	+ 5	07	13.2
Prec	+	3 53.8	+	3 51.3		+	3 52.3	
S + 6	22	08.3	+ 6	34	35.2	+ 5	11	05.5
D + 6	12	33	+ 6	12	33	+ 6	12	33
K-D	+	9 35.3	+	22 02.2		-	1 01 27.5	
Sub(K-D)		+ 575.3	+	1322.2		-	3687.9	
log ₁₀	2.75989		3.12130			3.56678 ^m		
log ₁₀	0.09104		0.45245			0.89793 ^m		
stars	9 0477		9 0618			8.9578		
Σ ₁	17456		13967			14189		
Σ ₂	78467		75119			74301		
Σ ₃	+	1.2332	+	2.8343		-	7.9055	
Σ ₄	+	70	+	33		+	27	
Σ ₅	23.2402		24.8376			14.0972		
Σ ₆	23.2840		24.8078			14.0698		
Σ ₇	+	438	-	298		-	274	

1973 Standard Coordinates

6

Cape No. 124 mg 69			Cape No. 141 mg 78			Cape No. 142 mg 62		
C	0° 53' 08.19		0° 59' 37.80			0° 59' 41.70		
L		21		86			71	
B		22		92			68	
mean	0 53 08.21		0 59 37.86			0 59 41.70		
Pre		+ 3729		+ 3745			+ 3725	
A	0 53 45.50		1 00 15.31			1 00 18.95		
A	0 57 39		0 57 39			0 57 39		
x-A	- 3 53.50		+ 2 36.31			+ 2 39.95		
sin(A-A)		+ 233.49		+ 156.31			+ 159.95	
log	2.36827		2.19399			2.20398		
cos	9.99781		9.99713			9.99822		
30	0.87282		0.69836			0.70944		
3	+ 7.4613		+ 4.9930			+ 5.1220		
3	7 10		+ 4			+ 12		
3	10.5377		22.9934			23.1232		
x	10.5682		23.0288			23.0948		
-3	+ 305		+ 354			- 284		
C + 6°	18' 14.90		+ 6° 30' 43.8			+ 5° 07' 12.8		
L		14.7		44.3			13.6	
B		14.7		43.5			13.2	
mean + 6	18 14.5		+ 6 30 43.9			+ 5 07 13.2		
Pre	+ 3 53.8		+ 3 51.3			+ 3 52.3		
S + 6	22 08.3		+ 6 34 35.2			+ 5 11 05.5		
D + 6	12 33		+ 6 12 33			+ 6 12 33		
x-D	+ 9 35.3		+ 22 02.2			- 1 01 27.5		
tan(6-D)		+ 575.3		+ 1322.2			- 3687.9	
log	2.75989		3.12130			3.56678		
30	0.09104		0.45245			0.89793		
tan 3	9.0477		9.0618			8.9578		
3	17456		13967			14989		
3	78467		75119			74301		
4	+ 1.2332		+ 2.8343			- 7.9055		
4	+ 70		+ 53			+ 27		
4	23.2402		24.8376			14.0972		
4	23.2840		24.8078			14.0698		
4-2	+ 438		- 298			- 274		

pt	ms. L	resid.	resid.
1	134.7	+249	+261
2	115.0	+53	+53
3	90.0	-245	-259
4	66.6	+83	+57
5	45.3	-27	-61
6	25.5	-2	-38
7	11.9	+53	+18
8	0.0	+45	+12
9	342.5	+126	+99

1973 Moon's Center

	x	$y - Y_0$	Δx	$(x - X_0)^2$	$(x - X_0)^2 + (y - Y_0)^2$	$0 - c$
1	19.00000	+1.40800	+3	1.9833	3.9104	+350
2	19.3817	+1.7897	+2	3.2037	3.9011	+257
3	19.5620	+1.9700	0	3.8809	3.8809	+55
4	19.4100	+1.8180	-2	3.3044	3.9177	+423
5	19.0000	+1.4080	-3	1.9805	3.9054	+300
6	18.4426	+0.8506	-4	0.7228	3.9026	+272
7	18.0000	+0.4080	-4	0.1661	3.9026	+272
8	17.5920	0.0000	-4	0.0000	3.8959	+205
9	17.0000	-0.5920	-4	0.3509	3.8943	+189

Comp. $R^2 = 3.8754$

	y	$x - X_0$	Δy	$(y - Y_0)^2$
1	16.8290	-1.3880	-2	1.9271
2	17.3820	-0.8350	-1	0.6974
3	18.2170	0.0000	0	0.0000
4	19.0000	+0.7830	+1	0.6133
5	19.6042	+1.3872	+2	1.9249
6	20.0000	+1.7830	+2	3.1798
7	20.1997	+1.9327	+3	3.7365
8	20.1965	+1.9735	+3	3.8959
9	20.0991	+1.8821	+3	3.5434

Approximate Center

$$x = 19.0 \quad y = 16.8290$$

$$19.6042$$

$$3.64332$$

$$Y_0 = 18.2166$$

$$y_{\text{max}} = 20.1910$$

$$R = 1.9744$$

$$x_{\text{max}} = 19.5624$$

$$X_0 = 17.5880$$

$$\text{Center} \begin{cases} X_0 = 17.5920 \\ Y_0 = 18.2170 \end{cases}$$

1973 *known center*

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$o - c$
1	190000	+1.4080	+3	1.9833	3.4104	+350
2	19.3817	+1.7897	+2	3.2037	3.9011	+257
3	19.5620	+1.9700	0	3.8809	3.8809	+55
4	19.4100	+1.8180	-2	3.3044	3.9177	+423
5	190000	+1.4080	-3	1.9805	3.9054	+300
6	18.4426	+0.8506	-4	0.7228	3.9026	+272
7	180000	+0.4080	-4	0.1664	3.9026	+272
8	17.5920	0.0000	-4	0.0000	3.8959	+205
9	17.0000	-0.5920	-4	0.3509	3.8943	+189

Comp. $R^2 = 3.8754$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	16.8290	-1.3880	-2	1.9271
2	17.3820	-0.8350	-1	0.6974
3	18.2170	0.0000	0	0.0000
4	19.0000	+0.7830	+1	0.6133
5	19.6042	+1.3872	+2	1.9249
6	20.0000	+1.7830	+2	3.1798
7	20.1897	+1.9327	+3	3.7365
8	20.1965	+1.9735	+3	3.8949
9	20.0991	+1.8821	+3	3.5434

Approximate Center

$$x = 19.0 \quad y = 16.8290$$

$$19.6042$$

$$3.64332$$

$$y_0 = 18.2166$$

$$y_{\text{max}} = 20.1910$$

$$R = 1.9744$$

$$x_{\text{max}} = 19.5624$$

$$x_0 = 17.5880$$

$$\text{Center} \begin{cases} x_0 = 17.5920 \\ y_0 = 18.2170 \end{cases}$$

Formation of Hounsels

ab

ak

bu

1	- 1.96	+ 493.5	- 486.5
2	- 1.50	+ 460.0	- 215.9
3	+ 0.00	+ 27.4	+ 0.0
4	+ 0.35	+ 191.2	+ 82.8
5	+ 1.96	+ 423.0	+ 417.0
6	+ 1.51	+ 231.2	+ 484.2
7	+ 0.79	+ 111.5	+ 525.0
8	+ 0.00	+ 0.0	+ 403.8
9	- 7.11	- 111.5	+ 355.3
	+ 0.04	+ 1826.3	+ 1565.7
	+ 1.07	+ 579.3	+ 246.7
	+ 1.47	- 369.1	+ 364.9
	+ 2.58	+ 2036.5	2177.3

giving (4) full wt.
giving (1) half wt.

Residuals -

	O	C	O - C	
1	+ 310	+ 225 - 136 = + 89	+ 261	$\frac{1}{2}$ wt
2	+ 257	+ 286 - 82 = + 204	+ 53	
3	+ 55	+ 314 - 0 = + 314	- 259	$\frac{1}{2}$ wt.
4	+ 423	+ 290 + 76 = + 366	+ 57	
5	+ 300	+ 225 + 136 = + 361	- 61	
6	+ 272	+ 136 + 174 = + 310	- 38	
7	+ 272	+ 65 + 189 = + 254	+ 18	
8	+ 205	+ 0 + 193 = + 193	+ 12	
9	+ 189	+ 94 + 184 = + 90	+ 99	
			+ 500 - 358	
			Average = 95	

1973

Moon's Center

8

Conditional Equations

	a	b	0	c	0-c
1	+1.41	-1.39	= +350	+214 - 113 = +101	+249
2	+1.79	-0.84	= +257	+272 - 68 = +204	+153
3 ^{1/2} wt	+1.97	+0.00	= +55	+300 + 0 = +300	-245
4 ^{1/2} wt	+1.82	+0.78	= +423	+277 + 63 = +340	+83
5	+1.41	+1.39	= +300	+214 + 113 = +327	-27
6	+0.85	+1.78	= +272	+129 + 145 = +274	-2
7	+0.41	+1.93	= +272	+62 + 157 = +219	+53
8	+0.00	+1.97	= +205	+0 + 160 = +160	+45
9	-0.59	+1.88	= +189	-90 + 153 = +63	+126

Average = 98

Normal Equations

$$\begin{aligned}
 +12.00 + 0.04 &= +1826 \\
 +0.04 + 19.21 &= +1566 \\
 -0.04 - 0.00 &= -6 \\
 +19.21 &= +1560 \\
 +12.00 &= +1826 - 3 = +1823
 \end{aligned}$$

$$\begin{aligned}
 b &= +81.2 \\
 a &= +152.0
 \end{aligned}$$

Given (4) full wt. + (1) half wt. + (3)

$$\begin{aligned}
 +11.19 + 2.56 &= +2036 \\
 +2.56 + 18.07 &= +2177 \\
 -2.56 - 0.59 &= -466 \\
 +17.48 &= +1711
 \end{aligned}$$

$$b = +98.0$$

$$+11.19 = +2036 - 250 = +1786$$

$$a = +159.5$$

An measured 167

$$\text{Average}(0-c) = +15.8$$

$$\frac{p_0}{n} = 0.24$$

$$+ \frac{15.8}{24} = +.66 \quad \Delta c = +0.7$$

1973

Hovons Center

8

Conditional Equations

	a	b	c	0-c
1	+1.41	-1.39	+3.50	+2.14
2	+1.79	-0.84	+2.57	+2.72
3 ^{1/2}	+1.97	+0.00	+5.5	+3.00
4 ^{1/2}	+1.82	+0.78	+4.23	+2.77
5	+1.41	+1.39	+3.00	+2.14
6	+0.85	+1.78	+2.72	+1.29
7	+0.41	+1.93	+2.72	+0.62
8	+0.00	+1.97	+2.05	+0.00
9	-0.59	+1.88	+1.89	-0.90

Average = 98

Normal Equations

$$\begin{aligned}
 +12.00 + 0.04 &= +1.826 \\
 +0.04 + 19.21 &= +1.566 \\
 -0.04 - 0.00 &= -0.04 \\
 +19.21 &= +1.560 \\
 +12.00 &= +1.826 + 3 = +1.823
 \end{aligned}$$

$$b = +81.2$$

$$a = +152.0$$

Swing (4) full wt. + (11) half wt.

$$+11.19 + 2.56 = +20.36$$

$$-2.56 + 1.807 = +2.177$$

$$-2.56 - 0.59 = -3.15$$

$$+17.48 = +17.11$$

$$b = +98.0$$

$$-11.19 - 20.36 - 25.0 = +17.86$$

$$a = +159.5$$

Av. measured = 167

Average (0-c) = +15.8

$$\frac{p_0}{n} = 0.24$$

$$+ \frac{15.8}{24} = +0.66 \quad \Delta z = +0.7$$

Red. ad locum aph.

S +5° 43'

$$H+x \quad 8 \quad 3 \quad 5 = 128^{\circ} 45'$$

$$H \quad 7 \quad 3 \quad 8$$

$$x \quad 0 \quad 5 \quad 7$$

$$G \quad 21 \quad 2 \quad 8$$

$$G+x \quad 22 \quad 2 \quad 5 = 336^{\circ} 15'$$

$$l \cos S \quad 9.9978$$

$$l \quad 0.8763$$

$$(i) \quad 0.8741$$

$$l \cos(G+x) \quad 9.9616$$

$$g \quad 1.1794$$

$$\sin \quad 9.6050m$$

$$\tan S \quad 9.0005$$

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

$$g' \quad 1.1410$$

$$g \quad 8.6088m$$

$$h \quad 71.83$$

$$g \quad -0.04$$

$$h \quad +0.99$$

$$+278$$

$$l \sin S \quad 8.9983$$

$$\cos(H+x) \quad 9.7965m$$

$$h \quad 1.2796$$

$$\sin \quad 9.8920$$

$$\sec S \quad 0.0022$$

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

$$h' \quad 0.0744m$$

$$h \quad 9.9977$$

$$g' \quad +13.84$$

$$h' \quad -1.19$$

$$l \quad +7.49$$

$$+20.14$$

1273 Moon's mean Position (1912.0)

$X_0 = 17.5920''$	$Y_0 = 18.2170''$	17.5920	18.2170
$\frac{1}{2}a = + 76''$	$\frac{1}{2}b = + 41''$	$+ 80$	$+ 49$
$17.5996''$	$18.2211''$	17.6000	18.2219

from Plate Constants $X_0 = 17.6016''$ $Y = 18.2174''$
 17.6020 $18.2182''$

$\bar{z} = -0.3984'' - 0.3980$ $\eta = -3.7826'' - 3.7818$
 $\log \bar{z} = 9.60032 \sim 9.59988$
 $\log \cos \delta = 9.99783''$ $\log \tan \delta = 0.57779''$ 0.57770
 $\log \text{const} = 8.50724$ $\log \text{const} = 7.33115''$

$\log(X-A) = 1.09525 \sim 1.09481$ $(\delta - 1) = 3.24664 \sim 3.24655$

$X-A = 12.45'' (12.44) \delta = 29' 24.6'' (24.2)$

$A = 0'' 57''' 39''$ $D = +6 12 33''$

$d_0 = 0 57 26.55'' (26.56) \delta_0 = +5 43 08.4'' (08.8)$

Red. ad. l. app. $+ 27.8''$ Red. ad. l. app. $+ 20.1''$

$\alpha' = 0 57 29.33'' (29.34) \delta' = +5 43 28.5'' (28.9)$

cor to star $\alpha = -0.03$ -0.2

1373 known mean Position (1912.0)

$X_0 = 17.5920$	$Y_0 = 18.2170$	17.5920	18.2170
$+ 76$	$+ 41$	$+ 80$	$+ 49$
17.5996	18.2211	17.6000	18.2219

from Plate Constant $X_0 = 17.6016$ $Y = 18.2174$
 17.6020 18.2182

$$\bar{s} = -0.3984 - 0.3980$$

$$\bar{s} = -3.7826 - 3.7818$$

$$\log \bar{s} = 9.60032 - 9.5988$$

$$\cos S = 999783$$

$$\cos \delta = 850724$$

$$\log \bar{s}_0 = 0.57779 - 0.57770$$

$$\cos \delta_0 = 733115$$

$$(X-A) = 109525 - 109481 \quad (S-I) = 3.24664 - 3.24655$$

$$X-A = 1245 - 1244 \quad (S-I) = 29' - 29' (242)$$

$$H = 0^h 57^m 39^s \quad D = 0^h 57^m 33^s$$

$$d_0 = 0^h 57^m 26.55^s (26.56) S_0 = 0^h 57^m 43^s 08.4 (08.8)$$

$$\text{Red. ad l. app.} + 278 \quad \text{Red. ad l. app.} + 20.1$$

$$d' = 0^h 57^m 29.33^s 29.34 / S' = 0^h 57^m 43^s 28.5 (28.9)$$

$$\text{Corr. to star } \alpha = -0.03 \quad -0.2$$

1973

Lunar Parallax.

$$\begin{array}{r}
 \alpha \quad 0 \quad 57 \quad 29.33 \quad 29.34 \\
 \theta \quad 23 \quad 11 \quad 42.5 \\
 \theta - \alpha = -1 \quad 45 \quad 46.82 \\
 \quad \quad - 26'' \quad 26' \quad 42''
 \end{array}$$

$$\begin{array}{r}
 - \quad 9 \quad 12 \\
 - 26 \quad 17 \quad 30
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.04742
 \end{array}$$

$$\tan f = 0.00469$$

$$f = 45^\circ 18' 33.1''$$

$$+ 5 \quad 43 \quad 28.5''$$

$$+ 39 \quad 35 \quad 04.6''$$

$$9.82640$$

$$8.20782$$

$$9.80429$$

$$0.14818$$

$$\sin(\theta - \delta) = 7.98664$$

$$S - \delta' = + 33 \quad 20.4''$$

$$99.3''$$

$$S = + 6 \quad 16 \quad 48.9''$$

$$\text{Ann Eph } S = + 6 \quad 16 \quad 46.7''$$

$$O - C$$

$$+ 26''$$

$$\text{Overstand } \delta \text{ axis: } - 0.2$$

$$O - C$$

$$+ 2.4$$

$$S' + 5 \quad 43 \quad 28.5'' \quad 10$$

$$\pi \quad 55' \quad 28.6''$$

$$9.86913$$

$$8.20782$$

$$9.64869$$

$$0.00262$$

$$\sin(\alpha - \alpha') = 7.72826$$

$$\alpha - \alpha' = - 18' \quad 23.28''$$

$$= - 1'' \quad 13.55''$$

$$\alpha = 0 \quad 56 \quad 15.79''$$

$$\alpha = 0 \quad 56 \quad 15.20''$$

$$+ 0.59''$$

$$+ 0.58''$$

$$- 0.03$$

$$+ 0.56$$

1973

Lunar Parallax

10

$$\begin{array}{r}
 A \quad 0 \quad 57 \quad 29 \quad 32 \quad 29 \quad 34 \\
 0 \quad 23 \quad 11 \quad 42 \quad 5 \\
 G-H = 1 \quad 45 \quad 46.82 \\
 \quad \quad - 26'' \quad 26' \quad 42''
 \end{array}$$

$$\begin{array}{r}
 - \quad \quad 9 \quad 12 \\
 - 26 \quad 17 \quad 30
 \end{array}$$

$$\begin{array}{r}
 9.95727 \\
 0.00000 \\
 0.04743
 \end{array}$$

$$\log 0.00469$$

$$f \quad 95^\circ 18' \quad 33.1$$

$$+ 5 \quad 43 \quad 28.5$$

$$+ 39 \quad 35 \quad 04.6$$

$$\begin{array}{r}
 982640 \\
 820782 \\
 980429 \\
 014818
 \end{array}$$

$$\sin(\theta-d) \cdot 798664$$

$$S-S' : \quad + 33 \quad 20.4$$

$$99.3$$

$$S : \quad + 6 \quad 16 \quad 48.4$$

$$\text{True Eph } S : \quad + 6 \quad 16 \quad 46.7$$

$$O-C$$

$$\begin{array}{r}
 + 26 \\
 + 2.3
 \end{array}$$

$$+ \text{stand vacum} \quad - 0.2$$

$$O-C \quad + 2.4$$

$$S' \quad + 5 \quad 43 \quad 28.5 \quad 29.9$$

$$\pi \quad 55' \quad 28''6$$

$$\begin{array}{r}
 986913 \\
 820782 \\
 964869 \\
 000262
 \end{array}$$

$$\sin(1.9) \cdot 772826$$

$$\alpha - \alpha' : \quad - 1.8' \quad 23.28$$

$$= \quad - 1'' \quad 13.55$$

$$\begin{array}{r}
 1.579 \\
 1.578
 \end{array}$$

$$X : \quad 0 \quad 56 \quad 15.20$$

$$\begin{array}{r}
 + 0.59 \\
 - 0.58
 \end{array}$$

$$= 0.03$$

$$+ 0.56$$

13

1
9.7
23.2
22
243
22
14

1974

Star-Measures

1913. Dec. 4.

12

	d	x	v
1	19019	17858	
9.7	14513	1236170	
23.5	0610	63	
	17	48	
	<u>23.4509</u>	<u>4511</u>	

d	x	v
18350	19041	
1625-151	1112921	
53	30	
51	39	
<u>9.7902</u>	<u>7912</u>	

	d	x	v
2	16858	17319	
223	791612	16242	
24.9	2527	55-10	
	48	16	
	<u>24.8929</u>	<u>8730</u>	

d	x	v
17088	17739	
968585-	1514949	
80	50	
81	43	
<u>222600</u>	<u>2591</u>	

	d	x	v
3	14730	16044	
22.3	1317070	7618	
14.2	78	2515	
	23	50	
	<u>14.1559</u>	<u>1551</u>	

d	x	v
16506	16091	
908089	1350911	
6990	20	
10	09	
<u>22.2573</u>	<u>2583</u>	

Grade 3.

1974

Star-Measured

1913 Dec 4.

12

	d	N
1	19019	17858
17	14513	1206170
175	0610	63
	17	48
	<u>23.4509</u>	<u>4511</u>

	d	N
	18350	19041
	16215157	1112921
	53	30
	51	39
	<u>9.7902</u>	<u>7912</u>

	d	N
2	16858	17319
223	791612	1624250
249	2527	5150
	48	16
	<u>248929</u>	<u>8930</u>

	d	N
	17088	17739
	968585	1514949
	80	50
	81	43
	<u>222600</u>	<u>2591</u>

	d	N
3	14730	16044
222	1317070	7618
142	76	254
	23	50
	<u>14.1559</u>	<u>1551</u>

	d	N
	16506	16091
	908089	1350911
	6990	20
	10	09
	<u>222573</u>	<u>2583</u>

Grade 3.

Moon - Measures.

scratch	d	4	2	d	2
1074	19308	16055	14518	16268	
18.7	113111	1005250	1179300	899592	
17.4	01	49	00	0092	
	95	55	30	56	
	<u>17.3955</u>	<u>.3995</u>	<u>18.7277</u>	<u>.7267</u>	

2	19.0	19299	20365	
	17.7	1173105	17935	
		9892	4955	
		90	63	
	<u>17.7585</u>	<u>.7585</u>		

3	19.2	19329	19880	
18.0		10590	1759100	
		0892	02	
		41	86	
		<u>19.1257</u>	<u>.1283</u>	

4	19.3	19228	18939	
18.8		12079	1608077	
max		7970	6577	
u		49	30	
2		<u>19.2833</u>	<u>.2862</u>	

5	19.3	18200	17950	
19.0		1096961	1518076	
		62	71	
		21	40	
		<u>19.2749</u>	<u>.2771</u>	

6	19.0	18170	18891	
	19.7	997679	1708970	
		77	66	
		74	96	
	<u>19.8196</u>	<u>.8183</u>		

1974 known measures

13

scale	d	u	d	u
1	19308	16055	14518	16268
187	113111	1005250	1179300	899592
17.9	01	49	00	00
	95	55	30	56
	<u>17.3995</u>	<u>.3995</u>	<u>18.7277</u>	<u>.7267</u>

2	190	19294	20365
	17.7	1173105	179355
		9892	49
		90	63
	<u>17.7585</u>	<u>.7585</u>	

3
192
180

19329	18880
10590	1759100
0892	02
41	86
<u>19.1257</u>	<u>.1283</u>

4
193
188
180
180

19228	18939
12079	1608077
7970	6577
49	30
<u>19.2833</u>	<u>.2862</u>

5
193
180

18200	17950
1096961	1118076
62	71
21	40
<u>19.2749</u>	<u>.2771</u>

6

190	18170	18891
197	997679	1708970
	77	66
	74	96
	<u>19.8196</u>	<u>.8183</u>

1974

moon-lucanus.

14

	α	γ	μ	δ	Σ
2				17385	18080
18.7				16080	9380
20.0				89	7074
				80	68
				<u>188702</u>	<u>8694</u>
8	15053	18598			
18.0	8730	14822			
20.0	10	2923			
	55	06			
	<u>20.6331</u>	<u>.6317</u>			
9	15096	16259			
17.3	7555	13799			
20.7	67	0389			
max	90	50			
4	<u>20.7530</u>	<u>.7540</u>			
10	20106	16241			
17.0	12847	13505			
20.7	4143	0091			
	01	40			
	<u>20.7258</u>	<u>.7258</u>			

1974

Moon - Lincennes.

14

2
187
20017385-
1608090
89
8018080
938074
70
681887028694

8	15053	18598
18.0	8730	14522
W.6	10	2923
	55	06
	<u>20.6331</u>	<u>6317</u>

9	15096	16259
173	7555	13799
W7	67	0389
	90	50
	<u>20.7530</u>	<u>7140</u>

10	20106	16291
170	1284743	13505
W7	41	0091
	01	40
	<u>20.7258</u>	<u>7258</u>

1974 Times etc. 15

Exp. totals	1912 Aug 30, 23 ^h	1 8 ^m	✓	- 23 ^h 30 ^m	✓
... moon	✓ 3	24	25.4	- 23	24 25.7
clockslow		1	02.3	✓	
H. Sid T.	23	25	27.85	✓	
Khong	4	74	31.05	✓	
G. Sid T.	28	09	58.90	✓	
Sid T. in Moon	10	33	14.17	✓	
Interval	17	36	44.73	✓	
Reduction		2	53.12	✓	
G. M. T.	17	33	51.61	0-α = -1 ^h 31 ^m	✓

from Kant Alm.		R. @.	Decl.
Moon 17 ^m	0 ^h 55 ^m 38.30	0 ^h + 6° 11' 52.8"	
Motion in 1.8473 ^m		14.588"	
" 33.8602 ^m	1 02.55	+ 8 14.0	✓
Tubular place	0 ^h 56 ^m 40.55	+ 6 20 06.8	✓

Moon's age	18 days	✓
" parallax	55' 28.9"	✓
" semidiameter	15 08.7	✓
R	9087	✓
Augmentation	+ 112	✓
Irradiation (3)	- 0.7	✓
R	919.2	✓
R	1.9704	✓
a - 3.7 (1+a) R	19.697	✓
R ²	38797	✓

1974

Taurus etc

15

Exp. time	19.2 Aug 30, 23"	18"	-23" 30"
moon	23	24	25.4 - 23 24 25.7
clock slow		1	02.3
H. Sid T.	23	25	2785
Whong	4	44	3105
G. Sid T.	28	09	5890
Sid T. Moon	10	33	1417
Interval	17	36	44.73
Reduction		2	53.12
G. M. T.	17	33	5161 6-11-1 31"

from Kant Alm.		R @	Decl
Moon 17"	0" 55"	38.50 0	+6° 11' 52.8"
Moon 17" 1.2473			14.588
... 33.8602	1	02.55	+ 8 14.0
Tabular place	0" 56"	40.55	+6 20 06.8

Moons age 18 days.

	parallax	55' 28.9
	secularian	15 08.7
934 = 11.8	R	908.7
909 = 11.2	Augmentation	+11.2
	radiation/3	- 0.7
	R	919.2
	R	1970.4
a = 3.7	(1+a) R	19.697
	R ²	3879.7

1974

Plate Constants

16

x	9.7907 ^v	22.2596	22.2578
y	10.5377 ^v	22.9934	23.1232
$2-\bar{3}$	-7470 ^v	-7338	-8654

y	23.4510	24.8930	14.1515
y	23.2402	24.8376	14.0972
$y-y$	+2108	+554	+583

$2-\bar{3}$	-122.54	$+3.72$	$+1.0306$	
-7470	-2873	$= -1.0343$	$+36 = -1.0307$	$= -1$
-7338	-3049	$= -1.0387$	$+82 = -1.0305$	$= +1$
-8654	-1734	$= -1.0388$	$+82 = -1.0306$	$= 0$
17.3200	-2301^w	$+64^w$	$= 18.1269^w$	

$y-y$	$+124.52$	$+2.74$	-3391
$+2108$	$+1219$	$+3327 + 63 = +3390$	$= -1$
$+554$	$+2771$	$+3325 + 67 = +3392$	$= +1$
$+583$	$+2771$	$+3354 + 38 = +3392$	$= +1$
18.7843^v	$+2156^v$	$+51^v$	$= 18.6659^v$

Tables	$a = -1.0$	$e = -2.9$	$a - e = +1.9$	$b + a = +1.7$
Obs	$a = -3.7$	$e = -2.7$	$a - e = -1.0$	$b + a = -2.0$

1974

Plate Constants

2	9.7907	22.2596	22.2578
3	10.5377	22.9534	23.1232
2-3	-7470	+7338	-8654

4	23.4510	24.8930	14.1515
4	23.2402	24.8376	14.0972
4-4	+2108	+554	+583

2-3	-122.54	+3.72	+10306
-7470	-2873	-10343 + 36	-10307 = -1
-7338	-3099	-10387 + 82	-10305 = +1
-8654	-1739	-10388 + 82	-10306 = 0
172200	-2301	+64	= 18.1269

4-4	+124.52	+2.74	-3391
+2108	+1219	+3327 + 63	+3390 = -1
+554	+2771	+3325 + 67	+3392 = +1
+583	+2771	+3354 - 38	+3392 = +1
18.7843	+21.56	+51	= 18.6659

Tables	a = -1.0	b = -2.9	a - b = +1.9	b + a = +1.7
Obs	a = -3.1	b = -2.7	a - b = -1.0	b + a = -5.8

lat	pos. c	resid.
2	121.6	-40
3	113.7	+13
4	90.0	-191
5	83.8	-71
6	58.4	+131
7	52.0	+3
8	20.2	0
9	0.0	-7
10	359.6	-63

1974 Moon's Mean Position (1912.0)

x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0) + (y - y_0)^2$	$O - C$
1 ~~18.7272~~	~~+1.4052~~	~~+2~~	~~19.751~~	~~3.9064~~	
2 19.0000	+1.6780	+2	2.8164	3.8786	- 1 1
3 19.1270	+1.8050	+1	3.2584	3.8811	+ 1 4
4 19.2848	+1.9628	0	3.8526	3.8526 ^{1/2}	- 2 7 1
5 19.2760	+1.9540	-0	3.8181	3.8626	- 1 7 1
6 19.0000	+1.6780	-2	2.8150	3.8761	- 3 6
7 18.8698	+1.5478	-2	2.3951	3.8621	- 1 7 6
8 18.0000	+0.6780	-3	0.4593	3.8585	- 2 1 2
9 17.3220	0.0000	-3	0.0000	3.8604	- 1 9 3
10 17.0000	-0.3220	-3	0.1039	3.8563	- 2 3 4

Comp $R^2 = 3.8797$

y	$y - y_0$	Δy	$(y - y_0)^2$
1 ~~17.3995~~	~~-1.3895~~	~~-2~~	~~1.9313~~
2 17.7585	-1.0305	-1	1.0622
3 18.0000	-0.7890	-1	0.6227
4 18.7890	0.0000	0	0.0000
5 19.0000	+0.2110	+0	0.0445
6 19.8190	+1.0300	+1	1.0611
7 20.0000	+1.2110	+2	1.4670
8 20.6324	+1.8434	+3	3.3992
9 20.7535	+1.9645	+3	3.8604
10 20.7254	+1.9368	+3	3.7524

After - Center $x = 19.0$ $y = 17.7585$
 19.8190
 37.5775
 $y_0 = 18.7888$
 $y - \text{max} = 20.7535$
 $R = 1.9647$
 $x - \text{max} = 19.2848$
 $x_0 = 17.3201$

Center $\begin{cases} x_0 = 17.3220 \\ y_0 = 18.7890 \end{cases}$

1979 known median position (1912 0)

	x	y	$x - x_0$	$y - y_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - x$	
1	18.7272	+1.4052	+2	1.9758	3.9064				
2	19.0000	+1.6780	+2	2.8164	3.8786	-	1.1		
3	19.1270	+1.8050	+1	3.2584	3.8811	+	1.9		
4	19.2848	+1.9628	0	3.8526	3.8526	-	2.7	1	
5	19.2760	+1.9540	-0	3.8181	3.8626	-	1.7	1	
6	19.0000	+1.6780	-2	2.8150	3.8761	-	3.6		
7	18.8698	+1.5478	-2	2.3951	3.8621	-	1.7	6	
8	18.0000	+0.6780	-3	0.4593	3.8585	-	2.1	2	
9	17.3220	0.0000	-3	1.0000	3.8604	-	1.9	3	
10	17.0000	-0.3220	-3	0.1039	3.8563	-	2.3	4	
						Comp 10	3.8797		17

	x	y	$x - x_0$	$y - y_0$	Δy	$(y - y_0)^2$
1	17.3995	-1.3895	-2	1.9313		
2	17.7585	-1.0305	-1	1.0622		
3	18.0000	-0.7890	-1	0.6227		
4	18.7890	0.0000	0	0.0000		
5	19.0000	+0.2110	+0	0.0445		
6	19.8190	+1.0300	+1	1.0611		
7	20.0000	+1.2110	+2	1.4676		
8	20.6324	+1.8434	+3	3.3992		
9	20.7535	+1.9645	+3	3.8604		
10	20.7258	+1.9368	+3	3.7524		

Differ. Center $x = 19.07 = 17.7585$
 19.8190
 37.5775
 $y_0 = 18.7888$
 $y_{\text{max}} = 20.7535$
 $R = 1.9647$
 $x_{\text{max}} = 19.2848$
 $x_0 = 17.3201$

Center $\left\{ \begin{array}{l} x_0 = 17.3220 \\ y_0 = 18.7890 \end{array} \right.$

Formation of Normal.

	ab	ac	bc
2	- 1.73	- 18.5	+ 11.3
3	- 1.43	+ 25.3	- 11.1
~~4~~	+ 0.00	- 133.3	- 0.0
5	+ 0.41	- 333.4	- 35.9
6	+ 1.73	- 605	- 37.1
7	+ 1.88	- 272.8	- 213.0
8	+ 1.25	- 144.2	- 390.1
9	+ 0.00	- 0.0	- 378.3
10	- 0.62	+ 74.9	- 454.0
	+ 1.49	- 862.5	- 1508.2

1974

Moon's Center Conventional Equations

18

	a	b	0		c	0-c
1	+ 1.68	-1.03	= -1.1	- 69 + 98 =	+ 29	- 40
2	+ 1.81	-0.79	= +1.4	- 74 + 75 =	+ 1	+ 13
3	+ 1.96	+0.00	= -2.71	- 80 - 0 =	- 80	- 191
4	+ 1.95	+0.21	= -1.71	- 80 - 20 =	- 100	- 71
5	+ 1.68	+1.03	= -3.6	- 69 - 98 =	- 167	+ 131
6	+ 1.55	+1.21	= -1.76	- 64 - 115 =	- 179	+ 3
7	+ 0.68	+1.84	= -2.12	- 38 - 179 =	- 212	0
8	+ 0.00	+1.96	= -1.93	- 0 - 186 =	- 186	- 7
9	- 0.32	+1.94	= -2.34	+ 13 - 184 =	- 171	- 63

Average = 58

Normal Equations

$$\begin{aligned}
 &+ 17.59 + 1.49 = -862 \\
 &+ 1.49 + 15.27 = -1508 \\
 &- 1.49 - 0.13 = + 73 \\
 &\quad + 15.14 = -1435 \\
 &+ 17.59 = -862 + 141 = -721
 \end{aligned}$$

$$\begin{aligned}
 b &= -94.8 \\
 a &= -41.0
 \end{aligned}$$

1974

Unions Center Concultural Equations

18

τ	a	b	c	d	e	f	g
2	+1.68	-1.03	-1.1	-69	+98	+29	-40
3	+1.81	-0.79	+1.4	-79	+75	+1	+13
4	+1.96	+0.04	-2.71	-80	0	-80	-191
5	+1.95	+0.21	-1.71	-80	-20	-100	-71
6	+1.68	+1.03	-3.6	-69	+98	-167	+131
7	+1.55	+1.21	-1.76	-64	+115	-179	+3
8	+0.68	+1.84	-2.12	-38	+179	-212	0
9	+0.00	+1.96	-1.93	0	+186	-186	-7
10	-0.32	+1.94	-2.34	+1.3	+184	-171	-63

Average = 58

Normal Equations

$$\begin{aligned}
 +17.59 + 1.49 &= -862 \\
 +1.49 + 15.27 &= -1508 \\
 -1.49 - 0.13 &= +73 \\
 +15.14 &= -1435 \\
 +17.59 &= -862 + 141 = -721
 \end{aligned}$$

$$\begin{aligned}
 b &= -948 \\
 a &= -910
 \end{aligned}$$

Red. ad l. abh.

$$\begin{array}{rcl}
 H+K & 8 & 36 = 129^\circ \\
 H & 7 & 38 \\
 \alpha & 0 & 58 \\
 G & 21 & 28 \\
 G+K & 22 & 26 = 336^\circ 30'
 \end{array}$$

$$S = +5 \quad 47$$

$$\begin{array}{rcl}
 \log i & = & 0.8763 \\
 \cos S & = & 9.9978 \\
 (i) & = & 0.8741
 \end{array}$$

$$\begin{array}{rcl}
 \log \cos(G+K) & = & 9.9624 \\
 \log \sin(G+K) & = & 1.1793 \\
 \sin(G+K) & = & 9.6007 \\
 \tan S & = & 9.0055 \\
 \frac{1}{\sin} & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log \sin S & = & 9.0083 \\
 \cos(H+K) & = & 9.8089 \\
 \sin(H+K) & = & 1.2796 \\
 \sec S & = & 0.0022 \\
 \frac{1}{\sin} & = & 8.8239
 \end{array}$$

$$\begin{array}{rcl}
 \log(g') & = & 1.1417 \\
 \log(h') & = & 0.0910 \\
 (g) & = & 8.6094 \\
 (h) & = & 9.9962
 \end{array}$$

$$\begin{array}{rcl}
 f & = & +1.83 \\
 (g) & = & -0.04 \\
 (h) & = & +0.99 \\
 \hline
 & = & +2.78
 \end{array}$$

$$\begin{array}{rcl}
 g' & = & +13.86 \\
 h' & = & -1.23 \\
 (i) & = & +7.48 \\
 \hline
 & = & +20.11
 \end{array}$$

1974 Moon's Mean Position (1912.0)

19

$$\begin{array}{rcl} X_0 = 17.3220^\circ & Y_0 = 18.7890^\circ \\ \frac{1}{2}a = -20^\circ & \frac{1}{2}b = -47^\circ \\ \hline 17.3200^\circ & 18.7843^\circ \end{array}$$

from Platiconstant $X = 18.1269^\circ$ $Y = 18.6659^\circ$

$$\xi = +0.1269^\circ$$

$$\eta = -3.3341^\circ$$

$$\log \xi = 9.10346^\circ$$

$$\log \zeta = 9.99778^\circ$$

$$\log \cos \zeta = 8.50724^\circ$$

$$\log (\alpha - A) = 0.59844^\circ$$

$$\alpha - A = +3.97^\circ$$

$$A = 0.5739^\circ$$

$$\alpha_0 = 0.574297^\circ$$

$$\text{Reduct. app.} = +2.78^\circ$$

$$\alpha' = 0.594575^\circ$$

$$\log \tan \delta = 9.0093^\circ$$

$$\log \zeta^2 = 8.2069^\circ$$

$$\log \eta = 4.2696^\circ$$

$$\log \eta_0 = 0.52298^\circ$$

$$\log \cos \eta = 7.33115^\circ$$

$$\log (\delta - D) = 3.19183^\circ$$

$$\delta - D = -25.554^\circ$$

$$D = +6.1233^\circ$$

$$\delta_0 = +5^\circ 46' 37.6''$$

$$\text{Reduct. app.} = +20.1''$$

$$\delta' = +5^\circ 46' 57.7''$$

1974 known mean Position (1912.0)

19

$$\begin{array}{rcl}
 X_0 & = & 17.3220 \quad Y_0 = 18.7890 \\
 \hline
 \Delta\alpha & = & -20 \quad \Delta\delta = -47 \\
 \hline
 & & 17.3200 \quad 18.7843
 \end{array}$$

from Plate measurement $X = 18.1269 \quad Y = 18.6659$

$$\xi = +0.1269$$

$$\eta = -3.3341$$

$$\begin{array}{rcl}
 \log T & = & 9.10346 \\
 \log S & = & 9.99778 \\
 \log \cos \delta & = & 8.50724
 \end{array}$$

$$\begin{array}{rcl}
 \log \tan \delta & = & 9.0093 \\
 \log S^2 & = & 8.2069 \\
 \log \eta & = & 9.2696
 \end{array}$$

$$(X-A) = 0.59844$$

$$\begin{array}{rcl}
 \log \eta_0 & = & 0.52298 \\
 \log \cos \delta & = & 7.33115
 \end{array}$$

$$X-A = +33.97$$

$$(d-D) = 3.19183$$

$$A = 0.5739$$

$$\delta - D = -25.554$$

$$X_0 = 0.574297$$

$$D = +6.1233$$

$$\text{Reduct. app.} = +2.77$$

$$\delta_0 = +5^\circ 46' 37''.6$$

$$X' = 0.594575$$

$$\text{Reduct. app.} = +120.9$$

$$\delta' = +5^\circ 46' 50''.7$$

1974

Lunar Parallax

20

$$\begin{aligned} \alpha' &= 0 \quad 57 \quad 45.75'' \\ \theta &= 23 \quad 25 \quad 27.85'' \\ \theta - \alpha &= -1 \quad 32 \quad 17.89'' \\ &= -23 \quad 04 \quad 28'' \end{aligned}$$

$$\delta' = +5^\circ 46' 57.7''$$

$$\pi \quad 55' 28.9''$$

$$- \quad \quad \quad 8 \quad 06$$

$$22 \quad 56 \quad 22''$$

$$9.95727''$$

$$0.00000$$

$$0.03578''$$

$$\text{lang} \quad 9.99305''$$

$$\gamma \quad 44 \quad 32 \quad 28.1''$$

$$\delta \quad 5 \quad 46 \quad 57.7''$$

$$38 \quad 45 \quad 30.4''$$

$$9.82640$$

$$9.20786''$$

$$9.79660''$$

$$0.15402''$$

$$\sin(\theta - \delta') = 7.98488''$$

$$\delta - \delta' = + \quad 33 \quad 12.1''$$

$$S = +6 \quad 20 \quad 09.8''$$

$$\text{Air Eph } \delta = +6 \quad 20 \quad 06.8''$$

$$O - C \quad \quad \quad + \quad 3.0$$

$$9.86913''$$

$$8.20786''$$

$$9.59325''$$

$$0.00286''$$

$$\sin(\alpha - \alpha') = 7.67286''$$

$$\alpha - \alpha' = -16 \quad 11.16''$$

$$= -1 \quad 04.74''$$

$$\alpha = 0 \quad 56 \quad 41.01''$$

$$\alpha = 0^h \quad 56^m \quad 40.55''$$

$$+ \quad 0.46''$$

1174

Lunar Parallax

20

$$\begin{array}{r} \alpha = 0 \quad 57 \quad 45.75 \\ \delta = 23 \quad 25 \quad 27.85 \\ \alpha - \alpha' = -1 \quad 32 \quad 57.89 \\ \delta - \delta' = -23 \quad 09 \quad 28 \end{array}$$

$$= \quad \quad \quad 8 \quad 06$$

$$22 \quad 56 \quad 22$$

$$995727$$

$$000000$$

$$003578$$

$$\text{lang} \quad 999305$$

$$44 \quad 32 \quad 28.1$$

$$5 \quad 5 \quad 46 \quad 57.7$$

$$38 \quad 45 \quad 30.4$$

$$982640$$

$$920786$$

$$979660$$

$$015402$$

$$2(\alpha - \alpha') \quad 798488$$

$$\delta - \delta' = + \quad 33 \quad 12.8$$

$$\delta = +6 \quad 20 \quad 098$$

$$\text{Sun Eph } \delta = +6 \quad 20 \quad 068$$

$$O - C \quad \quad \quad + \quad 30$$

$$\delta' = +5 \quad 46 \quad 57.7$$

$$\pi \quad 55' \quad 28.9$$

$$986913$$

$$820786$$

$$959321$$

$$000266$$

$$2(\alpha - \alpha') \quad 767285$$

$$\alpha - \alpha' = -15 \quad 11.04$$

$$= -1 \quad 04.99$$

$$\alpha = 0 \quad 56 \quad 44.90$$

$$\alpha = 0 \quad 56 \quad 40.55$$

$$+ \quad 045$$

