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KG
11366
.881

V
968
72
74
77

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Harvard Lunar Plates

Measures and Reductions.

Mary Fowler.

Volume V.

Plate No.	Date	Page.
968	March 9, 1911	1
972	March 11, 1911	19
974	March 11, 1911	40
977	March 13, 1911	56

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MC968

Comparison stars - Standard coords.

See Vol. II pp. 38-39.

	1	2	3
α	$7^h\ 06^m\ 51^s.26$	$7^h\ 07^m\ 33^s.26$	$7^h\ 13^m\ 26^s.76$
A	7 12 37	7 12 57	7 12 37
α-A	− 5 45.74	− 5 03.74	+ 0 49.76
sin(α-A)	− 345.70	− 303.72	+ 49.76
log ρ sin φ'	2.53870n	2.48247n	1.69688
log ρ cos φ'	9.95376	9.94620	9.95328
ρ sin φ'	0.99970n	0.93591n	0.15740
ξ₀	−9.9930	−8.6280	+1.4368
ξ₁	− 31	− 37	+ 1
ξ	80039	9.36833	19436.9
x	7.9541	9.6791	19.4098
x-ξ	− 498	+.3108	− 271

	1	2	3
δ	$+25^\circ\ 58'\ 18''.0$	$+27^\circ\ 55'\ 56''.6$	$+26^\circ\ 06'\ 15''.4$
D	+26 37 24	26 37 24	+26 37 24
δ-D	− 39 06.0	+1 18 32.6	− 31 08.6
tan(δ-D)	− 2346.1	+ 4715.4	− 1868.7
log ρ cos φ'	3.37035n	3.67354	5.27154n
ρ cos φ'	0.70150n	1.00449	0.60269n
log tan δ	9.6876	9.7244	9.6902
log δ₀²	9.9994	1.8718	0.3148
η₁	8.7404	8.6496	7.0584
η₀	−5.0292	+10.1040	+4.0058
η₁	+ 550	+ 446	+ 11
η	17.0258	32.1486	17.9953
η	17.2388	32.3268	17.9366
η-η	+ 2130	+ 1782	− 587

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MC 968

Comparison Stars - Standard course.

See Wob. IX pp. 28-39.

	1	2	3
X	$7^h\ 06^m\ 51^s.26$	$7^h\ 07^m\ 33^s.26$	$7^h\ 13^m\ 26^s.76$
+	7 12 37	7 12 57	7 12 37
X-A	− 5 45.74	− 5 03.74	+ 0 49.76
(X-A)	− 345.70	− 303.72	+ 49.76
log	2.53870n	2.48247n	1.69688
log δ	9.95376	9.94620	9.95328
$\bar{3}_0$	0.99970n	0.93591n	0.15740
$\bar{3}_0$	− 9.9930	− 8.6280	+ 1.4361
$\bar{3}_1$	− 31	− 37	+
$\bar{3}_2$	80039	9.36113	19436 2
x	7.95541	9.67491	19.4098
x-3	− 498	~~+3178~~ 3108	− ~~264~~ 271

δ.	+25° 58′ 18.″0	+27° 55′ 56.″6	+26° 06′ 15.″4
D	+26 37 24	26 37 24	+26 37 24.
δ-D	− 39 06.0	+1 18 32.6	− 31 08.6
(δ-D)	− 2346.1	+ 4715.4	− 1868.7
log	3.37035n	3.67354	5.27154n
$\bar{3}_0$	0.70150n	1.00449	0.60269n
log δ	9.6876	9.7244	9.6902
$\bar{3}_0^2$	9.9994	1.8718	0.3158
$\bar{3}_1$	8.7404	8.6496	7.0594
$\bar{3}_0$	− 5.0292	+ 10.1040	+ 4.0058
$\bar{3}_1$	+ 550	+ 446	+ 11
4	17.0258	32.1486	17.9953
4	17.2388	32.3268	17.9366
4-4	+ 2130	+ 1782	− 587

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MC968 1912 Nov. 21. 2

Comparison Stars - Standard coordinates.

	4	5
α	$7^h\ 18^m\ 24^s.14$	$7^h\ 19^m\ 19^s.10$
A	7 12 37	7 12 37
α−A	+ 5 47.14 ✓	+ 6 42.10
sin(α−A)	+ 347.10 ✓	+ 402.04
log	2.540457 ✓	2.604277
a·cosδ	9.946077 ✓	9.950655
log S_0	0.99376 ✓	1.062161
S_0	+9.8574 ✓	+11.5387
S_1	+ 47 ✓	+ 38
S	27.8621 ✓	29.5425
x	28.1800	29.6978
y		
x−S	+ 3179 ✓	+ 1053

δ	+27° 58′ 03.″1	+26° 48′ 03.″9
D	26 37 24	26 37 24
δ−D	+1 20 39.1 ✓	+ 10 39.9
tan(δ−D)	+ 4839.9 ✓	+ 639.9
log	3.68484 ✓	2.80611
log η_0	1.01599	0.13726
log η	9.72251 ✓	9.70884
η_0	1.98755 ✓	2.12433
η_1	8.7660 ✓	8.8811
M_0	+10.37750 ✓	+1.37111
M_1	+ 583 ✓	+ 760
M	32.4333 ✓	23.4471
y	32.1760	23.1528
y−η	− 2573 ✓	− 2943

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MC 968 1912 Nov 21. 2

Comparison Stars
Standard coordinates

	4	5
α	$7^h\ 18^m\ 24^s.14$	$7^h\ 19^m\ 19^s.10$
A	7 12 37	7 12 37
α − A	+ 5 47.14	+ 6 42.10
sin(α − A)	+ 347.10	+ 402.04
log	2.540 45	2.604 27
δ · cos δ	9.946 07	9.950 65
log S_0	0.993 76	1.062 16
S_0	+ 9.857 4	+ 11.538 7
S_1	+ 47	+ 38
S	27.862 1	29.542 5
x	28.180 0	29.697 8
y		
y − S	+ .317 9	+ 1053

δ	+ 27° 58′ 03″.1	+ 26° 48′ 03″.9
D	26 37 24	26 37 24
δ − D	+1 20 39.1	+ 10 39.9
tan(δ − D)	+ 4839.9	+ 639.9
log	3.684 84	2.806 11
log $η_0$	1.015 99	0.137 26
log tan δ	9.972 51	9.703 4
log S_0	1.987 5	2.124 3
log $η_1$	8.766 0	8.881 1
$η_0$	+ 10.375 0	+ 1.371 1
$η_1$	+ 583	+ 760
η	32.433 3	23.471 1
η	32.176 0	23.152 8
η − η	− 257 3	− 2943

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Comparison stars - measures

poor images

	y d	y n	x d	x n
1				
7.9	16747	15841	11187	
17.2	14349 54	8226 30	10730 36	9700 00
	56	30	32	00
	49	47		9238
	17.2394	.2383	7.9546	.9538
2				
9.7	14403	14145	14318	14500
32.4	11134 34	7399 98	11094 90	7681 92
	35	00	00	90
	02	50	20	00
	32.3269	.3266	9.6776	.6812
3				
19.9		14798		
17.9	9376 80	14161 56	15742	14580
	80	57	9835 50	10482 78
	8750		41	81
			54	84
	17.9371	.9360	19.4094	.4101
4				
28.1	15310	13930	13979	16921
32.2	13543 45	5687 89	5778 74	15121 21
	47	84	80	19
	12	51	80	31
	32.1765	.1756	28.1797	.1803
5				
29.7	16286	15436	17869	14451
23.1	14750 53	6954 62	14352 48	7986 83
	50	60	42	83
	91	38	69	69
	23.1536	.1521	29.6478	.6479

Remeasures

1 d	12108	2 (d)	16197	2 (n) 14664 (n)
	11653 50		12978 81	7858 60
	54		81	56
			09	56
	7.9544		9.6779	9.6799

8865 69
60
8400
7.9535

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Comparison Stars - measures.
poor images

	4		4	
	d	n	d	n
1				
7.9	16747	15841	11187	
17.2	14349 54	8226 30	10730 36	9700 00
	56	30	32	00
	49	47		9238
	17.2394	.2383	7.9546	.9538
2				
9.7	14403	14145	14318	14500
32.4	11134 34	7399 98	11094 90	7681 92
	30	00	60	90
	8702	30	20	00
	32.3269	.3266	9.6776	.6812
3				
19.9		14798		
17.9	9376 80	14161 56	15742	14580
	80	57	98350	10482 78
	8750		41	81
			54	84
	17.9371	.9360	19.4094	.4101
4				
28.1	15310	13930	13979	16921
32.2	13543 45	5687 89	5778 74	15121 21
	41	84	80	19
	12	51	80	31
	32.1765	.1756	28.1797	.1803
5				
29.7	16286	15436	17869	14451
23.1	14750 53	6954 62	14352 48	7986 83
	50	60	42	83
	91	38	69	69
	23.1536	.1521	29.6478	.6479

Remeasures n

1(d)	12108	2(d)	16197	2(n)	14664	1(n)	
	11653 50		12978 81		7858 60		8865 69
	54		81		58		60
			09		56		8400
	7.9544		9.6779		9.6799		7.9535

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Points on Lorentz limit measures.

	d		2
1/			
16.5	15838		14478
25.3	1261910		7684 95
y=max	0924		9290
	42		86
	25.3223		.3206
2			
16.0	14900		17411
25.3	1223027		1006591
	3127		7772
	09		26
	25.2674		.2654
3/			
15.0	15526		14558
24.7	856546		11560 42
	5749		6054
	34		70
	24.6978		.6992
4/			
15.0	14968		15971
21.8	7366 62		13540 40
	6664		3250
	78		79
	21.7612		.7567
5			
16.0	13871		15108
21.1	1189489		705455
	9095		5356
	78		02
	21.1980		.1953
6			
14.8			
22.0			

remeasure reversed, Nov 4

15198	
1216984	
8075	
02	
.6978	

possibly a valley.

15479	14500
1346978	650998
6980	1004
94	98
14.7992	.7993

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MC 468 1912 Nov. 9. 4.

Position on Lowell's Print measures.

	4		
	a		2
1/			
16.5	15838		14478
25.3	12619 10		768495
y=max	0924		9290
	42		66
	25.3223		.3206
2/			
16.0	14900		17411
25.3	12230 27		1006591
	3127		7772
	09		26
	25.2674		.654
3/			
15.0	15526	14558	15198
24.7	856546	1156042	1216984
	5749	6054	2075
	34	10	02
	24.6978	.6992	.6978
4/			
15.0	14968	15971	
21.8	736662	1354040	
	6664	3250	
	78	79	
	21.7612	.7567	
5/			
16.0	13871	15108	
21.1	1189489	705455	
	9693	5356	
	78	02	
	21.1980	.1953	
6/			
14.8		15479	14500
22.0		1346978	650998
		6980	1001
		94	98
		14.7992	.7993

Measures reversed, not y

probably a valley.

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MC968 1912 Nov. 2. 5
Nov. 4

Points on Moon's Limb
measures.

	d	n
7		
14.4	14374	17570
23.0	847170	1348880
	7661	8081
	85	83
	14,4091	.4093
8		
14.4	14345	16594
23.2	829078	1262021
x = min	8072	1870
	50	98
	14.3932	.3976
9		
14.6	16211	15232
24.0	1169809	970006
	1108	0111
	27	38
	14.5488	.5531
10		
15.4	15805	15883
25.0	947678	1174956
	6971	6066
	15	98
	15.3663	.3731

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MC968 1912 Nov. 2. 5
Nov. 4

Points on Wolf's disk
measures.

	d	n
7h		
14.4	14378	17570
23.0	847170	1348880
	7661	8081
	85	83
	14,4091	.4093
8h		
14.4	14345	16594
23.2	829078	1262021
x : sun	8072	1820
	50	98
	14.3932	.3976
9h		
14.6	16211	15232
24.0	1169809	970000
	1108	0111
	27	38
	14.5488	.5531
10h		
15.4	15805	15483
25.0	947678	1174956
	6971	6066
	15	98
	15.3663	.3731

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M C 9 6 8 1912 Nov 20.

Comparison Stars — Mean Measures.
+ Center of plate.

Star	x	y
1	7.9541	17.2388
2	9.6791	32.3268
3	19.4098	17.9366
4	28.1800	32.1760
5	29.6478	23.1528
5	94.87	122.83
	18.97	24.57
	-18.	-22
	0.97	2.57
	31	465
	97	119.5"
	291	=19' 55"
	+30.07	

Mean
R.A.
$7^h\ 13^m\ 07^s$
$-\quad 30^s$
$7\ 12\ 37 = A$

Decl.
$+26°\ 57'\ 19''$
$-\quad 19'\ 55''$
$+26\ 37\ 24 = D$

Preliminary Reduction

Star	x − 5	− 2384		− 5x		+ 4628
1	−498	−4094 = −4592	−40	= −4632		= −4
2	+3108	−7687 = −4579	−49	= −4628		= 0
3	−271	−4260 = −4531	−96	= −4627		= +1
4	+3179	−7664 = −4485	−141	= −4626		= +2
Mean	16.4883	−5529		−82		= 16.3900
		25				

Star	y − m	+ 235x		− 54		− 3895
1	+2130	+1869 = +3999	−86	= +3913		= +18
2	+1782	+2275 = +4057	−162	= +3895		= 0
3	−587	+4561 = +3974	−90	= +3884		= −11
4	−2573	+6622 = +4049	−161	= +3888		= −7
Mean	23.2308	+3875		−116		= 23.2172
		3852				23.2149

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MC968 1912 Nov 20. 6

Comparison Stars — Mean Measures.
+ Center of Plate.

Star	x	y
1	7.9541	17.2388
2	9.6791	32.3268
3	19.4098	17.9366
4	28.1800	32.1760
5	29.6478	23.1528
	5|94.87	122.83
	18.97	24.57
	-18.	-22
	0.97	2.57
	31	465
	97	1195"
	291	=19'55"
	+30.07	

Mean R.A.
7h 13m 07s
− 30s
7 12 37

Decl.
+26° 57' 19"
− 19' 55"
+26 37 24

Preliminary Reduction.

Star	x − 5	−2384		−526		+4628
1	−498	−4094 =	−4592	−40 =	−4632	= −4
2	+3108	−7687 =	−4579	−49 =	−4628	= 0
3	−271	−4260 =	−4531	−96 =	−4627	= +1
4	+3179	−7664 =	−4485	−141 =	−4626	= +2
Mean	16.4683	−5529		−82		=16.3900

Star	y − η	+235x		−54		−3895
1	+2130	+1869 =	+3999	−86 =	+3913	= +18
2	+1782	+2275 =	+4057	−162 =	+3895	= 0
3	−587	+4561 =	+3974	−90 =	+3884	= −11
4	−2572	+6622 =	+4049	−161 =	+3888	= −7
Mean	23.2304	+3875		−116		=23.2172

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1912 Nov. 21.

7

Times etc.

Eph. to Stars	1911 Mar 9	8^h	20^m		8^h 32^m
" Moon		8	25	45.2	8 25 45.4
Clock fast			2	36.8	
H. Sid Time		8	23	08.5	
+ long		4	44	31.05	
G. Sid Time		13	07	39.55	
Sid T mean noon		23	04	13.82	
Interval		14	03	25.73	
Reduction.			− 2	18.18	
G. M. T.		14^h	01^m	07.55	

From Ane. Eph.	R.A.	Decl.
Moon at 14^h	7^h 12^m 38.10	+27° 03′ 34.1″
Motion in 1^m = 2.6074		= 3.027
" " 1.126	+ 2.94	− 3.4
Tabular Place	7^h 12^m 41.04	+27° 03′ 30.7

Moon's Parallax.	58′ 50.5″
" Semidiam.	16′ 03.5

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Times etc.

Of Wstars	1911 Mar 9	8^h	20^m		8^h	32^m
" Moon		8	25	45.2	8	25 45.4
Clockfast			2	36.8		
Mt. Sid Time		8	23	08.5		
" Long		4	44	31.05		
Gr Sid Time		13	07	39.55		
Gr T mean Noon		23	04	13.82		
Interval		14	03	25.73		
Reduction.			2	18.18		
G. M. T.		14^h	01^m	07.55		

From Am Eph.				R.A		Decl.	
Moon at 14^h		7^h	12^m	$38^s.10$		+27° 03' 34".1	
Motion in 1^m	2,6074				3.027		
" ~~1.99~~ 1.176			+	2,94	−		3.4
Tabular Place		7^h	12^m	$41^s.04$		+27° 03' 30".7	

Moons Parallax.	5'	50".4
" Semidiam.	16'	03".5

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MC868 1912 Dec. 5. 8

Comparison Stars – Plate Constants.

Conditional Equations.

a	b	c	x − 3	y − 7
+ 7.95	+ 17.24	+ 1 =	− 4	+ 18
+ 9.68	+ 32.33	+ 1 =	0	0
+ 19.41	+ 17.94	+ 1 =	+ 11	− 11
+ 28.18	+ 52.18	+ 1 =	+ 2	− 7

Mean Equations.

+ 8.82	+ 24.78	+ 1 =	− 2.00	+ 9.00
+ 23.80	+ 25.06	+ 1 =	+ 1.50	− 9.00
+ 13.68	+ 17.59	+ 1 =	− 1.50	+ 3.50
+ 18.93	+ 32.26	+ 1 =	+ 1.00	− 3.50
− 14.98	− 0.28	=	− 3.50	+ 18.00
− 5.25	− 14.67	=	− 2.50	+ 7.00
+ 5.25	+ 0.10	=	+ 1.22	− 6.31
	− 14.576	=	− 1.28	+ 0.69
	b	=	+ 0.09	− 0.05

$-14.98a - 3.50 + 0.03 = -3.47$ $\quad +18.00 - 0.0$

$a =$ + 0.23 $\quad a = -1.20$

− 2.0	+ 1.5	− 1.5	+ 1.0	+9.00	−9.0	+3.5	−8.5
− 2.2	− 2.2	− 1.5	− 2.8	+10.6	+28.6	+16.4	+22.7
− 2.0	− 5.5	− 3.2	− 4.4	+ 1.2	+ 1.2	+ 0.9	+ 1.6
+ 6.2	− 6.2	− 6.2	− 6.2	+20.8	+20.8	+20.8	+20.8

Residuals in x

				c	o	968 o − c	967 o − c	966 o − c
+ 2	+ 2	− 6	=	− 2	− 4	− 2	+ 3	+ 8
+ 2	+ 3	− 6	=	− 1	0	+ 1	− 3	− 6
+ 5	+ 2	− 6	=	+ 1	+ 1	0	− 3	− 6
+ 7	+ 3	− 6	=	+ 4	+ 2	− 2	+ 3	+ 7

Residuals in y

				c	o	968 o − c	967 o − c	966 o − c
− 10	− 1	+ 21	=	+ 10	+ 18	+ 8	+ 11	+ 14
− 12	− 2	+ 21	=	+ 7	0	− 7	− 11	− 12
− 23	− 1	+ 21	=	− 3	− 11	− 8	− 11	− 12
− 34	− 2	+ 21	=	− 15	− 7	+ 8	+ 12	+ 13

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Comparison stars - Plate Constants.

Conditional Equations.

a	b	c	z − z̄	y − ȳ
+ 7.95	+ 17.24	+ 1 =	− 15	+ 18
+ 9.68	+ 32.33	+ 1 =	− 35	0
+ 19.41	+ 17.94	+ 1 =	+ 47	− 11
+ 28.18	+ 32.18	+ 1 =	+ 3	− 7

Mean Equations

+ 8.82	+ 24.78	+ 1 =	− 25.00	+ 9.00
+ 23.80	+ 25.06	+ 1 =	+ 25.00	− 9.00
+ 13.68	+ 17.59	+ 1 =	+ 16.00	+ 3.50
+ 18.93	+ 32.26	+ 1 =	− 16.00	− 3.50
− 14.98	− 0.28	+ 1 =	− 50.00	+ 18.00
− 5.25	− 14.67	+ 1 =	+ 32.00	+ 7.00
+ 5.25	+ 0.19		+ 17.50	− 6.31
	− 14.57	b =	+ 49.50	+ 0.69
		b =	− 3.40	− 0.05

−14.98a = −50.00 − 0.95 = −50.95 +18.00 − 0.0

a = + 3.59 a = − 1.20

−25.0	+25.0	+16.0	−16.0	+9.00	−9.0	+3.5	−3.5
80.8	−83.2	−47.8	−66.2	+10.6	+28.6	+16.4	+22.7
+84.3	+85.2	+59.8	+109.1	+ 1.2	+ 1.2	+ 0.9	+ 1.6
+28.5	+27.0	+26.0	+26.9	+20.8	+20.8	+20.8	+20.8

Standard x

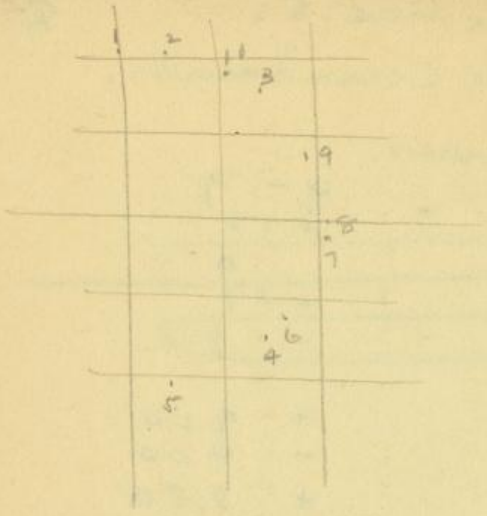
		c	o	968 o − c	967 o − c	966 o − c
+ 28	− 59	+ 28 =	− 3	− 15	− 12	+ 3	+ 8
+ 34	− 110	+ 28 =	− 48	− 35	+ 13	− 3	− 6
+ 68	− 61	+ 28 =	+ 35	+ 47	+ 12	− 3	− 6
+ 98	− 109	+ 28 =	+ 7	+ 3	− 14	+ 3	+ 7

Standard y

		c	o	968 o − c	967 o − c	966 o − c
− 10	− 1	+ 21 =	+ 10	+ 18	+ 8	+ 10	+ 14
− 12	− 2	+ 21 =	+ 7	0	− 7	− 10	− 12
− 23	− 1	+ 21 =	− 3	− 11	− 8	− 10	− 12
− 34	− 2	+ 21 =	− 15	− 7	+ 8	+ 9	+ 13

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Point	Pos ∠.	Resid
5	193°.5	+ 5
4	225.2	+ 5.2
6	234.0	− 8.1
7	263.7	− 3
8	270.0	+ 42
~~9~~	~~291.6~~	
3	314.5	− 8.4
10	327.7	+ 5.2
2	346.5	+ 6.0
1	0 0	− 5.5

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Moon's Center.

	x	$x - X_0$	$(x-X_0)^2$	$(x-X_0)^2-(y-Y_0)^2$	O − C
1	16.4863	0.0000	0.0000	4.3719	+ 6
2	16.0000	−0.4863	0.2365	4.3814	+ 101
3	15.0000	−1.4863	2.2091	4.3632	− 81
4	15.0000	−1.4863	2.2091	4.3744	+ 31
5	16.0000	−0.4863	0.2365	4.3733	+ 20
6	19.7992	−1.6871	2.8463	4.3604	−109
7	14.4092	−2.0771	4.3143	4.3674	− 39
8	14.3954	−2.0909	4.3719	4.3719	+ 6
9	14.5510	−1.9353	[3.7454]	[4.3375]	
10	15.3697	−1.1166	1.2468	4.3779	+ 66
				4.3713	+ 1

	y	$y - y_0$	$(y-Y_0)^2$
1	25.3214	+2.0909	4.3719
2	25.2664	+2.0359	4.1449
3	24.6982	+1.4677	2.1541
4	21.7590	−1.4715	2.1653
5	21.1966	−2.0339	4.1368
6	22.0000	−1.2305	1.5141
7	23.0000	−0.2305	0.0531
8	23.2305	0.0000	0.0000
9	24.0000	+0.7695	[0.5921]
10	25.0000	+1.7695	3.1311

Approximate Center.

$x = 16.0$ $y = 25.2664$
$x = 16.0$ $y = 21.1966$
46.4630 = most wt.

mean $Y = 23.2315$
Adopt $Y_0 = 23.2305$
max y = 25.3214
Y_0 = 2.0909
min y = 14.3954
X_0 16.4863

$x = 15.0$
$x = 15.0$

$y = 24.6982$
$y = 21.7590$
46.4572
23.2286

Assume center $\begin{cases} X_0 = 16.4863 \\ Y_0 = 23.2305 \end{cases}$

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Moore's Center.

	x	$x - X_0$	$(x-X_0)^2$	$(x-X_0)^2-(y-Y_0)^2$	O − C
1	16.4863	0.0000	0.0000	4.3719	+ 6
2	16.0000	+ 0.4863	0.2365	4.3814	+ 101
3	15.0000	− 1.4863	2.2091	4.3632	− 81
4	15.0000	− 1.4863	2.2091	4.3744	+ 31
5	16.0000	− 0.4863	0.2365	4.3733	+ 20
6	14.7992	− 1.6871	2.8463	4.3604	− 109
7	14.4092	− 2.0771	4.3143	4.3674	− 39
8	14.3954	− 2.0909	4.3719	4.3719	+ 6
9	14.5510	− 1.9353	3.7454	[4.3775]	
10	15.3697	− 1.1166	1.2468	4.3779	+ 66
				4.3713	+ 1

	y	$y - Y_0$	$(y-Y_0)^2$
1	25.3214	+ 2.0909	4.3719
2	25.2664	+ 2.0359	4.1449
3	24.6982	+ 1.4677	2.1541
4	21.7590	− 1.4715	2.1653
5	21.1966	− 2.0339	4.1368
6	22.0000	− 1.2305	1.5141
7	23.0000	− 0.2305	0.0531
8	23.2305	0.0000	0.0000
9	24.0000	+ 0.7695	0.5921
10	25.0000	+ 1.7695	3.1311

Approximate Center.

$x = 16.0$ $y = 25.2664$
$x = 16.0$ $y = 21.1966$
46.4630 = mean.
mean $Y = 23.2315$
Adopt $Y_0 = 23.2305$
mean $y = 25.3214$
$Y_0 = 2.0909$
mean $x = 14.3954$
$X_0 = 16.4863$

$x = 15.0$ $y = 24.6982$
$x = 15.0$ $y = 21.7590$
46.4572
23.2286

Assumed Center $\begin{cases} X_0 = 16.4863 \\ Y_0 = 23.2305 \end{cases}$

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No	ab	an	bn
1	0.00	0.0	+ 12.
2	− 0.98	− 49.6	+ 206.
3	− 2.19	+ 122	− 119.
4	+ 2.19	− 46.	− 46.
5	+ 0.98	− 9.8	− 41.
6	+ 2.08	+ 184	+ 134.
7	+ 0.48	+ 81.	+ 11.
8	0.00	− 12.	+ 0.0
10	− 1.98	− 74.	+ 117.
	+0.58	+196.	+274.

[aa] = +17.68 [bb] = +21.65

[ac] = −10.94 [bc] = +~~3.18~~ +2.41 [cn] = +1

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Moon's Centre.

Conditional Equations.

	a	b	c	O	c	O − C
1	0.00	+ 2.09	+ 1	= + 6	0 + 13 + 48	= + 61	− 55
2	− 0.49	+ 2.04	+ 1	= + 101	− 20 + 13 + 48	= + 41	+ 60
3	− 1.49	+ 1.47	+ 1	= − 81	− 60 + 9 + 48	= + 3	− 84
4	− 1.49	− 1.47	+ 1	= + 31	− 60 − 9 + 48	= − 21	+ 52
5	− 0.49	− 2.03	+ 1	= + 20	− 20 − 13 + 48	= + 15	+ 5
6	− 1.69	− 1.23	+ 1	= − 109	− 68 − 8 + 48	= − 28	− 81
7	− 2.08	− 0.23	+ 1	= − 39	− 83 − 1 + 48	= − 36	− 3
8	− 2.09	+ 0.00	+ 1	= + 6	− 84 + 0 + 48	= − 36	+ 42
9	[− 1.94]	+ 0.77	+ 1				
10	− 1.12	+ 1.77	+ 1	= + 66	− 45 + 11 + 48	= + 14	+ 52

− 223 + 211

Average (O−C) = 48

Normal Equations.

a	b	c	
+ 17.68	+ 0.58	− 10.94	= + 196
+ 0.58	+ 21.65	+ 2.48	= + 274
− 10.94	+ 2.48	+ 9.00	= + 1
− 0.58	− 0.07	+ 0.36	= − 6
+ 10.94	+ 0.36	− 6.77	= + 122
	+ 21.63	+ 2.77	= + 268
	+ 2.77	+ 2.23	= + 123
	− 2.77	− 0.36	= − 34
		+ 1.87	= + 89
	− 3.44	− 2.77	= − 153
	+ 18.19 b		= + 115
− 13.31	+ 2.93	+ 10.94	= + 1
+ 12.93	− 0.64	− 2.41	= − 0
+ 4.37	+ 3.51		= + 197
+ 3.51	+ 21.01		= + 274
− 0.59	− 3.51		= − 46
			= + 151
+ 9.78 a			
− 6.60 a		+ 4.11 c	= −

$\frac{\Delta\delta}{\Delta\alpha}$ = 2.09 − 0.13 = − 0.27

c = + 48

b = + 6

a = + 40

$\frac{\Delta\alpha}{\Delta\delta}$ = 2.09 + 0.62 = + 1.30

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Moon's Centre.

Conditional Equations.

	a	b	c		O		c	O − C
1	0.00	+ 2.09	+ 1	=	+ 6	0 + 73 + 48	+ 61	− 55
2	− 0.49	+ 2.04	+ 1	=	+ 101	− 204 + 13 + 48	+ 41	+ 60
3	− 1.49	+ 1.47	+ 1	=	− 81	− 60 + 9 + 48	+ 3	− 84
4	− 1.49	− 1.47	+ 1	=	+ 31	− 60 − 9 + 48	− 21	+ 52
5	− 0.49	− 2.03	+ 1	=	+ 20	− 20 − 13 + 48	+ 15	+ 5
6	− 1.69	− 1.23	+ 1	=	− 109	− 68 − 8 + 48	− 28	− 81
7	− 2.08	− 0.23	+ 1	=	− 39	− 83 − 1 + 48	− 36	− 3
8	− 2.09	+ 0.00	+ 1	=	+ 6	− 84 + 0 + 48	− 36	+ 42
9	[− 1.94]	+ 0.77	+ 1					
10	− 1.12	+ 1.77	+ 1	=	+ 66	− 45 + 11 + 48	+ 14	+ 52

− 223 + 211

Average (O−C) = 48

Normal Equations.

a	b	c		
+ 17.68	+ 0.58	− 10.94	= + 196	
+ 0.58	+ 21.65	+ 2.41	= + 274	
− 10.94	+ 2.41	+ 9.00	= + 1	
− 0.58	− 0.02	+ 0.42	= − 6	
+ 10.94	+ 0.36	− 6.77	= + 122	
	+ 21.63	+ 2.77	= + 268	$\frac{\Delta\delta}{\Delta\alpha}$ = 2.09 − 0.13 = − 0.77
	+ 2.77	+ 2.23	= + 123	
	− 2.77	+ 0.56	= − 34	
		+ 7.87	= + 89	c = + 48
	− 3.44	− 2.77	= − 153	
	+ 18.19 b		= + 115	b = + 6
− 13.31	+ 2.93	+ 10.94	= + 1	
+ 12.93	− 0.64	− 2.41	= − 0	
+ 4.37	+ 3.51		= + 197	
+ 3.51	+ 21.01		= + 274	
− 0.59	− 3.51		= − 46	
			= + 51	a = + 40
+ 3.78 a				
− 66.0 a		+ 41.1 c	= −	$\frac{\Delta\alpha}{\Delta\delta}$ = 2.09 + 0.62 = + 1.30

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Moon's mean position (1911.0

$X_0 = 16.4863$ $Y_0 = 23.2305$

$\pm\frac{1}{2}a = +20$ $+\frac{1}{2}b = +3$

16.4883 23.2308

From preliminary reduction $X = 16.3900$ $Y = 23.2172$

" Computed constants $ax = +4$ $= -20$

$by = +2$ -1

$\delta = -6$ $+21$

$X = 16.3900$ $Y = 23.2172$

$\bar{s} = -1.6100$

$\log \bar{s} = 0.20683_n$

$\log \cos \delta = 9.95072$

$\log \text{const} = 8.50724$

$\log (\alpha - A) = 1.74887_n$

$\alpha - A = -56^s.09$

$A = 7^h\ 12^m\ 37^s$

$\alpha_0 = 7\ 11\ 40.91$

Red to app place $+0.67$

$\alpha' = 7^h\ 11^m\ 41^s.58$

Rem $\alpha_0 = 7\ 11\ 41.04$

Mean $= 7\ 11\ 40.98$

$\eta = +1.2172$

$\log \tan \delta = 9.70822$

" $\bar{s}^2 = 0.4137$

" const. $= 7.0134$

" $\eta_0 = 7.1753$

$\eta_1 = +15$

$\eta_0 = +1.2157$

$\log \eta_0 = 0.08482$

" const $= 7.33115$

$\log (\delta - D)$ 2.75367

$(\delta - D) = +567.1$

$= +9'\ 27''.1$

$D = +26^\circ\ 37'\ 24''$

$\delta_0 = +26^\circ\ 46'\ 51''.1$

Red to app. plac $+7.2$

$\delta' = +26^\circ\ 46'\ 58''.3$

Rem $\delta_0 = +26\ 46\ 50.7$

Mean $+26\ 46\ 50.9$

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Morris Mean Position (1911.0

$X_0 = 16.4863$ $Y_0 = 23.2305$

$\pm\frac{1}{2}a = +20$ $\pm\frac{1}{2}b = +3$

16.4883 23.2308

From preliminary reduction $X = 16.3900$ $Y = 23.2172$

" Compiled constant $ax = +4$ $= -20$

$by = +2$ -1

$\delta = -6$ $+21$

$X = 16.3900$ $Y = 23.2172$

$\xi = -1.6100$

log ξ: 0.20683n

log cos δ: 9.75077

const: 8.50724

$(\alpha - A)$: 1.74887n

$\alpha - A$: $-$ 56.09

A: 7h 12 37

α_0: 7 11 40.91

+ 0.67

α' 7 11 41.58

$\eta = +1.7172$

log tan δ: 9.70852

" η^2: 0.4137

const.: 7.01734

η_0: 7.1753

η_0: $+$ 15"

η_0: +1.7157

log η_0: 0.08482

" const: 7.33115

log $(\delta - D)$ 2.75367

$(\delta - D)$: + 567.1

= + 9' 27.1

D +26° 37 24

δ_0 +26° 46' 51.1

+ 7.2

δ' = +26 46 58.3

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Lunar Parallax

α' = 7h 11m 41.59s ✓
Θ = 8 23 08.5 ✓
$\Theta - \alpha'$ = +1 11 26.91 ✓
= +17° 51' 44" ✓

$\frac{1}{2}(\alpha - \alpha')$ = + 0 07 29 ✓

$(\Theta - \alpha') - \frac{1}{2}(\alpha - \alpha')$ = + 17° 44 15 ✓

log tan ϕ' = 9.95727 ✓
" cos $\frac{1}{2}(\alpha - \alpha')$ = 0.00000
" " $(\Theta - \alpha') - \frac{1}{2}(\alpha - \alpha')$ = 9.97845 ✓
" Tan γ = 9.97842 ✓

γ = +43 34 38.5 ✓
δ' = +26° 46 58.3

$\gamma - \delta'$ = +16 47 40.2 ✓

log $\rho \sin\phi'$ = 9.82640 ✓
" sin π = 8.23339 ✓
" sin $(\gamma - \delta')$ = 9.46081 ✓
" sin γ = 9.83843 ✓
" sin $(\delta - \delta')$ = 7.68217 ✓
$\delta - \delta'$ = + 16 32.2 ✓

δ = +27 03 30.5 ✓
Am Ephm δ = +27° 03' 30".7 ✓
O - C = − 0.2 ✓
Rep δ = +27 03 30.1
Mean = +27 03 30.3
O - C = − 0.4
Corr to standard adopted = − 0.5
Final (O - C) = − 0.9

δ' = +26° 46' 58".3 ✓
π = 58' 50".5 ✓

log $\rho \cos\phi'$ = 9.86913 ✓
" sin π = 8.23339 ✓
" sin $(\Theta - \alpha')$ = 9.48676 ✓
" cos δ' = 9.95071 ✓
" sin $(\alpha - \alpha')$ = 7.63856 ✓
approx $(\alpha - \alpha')$ = +14' 57".5 ✓
log cos δ 9.94965 ✓
" sin $(\alpha - \alpha')$ = 7.63962 ✓
$\alpha - \alpha'$ = + 14 59.6 ✓
= + 59s.97 ✓

α = 7 12 41.56 ✓
α = 7h 12m 41s.04 ✓
+ 0.52 ✓
7 12 41.68
7 12 41.62
+ 0.68
+ 0.04
+ 0.72

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1912 Dec. 18 12

Lunar Parallax

α'	7h	11m	41.59
α	8	23	08.5
$\alpha - \alpha'$	+1	11	26.91
	= +17°	51′	+4″

δ'	= +26°	46′	58.″3
π		58′	50.″5

$\log \cos \phi' = 9.86913$
$\log \sin \pi = 8.23339$
$\log \sin (\alpha - \alpha') = 9.48676$
$\log \cos \delta' = 9.95071$
$\log \sin (\alpha - \alpha') = 7.63856$

$\frac{1}{2}(\alpha - \alpha')$	= +	0	07 29
$\alpha - \frac{1}{2}(\alpha - \alpha')$	=	17′	44 15

$\text{approx}(\alpha - \alpha') = +14′\ 57.″5$
$\log \cos \delta = 9.94965$
$\log \sin (\alpha - \alpha') = 7.63962$

$\log \tan \phi' = 9.95727$
$\log \cos (\alpha - \alpha') = 0.00000$
$\log \tan (\alpha - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.97845$
$\log \tan Y = 9.97842$

Y	=	+43	34	38.5
δ'	=	+26	46	58.3
$Y - \delta'$	=	+16	47	40.2

$\alpha - \alpha' = +14′\ 59.″6$
$= +59.^s97$

$\log \sin \phi' = 9.82640$
$\log \sin \pi = 8.23339$
$\log \sin (Y - \delta') = 9.46081$
$\log \sin Y = 9.83843$
$\log \sin (\delta - \delta') = 7.68217$

$\delta - \delta' = +16\ 32.2$

δ	=	+27	03	30.5
Ephem δ	=	+27°	03′	30.″7
O − C	=			−0.2

$\alpha = 7^h\ 12^m\ 41.^s56$
$\alpha = 7^h\ 12^m\ 41.^s04$
O − C = +0.52

O − C	−0.4	+0.64
Corr to standard radius	−0.5	+0.14
Final (O − C)	−0.9	+0.72

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Moon – Runeasures.

	d	n	d	n
1/	18317	15492		
1.60	1636062	7385-85		
21.3	60	71		
	17	49		
	21.1956	.1932		
2/	19149	15359		
15.0	11576888	12890 93	rerun gives	rerun gives
21.7	88	95-		.7535
	59	70		
	21.7573	.7531	21.7552	
3/	17819		17819	18702
14.8	157 95-90		157 95-90	10720 28
22.0	75-82		7582	20
	21		21	95-
			14.7967	.7973
4/	scratch			
14.6			16691	17238
22.5-	16211	16252	11991 90	11936 40
	11254 50	11222 23	91	48
	50	21	00	48
	17	60	14.5296	.5302
	22.4963	.4966		
5/			16534	15753
14.5			10610 09	11673 71
23.0			01	80
			40	56
			14.4069	.4079
6/			15489	14781
14.4			9450 40	10820 10
23.3			40	10
x =			90	80
pair			14.3953	.3966

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MC968 1913 Apr. 9. 13

Moon – Rumaker.

	d		n		d		n
1/	18317		15442				
160	1636062		7385-85				
21.3	60		71				
	17		49				
	21.1956		.1932				
2/	19149		15359				
15.0	1157688		1289093				
21.7	88		95-				
	59		70				
	21.7573		.7531		21.7552		.7535
3/	~~17819~~				17819		18202
14.8	~~157950~~				1579590		1622028
22.0	~~75-82~~				7582		20
	~~21~~				21		95-
					14.7967		.7973
4/	scratch.						
14.6					16691		17238
22.5-	16211		16252		1199190		1193640
	1125450		1122223		91		48
	50		21		00		48
	17		60		14.5296		.5302
	22.4963		.4966				
5/					16534		15753
14.5					1061309		1167371
23.0					01		80
					40		56
					14.4069		.4079
6/					15489		14781
14.4					9450-40		1082010
23.3					40		10
x =					90		80
mir					14.3953		.3966

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1913 Apr. 9. 14

MC 968

Moon - Remeasures.

	4		×	
7	a	n	a	n
14.6			15421	15068
24.0			1089620	9580 78
			0800	70
			30	72
			14.5481	.5494

8 Separated

14.7	18838	18100	14941	19067
24.3	1475961	1220717	1256052	1145548
	53	18	50	5050
		10	55	70
	24.4087	.4108	14.7610	.7648

9

15.0	17830	17125	remeasure direct
24.6	1083536	1412042	gives 24.7006
	5140	31	
	41	37	
	24.6998	.7005	

10

15.4			17765	17145
25.0			1143941	1342641
			49	2147
			70	47
			15.3676	.3712

11

16.0	15890	18520	
25.2	1322000	1124012	
	1010	13	
	98	20	
	25.2682	.2697	

12

6.3	14853	17567	
25.3	1160092	10815320	
	00	2120	
	59	67	
9	25.3258	.3254	

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1913 April 9.

1 IC 968

Moon - Remeasures.

		4			x	
	Z	a	ν	a	ν
	14.6			15421	15068
	24.0			1089620	958078
				0800	70
				30	72
				14.5481	.5494
8	Serated				
14.7	18838		18100	14941	19067
24.3	1475961		1220717	1256052	1145548
	5		18	50	5050
	53		10	55	70
	24.4087		.4108	14.7610	.7648
9					
15.0	17830		17125		
24.6	1083536		1412042	remeasure direct	
	5140		31	gives 24.7006	
	41		37		
	24.6998		.7005		
10					
15.4				17765	17145
25.0				1143941	1342641
				49	2147
				70	47
				15.3676	.3712
11					
16.0	15890		18520		
25.2	1322000		1124012		
	1010		13		
	98		20		
	25.2682		.2697		
12					
6.5	14855		17567		
25.5	1160092		1081530		
wt	00		2120		
½	59		67		
	25.3258		.3254		

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	Pos. L	Resid.	First measures Resid.	Mean Resid.
1	193.°6	+5.8	+5	+32
2	225.5	+110	+52	+81
3	234.0	−54	−81	−68
4	249.4	−32		−32
5	263.7	+73	−3	+35
6	270.0	+20	+42	+31
[7	291.6			
8	304.4	−97		−97
9	314.8	+43	−84	−64
10	327.5	+15	+52	+34
11	346.4	+65	+60	+62
12	6.0	−5	−55	−30

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MC968 1913 Apr. 9. 15

Moon's Center - Remeasures

	x	x − X₀	(x − X₀)²	(x − X₀)² + (y − Y₀)²	O − C
1	16.0000	−0.4911	0.2412	4.3869	−18
2	15.0000	−1.4911	2.2234	4.4011	+124
3	14.7970	−1.6941	2.8699	4.3840	−47
4	14.5299	−1.9612	3.8463	4.3852	−35
5	14.4074	−2.0837	4.3418	4.3950	+63
6	14.3960	−2.0951	4.3894	4.3894	+7
7	~~14.5488~~	~~−1.9423~~	3.7725	4.3647	
8	14.7629	−1.7282	2.9867	4.3774	−113
9	15.0000	−1.4911	2.2234	4.3830	−57
10	15.3694	−1.1217	1.2582	4.3894	+7
11	16.0000	−0.4911	0.2412	4.3954	+67
12	16.4911	0.0000	0.0000	4.3894	+7
			Means	4.3887	+5

	y	y − Y₀	(y − Y₀)²
1	21.1944	−2.0361	4.1457
2	21.7548	−1.4757	2.1777
3	22.0000	−1.2305	1.5141
4	22.4964	−0.7341	0.5389
5	23.0000	−0.2305	0.0532
6	23.2305	0.0000	0.0000
7	~~24.0000~~	~~+0.7695~~	0.5922
8	24.4098	+1.1793	1.3907
9	24.7004	+1.4699	2.1606
10	25.0000	+1.7695	3.1312
11	25.2687	+2.0382	4.1542
12	25.3256	+2.0951	4.3894

Approximate Center

x = 16.0 y = 21.1944
25.2687
46.4631
Mean y: 23.2316

x = 15.0 y = 21.7548
24.7004
46.4552
Mean y = 23.2276

Adopt y = 23.2305
y − mid: 25.3256
R = 2.0951
x − min = 14.3960
X₀ = 16.4911

Center { X₀ = 16.4911
Y₀ = 23.2305

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MC 968 1913 Apr. 9. 15

Moon's Center - Reinmuth -

	x	x − X₀	(x − X₁)²	(x − X₀)² + (y − Y₀)²	O − C
1	16.0000	−0.4911	0.2412	4.3869	− 18
2	15.0000	−1.4911	2.2234	4.4011	+ 124
3	14.7970	−1.6941	2.8699	4.3840	− 47
4	14.5299	−1.9612	3.8463	4.3852	− 35
5	14.4074	−2.0837	4.3418	4.3950	+ 63
6	14.3960	−2.0951	4.3894	4.3894	+ 7
7	~~14.5488~~	~~1.9423~~	~~3.7725~~	4.3647	
8	14.7629	−1.7282	2.9867	4.3774	− 113
9	15.0000	−1.4911	2.2234	4.3830	− 57
10	15.3694	−1.1217	1.2582	4.3894	+ 7
11	16.0000	−0.4911	0.2412	4.3954	+ 67
12	16.4911	0.0000	0.0000	4.3894	+ 7
			Mean	4.3887	+ 5

	y	y − Y₀	(y − Y₀)²
1	21.1944	−2.0361	4.1457
2	21.7548	−1.4757	2.1777
3	22.0000	−1.2305	1.5141
4	22.4964	−0.7341	0.5389
5	23.0000	−0.2305	0.0532
6	23.2305	0.0000	0.0000
7	~~24.0000~~	~~+0.7695~~	~~0.5922~~
8	24.4098	+1.1793	1.3907
9	24.7004	+1.4699	2.1606
10	25.0000	+1.7695	3.1312
11	25.2687	+2.0382	4.1542
12	25.3256	+2.0951	4.3894

Approximate Center.

x = 16.0 y = 21.1944
25.2687
46.4631
Mean y = 23.2316

x = 15.0 y = 21.7548
5247004
46.4552
Mean y = 23.2276

Adopt y = 23.2305
y = max: 25.3256
R = 20951
x = min = 14.3960
X₀ = 16.4911

Center { X₀ = 16.4911
Y₀ = 23.2305

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No	at	an	bn
1	+ 1,00	+ 8.8	+ 36.7
2	+ 2,20	- 185.0	- 183.5
3	+ 2.08	+ 79.5	+ 57.9
4	+ 1.43	+ 68.6	+ 25.6
5	+ 0.48	- 131.0	- 14.5
6	- 0.00	- 14.7	+ 0.0
8.	- 2.04	+ 195.4	- 133.0
9	- 2.19	+ 85.0	- 84.0
10	- 1.98	- 7.8	+ 12.4
11	- 1.00	- 32.8	+ 136.5
IN	- 0.00	- 6.0	+ 14.7
	- 0.02	+ 66.01	- 131.2

$[aa] = +24.62$ $[bb] = +23.66$

$[ac] = -14.64$ $[bc] = +2.85$ $[cn] = +5$

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MC968 1913 Apr 9.

Moons Center - Remeasures.

Conditional Equations

	a	b	c	O	c	O−C
1	−0.49	−2.04	+1	= −18	−10 +19 +31	= +40	+58
2	−1.49	−1.48	+1	= +124	−31 +14 +31	= +14	+110
3	−1.69	−1.23	+1	= −47	−35 +11 +31	= +7	−54
4	−1.96	−0.73	+1	= −35	−41 +7 +31	= −3	−32
5	−2.08	−0.23	+1	= +63	−43 +2 +31	= −10	+73
6	−2.10	+0.00	+1	= +7	−44 −0 +31	= −13	+20
8	−1.73	+1.18	+1	= −113	−36 −11 +31	= −16	−97
9	−1.49	+1.47	+1	= −57	−31 −14 +31	= −14	−43
10	−1.12	+1.77	+1	= +7	−23 −16 +31	= −8	+15
11	−0.49	+2.04	+1	= +67	−10 −19 +31	= +2	+65
12	0.00	+2.10	+1	= +7	0 −19 +31	= +12	−5

−289 +283

Average (O−C) = 52

Normal Equations.

+24.62 − 0.02 − 14.64 = +66
− 0.02 +23.66 + 2.85 = −131
− 14.64 + 2.85 +11.00 = +5

+ 0.02 − 0.00 − 0.01 = + 0
+ 14.64 − 0.01 − 8.70 = + 39

+23.66 + 2.84 = −131
+ 2.84 + 2.30 = + 44

− 2.84 − 0.34 = + 16
+ 1.96 = + 60

c = +31

− 3.50 − 2.84 = − 54
+20.16 = −185

b = − 9

− 0.10 + 0.02 + 6.08 = + 0
+12.80 − 23.66 − 9.40 = − 42

+24.52 − 14.56 = +66
+12.78 − 8.85 = −173

−20.00 +14.56 = + 28
+ 4.52 = + 94

a = +21

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MC968 1913 Apr. 9. 16

Moon's Center - Measures.

Conditional Equations

	a	b	c	O		c	O−C
1	−0.49	−2.04	+1	: −18	−10	+19+31 : +40	+58
2	−1.49	−1.48	+1	: +124	−31	+14+31 : +14	+110
3	−1.69	−1.23	+1	: −47	−35	+11+31 : +7	−54
4	−1.96	−0.73	+1	: −35	−41	+7+31 : −3	−32
5	−2.08	−0.23	+1	: +63	−43	+2+31 : −10	+73
6	−2.10	+0.00	+1	: +7	−44	−0+31 : −13	+20
8	−1.73	+1.18	+1	: −113	−36	−11+31 : −16	−97
9	−1.49	+1.47	+1	: −57	−31	−14+31 : −14	−43
10	−1.12	+1.77	+1	: +7	−23	−16+31 : −8	+15
11	−0.49	+2.04	+1	: +67	−10	−19+31 : +2	+65
12	0.00	+2.10	+1	: +7	0	−19+31 : +12	−5

−289+283

Average (O−C) : 52

Normal Equations.

+24.62 − 0.02 − 14.64 = +66
− 0.02 +23.66 + 2.85 = −131
− 14.64 + 2.85 + 11.00 = +5

+ 0.02 − 0.00 − 0.01 = + 0
+ 14.64 − 0.01 − 8.70 = + 39

+23.66 + 2.84 = −131
+ 2.84 + 2.30 = + 44

− 2.84 − 0.34 = + 16
+ 1.96 = + 60

c = +31

− 3.50 − 2.84 = − 59
+20.16 = −185

b = − 9

− 0.10 + 0.02 + 0.08 = + 0
+121.80 − 23.66 − 91.40 = − 42

+24.52 − 14.56 = +66
+121.78 − 88.55 = −173

−20.00 +14.56 = + 28
+ 4.52 = + 94

a = +21

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NIC 968. 1913 Apr. 9. 17

Moon's position from remeasures.

X_0 = 164911 + 10 = 164921 Y_0 = 232305 − 5 = 232300

From prelim. Reduction X = 16 39 38 Y = 23 21 64 0 0
plate constant

$\bar{\xi}$ = − 1.6062 η = + 1.2164

log $\bar{\xi}$ = 0.20580 − log Tan δ = 9.70031

log S = 9.95072 $\bar{\xi}^2$ = 0.41216

const = 8.50724 η_1 = 7.16815

η_1 = + 15″

(α − A) = 1 74784 m

α − A = − 55.96

A = 7 12 37 η_0 = + 1.2149

α_0 = 7 11 41.04 log η_0 = 0.08454

Red to app. place + 0.67 const = 9.33115

α′ = 7 11 41.71 log (δ − D) = 2.75359

Red = + 59.97

α = 7 12 41.68 δ − D = + 566.7

Tabular pl. 7 12 41.04 = + 9 26.7

O − C = + 0.64 D = 26 37 24

δ_0 = 26 46 50.7

Red = + 7 2

δ′ = +26 46 57.9

Red = + 16 32.2

δ = +27 03 30.1

Tabular pl = +27 03 30.7

O − C − 0.6

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NIC 968. 1913 Apr. 9. 19

Moon's position from reseasures.

X_0 = 16.4911 + .10 = 16.4921

Y_0 = 23.2305 − .5 = 23.2300

From prelim. Reduction X_0 = 16.3938 Y_0 = 23.2164
plate constants

ξ = − 1.6062
log ξ = 0.20580 n
cos δ = 9.95072
const = 8.50724

(α − A) = 17478 4m

α − A = − 55.96
A = 7 12 37

α_0 = 7 12 41.04
Red to app. place + 0.67
α′ = 7 11 41.71
Red = + 59.97

α = 7 12 41.68
Tabular pl. 7 12 41.04

O − C = + 0.64

η = + 1.2164
log Tan δ = 9.70031
ξ^2 = 0.41116
η_1 7.1681
η_1 = + 15″
η_0 = + 1.2149
log η_0 = 0.08454
const = 9.33115
log (δ − D) = 2.75339
δ − D = + 566.7
= + 9 26.7
D = 26 37 24

δ_0 = 26 46 50.7
Red = + 7.6
δ′ = + 26 46 57.9
Red = + 16 32.2
δ = + 27 03 30.1
Tabular pl. = + 27 03 30.7
O − C = − 0.6

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Giving 1st measures ½ wk.

$\alpha =$

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Giving 1st measures ½ wt.

$\alpha =$

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MC 972 — 1912 Nov. 4.7 / Nov. 19.5 — 19

Standard Coords. Comp. Stars.

	1	no.	mag
		1266	8.7
C	9h	06m 04.56	
L			58
E			55
Mean	9	06	04.56
Prec		+	37.62
α	9	06	42.18
A	9	11	00
α-A	−	4	17.82
sin(α-A)	−		257.80
log("	=	2.411284n	
" cosδ		9.97097	
" ξ0		0.89949n	
" η0		−7.7533	
" ξ1		−	14
" η1		1.02453	
" x		10.38826	
x-ξ		+	1373

	2	no.	mag
		1270	6.9
	9h	07m 54.67	
			.66
			66
	9	07	54.66
		+	37.76
	9	08	32.42
	9	11	00
	−	2	27.58
	−		147.58
		2.169031n	
		9.99682	
		0.64450n	
		−4.4106	
		−	3
		13.5891	
		13.8161	
		+	2270

	3.	no.	mag.
		1274	9.0
	9h	10m 24.18	
			21
			12
	9	10	24.15
		+	37.49
	9	11	01.64
	9	11	00
	+		01.64
	+		01.64
		0.21484	
		9.97175	
		8.69383	
		+0.0494	
		+	0
		1.80494	
		18.1608	
		+	1114

C	+20°	45′	47.1″	+21°	41′	42.9″	+20°	29′	21.6″
L			46.2			43.0			21.7
E			46.4			42.4			21.6
α mean	20	45	46.6	+21	41	42.8	+20	29	21.6
Prec	−	2	40.2	−	2	41.6	−	2	43.0
δ	+20	43	06.4	+21	39	01.2	+20	26	38.6
D	+21	15	36	+21	15	36	+21	15	36
δ-D	−	32	29.6	+	23	25.2	−	48	57.4
tan(δ-D)	−		1949.7		+1405.2		−	29.37.6	
log "		3.28996n			3.14774			3.46799n	
" η0	−	0.62111n			0.47889			0.79914n	
−tanδ		9.5778			9.5987			9.5715	
" ξ2		1.7790			1.2890			7.3877	
" η1		8.4102			7.9411			4.0126	
η0		−4.1794			+3.0123			−6.2971	
ξ1		+	257		+	87			0
ξ1		−17.8463			25.0210			15.7029	
4		17.9260			25.0594			15.6896	
4-η		+	797		+	384		−	133

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MC 972 1912 Nov. 4.7
Nov. 19.5

Standard Coords. Comp. Stars.

	1 no.	mag	2 no.	mag	3 no.	mag
	1266	8.7	1270	6.9	1274	9.0
C	$9^h\ 06^m\ 04^s.56$		$9^h\ 07^m\ 54.67$		$9^h\ 10^m\ 24^s.12$	
L	58		.66		21	
E	55		66		12	
mean	9 06 04.56		9 07 54.66		9 10 24.15	
Dec	+ 37.62		+ 37.76		+ 37.49	
x	9 06 42.18		9 08 32.42		9 11 01.64	
A	9 11 00		9 11 00		9 11 00	
x-A	− 4 17.82		− 2 27.58		+ 01.64	
Δ(x-A)	− 257.80		− 147.58		+ 01.64	
log Δ	= 2.411284		2.169031		0.21484	
cos δ	9.97097		9.96823		9.97175	
ξ₀	0.88949		0.64450		8.69383	
η₀	−7.7533		−4.4106		+0.0494	
ξ₁	− 14		− 3		+ 0	
η₁	10.2453		13.5891		18.0494	
ξ	10.3826		13.8161		18.1608	
x-ξ	+ 1373		+ 2270		+ 1114	

C	+20° 45′ 47.″1	+21° 41′ 42.″9	+20° 29′ 21.″6
L	46.2	43.0	21.7
E	46.4	42.4	21.6
mean	20 45 46.6	+21 41 42.8	+20 29 21.6
Dec	− 2 40.2	− 2 41.6	− 2 43.0
δ	+20 43 06.4	+21 39 01.2	+20 26 38.6
D	+21 15 36	+21 15 36	+21 15 36.
x-D	− 32 29.6	+ 23 25.2	− 48 57.4
Δ(x-D)	− 1949.7	+1405.2	− 2937.6
log Δ	3.289961	3.14774	3.467991
ξ₀	0.62111	0.47889	0.79914
tan δ	9.5778	9.5987	9.5715
ξ²	17790	12890	7.3877
η₁	84102	7.9411	4.0126
η₀	−4.1794	+3.0123	−6.2971
η₁	+ 257	+ 87	0
ξ³	−178463	25021.0	15.7029
4	17.9260	25.0594	15.6896
ξ⁴	+ 797	+ 384	− 133

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MC 972. Wos. 4. 1912 } Wos 19. 1912 }

Standard Coords - Comp. Stars.

	4	no. 1288	mag 8.3	5	no. 1290	mag 7.8
C						
C	9h	16m	17s.57	9h	18m	08s.77
L			.58			.75
E			61			67
mean	9	16	17.59	9	18	08.73
Prec.	+		37.66	+		37.28
α	9	16	55.25	9	18	46.01
A	9	11	00	9	11	00
α-A	+	05	55.25	+	07	46.01
Sin(α-A)	+		355.21	+		465.92
log "			2.550485			2.668321
" cosδ			9.996754			9.997089
" ξ_0			1.025526			1.146644
ξ_0			+10.59888			+140.1007
ξ_1			+ 34			+ 71
ξ			286022			320171
x			28.8503			32.1606
x-ξ			+ 2481			+ 1435

C	+21°	55'	26.5"	+20°	47'	29.6"		
L			26.1			29.2		
E			25.5			29.8		
mean	+21	55	26.0	+20	47	29.5		
Prec	−		46.8	−		47.9	−2.47.6	
δ	+21	52	39.2	+20	44	41.6	+20 44 41.9	
D	+21	15	36	+21	15	36.	+21 15 36	
δ-D	+	37	03.2	−	30	54.4	− 30 54.1	
tan(δ-D):	+		2223.3	−		1854.5	− 1854.2	
log "			3.347005			3.268222n	3.268160n	
" η_0			0.678155			0.599371n	0.599311n	
" tanδ			9.6037			9.5784		
" ξ^2			2.0505			2.2929		
" η_1			8.7076			8.9247		
η_0			+4.76600			−3.97530	−3.97497	
η_1			+ 510			+ 841	+ 841	
η			26.81700			18.10888	18.10994	
η			26.67666			17.92776	17.92776	
η-η			− 1404			− 1812	− 1818	

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MC 972.

Wed. 4. 1912.
Wed 19, 1912

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Stand and Coords Comp. Stars.

	1	no.	mag.	5	no.	mag
C		1288	8.3		1290	7.8
	9h	16m	17.57	9h	18m	08.77
			.58			.75
			61			67
Mean	9	16	17.59	9	18	08.73
Prec.	+		37.66	+		37.28
α	9	16	55.25	9	18	46.01
A	9	11	00	9	11	00
	+	05	55.25	+	07	46.01
α(α-A)	+		355.21	+		465.93
δ		255048	✓		266831	
cosδ		9.96754	✓		9.97089	✓
S_0		1.02526			1.14644	
Σ_0		+10.5988	✓		+14.0100	✓
Σ_1		+	34 ✓		+	71 ✓
Σ		286022	✓		32.0171	
x		28.8503	✓		32.1606	✓
x-Σ		+2481			+1435	

C	+21°	55′	26.5″	+20°	47′	29.6″			
			26.1			29.2			
			25.5			29.8			
Mean	+21	55	26.0	+20	47	29.5			
Prec	−	2	46.8	−	2	47.9	-2	47.6	
δ	+21	52	39.2	+20	44	41.6	+20	44	41.9
D	+21	15	36	+21	15	36.	+21	15	36
	+	37	03.2	−	30	54.4	−	30	54.1
(δ-D)		+	2223.8	−		1854.5	−		1854.2
		3.34700			3.26822n		3.26816n		
δ_{η_0}		0.67815			0.59937n		0.59931n		
lcosδ		9.6037	✓		9.5784	✓			
S_1		20505			22929	✓			
η_1		8.7076			8.9247				
η_0		+4.7660			−3.9753		−3.9747		
		+	510		+	841	+	841	
η_1		26.8170			18.1088		18.0941		
η		26.6766			17.9276		17.9276		
$\eta_1-\eta$		−1404			−1812		−1818		

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Comparison Stars - Measures.

1		4		2			
10.4	d		n		d		n
17.9	15038		17155		15900		15837
	57732	78	16410	10	97339	30	12016	11
	69		10		34		10	
	38		50		12		40	
	17.9865		.9255		10.3827		.3826
2	very poor images.						
13.8	16451		15340		14230		14300
25.1	15831	34	59330	45	123880	00	61364	41
	30		35		90		30	
	48		51		45		98	
	25.0600		.0587		13.8160		.8162
3							
18.1	14938		16492		14817		17261
15.7	8045	49	13379	83	64280	20	15651	49
	45		80		28		52	
	54		00		20		60	
	15.6905		.6888		18.1605		.1610
4							
28.8	14940		15851		13865		15762
26.6	8178	80	12620	89	12359	65	72533	50
	80		24		63		48	
	45		54		69		59	
	26.6764		.6769		28.8497		.8509
5							
32.1	15219		14340		15211		15130
17.9	5930	30	13620	10	68140	20	13517	25
	26		09		11		24	
	07		48		16		50	
	17.9279		.9272		32.1600		.1611

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Comparison Stars - measures.

1								
10.4	d		n		d		n	
17.9	15038		17155		15900		15837	
	5772	78	16410	10	9739	30	12016	11
	69		10		34		10	
	38		50		12		40	
	17.9265		.9255		10.3827		.3826	
2	very poor images.							
13.8	14431		15340		14230		14300	
25.1	15831	34	5930	45	12388	00	61364	1
	30		35		90		30	
	48		51		45		98	
	25.1840							
	250600		.0587		13.8160		.9168	
3								
18.1	14938		16492		14817		17261	
15.7	8045		13379	53	6428	20	15651	49
	45	49	50		28		52	
	54		00		20		60	
	15.6903		.6888		18.1605		.1610	
4.								
28.8	14940		15551		13865		15762	
26.6	8178	80	12620	89	12359	65	72533	
	80		24		63		48	50
	45		54		69		59	
	26.6764		.6769		28.5497		.8509	
5								
32.1	15219		14340		15211		15130	
17.9	5930	30	13620	10	6814	20	13517	25
	26		09		11		24	
	07		48		16		50	
	17.9279		.9272		32.1600		.1611	

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MC972. 1912 Nov. 5. 22.

Points on moon's limb. — measures.

	4 d	N	x d	N
1/				
19.0	16541	15808		
24.4	12380 96	993245		
	94 97	4443		
	51	30		
	24.4155	.4120		
2/				
18.3	15588	14778		
24.5	1056568	977877		
y=max	6972	7588		
	92	72		
	24.5022	.4995		
3/				
18.0	15629	13735		
24.4	1107482	828881		
	8482	8794		
	36	55		
	24.4552	.4542		
4/				
17.0	15861	15895		
23.9	6398 06	1537069		
	0005	7277		
	70	17		
	23.9468	.9476		
5/				
17.0	15208	15105		
20.9	608180	1427510		
	7878	1411		
	08	05		
	20.9129	.9110		
6/			13758	15686
16.9			1288080	657360
21.0			6170	6461
			58	86
			16.9115	.9122

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MC972. 1912 Nov. 5. 22.

Points on Moon's limb — measures.

	y d		x d	
1/		N		N
19.0	16541	15808		
24.9	12380 96	993245		
	94 97	4443		
	51	30		
	24.4.153	.4120		
2/				
18.3	15588	14778		
24.5	10565 68	977877		
y=max	6972	7588		
	92	92		
	24.5022	.4991		
3/				
18.0	15629	13735		
24.4	11074 82	828881		
	84 82	8794		
	36	55		
	24.4552	.4542		
4/				
17.0	15861	15895		
23.9	639806	1537069		
	0005	7277		
	70	17		
	23.9968	.9476		
5/				
17.0	15208	15105		
20.9	608180	1427510		
	7878	1411		
	08	95		
	20.9129	.9110		
6/				
16.9			13758	15686
21.0			1288080	657360
			6170	6461
			58	86
			16.9115	.9122

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Points on Moon's Limb — measures

	a	n
B/	13674	14772
16.4	755041	1088896
22.0	4152	9200
	91	72
	16.3865	.3878
8/	16606	14810
16.4	998698	1141019
22.4	9695	2617
x = min.	24	11
	16.3376	.3392
9/	15565	13860
16.4	977166	964158
23.0	6461	4757
	80	64
	16.4192	.4211
10/x	15170	16309
17.1	574150	1572126
24.0	4030	2820
	85	29
	17.0556	.0586

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Points on Lucon's Print

— Measures

x

	a	N
p/	13674	14772
16.4	755041	1088896
220	4152	92 00
	91	72
	16.3865	.3878
8/	16606	14810
16.4	998698	1141019
22.4	9695	2617
x = min.	24	11
	16.3376	.3392
9/	15565	13860
16.4	977166	964158
23.0	6461	4757
	80	64
	16.4192	.4211
10/	15170	16309
17.1	574150	1572126
24.0	4030	2820
	85	29
	17056	.0586

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MC972. 1912 Nov. 11.

Comparison stars
Mean measured coords and coords of center of plate.

Star	x	y	R.A.	Decl.
1	10.3826	17.9260	$9^h\ 06^m\ 42^s$	$+20^\circ\ 43'\ 06''$
2	13.8161	25.0594	08 37	21 39 01
3	18.1608	15.6896	11 02	20 26 39
4	28.8503	26.6766	16 55	21 52 39
5	32.1606	17.9276	18 46	20 44 42
5	103.37	5 103.28	5 61 57	5 26 07
	20.67	20.66	$9^h\ 12^m\ 23$	$21^\circ\ 05'\ 13''$
	−18	− 22	− 1 23	+ 10' 23"
	+ 2.67	− 1.34	A: $9^h\ 11^m\ 00^s$	D: $21^\circ\ 15'\ 36''$
	31	465		
	267	−623.10		
	801			
	+82.77			

Preliminary Reduction.

Star	x − 3	−1244	−2x	+868	
1	+1378	−2223 = −850	−21 = −871	= −3	
2	+2270	−3107 = −837	−28 = −865	= +3	
3	+1114	−1946 = −832	−36 = −868	= 0	
4	+2481	−3308 = −827	−58 = −885	= −17	
5	+1435	−2223 = −788	−64 = −852	= +16	✓
Mean	4.4094	−2.7781 ✓	−37	= +18.2144	

Star	4 − 1	+120x	−2047	
1	+797	+1246 = +2043	= −4	
2	+384	+1658 = +2042	= −5	
3	−133	+2179 = +2046	= −1	
4	−1404	+3462 = +2058	= +11	
5	−1818	+3859 = +2041	= −6	
Mean	22.4295	+2209 ✓	= +22.4457	✓

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MC 972. 1912 Nov. 11. 24

Comparison stars

Mean Measured Coords and coords of center of plate.

Star	x	y	R.A.	Decl.
1	10.3826	17.9260	$9^h\ 06^m\ 42^s$	$+20^\circ\ 43'\ 06''$
2	13.8161	25.0594	08 32	21 39 01
3	18.1608	15.6896	11 02	20 26 39
4	28.8503	26.6766	16 55	21 52 39
5	32.1606	17.9276	18 46	20 44 42
5 |	10337	5 | 10328	5 | 61 57	5 | 26 07
	20.67	20.66	$9^h\ 12^m\ 23^s$	21 05, 13
	18	22	− 1 23	+ 10' 23"
	+ 2.67	− 1.34	A: $9^h\ 11^m\ 00^s$	D: $21^\circ\ 15'\ 36''$
	81	465		
	267	−623,10		
	801			
	82.77			

Preliminary Reduction

Star	x − 3 − 1244	− 2x	+ 868
1	+ 1378 − 2228 = − 850	− 21 = − 871	= − 3
2	+ 2270 − 3107 = − 837	− 28 = − 865	= + 3
3	+ 1114 − 1946 = − 832	− 36 = − 868	= 0
4	+ 2481 − 3308 = − 827	− 58 = − 885	= − 17
5	+ 1435 − 2223 = − 788	− 64 = − 852	= + 16
Means	1094 − 2741	− 37	= + 18.2144

Star	4 − y + 180 = c	− 2047
1	+ 797 + 1246 = + 2043	= − 4
2	+ 384 + 1658 = + 2042	= − 5
3	− 133 + 2179 = + 2046	= − 1
4	− 1404 + 3462 = + 2058	= + 11
5	− 1812 + 3859 = + 2047	= 0
Means	1295 + 2209	= + 2.4457

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MC 972 1912 nov. 20. 25

Plate Constants

Conditional Equations.

	a	b	c			
1	+10.38	+17.93	+1	= −3	−4	
2	+13.82	+25.06	+1	= +3	−5	
3	+18.16	+15.69	+1	= 0	−1	
4	+28.85	+26.68	+1	= −17	+11	
5	+32.16	+17.93	+1	= +16	−6	−6

Mean Equations.

+14.12	+19.56	+1	= 0.00	−3.33 −3.33
+30.50	+22.30	+1	= −0.50	+5.50 +2.50
+21.34	+25.87	+1	= −7.00	+3.00 +3.00
+20.23	+17.18	+1	= +4.33	−1.67 −3.67
−16.38	−2.74		= +0.50	−8.83 −5.83
+1.11	+8.69		= −11.33	+4.67 +6.67
−1.11	−0.19		= +0.03	−0.60 −0.40
	+8.50	b	= −11.30	+4.07 +6.27
		b	= −1.33	+0.48 +0.74

$-16.38a = +0.50 - 3.65 = -3.15$

$a = +0.19$

$-8.83 + 1.34 = -7.49$

$+0.46$

$-5.83 + 2.02 = -3.81$

$a = +0.23$

0.0	−0.5	−7.0	+4.3
−2.7	−5.8	−4.0	−3.8
+26.1	+29.7	+34.4	+22.9
+23.4	+23.4	+23.4	+23.4

c for x − 5

−3.3	+5.5	+3.0	−1.7	−3.3	+2.5	+3.0	−3.7
−6.5	−14.0	−9.8	−9.3	−3.3	−7.1	−5.0	−4.9
−9.4	−10.7	−12.4	−8.3	−14.4	−16.4	−19.1	−12.7
−19.2	−19.2	−19.2	−19.3	−24.1	−24.1	−25.0	−24.9
				−21.0	−21.0	−21.1	−21.1

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MC 972 1912 nov. 20. 25

Plate constants.

Conditional Equations.

	a	b	c			
1	+10.38	+17.93	+1	= −3	−4	
2	+13.82	+25.06	+1	= +3	−5	
3	+18.16	+15.69	+1	= 0	−1	
4	+28.85	+26.68	+1	= −17	+11	
5	+32.16	+17.93	+1	= +16	6	−6

Mean Equations.

+14.12	+19.56	+1	= 0.00	−3.33 −3.33
+30.50	+22.30	+1	= −0.50	+5.50 +2.50
+21.34	+25.87	+1	= −7.00	+3.00 +3.00
+20.23	+17.18	+1	= +4.33	−1.67 −3.67
−16.38	−2.74		= +0.50	−5.83 −5.83
+1.11	+8.69		= −11.33	+4.67 +6.67
−1.11	−0.19		= +0.03	−0.60 −0.40
	+8.50b		= −11.30	+4.07 +6.27
	D		= −1.33	+0.48 +0.74

−16.38a = +0.50 − 3.65 = −3.15

a = +0.19

−4.83 + 1.34 = −7.49

+0.46

−5.83 + 2.02 = −3.81

a = +0.28

0.0	−0.5	−7.0	+4.3
−2.7	−5.8	−4.0	−3.8
+26.1	+29.7	+34.4	+22.9
+23.4	+23.4	+23.4	+23.4

c for x − 5

−3.3	+5.5	+3.0	−1.7	−3.3	+2.5	+3.0	−3.7
−6.5	−14.0	−9.8	−9.3	−3.3	−7.1	−5.0	−4.7
−9.4	−10.7	−12.4	−8.3	−19.4	−16.4	−19.4	−12.7
−19.2	−19.2	−19.2	−19.3	−24.1	−24.1	−25.0	−24.8
				−21.0	−21.0	−21.1	−21.1

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Plate Constants

Residuals in x.

Star				C	O	O − C
1	+ 2	− 24	+ 23 =	+ 1	− 3	− 4
2	+ 3	− 33	+ 23 =	− 7	+ 3	+ 10
3	+ 3	− 21	+ 23 =	+ 5	0	− 5
4	+ 5	− 36	+ 23 =	− 8	− 17	− 9
5	+ 6	− 24	+ 23 =	+ 5	+ 16	+ 11

Resids in y.

				C	O	O − C
1	+ 5	+ 9	− 19 =	− 5	− 4	+ 1
2	+ 6	+ 12	− 19 =	− 1	− 5	− 4
3	+ 8	+ 8	− 19 =	− 3	− 1	+ 2
4	+ 13	+ 13	− 19 =	+ 7	+ 11	+ 4
5	+ 15	+ 9	− 19 =	+ 5	0	− 5

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MC 977 — 1912 Nov. 20. — 26

Plate Constants

Residuals in x.

Star				C	O	O − C
1	+ 2	− 24	+ 23 =	+ 1	− 3	− 4
2	+ 3	− 33	+ 23 =	− 7	+ 3	+ 10
3	+ 3	− 21	+ 23 =	+ 5	0	− 5
4	+ 5	− 36	+ 23 =	− 8	− 17	− 9
5	+ 6	− 24	+ 23 =	+ 5	+ 16	+ 11

Residuals in y.

				C	O	O − C
1	+ 5	+ 9	− 19 =	− 5	− 4	+ 1
2	+ 6	+ 12	− 19 =	− 1	− 5	− 4
3	+ 8	+ 8	− 19 =	− 3	− 1	+ 2
4	+ 13	+ 13	− 19 =	+ 7	+ 11	+ 4
5	+ 15	+ 9	− 19 =	+ 5	0	− 5

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Times Eqs.

Exp. to Stars 1911. Mar 11	7^h	25^m		to 7^h	37^m	
" Moon	7	30	43.6	7	30	43.8
clock fast		2	37.4			
H. Sid T	7	28	06.3			
H Long	4	44	31.05			
G. Sid T	12	12	37.35			
Sid T. to Noon	23	12	6.92			
Interval	13	00	30.43			
Reduction.	−	2	7.87			
G. M. T.	12	58	22.56			

	R.A.		Decl.		
Geom. Ap. Eph	9^h	09^m	51.19	+21° 41'	05.8
Moon 13^m			3.8	10.216	
Motion in 1^m					
" " = 1.624 (2.35 23)		−	3.82	+	16.6
Tabular Place	9^h	09^m	47.37	+21° 41'	22.4

Moon's Parallax	58'	13.0"
" Semidiam	15'	53.3"

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Times Etc.

Exp. in Stars 1911. Mar. 11	7^h	25^m		= 7^h	37^m	
" in moon	7	30	43.6	7	30	43.8
clock fast		2	37.4			
H. Sid T	7	28	06.3			
H from 9	4	44	31.05			
G. Sid. T	12	12	37.35			
Sid T. Mn. noon	23	12	6.92			
Interval	13	00	30.43			
Reduction.	−	2	7.87			
G. M. T.	12	58	22.56			

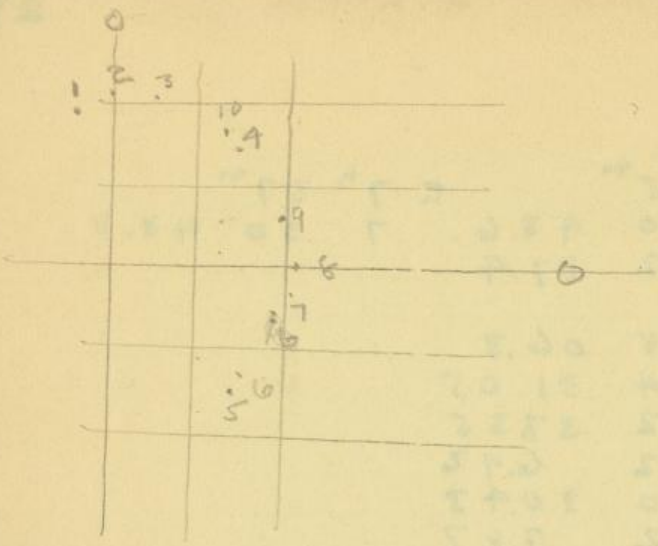
	R.A			Decl.		
Green Gm Eph.						
Moon 13"	9^h	09^m	51.19	+21°	41′	05.8
motion in 1"			3.8			16
" −1.62 2 5 23			3.8			16.6
Tabular Place	9^h	09^m	47.37	+21°	41′	22.4

Moon's Parallax 58" 13".9

" Semidiam 15′ 53".7

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Pt.	Pos. L	Resid
5	223°0	+40
6	226.2	+10
7	258.0	−119
8	270.0	+35
9	286.0	−28
4	319.0	+49
10	319.2	+102
3	348.5	−157
2	0.0	+55
1	16.6	+5

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MC972 1912 Dec. 12.

Moon's Center.

	x	$x - X_0$		Δx	$(x-X_0)^2$		O − C
1	19.0000	+0.5904	−	2	0.3483	4.2850	− 4
2	18.4096	0.0000	−	2	0.0000	4.2903	+ 49
3	18.0000	− 0.4096	−	2	0.1679	4.2693	− 161
4	17.0000	− 1.4096	−	1	1.9873	4.2904	+ 50
5	17.0000	− 1.4096	+	1	1.9867	4.2898	+ 44
6	16.9118	− 1.4978	+	1	2.2431	4.2868	+ 14
7	16.3872	− 2.0224	+	0	4.0901	4.2746	− 108
8	16.3384	− 2.0712		0	4.2898	4.2895	+ 41
9	16.4202	− 1.9894	−	0	3.9577	4.2836	− 24
10	17.0571	− 1.3525	−	1	1.8295	4.2956	+ 102
						4.2854	+ 3

	y	$y - Y_0$		Δy	$(y-Y_0)^2$
1	24.4136	+ 1.9840	+	1	3.9367
2	24.5008	+ 2.0712	+	1	4.2903
3	24.4547	+ 2.0251	+	1	4.1014
4	23.9472	+ 1.5176		0	2.3031
5	20.9120	− 1.5176		0	2.3031
6	21.0000	− 1.4296		0	2.0437
7	22.0000	− 0.4296		0	0.1845
8	22.4296	0.0000		0	0.0000
9	23.0000	+ 0.5704		0	0.3253
10	24.0000	+ 1.5704		0	2.4661

Approximate Center.

$x = 17.0$ $y = 23.9472$

20.9120

44.8592

mean y = 22.4296

y max 24.5008

R_0 = 2.0712

x min = 16.3384

mean X = 18.4096

Center $\{ X_0 = 18.4096 \quad Y_0 = 22.4296$

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1912 Dec. 12. 28

Moons Center.

	x	x − X_0	Δx	$(x-X_0)^2$		O − C
1	19.0000	+0.5904	− 2	0.3483	4.2850	− 4
2	18.4096	0.0000	− 2	0.0000	4.2903	+ 49
3	18.0000	− 0.4096	− 2	0.1679	4.2693	− 161
4	17.0000	− 1.4096	− 1	1.9873	4.2904	+ 50
5	17.0000	− 1.4096	+ 1	1.9867	4.2898	+ 44
6	16.9118	− 1.4978	+ 1	2.2431	4.2868	+ 14
7	16.3872	− 2.0224	+ 0	4.0901	4.2746	− 108
8	16.3384	− 2.0712	0	4.2898	4.2895	+ 41
9	16.4202	− 1.9894	− 0	3.9577	4.2836	− 24
10	17.0571	− 1.3525	− 1	1.8295	4.2956	+ 102
					4.2854	+ 3

	y	y − Y_0	Δy	$(y-Y_0)^2$
1	24.4136	+ 1.9840	+ 1	3.9367
2	24.5008	+ 2.0712	+ 1	4.2903
3	24.4547	+ 2.0251	− 1	4.1014
4	23.9472	+ 1.5176	0	2.3031
5	20.9120	− 1.5176	0	2.3031
6	21.0000	− 1.4296	0	2.0437
7	22.0000	− 0.4296	0	0.1845
8	22.4296	0.0000	0	0.0000
9	23.0000	+ 0.5704	0	0.3253
10	24.0600	+ 1.6304	0	2.4661

Approximate Center.

x = 17.0 y = 23.9472
20.9120
44.8592
mean Y = 22.4296
y − max 24.5008
R_0 = 2.0712
x = min 16.3384
mean X = 18.4096

Center { X_0 = 18.4096
Y_0 = 22.4296

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Formation of normals.

No	ab	ac	bc
1	+ 1.16	- 2.4	- 7.9
2	0.00	0.0	+ 101.4
3	- 0,83	+ 66.0	- 325.2
4	- 2,14	- 70.5	+ 76.0
5	+ 2,14	- 62,0	- 66.9
6	+ 2,14	- 21.0	- 20.0
7	+ 0,87	+ 218.2	+ 46.4
8	0,00	- 84.9	+ 0.0
9	- 1,13	+ 47.8	- 13.7
10	- 2.11	- 137.7	+ 160 1
	+0.10	- 46.5	- 49.8

[aa] = 120.90 [bb] = + 21.95

[ac] = -11.57 [bc] = + 6.35 [cc] = + 3

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MC972 1912 Dec. 13.

Wood's Center.

Conditional Equations.

	a	b	c	O	Residuals c	O − C
1	+0.59	+1.98	+1	= −4	−3−2−4 = −9	+5
2	0.00	+2.07	+1	= +49	0−2−4 = −6	+55
3	−0.41	+2.02	+1	= −161	+2−2−4 = −4	−157
4	−1.41	+1.52	+1	= +50	+7−2−4 = +1	+49
5	−1.41	−1.52	+1	= +44	+7+1−4 = +4	+40
6	−1.50	−1.43	+1	= +14	+7+1−4 = +4	+10
7	−2.02	−0.43	+1	= −108	+10+0−4 = +6	−114
8	−2.07	+0.00	+1	= +41	+10+0−4 = +6	+35
9	−1.99	+0.57	+1	= −24	+9−1−4 = +4	−28
10	−1.35	+1.57	+1	= +102	+6−2−4 = 0	+102

−299 +296

average (O−C) = 59

Normal Equations.

a	b	c	
+20.90	+0.10	−11.57	= −46
+0.10	+21.95	+6.35	= −50
−11.57	+6.35	+10.00	= +3
−0.10	−0.00	+0.06	= +0
+11.57	+0.06	−6.36	= −25
	+21.95	+6.41	= −50
	+6.41	+3.64	= −22
	−6.41	−1.85	= +15
		+1.79	= −7
	−11.31	−6.41	= +39
	+10.64 b		= −11
−13.36	+7.34	+11.57	= +3
+7.34	−4.04	−6.35	= −2
+7.54	+7.44		= −43
+7.44	+17.91		= −52
−3.09	−7.44		= +22
+4.45			= −21
−45.8a		+26.0c	=

$\frac{\Delta \cdot \delta}{\Delta n} = 2.07 - .29 = -0.61$

c = −4

b = −1

a = −5

$\frac{\Delta K}{\Delta n} = 2.07 \cdot 4.57 = +1.18$

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MC972 1912 Dec. 13. 29

Woods Center.

Conditional Equations.

	a	b	c	O	Residuals	O - C
1	+ 0.59	+ 1.98	+ 1	= − 4	− 3 − 2 − 4 = − 9	+ 5
2	0.00	+ 2.07	+ 1	= + 49	0 − 2 − 4 = − 6	+ 55
3	− 0.41	+ 2.02	+ 1	= − 161	+ 2 − 2 − 4 = − 4	− 157
4	− 1.41	+ 1.52	+ 1	= + 50	+ 7 − 2 − 4 = + 1	+ 49
5	− 1.41	− 1.52	+ 1	= + 44	+ 7 + 1 − 4 = + 4	+ 40
6	− 1.50	− 1.43	+ 1	= + 14	+ 7 + 1 − 4 = + 4	+ 10
7	− 2.02	− 0.43	+ 1	= − 108	− 10 − 0 − 4 = + 6	− 114
8	− 2.07	+ 0.00	+ 1	= + 41	+ 10 + 0 − 4 = + 6	+ 35
9	− 1.99	+ 0.57	+ 1	= − 24	+ 9 − 1 − 4 = + 4	− 28
10	− 1.35	+ 1.57	+ 1	= + 102	+ 6 − 2 − 4 = 0	+ 102

Average (O-C) = 59

Normal Equations.

a	b	c	
+ 20.90	+ 0.10	− 11.57	− 46
+ 0.10	+ 21.95	+ 6.35	= − 50
− 11.57	+ 6.35	+ 10.00	= + 3
− 0.10	− 0.00	+ 0.06	= + 0
+ 11.57	+ 0.06	− 6.36	= − 25
	+ 21.95	+ 6.41	= − 50
	+ 6.41	+ 3.64	= − 22
	− 6.41	− 1.85	= + 15
		+ 1.79	= − 7
	− 11.31	− 6.41	= + 39
	+ 10.64 b		= − 11
− 13.36	+ 7.34	+ 11.57	= + 3
+ 7.34	− 4.04	− 6.35	= − 2
+ 7.54	+ 7.44		= − 43
+ 7.44	+ 17.91		= − 52
− 3.09	− 7.44		= + 22
+ 4.45			= − 21
− 458 a	+ 260 c		

$\frac{\Delta S}{\Delta n} = 2.07 - .29 - 0.61$

c = − 4

b = − 1

a = − 5

$\frac{\Delta x}{\Delta n} = 2.07 + .51 + 1.18$

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Means from position (1911.0).

$X_0 = 18.4096$ $Y_0 = 22.4296$

$+\frac{1}{2}a$ -2 $+\frac{1}{2}b$ -1

18.4094 22.4295

From preliminary Reduction $X = 18.2144$ $Y = 22.4457$

" plate constants $ax = +4$ $+8$

$by = -30$ $+11$

$c = +23$ -19

$x = 18.2141$ $y = 22.4457$

$\xi = +0.21417$ $\eta = +0.44457$

$\log \xi = 9.33062$

" $\cos\delta = 9.969222$ $\log \tan\delta = 9.5898$

" const $= 8.507724$ " $\xi^2 = 8.6602$

" const $= 7.0534$

$(\alpha - A) = 0.854116$ " $\eta_1 = 5.3034$

$\eta_1 = 0$

$\alpha - A = +7^s.15$

$A = 9^h\ 11^m\ 00^s.1$ $\eta_0 = +0.44457$

$\alpha_0 = 9^h\ 11^m\ 07^s.15$ $\log \eta_0 = 9.64904$

" const $= 7.33115$

Red to app. place $= +1.20$ $(\delta - D) = 2.31789$

$\alpha' = 9^h\ 11^m\ 08^s.35$ $\delta - D = +207''.9$

$= +3'\ 27''.9$

$D = +21^\circ\ 15'\ 36''$

$\delta_0 = +21^\circ\ 19'\ 03''.9$

Red to app. place $= +1.3$

$\delta' = +21^\circ\ 19'\ 05''.2$

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MC 972 1912 Dec. 13. 30

Coordinates Wolbach Spectrum (1911.0)

$X_0 = 18.4096$ $Y_0 = 22.4296$

$\frac{1}{2}a = -2$ $\frac{1}{2}b = -1$

18.4094 22.4295

From fundamental Reduction $X = 18.2144$ $Y = 22.4457$

Plate constants $\alpha x = +4$ $+8$

$by = -30$ $+11$

$c = +23$ -19

$x = 18.2141$ $y = 22.4457$

$\xi = +0.2141$ $\eta = +0.4457$

$\log \xi = 9.330662$ $\log \tan \delta = 9.58998$

$\cos \delta = 9.969228$ $\xi^2 = 9.6602$

$\cot = 8.507274$ $\cot = 7.0534$

$\eta' = 5.3039$

$\eta' = 0$

$(\alpha - A) = 085416$ $\eta_0 = +0.4459$

$\log \eta_0 = 9.649904$

$\alpha - A = +7^s.15$ $\log \sec \delta = 7.331.5$

$A = 9^h\ 11^m\ 00^s.$ $(A - D) = 231789$

$\alpha_0 = 9^h\ 11^m\ 07^s.15$ $\delta - D = +20'.9$

$= +3.27.9$

$D = +21^\circ\ 15'\ 56''$

$\delta_0 = +21^\circ\ 19'\ 03''.9$

Predicted place = $+1.20$ Predicted place = $+1.3$

$\alpha' = 9^h\ 11^m\ 08^s.35$ $\delta' = +21^\circ\ 19'\ 05''.2$

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MC 972 (1911. May 11, 7h) Moon. 1912 Dec. 19. 31

Reduction to apparent place.

$\alpha_0 = 9^h\ 11^m\ 07^s$
$G = 17\ 46\ 48$
$G+\alpha = 2^h\ 57^m\ 55^s$
$= 44^\circ\ 29'$

$\delta_0 = +21^\circ\ 19'\ 04''$
$H = 18^h\ 40^m\ 36^s$
$H+\alpha_0 = 3\ 51\ 43$
$= 57^\circ\ 56'$

$\log \frac{1}{15} = 8.8239$
$\therefore q = 0.8633$
$\therefore \sin(G+\alpha_0) = 9.8455$
$\therefore \tan\delta_0 = 9.5913$
$\therefore (\delta) \quad 9.1240$

$\log \delta = \overline{*}0.8633$
$\therefore \cos(G+\alpha_0) = 9.8534$
$\therefore (\zeta') = -0.7167$

$\log \frac{1}{15} = 8.8239$
$\therefore h = 1.2742$
$\therefore \sin(H+\alpha_0) = 9.9281$
$\therefore \sec\delta_0 = 0.0308$
$\therefore (h) = 0.0570$

$\therefore h = 1.2742$
$\therefore \cos(H+\alpha_0) = 9.7250$
$\therefore \sin\delta_0 = 9.5605$
$\therefore (h') \quad 0.5597$

$\log i = 0.9047_n$
$\therefore \cos\delta_0 = 9.9692$
$\therefore (i) = 0.8739_n$

$f = -0.07$
$(\zeta) = +0.13$
$(k) = +1.14$
Red. in α: $+1.20$

$(\zeta') = +5.2$
$(k') = +3.6$
$(i) = -7.5$
Red. in δ: $+1.3$

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(1911. Aug 11. 7h)
MC 977 Wilson.

1912 Dec. 19. 31

Reduction to apparent place.

α_0 = 9h 11m 07s
G = 17 46 48
G + X = 2h 57 55
= 44° 29'

δ_0 = + 21° 19' 04"
H = 18h 40 36
H + λ_0 = 3 51 43
= 57° 56'

log $\frac{1}{15}$ = 8.8239
log c = 0.8633
sin(G+X) 9.8455
tan δ_0 9.5913
(g) 9.1240

log $\frac{1}{15}$ = 8.8239
log h = 1.2742
sin(H+λ_0) 9.9281
sec δ_0 0.0308
(h) 0.0570

log i = 0.9047n
cos δ_0 9.9292
(L) 0.8739n

log g 0.8633
cos(G+λ_0) 9.8534
(g') − 0.7167

h 1.2742
cos(H+λ_0) 9.7250
sin δ_0 9.5605
(h') 0.5597

f : − 0.07
(g) : + 0.13
(h) : + 1.14
Red. to : + 1.20

(g') : + 5.2
(h') : + 3.6
(L) : − 7.5
Reduced : + 1.3

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MC 972

Lunar parallax.

α' = 9h 11m 08.35s ✓
Θ = 7h 28 06.3 ✓
$\Theta - \alpha'$ = −1 43 02. ✓
= −25° 45′ 30″ ✓

$\frac{1}{2}(\alpha - \alpha')$ = − 10 03

$(\Theta - \alpha') - \frac{1}{2}(\alpha - \delta')$ = −25° 35′ 27″ ✓

log tan ϕ' = 9.957227 ✓
∴ cos $\frac{1}{2}(\alpha - \alpha')$ = 0 000000
− ∴ $(\Theta - \alpha') - \frac{1}{2}(\alpha - \delta')$ = 9.955116 ✓
∴ tan ζ 0.002111 ✓

ζ +45 08 21.7 ✓

δ' = +21 19 05.2 ✓

$\zeta - \delta'$ = +23 49 16.5 ✓

log $\rho \sin\phi'$ = 9.826400 ✓
∴ sin π = 8.228754 ✓
∴ sin $(\zeta - \delta')$ = 9.606226 ✓
− ∴ sin ζ = 9.850547 ✓
∴ sin $(\xi - \delta')$ = 7.810879 ✓
$\xi - \delta'$ = + 22 14.4″ ✓

δ' = +21 19 05.2 ✓
π = 58′ 13.0 ✓

log $\rho \cos\phi'$ = 9.869137 ✓
∴ sin π = 8.228754 ✓
∴ sin $(\Theta - \alpha')$ = 9.638071 ✓
− ∴ cos δ' = 9.969220 ✓
∴ sin $(\alpha - \alpha')$ 7.766772 ✓

approx $(\alpha - \alpha')$ = − 20′ 06″
log cos δ = 9.968120 ✓
∴ sin $(\alpha - \alpha')$ = 7.767831 ✓
$(\alpha - \alpha')$ = − 20′ 08.5 ✓
= −1m 20.57s ✓

δ = +21 41 19.6 ✓ α = 9 09 47.78 ✓
Am Eph. δ = +21 41 22.4 ✓ α = 9 09 47.37 ✓
O − C = − 2.8 ✓ + 0.41 ✓
Corr to standard radius − 0.8 + 0.11
Final (O − C) − − 3.6 + 0.52

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MC 972

Lunar parallax.

$\alpha' = 9^h\ 11^m\ 08^s.35$
$\odot = 7^h\ 28\ 06.3$
$\odot - \alpha' = -1\ 43\ 02$
$= -25^\circ\ 45'\ 30''$

$\frac{1}{2}(\alpha - \alpha') = -10\ 03$

$\odot - \alpha' - \frac{1}{2}(\alpha - \alpha') = -25^\circ\ 35'\ 27''$

$\log \tan \varphi' = 9.95727$
$\cos \frac{1}{2}(\alpha - \alpha') = 0.000000$
$- \sin(\odot - \alpha') - \frac{1}{2}(\alpha - \alpha') = 9.955516$
$\tan \gamma \quad 0.002111$

$\gamma \quad +4\ 5\ 08\ 21.7$
$\delta' = +21\ 19\ 05.3$

$\gamma - \delta' = +23\ 49\ 16.4$

$\log \rho \sin \varphi' = 9.82646$
$\sin \pi = 8.22879$
$\sin(\gamma - \delta') = 9.60622$
$- \sin \gamma = 9.85054$

$\sin(\delta - \delta') = 7.81087_n$
$\delta - \delta' = +\ 22'\ 14''.4$

$\delta = +21\ 41\ 19.7$
Am Ephem. $\delta = +21\ 41\ 22.4$
$O - C = -2.6$
Corr to standard radius $= -0.8$
Final $(O - C) = -3.6$

$\delta' = +21^\circ\ 19'\ 05''.3$

$\pi = 58'\ 13''.9$

$\log \rho \cos \varphi' = 9.86913$
$\sin \pi = 8.22879$
$\sin(\odot - \alpha') = 9.63803_n$
$- \cos \delta' = 9.96922$

$\sin(\alpha - \alpha') = 7.76848_n$

Approx $(\alpha - \alpha') = -20'\ 06''$

$\log \cos \delta = 9.96812$

$\sin(\alpha - \alpha') = 7.76778_n$

$(\alpha - \alpha') = -20'\ 08.5$
$= -1^m\ 20^s.57$

$\alpha = 9\ 09\ 47.78$
$\alpha = 9\ 09\ 47.37$
$+ 0.41$
$+ 0.11$
$+ 0.52$

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First Normals.

Assumed Center

$+25.97a + 0.97b - 14.67c = +2$ — 18.0039
$+16.78 + 0.75 = +171$ — 22.8534
$+10.00 = +1$ — 4.2753

Given ½ wt.

$+12.99 + 0.48 - 7.33 = +2 + 437 = +439$
$+8.39 + 0.38 = 171 - 161 = +10$
$+5.00 = +1 - 355 = -354$

Normals of new axes.

Assumed Centre

$+21.88a' + 0.40b' - 11.05c' = +287$ — 18.0050
$+1670 + 5.27 = -172$ — 22.8340
$+9.00 = +1$ — 4.2870

$a = a' + 32$
$b = b' + 17$
$c = c' + 117$

Combined Normals

$+34.87a' + 0.08b' - 18.38c' = +726$
$+25.09b' + 5.65c' = -162$
$+14.00c' = -353$

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NGC 974 1913 Apr. 14. 37

Combination of measures & remeasures

Normals

1/2 wt is given to 1st measure

a'	b'	c'	
+34.87	+ 0.08	−18.38	= +726
+ 0.08	+25.09	+ 5.65	= −162
−18.38	+ 5.65	+14.00	= −353
− 0.08	− 0.00	+ 0.04	= − 2
+18.38	+ 0.04	− 9.66	= +382
	+25.09	+ 5.69	= −164
	+ 5.69	+ 4.34	= + 29
	− 5.69	− 1.29	= + 37
		+ 3.05	= + 66
			a' = + 22
	− 7.45	− 5.69	= − 38
	+17.64		= −202
			b' = − 11.7
+ 0.26	− 0.08	− 0.20	= + 5
+81.61	−25.09	−62.16	= +1567
+35.13		−18.58	= +731
+81.69		−56.51	= +1405
−26.88		+18.58	= − 462
+ 8.25			= + 269
			a' = + 33

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Combination of measures & remeasures.

Normals.

½ wt. is given to 1st measures.

a'	b'	c'	
+34.87	+ 0.08	−18.38	= +726
+ 0.08	+25.09	+ 5.65	= −162
−18.38	+ 5.65	+14.00	= −353
− 0.08	− 0.00	+ 0.04	= − 2
+18.38	+ 0.04	− 9.66	= +382
	+25.09	+ 5.69	= −164
	+ 5.69	+ 4.34	= + 29
	− 5.69	− 1.29	= + 37
		+ 3.05	= + 66
			a' = +22
	− 7.45	− 5.69	= − 38
	+17.64		= −202
			b' = −11 +

+ 0.26	− 0.08	− 0.20	= + 5
+81.61	−25.09	−62.16	= +1567
+35.13		−18.58	= +731
+81.69		−56.51	= +1405
−26.86		+18.58	= −462
+18.25			= +269
			a = +33

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Giving ½ wt to 1st measures.

$\alpha_0 =$	$9^h\ 12^m\ 04.91$	$\delta =$ +21 13 47.5
staff.	+ 1.20	+ 1.3
par.	− 54.37	+21 27.8
$\alpha =$	9 11 11.74	+21 35 16.6
Com Eph.	9 11 11.12	+21 35 17.1
	O−C = +0.62	O−C = −0.5

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Giving ½ wt to 1st measures.

α_0 =	$9^h\ 12^m\ 04.91$	δ = +21 13 47.5
taff.	+ 1.20	+ 1.3
par.	− 54.37	+ 21 27.8
α =	9 11 11.74	+21 35 16.6
Eph.	9 11 11.12	+21 35 17.1
	O−C = + 0.62	O−C = − 0.5

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MC 974 1912 Nov. 11. 40

Comparison Stars – Standard Coords.
see plate 19-20

	1	2	3
α	$9^h 06^m 42^s.18$	$9^h 08^m 32^s.42$	$9^h 11^m 01^s.64$
A	9 12 06	9 12 06	9 12 06.
α−A	− 5 23.82	− 3 33.58	− 1 04.36
sin(α−A)	− 323.79	− 213.57	− 64.36
log "	2.510279n	2.329549n	1.808629n
" · cos δ	9.970979	9.968239	9.971759
" ξ₀	0.988488n	0.805018n	0.287619n
ξ₀	−9.7382	−6.3828	−1.9391
ξ₁	− 26	− 9	− 1
ξ₁/ξ₀	8.2592	11.6163	16.0608
x	8.2718	11.6792	16.0614
x−ξ	+ 126	+ 629	+ 6

δ	+20° 43′ 06.″4	+21° 39′ 01.″2	+20° 26′ 38.″6
D	+21 03 21	21 03 21	+21 03 21
δ−D	− 20 14.6	+ 35 40.2	− 36 42.4
tan(δ−D)	− 1214.6	+ 2140.3	− 2202.5
log "	3.084444n	3.330479	3.342911n
log η₀	0.415599n	0.661629	0.674069n
" tan δ	9.5778v	9.5987v	9.5715v
" ξ₀	19770	1.6100	0.5752
" η₁	8.6082	8.2621	9.2001
η₀	−2.6037	+4.5880	−4.7213
η₁	+ 406	+ 183	+ 16
η₁/η₀	19.4369	26.6063	17.2803
η	18.9908	26.1391	16.7832
η−η	− 4461	+ 4672	− 4971

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MC 974 1912 Nov. 11. 40

Comparison Stars - Standard Coords.

Epoch = 19-20.

	1	2	3
α	$9^h 06^m 42^s.18$	$9^h 08^m 32^s.42$	$9^h 11^m 01^s.64$
A	9 12 06	9 12 06	9 12 06.
x-A	- 5 23.82	- 3 33.58	- 1 04.36
Sm(x-A)	- 323.79	- 213.57	- 64.36
log "	2.510279n	2.329549n	1.808629n
" cos δ	9.970979	9.968239	9.971759
" ξ_0	0.988489n	0.805019n	0.287619n
ξ_0	-9.7382	-6.3828	-1.9391
ξ_1	- 26	- 9	- 1
$\bar{x}$	8.2592	11.6163	16.0608
x	8.2718	11.6792	16.0614
x-$\bar{x}$	+ 126	+ 629	+ 6

δ	+20° 43' 06".4	+21° 39' 01".2	+20° 26' 38".6
D	+21 03 21	21 03 21	+21 03 21
δ-D	- 20 14.6	+ 35 40.2	- 36 42.4
Sm(δ-D)	- 1214.6	+ 2140.3	- 2202.5
log "	3.084449n	3.330479	3.342919n
log ρ_0	0.415599n	0.661629	0.674069n
" tan δ	9.5778n	9.5987	9.5715
ξ_0^2	1.9770	1.6100	0.5752
η_1	8.6082	8.2621	7.2001
η_0	-2.6037	+4.5880	-4.7213
η_1	+ 406	+ 183	+ 16
$\bar{\eta}$	1.94369	2.66063	1.72803
η	18.9908	26.1391	16.7832
η-$\bar{\eta}$	- 4461	+ 4672	-4971

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MC974 1912 Nov. 11

Comparison star – Standard coords.
see pp. 19-20.

	A	S
α	$9^h\ 16^m\ 55^s.25$	$9^h\ 18^m\ 46^s.01$
A	9 12 06	9 12 06
α − A	+ 4 49.25	+ 6 40.01
sin(α−A)	+ 289.23	+ 399.95
log ..	2.46125	2.60201
.. cosδ	9.96754 ✓	9.98089 ✓
.. ξ₀	0.93603	1.08014
ξ₀	+8.6304	+12.0265
ξ₁	+ 24	+ 44
ξ	26.6328	30.0309
x	26.7683	30.0500
x − ξ	+ 755	+ 191

δ	+21° 52′ 39″.2	+20° 44′ 41″.6
D	+21 03 21	+21 03 21
δ − D	+ 49 18.2	− 18 39.4
Tan(δ−D)	+ 2958.4	− 1119.4
log ..	3.47106	3.04899 m
.. η₀	0.80221	0.38014 m
.. tanδ	9.6037 ✓	9.5784 ✓
.. ξ₀²	1.8721	2.1603
.. η₁	85292	8.7921
η₀	+6.3417	− 2.3996
η₁	+ 338	+ .620
η	28.3755	19.6624
y	27.8076	19.0710
y − η	− .5679	− .5914

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MC 974 1912 Nov. 11 41

Comparison star – Standard coords
see pp. 19-20.

	4	5
α	$9^h\ 16^m\ 55^s.25$	$9^h\ 18^m\ 46^s.01$
A	9 12 06	9 12 06
α − A	+ 4 49.25	+ 6 40.01
sin(α−A)	+ 289.23	+ 399.95
log	2.46125	2.60201
cos δ	9.96754	9.99089
$\bar{x}_0$	0.93603	1.08014
$\bar{y}_0$	+ 8.6304	+ 12.0265
y_1	+ 24	+ 44
$\bar{y}$	26.6328	30.0309
x	26.7083	30.0500
x − ȳ	+ 755	+ 191

δ	+ 21° 52′ 39.″2	+ 20° 44′ 41.″6
D	+ 21 03 21	+ 21 03 21
δ − D	+ 49 18.2	− 18 39.4
tan(δ − D)	+ 2958.4	+ 1119.4
log	3.47106	3.04899 m
η_0	0.80221	0.38014 m
tan δ	9.6037	9.5784
δ_1	1.8721	2.1603
η_1	85292	8.7921
m_0	+ 6.3417	− 2.3996
m_1	+ 338	+ 620
m	28.3755	19.6624
y	27.8076	19.0710
y − h	− 5679	− 5914

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MC974. 1912 Nov. 8. 42.

Comparison stars - measures.

1/	d		n	
8.3	16358		8671	
19.0	6463	63	8589	86
	63		86	

18.9895 ✓ .9916 ✓

2/ very poor image.				
11.7	16396		14799	
26.1	14997	02	6176	70
	90		74	
	90		89	

26.1399 .1383

3/ not a good image.				
16.1	13489		17220	
16.8	5645	41	15042	46
	47		50	
	79		16	

16.7837 .7827

4/				
26.8	16621		14144	
27.8	8530	32	12218	10
	35		17	
	08		30	

27.8079 .8074

S				
30.0	9332		8496	00
19.0	8631	30	98	
	27		7780	

19.0703 ✓ .0718 ✓

d			
16869		16081	
9586	80	13367	65
80		67	
61		81	

8.2719 ✓ .2718

15840		16582	
12628	27	9778	80
29		81	
35		70	

11.6790 .6794

14682		16248	
5285	89	15634	29
90		31	
76		40	

16.0612 .0617

16059		13780	
13140	39	6690	91
38		98	
59		79	

26.7080 .7086

7790		8240	
96	97	7742	41
7290		46	

30.0504 .0497

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Comparison stars - measures

1/							
	16.9895		.9916		8.2719		.2718
8.3	16358		8671		16869		16081
14.0	64635	62	85898	86	9586	80	13367	65
	63		86		80		67
					61		81
2/							
	26.1399		.1383		11.6790		.6794
11.7	16396		14799		15840		16582
26.1	14997	02	61767	70	12628	27	9778	80
	90		74		29		81
	90		89		35		70
3/							
	16.7837		.7827		16.0612		.0617
16.1	13489		17220		14682		16248
16.8	56457	41	150426	46	52855	89	15634	29
	47		50		90		31
	79		16		76		40
4/							
	27.8079		.8074		26.7080		.7086
26.8	16621		14144		16059		13780
27.8	85730	32	122187	10	13140	39	669091
	31		17		38		98
	08		30		59		79
5							
	19.0703		.0718		30.0504		.0497
30.0	9532		84966	00	7790	97	8240
19.0	86312	20	987		96		77424	41
	27		7780		7299		46

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Points on moon's limb. measures.

poor image

	d	n
1		
17.0		
21.0	8236	1055041
	7915-29	4046
	2035	10309
	21.0311	.0235
2		
16.0	16187	13210
22.4	1296351	6354201
	4720	5441
	80	90
	22.3240	.3146
3.		
16.0	15899	16190
23.4	1246922	9620911
	3230	3841
	84	81
	23.3456	.3441
4.		
17.0	16886	13807
24.6	965067	10205-12
	7053	1025
	65	10
	24.6412	.6405
5		
18.0	15040	16850
24.8	600080	15876555
y = max	9181	6178
	25	50
	24.9038	.9018
6		
16.3		
24.0		

blurry edge

irregular and oblique

" "

	d	n
	14551	16498
	7520010	1349292
	1512	8480
	37	98
	16.2973	.3011

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MC974 1912 Nov. 8 45

Points on moons limb. measures.

1		4
17.0	a	n
21.0	8236	1055041
	7915-29	4046
	2035	10309
	21.03111	.0235

Bright edge.

E		
160	16187	13210
234	1296351	6354201
	4720	5441
	80	90
	24.3240	.3146

irregular and oblique

3		
160	15899	16190
234	1246922	9620911
	3230	3841
	84	81
	23.3456	.3441

"

4.		
17.0	16886	13807
24.6	965067	10205-12
	7053	1025
	65	10
	24.6412	.6405

5		
18.0	15040	16850
24.8	600080	1587.655
4 = max	9181	617.8
	25	50
	24.9038	.9018

6	d	n
16.3	14551	16498
24.0	7520 10	1349292
	1512	8480
	37	98
	16.2973	.3011

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MC974. 1912 Nov. 8. 44.

Points on Moon's Limb - measures.

	a	n
7		
15.9	17352	16341
23.0	1675051	689814
	5050	0910
	60	31
	15.9397	.9424
8		
15.9	16372	15322
22.8	1571088	5955960
x =	0192	6061
min.	68	12
	15.9326	.9353
9		
16.1	15797	14001
22.0	6913796	1286370
	0290	6978
	95	90
	16.1105	.1130
10		
17.0	1088079	11281
21.0	8061	1077882
	10406	7578
obliques.		
	17.0469	.0503

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Points on Nubecula Minor measures.

	a	n
2		
15.9	17352	16341
23.0	1675051	6898114
	5050	0910
	60	31
	15.9397	.9424
8		
15.9	16372	15322
22.8	1571088	5959160
K:	0192	6061
ring	68	12
	15.9326	.9353
9		
16.1	15797	14001
22.0	6913096	1286370
	0290	6978
	95	90
	16.1105	.1130
19		
17.0	1085079	11281
21.0	5061	1077882
	10406	7578
	17.0469	.0503

oblique.

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MC 974 1912 Nov. 11 45

Comparison stars
mean measured coordinates and
coords of plate center

	x	y
1	8.2718	18.9906
2	11.6792	26.1391
3	16.0614	16.7832
4	26.7088	27.8076
5	30.0500	19.0710
5 |	92.77	108.79
	18.55	21.76
	− 18.	− 22
	+ 955	− 0.24
	31	465
	55	1860
	165	930
	+17.05	−11.160

From p. 24
mean R.A. = $9^h\ 12^m\ 23^s$
$-\quad\quad\quad 17$
$4 = \quad 9\ 12\ 06$

mean Decl = $+21^\circ\ 05'\ 13''$
$+\quad\quad\quad\quad 1\ 52$
D: $+21\ 03\ 21$

Preliminary Reduction

Star	x − 3	− 684	− 2x		+1175
1	+126 − 1291 = −1165	−16	= −1181	=	−6
2	+629 − 1777 = −1148	−23	= −1171	=	+4
3	+ 6 − 1141 = −1135	−32	= −1167	=	+8
4	+755 − 1891 = −1136	−53	= −1189	=	−14
5	+191 − 1297 = −1106	−60	= −1166	=	+9
From	18.0032 − 1553	− 36	=		17.9618

Star	y − y	+ 67x		+3896
1	−4461 + 554 = −3907		=	−11
2	−4672 + 783 = −3889		=	+ 7
3	−4971 + 1076 = −3895		=	+ 1
4	−5679 + 1790 = −3889		=	+ 7
5	−5914 + 2013 = −3901		=	− 5
From	22.8339 + 1206		=	23.3447

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Comparison star
mean measured coordinates and
coords of plate center

	x	y
1	8.2718	18.9906
2	11.6792	26.1391
3	16.0614	16.7832
4	26.7087	27.8076
5	30.0500	19.0710
5	92.77	108.79
	1855	21.76
	18.	-22
	0.555	-0,24
	31	465
	55	1860
	165	930
	+17.05	-11160

From p. 24
mean R.A. = $9^h\ 12^m\ 23^s$
$-\quad 17$
4 = $9\ 12.06$

mean Decl = $+21^\circ\ 05'\ 13''$
$+\quad 1\ 52$
D: $+21\ 03\ 21$

Preliminary Reduction.

Star	x-3	-684	-276		+1175
1	+126	-1291 = -1165	-16	= -1181	= -6
2	+629	-1777 = -1148	-23	= -1171	= +4
3	+6	-1141 = -1135	-32	= -1167	= +8
4	+755	-1891 = -1136	-53	= -1189	= -14
5	+191	-1297 = -1106	-60	= -1166	= +9
mean	18.0032	-1553	-36	=	17.9618

Star	y-y	+67x	+3896	
1	-4461	+554 = -3907	=	-11
2	-4672	+783 = -3889	=	+7
3	-4971	+1076 = -3895	=	+1
4	-5679	+1790 = -3889	=	+7
5	-5914	+2013 = -3901	=	-5
mean	2.8339	+1206	=	23.3443

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Plate Constants.

Conditional Equations.

Star	a	b	c	x − x̄	y − ȳ
1	+8.27	+18.99	+1 =	−6	−11
2	+11.68	+26.14	+1 =	+4	+7
3	+16.06	+16.78	+1 =	+8	+1
4	+26.71	+27.81	+1 =	−14	+7
5	+30.05	+19.07	+1 =	+9	−5

Mean Equations.

+12.00	+20.64	+1 =	+2.00	−1.00
+28.38	+23.44	+1 =	−2.50	+1.00
+19.20	+26.98	+1 =	−5.00	+7.00
+18.13	+18.28	+1 =	+3.67	−5.00
−16.38	−2.80	=	+4.50	−2.00
+1.07	+8.70	=	−8.67	+12.00
−1.07	−0.18	=	+0.29	−0.13
	+8.52 b	=	−8.38	+11.87
	b	=	−0.98	+1.39

−16.38a = +4.50 − 2.74 = +1.76 −2.00 + 3.89 = +1.89

a = +0.11 −0.12

+2.0	−2.5	−5.0	+3.7
+1.3	+3.1	+2.1	+20
+20.2	+22.9	+26.5	+17.9
+23.5	+23.5	+23.6	+23.6

c from x − x̄

−1.0	+1.0	+7.0	−5.0
+1.4	+3.4	+2.3	+2.2
−28.6	−32.5	−37.5	−25.4
−28.2	−28.1	−28.2	−28.2

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Plate Constants.

Conditional Equations.

Star	a	b	c	z − 5	4 − 7
1	+8.27	+18.99	+1 =	−6	−11
2	+11.68	+26.14	+1 =	+4	+7
3	+16.06	+16.78	+1 =	+8	+1
4	+26.71	+27.81	+1 =	−14	+7
5	+30.05	+19.07	+1 =	+9	−5

Mean Equations.

+12.00	+20.64	+1 =	+2.00
+28.38	+23.49	+1 =	−2.50
+19.20	+26.98	+1 =	−5.00
+18.13	+18.28	+1 =	+3.67

−16.38	−2.80	=	+4.50
+1.07	+8.70	=	−8.67
−1.07	−0.18	=	+0.29

	+8.52 b	=	−8.38
	b	=	−0.98

−16.38a	= +4.50 − 2.74	=	+1.76
a	=		−0.11

−2.00	+2.89	=	+1.89
			−0.12

+2.0	−2.5	−5.0	+3.7
+1.3	+3.1	+2.1	+2.0
+20.2	+22.9	+26.5	+17.9
+23.5	+23.5	+23.6	+23.6

c from z − 5

−1.0	+1.0	+7.0	−5.0
+1.4	+3.4	+7.3	+2.7
−28.8	−32.4	−37.5	−25.4
−28.4	−28.1	−28.2	−28.1

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Plate Constants.

Resids. in x.

Star					C	O	974 O-C	972 O-C
1	-	1 - 19	+24	=	+4	-6	-10	-4
2	-	1 - 26	+24	=	-3	+4	+7	+10
3	-	2 - 16	+24	=	+6	+8	+2	-5
4	-	3 - 27	+24	=	-6	-14	-8	-9
5	-	3 - 19	+24	=	+2	+9	+7	+11

Resids. in y.

					C	O	O-C	
1	-	1 + 26	-28	=	-3	-11	-8	+1
2	-	1 + 36	-28	=	+7	+7	0	-4
3	-	2 + 23	-28	=	-7	+1	+8	+2
4	-	3 + 39	-28	=	+8	+7	-1	+4
5	-	3 + 27	-28	=	-4	-5	-1	-5

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Plate Constants.

Resids. in x.

Star				C	O	974 O − C	972 O − C
1	−	1 − 19	+24 =	+4	−6	−10	−9
2	−	1 − 26	+24 =	−3	+9	+7	+10
3	−	2 − 16	+24 =	+6	+8	+2	−5
4	−	3 − 27	+24 =	−6	−14	−8	−9
5	−	3 − 19	+24 =	+2	+9	+7	+11

Resids. in y.

				C	O	O − C	
1	−	1 + 26	−28 =	−3	−11	−8	+1
2	−	1 + 36	−28 =	+7	+7	0	−4
3	−	2 + 23	−28 =	−7	+1	+8	+2
4	−	3 + 39	−28 =	+8	+7	−1	+4
5	−	3 + 27	−28 =	−4	−5	−1	−5

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MC 974 1912 Nov. 25.

Times etc.

Exp. to stars 1911, Mar. 11	8^h	00		8^h	12^m	
" " moon	8	06	27.4	8	06	27.6
clock fast		2	37.4			
H. Sid Time	8	03	50.1			
H Long	4	44	31.05			
G Sid Time	12	48	21.15			
Sid T. m. moon	23	12	06.92			
Interval	13	36	14.23			
Reduction		2	13.72			
G. M. T.	13	34	00.51			

	R A			Decl.		
From Am Eph.						
moon 13^h	9^h	09^m	$51^s.19$	$+21°$	41′	05.″8
motion in 1^m = 2.3503			10.252			
" " 34.008		1^m	19.93	−	5	48.7
Tabular place	9	11	11.12	+21	35	17.1
moons parallax		58′	12.″4			
" Semidiam.	1	5	53.2			

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MC 974 1912 Nov. 25.

Times etc.

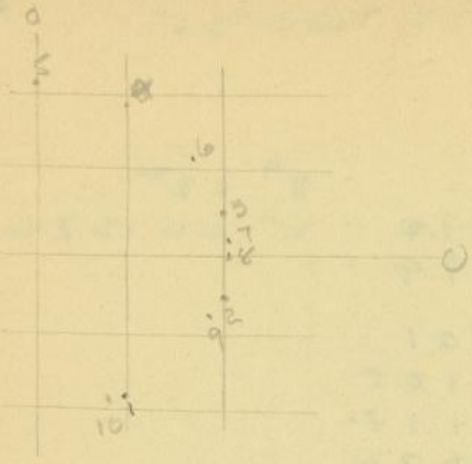
Exp. to stars 1911, Mar 11	8^h	00		8^h	12^m	
" noon	8	06	27.4	8	06	27.6
clock fast		2	37.4			
H. Sid. Time	8	03	50.1			
H Long	4	44	31.05			
G Sid. Time	12	48	21.15			
Sid. T. mi. noon.	23	12	06.92			
Interval	13	36	14.23			
Reduction		2	13.72			
G. M. T.	13	34	00.51			

	R. A.			Decl.		
from Eph.						
noon 13^h	9^h	09^m	$51^s.19$	$+21°$	41′	05.″8
motion in 1^m = 2.3483			10.286			
34.08		1^m	19.93	−	5	49.8
Tabular place	9	11	11.12	+21	35	16.0

noon parallax	58′	12.″4
Semidiam.	15	53.1

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Point	Pos. ∠	Resid	Reversures Resid	P	Mean
10	207.°5	+3			+3
1	209.0	−42	−60	214.9	−42
9	246.2	−17	−6		−60
2	255.6	+30			−12
8	270.°0	+69	+75		+30
7	274.6	+56	+126		+72
3	284.4	−8			+91
6	304.4	−113	−33	289.8	−6
4	331.0	−36	−115		−33
5	0.0	+60	−54		−114
			+31		−45
			+35	23.2	+46
					+35

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Moon's center

	x	x − X₀	Δx	(x − X₀)²	(x − X₀)² + (y − Y₀)²	O − C
1	17.0000	− 1.0034	+ 1	1.0066	4.2689	− 64
2	16.0000	− 2.0034	+ 0	4.0136	4.2779	+ 26
3	16.0000	− 2.0034	− 0	4.0136	4.2751	− 2
4	17.0000	− 1.0034	− 1	1.0066	4.2733	− 20
5	18.0000	− 0.0034	− 1	0.0000	4.2828	+ 75
6	16.2992	− 1.7042	− 0	2.9043	4.2653	− 100
7	15.9410	− 2.0624	− 0	4.2535	4.2813	+ 60
8	15.9340	− 2.0694		4.2824	4.2824	+ 71
9	16.1118	− 1.8916	+ 0	3.5782	4.2728	− 25
10	17.0486	− 0.9548	+ 1	0.9116	4.2733	− 20
					4.2753	+ 1

	y	y − Y₀	Δy	(y − Y₀)²
1	21.0273	− 1.8061	− 1	3.2623
2	22.3193	− 0.5141	0	0.2643
3	23.3448	+ 0.5114	0	0.2615
4	24.6408	+ 1.8074	+ 1	3.2667
5	24.9028	+ 2.0694	+ 1	4.2828
6	24.0000	+ 1.1666	0	1.3610
7	23.0000	+ 0.1666	0	0.0278
8	22.8334	0.0000	0	0.0000
9	22.0000	− 0.8334	0	0.6946
10	21.0000	− 1.8334	− 1	3.3617

Approximate center of moon

x = 17.0 y: 21.0273
24.6408
45.6681
mean y: 22.8340 not 2

x = 16.0 y = 22.3193
23.3448
45.6641
mean y: 22.8320

22.8334
y = max 24.9028
K₀ = 2.0694
x = min: 15.9340
X₀ = 18.0034

Assume { X₀ = 18.0034, Y₀ = 22.8334

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Nebula Cancri.

	x	$x - x_0$	Δx	$(x-x_0)^2$	$(x-x_0)^2+(y-y_0)^2$	O − C
1	17.0000	− 1.0034	+ 1	1.0066	4.2089	− 64
2	16.0000	− 2.0034	+ 0	4.0136	4.2779	+ 26
3	16.0000	− 2.0034	− 0	4.0136	4.2751	− 2
4	17.0000	− 1.0034	− 1	1.0066	4.2783	− 20
5	16.0000	− 0.0034	− 1	0.0000	4.2828	+ 75
6	16.2992	− 1.7042	− 0	2.9043	4.2653	− 100
7	15.9410	− 2.0624	− 0	4.2535	4.2843	+ 60
8	15.9340	− 2.0694		4.2829	4.2804	+ 71
9	16.1118	− 1.8916	+ 0	3.5782	4.2724	− 25
10	17.0486	− 0.9548	+ 1	0.9116	4.2733	− 20
					4.2753	+ 1

	y	$y - y_0$	Δy	$(y-y_0)^2$
1	21.0273	− 1.8061	− 1	3.2623
2	22.3193	− 0.5141	0	0.2643
3	23.3448	+ 0.5114	0	0.2615
4	24.6408	+ 1.8074	+ 1	3.2667
5	24.9028	+ 2.0694	+ 1	4.2828
6	24.0000	+ 1.1666	0	1.3610
7	23.0000	+ 0.1666	0	0.0278
8	22.8334	0.0000	0	0.0000
9	22.0000	− 0.8334	0	0.6946
10	21.0000	− 1.8334	− 1	3.3617

Approximate Center of Work

x = 17.0 y = 21.0273
24.6408
45.6681
mean y = 22.8340

x = 16.0 y = 22.3193
23.3448
45.6641
mean y = 22.8320

22.8334
y-max 24.9028
K_0 2.0694
x-min 15.9340
x_0 18.0034

Assume $x_0 = 18.0034$, $y_0 = 22.8334$

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Formation of Normals.

No	ab	aa	bb
1	+ 1.81	+ 64.0	+ 115.8
2	+ 1.02	- 52.0	- 13.2
3	- 1.02	+ 4.0	- 1.0
4	- 1.81	+ 20.0	- 36.2
5	- 0.00	- 0.0	+ 155.2
6	- 1.99	+ 170.0	- 117.0
7	- 0.35	- 123.6	+ 10.2
8	0.00	- 147.0	+ 0.0
9	+ 1.57	+ 47.2	+ 21.0
10	+ 1.74	+ 19.0	+ 36.6
	+ 0.97	+ 2.0	+ 171.4

[aa] = +25.97 [bb] = +16.78

[ac] = -14.67 [bc] = + 0.75 [cm] = +1

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Leonis Centr.

Conditional Equations.

	a	b	c	O	c	O − C
1	− 1.00	− 1.81	+ 1	= − 64	+ 4 − 19 − 7	= − 22	− 42
2	− 2.00	− 0.51	+ 1	= + 26	+ 8 − 5 − 7	= − 4	+ 30
3	− 2.00	+ 0.51	+ 1	= − 2	+ 8 + 5 − 7	= + 6	− 8
4	− 1.00	+ 1.81	+ 1	= − 20	+ 4 + 19 − 7	= + 16	− 36
5	0.00	+ 2.07	+ 1	= + 75	+ 0 + 22 − 7	= + 15	+ 60
6	− 1.70	+ 1.14	+ 1	= − 100	+ 7 + 13 − 7	= + 13	− 113
7	− 2.06	+ 0.17	+ 1	= + 60	+ 9 + 2 − 7	= + 4	+ 56
8	− 2.07	0.00	+ 1	= + 71	+ 9 0 − 7	= + 2	+ 69
9	− 1.89	− 0.83	+ 1	= − 25	+ 8 − 9 − 7	= − 8	− 17
10	− 0.95	− 1.83	+ 1	= − 20	+ 4 − 20 − 7	= − 23	+ 3

+ 218 − 216

average (O − C) = 43

Normal Equations.

~~+ 25a~~	b	c	
+ 25.97 +	0.97 −	14.67	= + 2.
+ 0.97 +	16.78 +	0.75	= + 171
− 14.67 +	0.75 +	10.00	= + 1
− 0.97 −	0.04 +	0.55	= − 0
+ 14.67 +	0.55 −	8.28	= + 1
	+ 16.74 +	1.30	= + 171
	+ 1.30 +	1.72	= + 2
	− 1.30 −	0.10	= − 13
	+	1.62	= − 11
	− 0.98 −	1.30	= − 2
	+ 15.76		= + 169

$\frac{\Delta\delta}{\Delta\omega} = 207 \cdot -.08 = -0.16$

e = −7

b = +11

− 21.50 +	1.10 +	14.67	= + 1
+ 1.10 −	0.05 −	0.75	= − 0
+ 4.47 +	207		= + 3
+ 207 +	16.73		= + 171
− 0.26 −	2.07		= − 21
+ 4.21			= − 18

a = −4

− 448a + 254c = —

$\frac{\Delta\alpha}{\Delta n} = 207 \cdot 4.57 = + 1.17$

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Two Star Catalog

Conditional Equations

	a	b	c	O		c	O − C
1	− 1.00	− 1.81	+ 1	= − 64	+	4 − 19 − 7 = − 22	− 42
2	− 2.00	− 0.51	+ 1	= + 26	+	8 − 5 − 7 = − 4	+ 30
3	− 2.00	+ 0.51	+ 1	= − 2	+	8 + 5 − 7 = + 6	− 8
4	− 1.00	+ 1.81	+ 1	= − 20	+	4 + 19 − 7 = + 16	− 36
5	0.00	+ 2.07	+ 1	= + 75	+	0 + 22 − 7 = + 15	+ 60
6	− 1.70	+ 1.17	+ 1	= − 100	+	7 + 13 − 7 = + 13	− 113
7	− 2.06	+ 0.17	+ 1	= + 60	+	9 + 2 − 7 = + 4	+ 56
8	− 2.07	0.00	+ 1	= + 71	+	9 0 − 7 = + 2	+ 69
9	− 1.89	− 0.83	+ 1	= − 25	+	8 − 9 − 7 = − 8	− 17
10	− 0.95	− 1.83	+ 1	= − 20	+	4 − 20 − 7 = − 23	+ 3
						+ 218 − 216	

Average (O − C) = 43

Normal Equations.

~~+ 25a~~ b c

+ 25.97 + 0.97 − 14.67 = + 2

+ 0.97 + 16.78 + 0.75 = + 171

− 14.67 + 0.75 + 10.00 = + 1

− 0.97 − 0.04 + 0.55 = − 0

+ 14.67 + 0.55 − 8.28 = + 1

+ 16.74 + 1.30 = + 171 $\frac{\Delta S}{\Delta w}$ = 207 − .08 = − 0.16

+ 1.30 + 1.72 = + 2

− 1.30 − 0.10 = − 13

+ 1.62 = − 11 c = − 7

− 0.98 − 1.30 = − 2

+ 15.76 = + 169 b = + 11

− 21.50 + 1.10 + 14.67 = + 1

+ 1.10 − 0.05 − 0.75 = − 0

+ 4.47 + 207 = + 3

+ 207 + 16.73 = + 171

− 0.26 − 2.07 = − 21

+ 4.21 = − 18 a = − 4

− 448a + 254c = — $\frac{\Delta x}{\Delta n}$ = 207 − 4.57 = + 1.17

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MC974. 1912 Dec 13 51

Mean Position of Moon (1911.0)

X_0 = 18.0034 ✓ Y_0 = 22.8334 ✓
$\frac{1}{2}u$ = − 2 ✓ $\frac{1}{2}v$ = + 5 ✓
18.0032 ✓ 22.8339 ✓

From preliminary Reduction x = 17.9618 ✓ y = 23.3441 ✓
∴ plate constants ax − 2 ✓ − 2 ✓
by − 23 ✓ + 32 ✓
c + 24 ✓ − 28 ✓
+17.9617 ✓ 23.3443 ✓

ξ = −0.0383 ✓
log ξ = 8.583208 ✓
∴ cos δ = 9.969488 ✓
∴ const = 8.507124 ✓
∴ $(\alpha - A)$ = 0.106488 ✓

η = +1.3443 ✓
log tan δ = 9.5913 ✓
∴ ξ^2 = 71664 ✓
∴ const = 7.0534 ✓

∴ m_0 = 3.8111 ✓
n_1 = 0 ✓

η_0 = +1.3443 ✓
log η_0 = 0.128510 ✓
∴ const = 7.533115 ✓
∴ $(\delta - D)$ = 2.79735 ✓

$\alpha - A$ = + 1.28 ✓
A = 9h 12m 06s ✓
α_0 = 9h 12m 04.72s ✓
Red to app. place = + 1.20 ✓
α' = 9 12 05.92 ✓
Rem α_0 = 9 12 05.00
Mean = 9 12 04.86

$\delta - D$ = 627.1" ✓
± 10, 27.1" ✓
D = +21° 03' 21" ✓
δ_0 = +21° 13' 48.1" ✓
Red = + 1.3 ✓
δ' = +21 13 49.4 ✓
Rem δ_0 = 21 13 47.2
Mean 21 13 47.6

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VIC974. 1912 Dec. 13 51

Mean Position of Nucleus (1911.0)

X_0 = 18.0034 + ½a = − 2 = 18.0052

Y_0 = 22.8334 + ½b = + 5 = 22.8339

From graelin Reduction X = 17.9618 − 2 − 23 + 24 = 17.9617

Y = 23.3441 − 2 + 32 − 28 = 23.3443

From plate constants Δx

$\bar{\xi}$ = −0.0383
log ξ = 8.58320n
cos δ − 9.96948
const: 8.50724

(x − A) −0.01064 8n

η = +1.3443
log tan δ = 9.5913
ξ² = 71664
const = 7.0534

η₀ 3.8111
m₁ 0

η₀ = +1.3443
log η₀ = 0.12850
const = 7.53115

(δ − D) = 2.79735

x − A = − 1.28
A = 9h 12m 06s

x_0 = 9h 12m 04.72

δ − D = 627.1
10, 27.1
D = +21° 03′ 21″

δ_0 = +21° 13′ 48.1

Red aff. plac = + 1.20

α′ = 9 12 05.92

Red = + 1.3

δ′ = +21 13 49.4

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Lunar parallax.

α'	9^h	12^m	$05^s.92$
Θ	8	03	50.1
$\Theta-\alpha'$	−1	08	16
	= −	17°	04′ 00″
$\frac{1}{2}(\alpha-\alpha')$	= −		06′ 47″
$(\Theta-\alpha')-\frac{1}{2}(\alpha-\alpha')$	= −	16	57 13

$\log\tan\phi' = 9.95727$
$\log\cos\frac{1}{2}(\alpha-\alpha') = 0.00000$
$\log\cos[(\Theta-\alpha')-\frac{1}{2}(\alpha-\alpha')] = 9.98070$
$\log\tan\gamma = 9.97657$

$\gamma = +43^\circ\ 27'\ 19.0''$

$\delta' = +21\ 13\ 49.4$

$\gamma-\delta' = +22\ 13\ 29.6$

$\log\sin\phi' = 9.82640$
$\log\sin\pi = 8.27868$
$\log\sin(\gamma-\delta') = 9.57777$
$\log\sin\zeta = 9.83745$

$\sin(\delta-\delta') = 7.79540$

$\delta-\delta' = +21\ 27.7$

$\delta = 21\ 35\ 17.1$

Am Eph $\delta = +21\ 35\ 17.1$

O − C = + 0.0

Rem δ	= 21	35	16.3
Mean	21	35	16.7
O − C		−	0.4
Corr. to stand. radius	=	−	0.2
Final (O − C)		−	0.6

$\delta' = +21^\circ\ 13'\ 49.4''$

$\pi = 58'\ 12''.4$

$\log\rho\cos\phi' = 9.86913$
$\log\sin\pi = 8.22868$
$\log\sin(\Theta-\alpha') = 9.46758$
$\log\cos\delta' = 9.96948$

$\log\sin(\alpha-\alpha') = 7.59591$

Approx $(\alpha-\alpha') = -13'\ 34''$

$\log\cos\delta = 9.96842$

$\log\sin(\alpha-\alpha') = 7.59697$

$(\alpha-\alpha') = -13'\ 35.5$
$= -54^s.37$

$\alpha = 9^h\ 11^m\ 11^s.55$

$\alpha = 9\ 11\ 11.12$

+ 0.43

	9	11	11.83
	9	11	11.69
			+ 0.57
			+ 0.10
			+ 0.67

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Lunar parallax.

α' = 9h 12m 05s.92
$\odot$ = 8 03 50.1
$\odot - \alpha'$ = −1 08 16
= −17° 04′ 00″

$\frac{1}{2}(\alpha - \alpha')$ = − 06′ 47″

$\odot - \gamma' - \frac{1}{2}(\alpha - \alpha')$ = − 16 57 13

log tan ϕ' = 9.95727
∴ cos $\frac{1}{2}(\alpha - \alpha')$ = 0.00000
∴ ∴ $[\odot - \alpha') - \frac{1}{2}(\alpha - \alpha')$ = 9.98070
∴ tan γ = 9.97657

γ = +43° 27′ 19.0

δ' = +21 13 49.4

$\delta - \delta'$ = + 21 29.6

log sin ϕ' = 9.82640
∴ sin π = 8.22868
∴ sin $(\gamma - \delta')$ = 9.59772
∴ sin γ = 9.82745
∴ sin $(\delta - \delta')$ = 7.79540

$\delta - \delta'$ = + 21 27.7

δ = 21 35 17.1

Am Eph δ = +21 35 17.0

O − C = + 0.0

Rem δ = 21 35 16.3

Mean 21 35 16.7

O − C − 0.4

Corr Helland nadir = − 0.2

Final (O − C) − 0.6

δ' = +21° 13′ 49.″4

π = 58′ 12.″4

log p cos ϕ' = 9.86913
∴ sin π = 8.22868
∴ sin $(\odot - \alpha')$ = 9.46758
∴ cos δ' = 9.96818

∴ sin $(\alpha - \alpha')$ = 7.59621 n

Approx $(\alpha - \alpha')$ = − 13′ 34″

log cos δ = 9.96841

∴ sin $(\alpha - \alpha')$ 7.59698

$(\alpha - \alpha')$ = − 13′ 35.5

= − 54.37

α = 9 11 11.55

α = 9 11 11.05

+ 0.50

9 11 11.83

9 11 11.69

+ 0.57

+ 0.10

Final (O − C) + 0.67

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MC974 1913 Apr 9

Moon - Reseaux
poor image

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Moon - Remeasures poor image.

	d	n
1 scratch		
10.8	16061	15347
21.1	14845 40	6570 63
	40	68
	57	43
	21.1218	.1223
2	15459	16609
0.1	6539	15505 05
2.0	5640	11
	55	07
	16.1089	.1102
4		
15.9	11423	9781 89
18.0	10819 10	70
	10	9171
	15.9390	.9391
5 scratch.		
16.2	18258	16831
23.5	12921 20	12182 80
	21	79
	54	35
	25.5335	.5347
7		
17.0	16516	15827
24.6	101.0815	12250 51
	0206	65
	10	29
	24.6409	.6428
9 scratch		
7.5	15505	14843
9.8	7218 21	13139 32
	10	40
	00	49
	24.8285	.8293
10 scratch		
18.8	16171	18105
44.7	10753 44	15505 03
	50	10
	61	05
	24.7415	.7401

	d	n
4	16495	16115
	14870 75	9685 30
	8879	7532
	95	08
	16.8383	.8394
3	11437	
15.9	10758 46	10835 35
22.7	58	50
min in 22	15.9377	10190
		.9350
6		
16.4	18242	18541
24.0	11225 26	15540 37
	30	45
	45	30
	16.2983	.2997
5	19276	18881
	9856 60	18290 90
	50	81
	74	82
	16.0577	.0594
9	15481	19073
18.0	6428 21	18128 33
24.9	25	25
min in 24	79	72
	24.9056	.9056
8	16886	14592
	11643 21	9842 51
	20	54
	82	80
	17.4734	.4758
10	16147	17970 79
	14320 20	9787 70
	20	77 61
	32	68
	18.8180	.8193

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Formation of Normals

No	ab	aa	bn
1	+ 1.98	- 46.4	- 68.5
2	+ 1.58	- 20.8	- 9.2
3	- 0.00	- 93.0	+ 0.0
4	- 0.34	- 166.0	+ 14.9
5	- 1.36	+ 163.2	- 58.8
6	- 1.99	+ 290.0	- 198.3
7	- 1.81	+ 90.4	- 162.7
8	- 0.01	- 0.0	+ 10.4
10	+ 1.55	+ 89.5	+ 209.6
0	- 0.40 ✓	+ 286.9 ✓	- 171.6 ✓

$[aa] = +21.88$ ✓ $[bb] = +16.70$ ✓

$[ac] = -11.05$ ✓ $[bc] = +5.27$ ✓ $[cn] = +1$

	P	Residl.
1	214.4	-6.0
2	246.2	-6
3	270.0	+7.5
4	274.6	+12.6
5	289.8	-3.3
6	304.4	-11.5
7	331.0	+5.4
[8	345.0]	
9	0.0	+3.1
10	23.2	+3.5

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MC 974 — 1913 April 10. — 54

Moon's Center – Rencarnico.

new		x	x − X₀	Δx	(x − X₀)²	(x − X₀)² + (y − Y₀)²	O − C
1		16.8388	−1.1662	+1	1.3598	42910	+40
2		16.1096	−1.8954	0	3.5925	42881	+11
−3		15.9334	−2.0716	0	4.2915	42915	+45
4		15.9390	−2.0660	0	4.2684	42960	+90
5		16.0586	−1.9464	0	3.7885	42786	−84
6		16.2990	−1.7060	0	2.9104	42700	−170
7		17.0000	−1.0050	−1	1.0102	42780	−90
~~8~~		~~17.4736~~	~~−0.5314~~	~~−1~~	~~0.2824~~	~~41624~~	
9		18.0000	−0.0050	−1	0.0000	42919	+49
10		18.8186	+0.8136	−1	0.6618	42980	+110
					mean	42870	+1

	y	y − Y₀	Δy	(y − Y₀)²
1	21120	−1.7120	−1	2.9312
2	22.0000	−0.8340	0	0.6956
3	22.8340	0.0000	0	0.0000
4	23.0000	+0.1660	0	0.0276
5	23.5341	+0.7001	0	0.4901
6	24.0000	+1.1660	0	1.3596
7	24.6416	+1.8076	+1	3.2678
~~8~~	~~24.8289~~	~~+1.9949~~	~~+1~~	~~3.9800~~
9	24.9056	+2.0716	+1	4.2919
10	24.7408	+1.9068	+1	3.6362

Approximate Center.

x = 17.0 y = 24.6416

21.0265 (1st measure)

45.6681

mean y = 22.8340

y = meas. = 24.9056

R = 2.0716

x = mn = 15.9334

X_0 = 18.0050

Center $\begin{cases} X_0 = 18.0050 \\ Y_0 = 22.8340 \end{cases}$

	Residuals	C	O − C
1	−75 + 72 + 104	+100	−60
2	−127 + 35 + 104	+17	−6
3	−134 − 0 + 104	−30	+75
4	−133 − 67 + 104	−36	+126
5	−126 − 29 + 104	−51	−33
6	−110 − 49 + 104	−55	−115
7	−65 − 75 + 104	−36	−54
9	−0 − 86 + 104	+18	+31
10	+52 − 79 + 104	+75	+35
		−268	+267

Average (O − C) = −.9

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MIC 974 1913 April 10. 54

Moon's Center – Rencarnacao.

	x	x − X₀	Δx	(x − X₀)²	(x − X₀)² + (y − Y₀)²	O − C
1	16.8388	− 1.1662	+ 1	1.3598	4.2910	+ 40
2	16.1096	− 1.8954	0	3.5925	4.2881	+ 11
3	15.9334	− 2.0716	0	4.2905	4.2915	+ 45
4	15.9390	− 2.0660	0	4.2684	4.2960	+ 90
5	16.0586	− 1.9464	0	3.7885	4.2786	− 84
6	16.2990	− 1.7060	0	2.9104	4.2700	− 170
7	17.0000	− 1.0050	− 1	1.0102	4.2780	− 90
~~8~~	~~17.4736~~	~~− 0.5314~~	~~− 1~~	~~0.2824~~	~~4.1624~~	
9	18.0000	− 0.0050	− 1	0.0000	4.2919	+ 49
10	18.8186	+ 0.8136	− 1	0.6618	4.2980	+ 110
				Mean	4.2870	+ 1

	y	y − Y₀	Δy	(y − Y₀)²
1	21.1220	− 1.7120	− 1	2.9312
2	22.0000	− 0.8340	0	0.6956
3	22.8340	0.0000	0	0.0000
4	23.0000	+ 0.1660	0	0.0276
5	23.5341	+ 0.7001	0	0.4901
6	24.0000	+ 1.1660	0	1.3596
7	24.6416	+ 1.8076	+ 1	3.2678
~~8~~	~~24.8289~~	~~+ 1.9949~~	~~+ 1~~	~~3.9800~~
9	24.9056	+ 2.0716	+ 1	4.2919
10	24.7408	+ 1.9068	+ 1	3.6362

Approximate Center.

x = 17.0 y = 24.6416

21.0265 (1st measure)

45.6681

mean y = 22.8340

y = mean = 24.9056

R = 2.0716

x = mm = 15.9334

X₀ = 18.0050

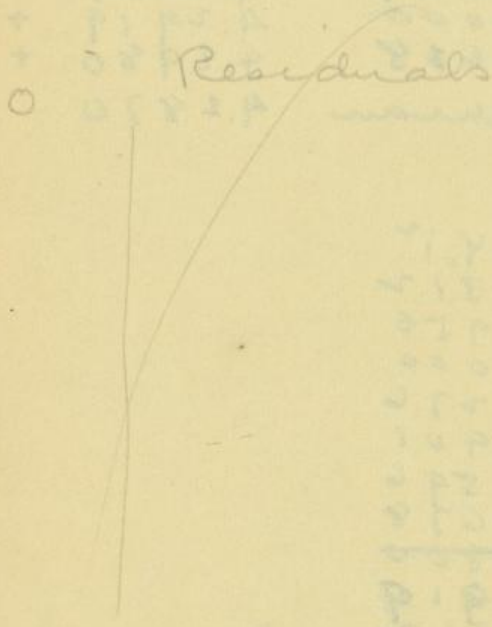
Center { X₀ = 18.0050, Y₀ = 22.8340

	Residuals			C	O − C
1	− 75	+ 72	+ 105	+ 102	− 60
2	− 122	+ 35	+ 104	+ 17	− 6
3	− 134	− 0	+ 104	− 30	+ 75
4	− 133	− 67	+ 104	− 36	+ 126
5	− 126	− 39	+ 104	− 51	− 33
6	− 110	− 49	+ 104	− 55	− 115
7	− 65	− 76	+ 105	− 36	− 54
9	− 0	− 82	+ 104	+ 18	+ 31
10	+ 52	− 79	+ 104	+ 75	+ 35
				− 268	+ 267

Average (O − C) : − 1

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MC974 Moon's Centres - Remeasures. 1913 Apr. 10. 55

Normal Equations.

a	b	c	
+21.88	− 0.40	− 11.05	= +287
− 0.40	+16.70	+ 5.27	= −172
−11.05	+ 5.27	+ 9.00	= +1
+ 0.40	− 0.01	− 0.20	= + 5
+11.05	− 0.20	− 5.59	= +145
	+16.69	+ 5.07	= −167
	+ 5.07	+ 3.43	= +146
	− 5.07	− 1.54	= + 51
	+	1.89	= +197
	− 7.50	− 5.07	= −216
	+ 9.19		= −383
− 0.84	+ 0.40	+ 0.68	= + 0
+55.00	−16.70	−26.50	= − 3
+21.04		−10.37	= +287
+34.60		−23.23	= −175
−15.40		+10.37	= + 78
+ 5.64			= +365

c = +104

b = −42

Y = 22.8340 − 21 = 22.8319

X = 18.0050 + 65 = 18.0115

a = +165

X = 17.9700

Y = 23.3423

$\bar{x}$ = −0.0300 η_0 = +1.3423

log $\bar{x}$ = 8.47712 − log η_0 = 0.12785

Boss = 9.96948 Denot = 7.33115

cosec 85°07'24 log (α − D) = 2.79670

(α − A) = 0.00040 α − D = +10 26.2

α − A = − 1.00 D = +21 03 21

A = 9 12 06.

α_0 = 9 12 05.00 δ_0 = +21 13 47.2

Red. to ph. plane +1.20 Red. to ph. plane + 1.3

α' = 9 12 06.20 δ' = +21 13 48.5

parallax − 54.37 parallax + 21 27.8

α = 9 11 11.83 δ = +21 35 16.3

Tabular place 9 11 11.12 +21 35 17.1

O − C = +0.71 O − C = − 0.8

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MC 974 Moon's Center - Reincarnus. 1913 Apr. 10.

Normal Equations.

a	b	c	
+21.88	− 0.40	− 11.05	= +287
− 0.40	+16.70	+ 5.27	= −172
− 11.05	+ 5.27	+ 9.00	= +1
+ 0.40	− 0.01	− 0.20	= + 5
+ 11.05	− 0.20	− 5.57	= +145
	+16.69	+ 5.07	= −167
	+ 5.07	+ 3.43	= +146
	− 5.07	− 1.54	= + 51
		+ 1.89	= +197
	− 7.50	− 5.07	= −216
	+ 9.19		= −385

c = +104

b = −42

− 0.84	+ 0.40	+ 0.68	= + 0
+35.90	− 16.70	− 28.50	= − 3
+21.04		− 10.37	= +287
+34.60		− 23.23	= −175
−15.49		+ 10.37	= + 78
+ 5.64			= +365

Y = 22.8340
− 21
22.8319

X = 18.0050
+ 65
18.0115

a = +765

X = 17.9700

$\frac{1}{s}$ = −0.0300

log s = 8.477120

Boss: 9.96948

corr. 85.0724

(α − A) = 0.00040

α − A = − 1.00

A = 9 12 06.

α_0 = 9 12 05.00

Red. to ref. plane + 1.20

α' = 9 12 06.20

parallax − 54.37

α = 9 11 11.83

Tabular place 9 11 11.12

O − C = +0.71

Y = 23.3423

η_0 = + 1.3423

log η_0 = 0.12785

Donat: 7.33115

log (d − D) = 2.79670

δ − D = + 10 26.2

D = +21 03 21

δ_0 = +21 13 47.2

Red. to ref. plane + 1.3

δ' = +21 13 48.5

Parallax + 21 27.8

δ = +21 35 16.3

+21 35 17.1

O − C = − 0.8

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MC 977. 1912 Nov. 11 56

Comparison Stars - Standard Coords.

	1 no. mag.	2 no. mag.	3. no. mag.
	C 1491 7.0	1494 6.4	1499 7.1
C	$10^h\ 54^m\ 19^s.52$	$10^h\ 54^m\ 27^s.57$	$10^h\ 57^m\ 20^s.10$
L	.55	63	14
E	55	52	13
mean	54	57	12
Prec.	+ 34.56	+ 34.69	+ 34.47
α	$10^h\ 54^m\ 54^s.10$	10 55 02.26	10 57 54.59
A	10 58 36	10 58 36	10 58 36
α-A	- 3 41.90	- 3 33.74	- 0 41.41
Sin(α-A)	- 221.89	- 213.73	- 41.41
log	2.346 14n	2.329 86n	1.617 11n
log cos δ	9.992 80	9.990 11	9.993 81
log ξ_0	0.846 18n	0.827 21n	0.1 18 16n
ξ_0	-7.0175	-6.7175	-1.3127
ξ_1	- 13	- 18	- 4
ξ	250 188	24.7193	19.3131
x	25.0156	24.5825	19.3712
x - ξ	+ 32	+ 1368	- 581

signs of x + y are changed.

C.	+10° 28' 0.3	+12° 14' 26.54	+9° 42' 39.4
L	0.8	.4	.4
E	0.3	.3	2
mean	0.5	.4	.3
Prec.	- 3 31.6	- 3 31.6	- 3 32.4
δ	+10° 24' 28.9	+12 10 54.8	+9 39 06.9
D	+11 05 11	+11 05 11	+11 05 11
δ-D	- 40 42.1	+ 1 05 43.8	- 1 26 04.1
sin(δ-D)	- 2442.2	+ 3944.3	- 5165.2
log	3.387 78n	3.595 97n	3.713 09n
log η_0	0.718 93n	0.927 12n	1.044 24n
tan δ	9.2641n	9.3342n	9.2298n
ξ_2	16924n	16544n	02362n
η_1	8.0099n	8.0420n	6.5794n
η_0	-5.2351n	+ 8.4552n	- 11.0723n
η_1	+ 102n	+ 110n	+ 3n
η	27.2249n	13.5338n	33.0720n
η	27.1598n	13.4763n	33.0632n
η-η	+ 651n	+ 575n	+ 88n

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MC 977. 1912 Nov. 11 56

Comparison Stars - Standard Coords.

	1 no. mag.	2 no. mag.	3. no. mag.
	1491 7.0	1494 6.4	1499 7.1
C	$10^h\ 54^m\ 19^s.52$	$10^h\ 54^m\ 27^s.57$	$10^h\ 57^m\ 20^s.10$
L	.55	63	14
E	55	52	13
mean	54	57	12
	+ 34.56	+ 34.69	+ 34.47
α	$10^h\ 54^m\ 54^s.10$	10 55 02.26	10 57 54.59
A	10 58 36	10 58 36	10 58 36
α-A	- 3 41.90	- 3 33.74	- 0 41.41
Sin(α-A)	- 221.89	- 213.73	- 41.41
-log	2.346 14m	2.32986m	1.61711m
cos δ	9.99288	9.99011	9.99381
ξ_0	0.84618m	0.82721m	0.11816m
ξ_0	-7.0175	-6.7175	-11.3187
ξ_1	- 13	- 18	- 94
ξ	25.0188	24.7193	19.3131
x	25.0156	24.5825	19.3712
x - $\bar{x}$	+ 32	+ 1368	- 581

signs of x + y are changed.

C.	+10° 28' 0".3	+12° 14' 26".4	+9° 42' 39".4
L	0.8	.4	.4
E	0.3	.3	.2
mean	0.5	.4	.3
δ	- 5 31.6	- 3 31.6	- 3 32.4
δ	+10° 24' 28".9	+12 10 54.8	+9 39 06.9
D	+11 05 11	+11 05 11	+11 05 11
δ-D	- 40 42.1	+ 1 05 43.8	- 1 26 04.1
Sin(δ-D)	- 2442.2	+ 3944.3	- 5165.2
log	3.38778m	3.59597	3.71309m
η_0	0.71893m	0.92718	1.04824m
tan δ	9.2641	9.3342	9.2333
ξ_0^2	1.6924	1.6544	0.2362
K_1	8.0099	8.0420	6.5229
η_0	-5.2351	+ 8.4552	- 11.0723
η_1	+ 102	+ 110	+ 33
η	27.2249	13.5338	33.0720
η	27.1598	13.4763	33.0632
$\eta - \bar{\eta}$	+ 651	+ 575	+ 788

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MC 977 1912 Nov. 11. 57

Comparison stars. Standard coordinates.

	4 no. mag 8			5 no. mag.		
	1508	7.3	✓	1517	7.5	✓
C.	11h	01m	54.91 ✓	11h	05m	23.39 ✓
L			.95			47
E			.94			38
Mean	11	01	59.93 ✓	11	05	23.41 ✓
Prec		+	34.49 ✓		+	34.52 ✓
α	11	02	34.42 ✓	11	05	57.93
A	10	58	36 ✓	10	58	36.
α−A	+	3	58.42 ✓	+	7	21.93 ✓
Sin(α−A)	+		23841 ✓	+		44185 ✓
log			2.37733 ✓			2.64527 ✓
log cos δ			9.99259 ✓			9.99075 ✓
ξ_0			0.87696 ✓			1.14326
ξ_0			+7.53328 ✓			+13.90788 ✓
ξ_1			+ 13			+ 75
ξ			10.46596 ✓			4.08447 ✓
x			10.44456 ✓			3.97806 ✓
x−ξ		+	203 ✓			+1067 ✓

signs of x + y are changed

C	+10°	45′	12.1″ ✓	+11°	50′	39.6″ ✓
L			11.4			.7
E			11.1			.3
Mean	+10	45	11.5 ✓	+11	50	39.5 ✓
Prec	−	3	33.6 ✓	±	3	34.3 ✓
δ	+10	41	37.9		11 47	052
D	+10	05	11	+11	05	11
δ−D	−	23	33.1 ✓		+ 41	54.2 ✓
tan (δ−D)	−	1413.1			+ 25	14.3 ✓
log			3.15017 ✓n			3.40042 ✓
log η_0			0.48132 ✓n			0.73157 ✓
log tan δ			9.2761 ✓			9.3193 ✓
log ξ_0			17539 ✓			22865 ✓
log η_1			4.0834 ✓			8.6592 ✓
η_0			−3.0291 ✓			+5.3898 ✓
η_1			+ 121 ✓			+ 456 ✓
η_1			25.0170 ✓			16.5646 ✓
η_0			25.0916 ✓			16.7028
$\eta - \eta_0$		−	746 ✓			−1382

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MC 977 1912 Nov. 11. 57

Comparison Stars. Standard Coordinates.

	4 no. mag. 8	5 no. mag.
	1508 7.5	1517 7.5
C.	$11^h\ 01^m\ 59^s.91$	$11^h\ 05^m\ 23^s.39$
L	.95	47
E	.94	38
mean	11 01 59.93	11 05 23.41
Prec	+ 34.49	+ 34.52
α	11 02 34.42	11 05 57.93
A	10 58 36	10 58 36.
α-A	+ 3 58.42	+ 7 21.93
sin(α-A)	+ 23841	+ 441.85
log	2.37733	2.64527
log cos δ	9.99259	9.99075
β_0	0.87696	1.14326
β_0	+7.5328	+13.9078
β_1	+ 13	+ 75
β	10.4659	4.0847
β	10.4456	3.9780
β-B	+ 203	+ 1067

signs of α + η are changed.

C	$+10^\circ\ 45'\ 12.''1$	$+11^\circ\ 50'\ 39.''6$
L	11.4	.7
E	11.1	.3
mean	+10 45 11.5	+11 50 39.5
Prec	− 3 33.6	+− 3 34.3
D	+10 41 37.9	11 47 05.2
D	+10 05 11	+11 05 11
δ-D	− 23 33.1	+ 41 54.2
sin(δ-D)	− 1413.1	+ 2514.3
log	3.15017n	3.40042
log η_0	0.49132n	0.73157
log tan δ	9.2761	9.3223
ξ_0	17539	22865
η_1	8.0834	8.6622
η_0	−3.0291	+5.3898
η_1	+ 121	+ 459
η_2	25.0170	16.5646
η	25.0916	16.7028
η-η_2	− 746	+ 81
		11382

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1912 Dec 19.

Remeasures.

1	17708	17900	13200	11890
	16109 10	9598 95	08 98	11779 31
	10	90	13050	31
	98	09		
	27.1596	.1594	25.0152	.0160
2	16812	17987	16036	18309
	12048 47	12738 44	11838	11473 69
	44	41	4843	69
	08	76	40	0
	13.4764	.4759	24.5805	.5830
3	15764	15140	17163	14715
	15152 50	5759 61	10869 69	10990 96
	46	50	68	90
	80	37	65	10
	33.0616	.0620	19.3705	.3721
4	15461	16977	14094	17186
	14544 41	7879 86	8522 18	12730 20
	46	76	24	28
	56	65	86	77
	25.0917	.0914	10.4431	.4456
5	18280	14539	10052	12004 10
	11239 42	11360 58	9834 38	03
	39	60	32	11797
	67	39	3.9783	.9791
	16.7031	.7023		

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M C 977 1912 Nov. 13.

Comparison Stars - Measures

	y	d		n		x	d		N	
1	25.0	18290		16240			11721	23	9870	
	27.1	15685	89	7829	21		21		9709	09
		60		27			11571		06	
		75		30						
		27.1603		27.1594			25.0151		25.0162	
2	24.5	15560		14059					16894	
	13.5	10789	90	8810	19		15133		11063	68
		93		11			10959	60	66	
		50		44			53		99	
							45			
		13.4764		13.4762			24.5819		24.5831	
3	19.3	12169		9978	75		15077		15188	
	33.0	11530	31	80			8777	85	11466	65
		35		9351			81		70	
							80		90	
		33.0637		33.0627			19.3702		19.3722	
4	10.4	16934		14185			16250		15175	
	25.1	16012	14	5079	84		10705	99	10711	17
		14		85			01		11	
		30		71			50		71	
		25.0921		25.0911			10.4452		10.4460	
5	4.0	14974		15755						
	16.7	7946	40	12773	78		8960		8727	20
		40		75			8732	34	20	
		69		30			34		8509	
		16.7028		16.7027			3.9773		3.9787	

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Comparison Stars — Measures

	d	N	d	N
1/		4		4
25.0	18290	16240	11721 23	9870
27.1	16685 89	78291 21	21	9709 09
	60	27	11571	06
	75	30		
	27.1603	27.1594	25.0151	25.0162
2/				
24.5	15560	14059		16894
13.5	10789 90	68810 19	15133	11063 68
	93	11	10959 60	06
	50	44	53	99
			45	
	13.4764	13.4762	24.5819	24.5831
3/				
19.3	12169	99785	15077	15186
33.0	11530 31	80	8777 85	11466 65
	35	9351	81	70
			80	90
	33.0637	33.0627	19.3702	19.3722
4/				
10.4	16934	14185	16250	15175
25.1	16012 14	50794 84	10705 99	10711 17
	14	85	01	11
	30	71	50	71
	25.0921	25.0911	10.4452	10.4460
5/				
40	14974	15755		
16.7	7946 40	12773 78	8960	8727 20
	40	75	8732 34	20
	69	30	34	8509
	16.7028	16.7027	3.9773	3.9787

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Points on moons limb – measures. Faint image of moon.

4

1/	d	N
20.	16517	17795
22.5	1188010	1236180
	5780	8180
	10	91
	23.4652	.4583
2		
20	15891	16150
21.2	1379489	8179743
	2684	7235
	85	50
	21.2092	.2007
3		
19.0	15060	15380
20.4	1084030	9589779
	2539	7657
	50	76
	20.4222	.4197
4		
18.4	14127	15312
20.3	1110077	8333380
	8580	0087
4 min	21	02
	20.3039	.2995
5		
18.0	14169	14292
20.4	1087290	7501911
	7989	88482
	59	87
	20.3284	.3201
6		
17.0	18256	
20.8	1039295	17293
	9587	1505647
	45	5849
		65
	20.7855	.7761

irregular edge

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1912 Nov. 14. 59

MC977

Points on Inferior Limb — Measures.
Faint image of Moon.

4

1/	d	n
20.	16517	17795
23.5	11880 10	1236180
	5780	8180
	10	91
	23.4652	.4583
2/		
20	15891	16150
21.2	1379489	817943
	2684	7235
	85	50
	21.2092	.2007
3/		
19.0	15060	15380
20.9	10840 30	9589 79
	2539	7657
	50	76
	20.4222	.4197
4/		
18.4	14127	15312
20.3	1110077	833380
	8580	0047
	21	02
	20.3039	.2995
5/		
20.	14169	14292
20.4	10877290	7501 91
	7989	8862
	59	87
	20.3284	.3201
6/		
17.0	18256	
20.8	10392 95	17293
	9587	1505647
	45	5849
		65
	20.7855	.7761

irregular edge

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MC977 1912 Nov. 14 60

Points on Moon's limb - measures.

		d	N
7/		18198	16521
16.8		1600307	8682211
21.0		0205	0000
		90	20
		16.7808	.7822
8/		15183	15720
19.8		1356779	7277769
21.0		7568	6061
		83	20
		19.8389	.8453
9/		17355	15981
20.3		1050705	12798 51
22.0		0205	6150
		42	87
		20.3159	.3219
10/		16306	16007
20.3		972240	1254837
22.4		1831	4238
x-max		09	97
		20.3420	.3465
11/		15247	14379
20.2		754239	1205968
23.0		3043	5973
		40	80
		20.2297	2314
12/		14011	16258
19.5		802685	1168075
24.0	oblique and irregular	3975	7269
		09	72
		19.4696	.4591

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Princeton Photometric measures.

	α	N
7/		
16.8	18198	16521
21.0	1600307	8682211
	0205	0000
	90	20
	16.7805	.7822
8/		
19.8	15183	15720
21.0	1356779	7277769
	7568	6061
	83	20
	19.8389	.8453
9/		
20.3	17355	15981
22.0	1050705	12798 51
	0205	6150
	42	87
	20.3159	.3219
10/		
20.3	16306	16007
22.4	9722 40	12548 37
x-wrap	1831	4238
	09	97
	20.3420	.3465
11/		
20.2	15247	14379
23.0	7542 39	12059 68
	3043	5973
	40	80
	20.2297	.2314
12/		
19.5	14011	16258
24.0 obtuse and irregular	720 85	116807 5
	3975	7209
	09	72
	19.4696	.4591

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Mean Measured Coords. + centre of plate.

Star	x	y	R.A.	Decl.
1	25.0156	27.1598	10h 54m 54.1	+ 10° 24' 29"
2	24.5825	13.4763	55 02	12° 10' 55"
3	19.3712	33.0632	57 55	9 39 07
4	10.4456	25.0916	11 02 34	10 41 38
5	3.9780	16.7028	11 05 58	11 47 05
5	85.39	115.49	54 56 23	54 43 14
	16.68	23.10	10h 59 17	10 56 39
	-18	-22	- 41	+ 8 32
	- 1.32	+ 1.10	A = 10h 58m 36s	11° 05' 11"
	31	465		
	132	5 11.5		
	396			
	40.92			

A = 10h 58m 36s
D = +11° 05' 11"

Preliminary Reduction. (Remeasures)

x − 5 + 1004			− 2730
+ 32 + 2716	= + 2748	=	+ 18
+ 1375 + 1348	= + 2723	=	− 7
− 582 + 3306	= + 2724	=	− 6
+ 215 + 2509	= + 2724	=	− 6
+ 1060 + 1670	= + 2730	=	0
Mean −18.3125 + 2233		=	−18.3622

y − m − 95x			− 24		+ 1790
+ 654 − 2376	= − 1722	− 54	= − 1776	=	+ 14
+ 576 − 2335	= − 1759	− 27	= − 1786	=	+ 4
+ 102 − 1840	= − 1738	− 66	= − 1804	=	− 14
− 746 − 993	= − 1739	− 50	= − 1789	=	+ 1
− 1381 − 378	= − 1759	− 33	= − 1792	=	− 2
Mean −22.3327 − 1739		− 45		=	−22.3321
− 1745				=	

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Mean Measured Coords + centre of plate

Star	x	y	R.A.	Decl.
1	25.0156	27.1598	10h 54m 54.1	+10° 24' 29"
2	24.5825	13.4763	55 02	12° 10' 55"
3	19.3712	33.0632	57 55	9 39 07
4	10.4956	25.0916	11 02 34	10 41 38
5	3.9780	16.7028	11 05 58	11 47 05
5	83.39	115.49	54 56 23	54 43 14
	16.68	23.10	10h 59 17	10 56 39
	-18	-22	41	+ 8 32
	- 1.32	+ 1.10	A = 10h 58m 36s	11° 05' 11"
	31s	465		
	132	511.5		
	396			
	40.92			

A = 10h 58m 36s
D = +11° 05' 11"

Preliminary Reduction. (Remeasures)

x − 3 + 1004		− 2730
+ 32 + 2716	= + 2748	= + 18
+1375 + 1348	= + 2723	= − 7
− 582 + 3306	= + 2724	= − 6
+ 215 + 2509	= + 2724	= − 6
+1060 + 1670	= + 2730	= 0
-18.3125 + 2.233		= − 18.3622

y − m − 95x		− 24	+ 1790
+ 654 − 2376	= − 1722	− 54 = −1776	= + 14
+ 576 − 2335	= − 1759	− 27 = −1786	= + 4
+ 102 − 1840	= − 1738	− 66 = −1804	= − 14
− 746 − 993	= − 1739	− 50 = −1789	= + 1
− 1381 − 378	= − 1759	− 33 = −1792	= − 2
-22.3327 − 1739		− 45	= − 22.3321

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Plate constants.

Conditional Equations.

a	b	c	$x-\frac{1}{5}$	$y-\eta$
+25.02	+27.16	+1 =	+18	+14
+24.58	+13.48	+1 =	−7	+4
+19.37	+33.06	+1 =	−6	−14
+10.45	+25.09	+1 =	−6	+1
+3.98	+16.70	+1 =	0	−2

+24.80	+20.32	+1 =	+5.50	+9.00
+11.27	+24.95	+1 =	−4.00	−5.00
+18.38	+28.44	+1 =	+2.00	+0.33
+14.28	+15.09	+1 =	−3.50	+1.00

+13.53	−4.63		= +9.50	+14.00
+4.10	+13.35		= +5.50	−0.67
−4.10	+1.41		= −2.88	−4.25
	+14.76		= +2.62	−4.92
		b	= +0.18	−0.33
+13.53a	= +9.50	+0.82	= +10.32	+14.00 − 1.55 = +12.45
		a	= +0.76	+0.92

+5.5	−4.0	+2.0	−3.5		+9.0	−5.0	+0.3	+1.0
−18.9	−8.6	−14.0	−10.9		−22.8	−10.3	−16.9	−13.2
−3.6	−4.4	−5.0	−27		+6.8	+8.3	+9.5	+5.0
−17.0	−17.0	−17.0	17.1		−7.0	−7.0	−7.1	−7.2

Resids in x	c	O	O − C
+19 + 5 − 17	= +7	+18	+11
+19 + 2 − 17	= +4	−7	−11
+15 + 6 − 17	= +4	−6	−10
+4 + 4 − 17	= −5	−6	−1
+3 + 3 − 17	= −11	0	+11

Resids in y	c	O	O − C
+23 − 9	−7 = +7	+14	+7
+23 − 4	−7 = +12	+4	−8
+18 − 11	−7 = 0	−14	−14
+10 − 8	−7 = −5	+1	+6
+4 − 6	−7 = −9	−2	+7

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MC 977. 1912 Dec. 13. 62

Plate Constants.

Conditional Equations.

a	b	c	x − x₀	y − y₀
+ 25.02	+ 27.16	+ 1 =	+ 18	+ 14
+ 24.58	+ 13.48	+ 1 =	− 7	+ 4
+ 19.37	+ 33.06	+ 1 =	− 6	− 14
+ 10.45	+ 25.09	+ 1 =	− 6	+ 1
+ 3.98	+ 16.70	+ 1 =	0	− 2

+ 24.80	+ 20.32	+ 1 =	+ 5.50	+ 9.00
+ 11.27	+ 24.95	+ 1 =	− 9.00	− 5.00
+ 18.38	+ 28.44	+ 1 =	+ 2.00	+ 0.33
+ 14.28	+ 15.09	+ 1 =	− 3.50	+ 1.00

+ 13.53	− 4.63	=	+ 9.50	+ 14.00
+ 4.10	+ 13.35	=	− + 5.50	− 0.67
− 4.10	+ 1.41	=	− 2.85	− 4.25
	+ 14.76	=	+ 2.62	− 4.92
		b =	+ 0.18	− 0.33

+ 13.53a = + 9.50 + 0.32 = + 10.32 + 14.00 − 1.55 = + 12.45

a = + 0.76 + 0.92

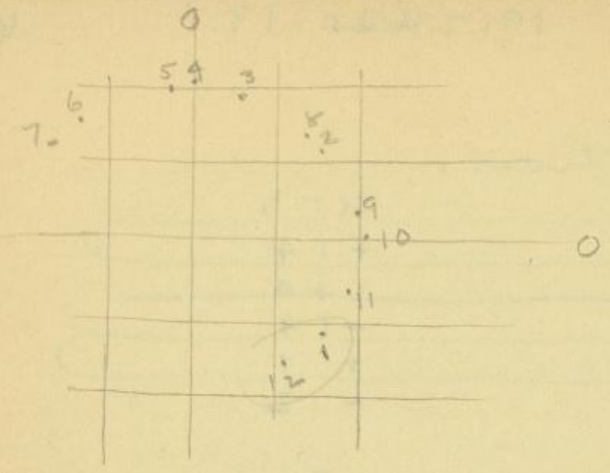
+ 5.5	− 4.0	+ 2.0	− 3.5	+ 9.0	− 5.0	+ 0.3	+ 1.0
− 18.9	− 18.6	− 14.0	− 10.9	− 22.8	− 10.3	− 16.9	− 13.2
− 3.6	− 4.9	− 5.0	− 2.7	+ 6.8	+ 8.3	+ 9.5	+ 5.0
− 17.0	− 17.0	− 17.0	17.1	− 7.0	− 7.0	− 7.1	− 7.2

Reads	x	c	o	o − c
+ 19	− 5	− 17 =	+ 7	+ 18	+ 11
+ 19	+ 2	− 17 =	+ 4	− 7	− 11
+ 15	+ 6	− 17 =	+ 4	− 6	− 10
+ 8	+ 4	− 17 =	− 5	− 6	− 1
+ 3	+ 3	− 17 =	− 11	0	+ 11

Reads	y	c	o	o − c
+ 23	− 9	− 7 =	+ 7	+ 14	+ 7
+ 23	− 4	− 7 =	+ 12	+ 4	− 8
+ 18	− 11	− 7 =	0	− 14	− 14
+ 10	− 8	− 7 =	− 5	+ 1	+ 6
+ 4	− 6	− 7 =	− 9	− 2	+ 7

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Point	Pos. ∠	Resid.
(12)	214.5	
(1)	236.4	
11	250.9	−28
10	270.0	+15
9	279.4	+104
2	303.7	−53
8	311.0	−89
3	340.3	+23
4	0.0	−7
5	88	+56
6	40.0	+48
7	49.0	−69

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Moore's Center.

	x	$x - x_0$	v	Δx	$(x-x_0)^2$	$(x-x_0)^2+(y-y_0)^2$	O − C
1	20.0000	− 1.6876	+	4	[2.8467]	[4.1177]	prob. error
2	20.0000	− 1.6876	−	4	2.8493	4.1230	− 50
3	19.0000	− 0.6876	−	6	0.4736	4.1316	+ 36
4	18.3124	0.0000	−	7	0.0000	4.1286	+ 6
5	18.0000	+ 0.3124	−	7	0.0971	4.1348	+ 68
6	17.0000	+ 1.3124	−	5	1.7210	4.1331	+ 51
7	16.7815	+ 1.5309	−	4	2.3424	4.1209	− 71
8	19.8421	− 1.5297	−	4	2.3412	4.1197	− 83
9	20.3189	− 2.0065	−	1	4.0264	4.1376	+ 96
10	20.3442	− 2.0318		0	4.1282	4.1282	+ 2
11	20.2306	− 1.9182	+	2	3.6787	4.1229	− 51
12	19.4644	− 1.1520	+	6	[1.3257]	[4.1038]	prob. error
						4.1280	+ 4

Signs of x + y changed.

	y	$y - y_0$	v	Δy	$(y-y_0)^2$
1	23.4608	− 1.1273	−	1	[1.2710]
2	21.2050	+ 1.1285	+	1	1.2737
3	20.4210	+ 1.9125	+	1	3.6580
4	20.3017	+ 2.0318	+	1	4.1286
5	20.3242	+ 2.0093	+	1	4.0377
6	20.7805	+ 1.5530	+	1	2.4121
7	21.0000	+ 1.3335	+	1	1.7785
8	21.0000	+ 1.3335	+	1	1.7785
9	22.0000	+ 0.3335		0	0.1112
10	22.3335	0.0000		0	0.0000
11	23.0000	− 0.6665		0	0.4442
12	24.0000	− 1.6665	−	1	[2.7776]

Approx. Centre.

$x = 20.0$ $y = 23.4608$
$y = 21.2050$
44.6658
mean $y = 22.3329$
$y_0 = \text{min} = 20.3017$
$R_0 = 2.0312$
$x = \text{max} = 20.3442$
$x_0 = 18.3130$

$y = 21.0$ $x = 16.7815$
19.8421
36.6236
mean $x = 18.3118$
$x = \text{max} = 20.3442$
$R_0 = 2.0324$
$y_0 = \text{min} = 20.3017$
$y_0 = 22.3341$

Assume $\begin{cases} x_0 = 18.3124 \\ y_0 = 22.3335 \end{cases}$

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Inverse Center.

	x	$x - x_0$		Δx	$(x-x_0)^2$	$(x-x_0)^2+(y-y_0)^2$	O − C
1	20.0000	− 1.6876	+	9	2.8467	[4.1177]	
2	20.0000	− 1.6876	=	9	2.8493	4.1230	− 50
3	19.0000	− 0.6876	−	6	0.4736	4.1316	+ 36
4	18.3124	0.0000	−	7	0.0000	4.1286	+ 6
5	18.0000	+ 0.3124	−	7	0.0971	4.1348	+ 68
6	17.0000	+ 1.3124	−	5	1.7210	4.1331	+ 51
7	16.7815	+ 1.5309	−	4	2.3429	4.1209	− 71
8	19.8421	− 1.5297	=	4	2.3412	4.1197	− 83
9	20.3189	− 2.0065	=	1	4.0264	4.1376	+ 96
10	20.3442	− 2.0318		0	4.1282	4.1282	+ 2
11	20.2306	− 1.9182	+	2	3.6787	4.1229	− 51
12	19.4644	− 1.1520	+	6	1.3257	[4.1033]	prob. error
						4.1280	+ 4

Signs of x + y changed.

	y	$y - y_0$		Δy	$(y-y_0)^2$
1	23.4608	− 1.1273	−	1	1.2710
2	21.2050	+ 1.1285	+	1	1.2737
3	20.4210	+ 1.9125	+	1	3.6580
4	20.3017	+ 2.0318	+	1	4.1286
5	20.3242	+ 2.0093	+	1	4.0377
6	20.7805	+ 1.5530	+	1	2.4124
7	21.0000	+ 1.3335	+	1	1.7785
8	21.0000	+ 1.3335	+	1	1.7785
9	22.0000	+ 0.3335		0	0.1112
10	22.3335	0.0000		0	0.0000
11	25.0000	− 0.6665		0	0.4442
12	24.0000	− 1.6665	−	1	2.7776

Approx. Center.

$x = 20.0$ $y = 23.4608$
$y = 21.3050$
44.6658
mean $y = 22.3329$
y min $= 20.3017$
$y_0 = 2.0312$
x max $= 20.3442$
$x_0 = 18.3130$

$y = 21.0$ $x = 16.7815$
19.8421
36.6236
mean $x = 18.3118$
x max $= 20.3442$
$x_0 = 2.0324$
y min $= 20.3017$
$y_0 = 22.3341$

Assume $\begin{cases} x_0 = 18.3124 \\ y_0 = 22.3335 \end{cases}$

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Times etc.

Exp. to stars 1911, Mar. 13	8^h	09^m		8^h	21^m	
" " moon	8	14	44.3"	8	14	44.5"
Clock fast		2	37.7			
H. Sid. T.	8	12	06.7"			
H. Long	4	44	31.05			
G. Sid. T.	12	56	37.75"			
Sid. T. M. noon	23	20	00.03"			
Interval	13	36	37.72"			
Reduction		2	13.78"			
G. M. T.	13	34	23.94			

		R. A.		Decl.		
From Am. Eph.						
Moon 13^h	10^h	55^m	$19^s.62$"	$+11^\circ$	$42'$	$15''.3$"
Motion in 1^m = $20^s.554$			$14''.144$"			
" " $34^m.399$		1	10.70"		$8'$	06.5"
Tabular place	10	56	$30^s.32$*	$+11$	34	08.8"
Moons parallax		$57'$	1.69*			
" semidiam.		15	38.0*			

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Times etc.

Exp. to Talas 1911, Mar. 13	8^h	09^m		8^h	21^m	
moon	8	14	44.3	8	14	44.5
Clock fast		2	37.7			
H. Sid. T.	8	12	06.7			
H. long	4	44	31.05			
G. Sid. T.	12	56	37.75			
Sid. T. M. noon	23	20	00.03			
Interval	13	36	37.72			
Reduction		2	13.79			
G. M. T.	13	34	23.93			

Trans. Cen. Eph.			R.A.			Decl.	
moon 13^h	10^h	55^m	$19^s.62$	$+11°$	$42'$	$15''.3$	
Motion in 1^m = 205.914						$14''.144$	
" " $34^m.40$		1	10.70			$-8'.065$	
Tabular place	10	56	30.32	+11	34	08.8	
Moons parallax			$57'$	$16''.9$			
" semidiam.			15	38.0			

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Formation of Normal Equations.

No		aa		ab		bb
2	-	1,89	+	84,5	-	56,0
3	-	1,32	-	24,9	+	68,8
4		0,00		0,0	+	12,2
5	+	0,62	+	21,1	+	136,9
6	+	2,03	+	66,8	+	79,0
7	+	2,04	-	108,8	-	94,4
8	-	2,04	+	127,0	-	110,2
9	-	0,66	-	195,0	+	31,7
10		0,00	-	4,6	+	0,0
11	+	1,29	+	97,8	+	34,1
	+	0,07	+	65,9	+	102,1

$[aa] = +21.66$ $[bb] = +19.62$

$[ac] = -6.72$ $[bc] = +10.94$ $[cc] = +4$

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+1912MC977 1912 Dec 18. 65

Moon's Center.

Conditional Equations

	a	b	c	O				c	O − C
+	−11.69								
2	−1.69	+1.12	+1	= −50	+	4 + 17	−18	= +3	−53
3	−0.69	+1.91	+1	= +36	+	2 + 29	−18	= +13	+23
4	0.00	+2.03	+1	= +6		0 + 31	−18	= +13	−7
5	+0.91	+2.01	+1	= +68	−	1 + 31	−18	= +12	+56
6	+1.31	+1.55	+1	= +51	−	3 + 24	−18	= +3	+48
7	+1.53	+1.33	+1	= −71	−	4 + 20	−18	= −2	−69
8	+1.53	+1.33	+1	= −83	+	4 + 20	−18	= +6	−89
9	−2.01	+0.33	+1	= +96	+	5 + 5	−18	= −8	+104
10	−2.03	0.00	+1	= +2	+	5 0	−18	= −13	+15
11	−1.92	−0.67	+1	= −51	+	5 − 10	−18	= −23	−28

+246 −246

Average (O−C) = 49

Normal Equations.

a	b	c	
+21.66	+0.07	−6.72	= +66
+0.07	+19.62	+10.94	= +102
−6.72	+10.94	+10.00	= +4
−0.07	−0.00	+0.02	= −0
+6.72	+0.02	−2.09	= +20
	+19.62	+10.96	= +102
	+10.96	+7.91	= +24
	−10.96	−6.11	= −57
		+1.80	= −33
	−15.14	−10.96	= −33
	+4.48		= +69
−4.51	+7.35	+6.72	= +3
+7.35	−11.98	−10.94	= −4
+17.15	+7.42		= +69
+7.42	+7.64		= +98
−7.22	−7.42		= −95
+9.93			= +26

$\frac{\Delta\alpha}{\Delta\delta} = 2.03 \div .31 = +0.63$

$\frac{\Delta\delta}{\Delta\alpha} = 2.03 \div .56 = -1.13$

c = −18

b = +15

a = −3

− +

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Moon's Center.

Conditional Equations

	a	b	c	O		c	O-C
+	-1.41						
2	-1.69	+1.12	+1	= -50	+	4+17-18 = +3	-53
3	-0.69	+1.91	+1	= +36	+	2+29-18 = +13	+23
4	0.00	+2.03	+1	= +6		0+31-18 = +13	-7
5	+0.31	+2.01	+1	= +68	-	1+31-18 = +12	+56
6	+1.31	+1.55	+1	= +51	-	3+24-18 = +3	+48
7	+1.53	+1.33	+1	= -71	-	4+20-18 = -2	-69
8	-1.53	+1.33	+1	= -83	+	4+20-18 = +6	-89
9	-2.01	+0.33	+1	= +96	+	5+5-18 = -18	+104
10	-2.03	0.00	+1	= +2	+	5 0-18 = -13	+15
11	-1.92	-0.67	+1	= -51	+	5-10-18 = -23	-28

+246 -246

Average (O-C) = 49

Normal Equations.

a	b	c	
+21.66	+0.07	-6.72	= +66
+0.07	+19.62	+10.94	= +102
-6.72	+10.94	+10.00	= +4
-0.07	-0.00	+0.02	= -0
+6.72	+0.02	-2.09	= +20
	+19.62	+10.96	= +102
	+10.96	+7.91	= +24
	-10.96	-6.11	= -57
		+1.80	= +33
	-15.14	-10.96	= -33
	+4.48		= +69
-4.51	+7.35	+6.72	= +3
+7.35	-11.98	-10.94	= -4
+17.15	+7.42		= +69
+7.42	+7.64		= +98
-7.22	-7.42		= -95
+9.93			= +26

$\frac{\Delta x}{\Delta N}$ = 2.03 + 1.31 = +0.67

$\frac{\Delta \delta}{\Delta N}$ = 2.03 - .56 = 1.13

c = -18

b = +15

a = +3

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Mean position (1911.0

$X_0 = -18.3124$ $Y_0 = -22.3335$

$+\frac{1}{2}a = -1$ $+\frac{1}{2}b = +8$

$X = -18.3125$ ✓ $Y = -22.3327$ ✓

From preliminary Reduction $X = -18.3622$ ✓ $Y = -22.3321$ (22.33327)

" computed plate constants $ax = +14$ $+17$

$by = +4$ -7

$c = -17$ -7

$X = -18.3621$ $Y = -22.3318$

$\xi = -0.3621$ ✓

$\log \xi = 9.558830_n$

$\therefore \cos\delta = 9.99188$ ✓

$\therefore \sec^2\delta = 8.50724$

$\therefore (\alpha - A) = 1.059711_m$ ✓

$\alpha - A = -11^s.47$ ✓

$A = +10^h\ 58^m\ 36^s$ ✓

$\alpha_0 = 10^h\ 58^m\ 24^s.53$ ✓

Red. $-\quad +1.30$

$\alpha' = 10^h\ 58^m\ 25^s.83$ ✓

$\eta = -0.3318$ -0.33324

$\log \tan\delta = 9.29220$

$\therefore \delta^2 = 9.11177$

$\therefore \eta_1 = 5.46311$

$\eta_1 = 0$

$\eta_0 = -0.3318$

$\log \eta_0 = 9.52088_n$ 9.521664

$\therefore \text{const} = 7.33115$

$\therefore (\delta - D) = 2.18973_n$ 2.19051

$\delta - D = -154''.8$ $-155''.1$

$= -2'\ 34''.8$ $-2\ 35.1$

$D = +11\ 05\ 11.$

$\delta_0 = +11^\circ\ 02'\ 36''.2$ $02\ 35.9$

Red. $= \quad -5.1$ -5.1

$\delta' = +11^\circ\ 02'\ 31''.1$ 30.8

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Mean position (1911.0

$X_0 = -18.3124$	$Y_0 = -22.3335$
$+\frac{1}{2}a = -1$	$+\frac{1}{2}b = +8$
$X = -18.3125$	$Y = -22.3327$

From preceding. Reduction $X = -18.3622$ $Y = -22.3321$

" computed plate constants $ax = +14$ $+17$

$by = +4$ -7

$c = -17$ -7

$x = -18.3621$ $y = -22.3318$

$\xi = -0.3621$

$\log \xi = 9.55883_n$

$\cos\delta = 9.99188$

$\operatorname{cotan} = 8.50724$

$(\alpha - A) = 1.05971_m$

$\eta = -0.3318$

$\log \tan\delta = 9.2920$

$= 9.1177$

$\therefore \eta_1 = 5^s.4631$

$\eta_2 = 0$

$\alpha - A = -11^s.47$

$A = +10^h\ 58^m\ 36^s.$

$\alpha_0 = 10^h\ 58^m\ 24^s.53$

Red. $+1.30$

$\alpha' = 10^h\ 58^m\ 25^s.83$

$\eta_0 = -0.3318$

$\log \eta_0 = 9.52088_m$

$\log a = 7.33115$

$(\delta - D) = 2.18973_m$

$\delta - D = -154''.8$

$= -2'\ 34''.8$

$D = +11°\ 05'\ 11''.$

$\delta_0 = +11°\ 02'\ 36''.2$

Red $\delta = -5''.1$

$\delta' = +11°\ 02'\ 31''.1$

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NC 977 (1911, Mar 13, 8^h) 1912 Dec 20.

Reduction to apparent place.

α_0 =	10^h	58^m	24^s		δ_0 =	$+11^\circ$	$02'$	$36''$
G =	17^h	48^m	48^s		H =	18^h	32^m	06^s
$G+\chi_0$ =	4^h	47^m	12^s		$H+\chi$ =	5^h	30^m	30^s
=	$+71^\circ$	$48'$	$00''$		=	82°	$37'$	$30''$

$\log \frac{1}{r_0}$:	8.8239			$\log \frac{1}{r_0}$:	8.8239			$\log i$ =	0.9068n
$\therefore q$:	0.8686			$\therefore h$:	1.2738			$\therefore d\alpha\delta_0$ =	9.9919
$\therefore \sin(G+\chi)$:	9.9777			$\therefore \sin(H+\chi)$:	9.9964			$\therefore (i)$	0.8977n
$\therefore \tan\delta_0$:	9.2903			$\therefore \sec\delta_0$:	0.0081				
$\therefore (g)$:	8.9605			$\therefore (h)$:	0.1072				

$\log q$:	0.8686			$\log h$:	1.2738				
$\therefore \cos(G+\chi)$:	9.4946			$\therefore \cos(H+\chi)$	9.1084				
$\therefore (g')$	0.3632			$\therefore \sin\delta_0$	9.2823				
				$\therefore (h')$:	9.6645				

$\frac{1}{r}$:	-0.06			(g') :	$+2.3$			
(g) :	$+0.09$			(h') :	$+0.5$			
(h) :	$+1.27$			(i) :	-7.9			
Red in α :	$+1.30$			Red. in δ :	-5.1			

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MC 9.77 (1911, Mar 13, 8h) 1912 Dec 20. 67

Reduction to apparent place.

α_0 = 10h 58m 74s
G = 17, 48 48
G+X = 4 47 12
= +71° 48' 00"

δ_0 = +11° 02' 36"
H = 18h 32m 00s
H+X = 5 30 30
= 82° 37' 30"

log $\frac{1}{r}$ = 8.8239
log $\frac{1}{r}$ = 8.8239
log i = 0.9068n
log ζ = 0.8686
log h = 1.2738
dδ₀ = 9.9919
sin(G+X) 9.9777
sin(H+X) 9.9964
(i) 0.8977n
tan δ₀ 9.2903
sec δ₀ 0.0081
(ζ) = 8.9605"
(h) = 0.1072

log ζ = 0.8686
log ξ = 1.2738
cos(G+X) 9.4946
cos(H+X) 9.1084
(ζ') 0.3632
sin δ₀ 9.2823
(η') = 9645"

t = −0.06
(q') = +2.3
(η) = +0.09
(k') = +0.5
(ξ) = +1.27
(i) = −7.9
Red. in α = +1.30ˢ
Red. in δ = −5.1"

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Lunar parallax.

α'	=	10^h	58^m	$25^s.83$	δ'	=	$+11^\circ$	$02'$ $30''.8$
$\odot$	=	8	12	06.7	π	=		$57'$ $16''.9$
$\odot - \alpha'$	=	-2	46	19.13				
	=	-41°	$34'$	$47''$				

$\log \rho \cos\phi'$ =	9.86913
$\therefore \sin\pi$ =	8.22172
$\therefore \sin(\odot - \alpha')$ =	9.82195
$-\therefore \cos\delta'$ =	9.99188
$\therefore \sin(\alpha - \alpha')$ =	7.92091
approx. $(\alpha - \alpha')$ =	$-28'$ $39''.2$
$\log(\cos\delta$ =	9.99109
$\therefore \sin(\alpha - \alpha')$ =	7.92171
$(\alpha - \alpha'$ =	$-28'$ $42''.4$
=	-1^m $54^s.83$

$\frac{1}{2}(\alpha - \alpha')$ =	$-$	14	20	
$\odot - \alpha' - \frac{1}{2}(\alpha - \alpha')$ =	-41	20	27	

$\log \tan\phi'$ =	9.95727
$\therefore \cos\frac{1}{2}(\alpha - \alpha')$ =	0.00000
$\therefore \log(\odot - \alpha') - \frac{1}{2}(\alpha - \alpha')$ =	9.87552
$-\therefore \tan\gamma$ =	0.08175

γ	=	50°	$21'$	$39''.2$
δ'	=	11	02	31.1
$\gamma - \delta'$	=	39	19	08.1

$\log \rho \sin\phi'$ =	9.82640
$\therefore \sin\pi$ =	8.22172
$\therefore \sin(\phi - \delta')$ =	9.80184
$-\therefore \sin\gamma$ =	9.88653
$\therefore \sin(\phi - \delta')$ =	7.96343

$\delta - \delta'$	=	+	31	36.1
δ	=	$+11^\circ$	$34'$	$06''.9$

α	=	10^h	56^m	$31^s.00$
approx. δ	=	$+11^\circ$	$34'$	$08''.8$	α	=	10^h	56^m $30^s.32$
O - C	=			$-1''.9$				$+0^s.68$
corr. to stand. radius				$-0''.4$				$+0^s.02$
trial (O - C)				$-2''.3$				$+0^s.70$

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Lunar parallax.

α'	=	10^h	58^m	$25^s.83$	
Θ	=	8	12	06.7	
$\Theta - \alpha'$	=	−2	46	19.13	
	=	-41°	34′	47″	
$\frac{1}{2}(\alpha - \alpha')$	=	−	14	20	
$\Theta - \frac{1}{2}(\alpha - \alpha')$	=	−41	20	27	

δ'	=	+11°	02′	30.″1	
π	=		57′	16.″9	
log ρ cos φ′	=			9.86913	
log sin π	=			8.22178	
log sin(Θ − δ′)	=			9.82195	
− log cos δ′	=			9.99188	
log sin(α − α′)	=			7.92091	n
app. (α − α′)	=		−28′	39.″2	
log cos δ	=			9.99109	
log sin(α − α′)	=			7.92170	
(α − α′)	=		−28′	42.″4	
	=		-1^m	$54^s.83$	

log tan φ′	=			9.95727	
log cos ½(α − α′)	=			0.00000	
log(Θ − α′) − log(α − δ′)	=			9.87552	
tan γ	=			0.08175	
γ	=	50°	21′	39.″2	
δ′	=	11	02	31.″1	
γ − δ′	=	39	19	08.″1	

log ρ sin φ′	=			9.82640	
log sin π	=			8.22171	
log sin(γ − δ′)	=			9.80154	
− log sin γ	=			9.88653	
log sin(δ − δ′)	=			7.96342	
δ − δ′	=	+	31	36.″0	
δ	=	+11°	34′	06.″9	
corr'd for A δ	=	+11	34	08.″8	
O − C	=		−	1.9	
Corr'n to standard radius	=		−	0.4	
Final (O − C)	=		−	2.3	

α	=	10^h	56^m	$31.^s00$	
α	=	10	56	$30.^s32$	
O − C	=		+	$0.^s68$	
Corr'n to standard radius	=		−	0.02	
Final (O − C)	=		+	0.70	

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