

KG

11366

in 942

LXV



2370



1698

1748

Harvard Lunar Plates

Measures and Reductions

Mary Fowler.

Volume LXV

Plate No.	Date	Page
~~2370~~	~~1912 Dec. 19~~	~~1~~
1698	1912 Mar 2	1
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1698
~~2340~~

Stars - Measures

1914 Mar 4

1

a
 $\begin{array}{r} 17762 \\ 10.3 \ 145-14 \\ 324 \quad 2019 \\ \quad \quad 77 \\ \hline 32.3249 \end{array}$

v
 $\begin{array}{r} 17758 \\ 11020 \ 10 \\ \quad 19 \\ \quad 55 \\ \hline 3257 \end{array}$

d
 $\begin{array}{r} 18647 \\ 1003040 \\ \quad 28 \\ \quad 59 \\ \hline 10.2377 \end{array}$

w
 $\begin{array}{r} 17471 \\ 1507071 \\ \quad 70 \\ \quad 68 \\ \hline 2400 \end{array}$

$\begin{array}{r} 16980 \\ 10.6 \ 1126456 \\ 13.6 \quad 6556 \\ \quad \quad 98 \\ \hline 13.5729 \end{array}$

$\begin{array}{r} 16460 \\ 1219085 \\ \quad 8685 \\ \quad 67 \\ \hline 5724 \end{array}$

$\begin{array}{r} 16040 \\ 1194049 \\ \quad 51 \\ \quad 39 \\ \hline 10.5907 \end{array}$

$\begin{array}{r} 16201 \\ 1027665 \\ \quad 6965 \\ \quad 97 \\ \hline 5929 \end{array}$

$\begin{array}{r} 15075 \\ 26.3 \ 8320 \\ 19.6 \quad 1919 \\ \quad \quad 80 \\ \hline 19.6759 \end{array}$

$\begin{array}{r} 15075 \\ 1184338 \\ \quad 3938 \\ \quad 90 \\ \hline 6757 \end{array}$

$\begin{array}{r} 16270 \\ 860092 \\ \quad 0192 \\ \quad 65 \\ \hline 26.2332 \end{array}$

$\begin{array}{r} 15975 \\ 1364433 \\ \quad 4544 \\ \quad 88 \\ \hline 2340 \end{array}$

Grade 2

1698

Stars - Measures

1914 Mar. 9

1

d	n	d	n
1	17762	18647	17471
10.3	14519	1003040	15070
724	2019	28	707.1
	77	59	68
	<u>32.3249</u>	<u>10.2377</u>	<u>2400</u>
2	16980	16040	16201
10.6	11266	11940	10276
13.6	6556	5149	6965
	98	39	97
	<u>135729</u>	<u>10.5907</u>	<u>5929</u>
3	15075	16270	15979
263	8320	8600	1364433
196	1919	0192	4544
	80	65	88
	<u>19.6759</u>	<u>26.2332</u>	<u>2340</u>

Grade 2

1698 ~~Run~~ Work Means
$$\begin{array}{r} 14.8 \\ 200 \end{array}$$

$$\begin{array}{r} 14.8 \\ 20.5 \\ \text{min} \\ \times \end{array}$$

$$\begin{array}{r} 14.8 \\ 21.0 \end{array}$$

$$\begin{array}{r} 15.0 \\ 21.4 \\ 19.887 \\ 15.26271 \\ 68 \\ 91 \\ \hline 21.4622 \end{array}$$

$$\begin{array}{r} 15.4 \\ 22.0 \end{array}$$

$$\begin{array}{r} 16.0 \\ 22.5 \\ 19.455 \\ 15.33022 \\ 20 \\ 59 \\ \hline 22.4133 \end{array}$$

$$\begin{array}{r} 20139 \\ 1462740 \\ 2320 \\ 49 \\ \hline 21.4496 \end{array}$$

$$\begin{array}{r} 14919 \\ 904444 \\ 4144 \\ 28 \\ \hline 4119 \end{array}$$

$$\begin{array}{r} 15842 \\ 1399595 \\ 91 \\ 41 \\ \hline 14.8153 \end{array}$$

$$\begin{array}{r} 14855 \\ 1244530 \\ 4441 \\ 40 \\ \hline 14.7589 \end{array}$$

$$\begin{array}{r} 14830 \\ 1306270 \\ 70 \\ 20 \\ \hline 14.8239 \end{array}$$

see next page

$$\begin{array}{r} 19176 \\ 1317171 \\ 79 \\ 70 \\ \hline 15.4002 \end{array}$$

$$\begin{array}{r} 18961 \\ 1081008 \\ 65 \\ 68 \\ \hline 18158 \end{array}$$

$$\begin{array}{r} 18944 \\ 1234954 \\ 51 \\ 45 \\ \hline 7594 \end{array}$$

$$\begin{array}{r} 19949 \\ 1167290 \\ 77 \\ 31 \\ \hline 8255 \end{array}$$

$$\begin{array}{r} 15449 \\ 1148029 \\ 32 \\ 39 \\ \hline 4015 \end{array}$$

1
17
2
1
8
18
2
17
2
18
21
18
21
18
21

1698

Moon-measures

$$\begin{array}{r}
 2 \quad 18480 \quad 14881 \\
 17.0 \quad 12418 \quad 10944 \\
 22.5 \quad 1300 \quad 4048 \\
 \text{max} \quad 80 \quad 89 \\
 \text{y} \quad 22.6070 \quad .6060
 \end{array}$$

$$\begin{array}{r}
 8 \quad 18503 \quad 15845 \\
 18.0 \quad 15496 \quad 8821 \\
 22.3 \quad 8800 \quad 1817 \\
 \quad 10 \quad 51 \\
 \underline{22.3010} \quad \underline{2970}
 \end{array}$$

$$\begin{array}{r}
 9 \\
 184 \\
 220
 \end{array}$$

$$\begin{array}{r}
 18030 \\
 1186861 \\
 \quad 56 \\
 \quad 40 \\
 \underline{18.3838}
 \end{array}$$

$$\begin{array}{r}
 15758 \\
 1191220 \\
 \quad 17 \\
 \quad 62 \\
 \underline{3844}
 \end{array}$$

$$\begin{array}{r}
 10 \\
 189 \\
 210
 \end{array}$$

possibly on
terminal.

$$\begin{array}{r}
 13929 \\
 1355248 \\
 \quad 50
 \end{array}$$

$$\begin{array}{r}
 10590 \\
 8885 \\
 10211
 \end{array}$$

$$\underline{18.9621}$$

$$\underline{.9623}$$

4- scratch instead of pt (4)

$$\begin{array}{r}
 15.0 \quad 20100 \quad 18810 \\
 21.5 \quad 1476169 \quad 1417478 \\
 \quad 65 \\
 \quad 10 \quad 20 \\
 \underline{21.5340} \quad \underline{.5362}
 \end{array}$$

$$\begin{array}{r}
 14189 \\
 1 \quad 8983 \\
 13775 \\
 \underline{15.0412}
 \end{array}$$

$$\begin{array}{r}
 14961 \\
 1452413 \\
 \quad 20 \\
 \underline{.0442}
 \end{array}$$

1698 *lunar-measures*

	<i>d</i>	<i>4</i>	<i>n</i>	<i>d</i>	<i>n</i>
2	18480		14881		
17.0	12418		10944		
22.5	1300		40		
max	80		89		
<i>y</i>	<u>22.6070</u>		<u>.6060</u>		
<i>x</i>	18503		15845		
18.0	15496		8821		
22.3	8800		1817		
	10		51		
	<u>22.3010</u>		<u>2970</u>		

9
184
220

18030
11868
56
20
18.3838

15758
11912
17
62
3844

10
189
210

*possibly on
terminator*

13929
13152
50
48

10590
8885
10211

18.9621

9623

4- *scratched instead of pt (4)*

15.0 20100 18810
21.5 14761 14174
65 80
10 20
21.5340 15362

14189
1 8983
13775
150912

14961
14524
20
0442

1698

Times Etc.

Exh. test	1912 Mar 2, 12 ^h 20 ^m	- 12 ^h 32 ^m
moon	12 25 46.4	- 12 25 46.8
clock slow	1 45.7	
H. Sid. T.	12 27 32.3	$\theta - \alpha = +1^h 36'$
H. long	4 44 31.05	
G. Sid. T.	17 12 03.35	
Sid. T. w. moon	22 39 37.50	
Interval	18 32 25.85	
Reduction	3 02.24	
G. M. T.	18 29 23.61	

From Kant Allen

R. A.

Decl.

moon 18 ^h	10 ^h 50 ^m 11.91	+ 11° 10' 41.1
motion 22290		16.135
" 29.3935	+ 1 05.52	- 7 54.3
Tabular place	10 51 17.43	+ 11 02 46.8

Moon's age 14 days

Moon's parallax 60' 01".6

Semi-diam 16 22.7

R 982.7

Augmentation + 13.8

Irradiation (2) - 0.5

R 996.0

R 2.1350

R 2.1342

R² 4.5548

934 = 12.45

983 = 13.8

a - - 4.0

(1 + a)K

R²

1698

Times Etc.

Exhibition 1912 Mar 2, 12^h 20^m - 12^h 32^m
 Moon 12 25 46.4 - 12 25 46.8
 Clock slow 1 45.7

H. Sid T. 12 27 32.3 $\Theta - X = +1^h 36'$
 H. long 4 44 31.05
 G. Sid T. 17 12 03.35
 Sid T. h. moon 22 39 37.50
 Interval 18 32 25.85
 Reduction 3 02.24
 G. h. T. 18 29 23.61

from Hunt Allen R. G. Keel.
 Moon 18^h 10^h 50^m 11^s 91 + 11^h 10' 41.11
 Moon 17 22 29.0 16.135
 " 29.3935 + 1 05.52 - 7 54.3
 Tabular place 10 51 17.43 + 11 02 46.8

Moon as 14 days.

Moon's parallax 60' 01.6

Sun's diam 16 22.7^v

R 982.7

Augmentation + 13.8

Irradiation (2) - 0.5

R 996.0

R 2135.0^v

a - + 4.0

(1 + a) R 2135.8

R² 4561.6

1698-

Plate constants.

	1	2	3
x	10.2388	10.5918	26.2336
z	12.8116	13.1374	28.7945
$x-z$	-2.5728	2.5456	-2.5609

y

y	32.3253	13.5726	19.6758
η	31.1294	12.3765	18.4630
$y-\eta$	+1.1959	+1.1961	+1.2128

$$x-z \quad +1.1961 \quad +4x \quad +2.5216$$

$$\begin{aligned} -2.5728 + 471 &= -2.5257 + 41 = -2.5216 = 0 \\ -2.5456 + 198 &= -2.5258 + 42 = -2.5216 = 0 \\ -2.5609 + 257 &= -2.5322 + 105 = -2.5217 = -1 \\ 16.8935 + 299 &= 17.1925 + 68 = 17.2605 \end{aligned}$$

$$y-\eta \quad -1.1959 \quad -1.19 \quad -1.1848$$

$$\begin{aligned} +1.1959 - 108 &= +1.1851 - 3 = +1.1848 = 0 \\ +1.1961 - 112 &= +1.1849 - 1 = +1.1848 = 0 \\ +1.2128 - 278 &= +1.1850 - 2 = +1.1848 = 0 \\ 20.4744 - 179 &= 19.2954 - 2 = 19.2715 \end{aligned}$$

$$\begin{aligned} \text{Tables: } a &= -0.0 & a &= -1.5 & a-e &= +1.5 & b+a &= -1.5 \\ \text{Obs } a &= -4.0 & a &= +0.1 & a-e &= -4.1 & b+a &= -4.0 \end{aligned}$$

1698-

Plate constants

	1	2	3
x	10.2388	10.5918	26.2336
y	12.8116	13.1374	28.7945
$x-y$	-2.5728	2.5456	-2.5609

y			
x	32.3253	13.5726	19.6758
y	31.1294	12.3765	18.4630
$x-y$	+1.1959	+1.1961	+1.2128

$$\begin{array}{rclcl}
 x - y & + 1.1959 & & + 4x & + 2.5216 \\
 -2.5728 + 4.71 & = -2.5257 & + 4.1 & = -2.5216 & = 0 \\
 -2.5456 + 1.98 & = -2.5258 & + 4.2 & = -2.5216 & = 0 \\
 -2.5609 + 2.87 & = -2.5322 & + 1.05 & = -2.5217 & = -1 \\
 16.8935 + 2.99 & & + 6.8 & & = 19.4528
 \end{array}$$

$$\begin{array}{rclcl}
 y - x & - 1.0672 & & - 1.4 & - 1.1848 \\
 +1.1959 - 1.08 & = +1.1851 & - 3 & = +1.1848 & = 0 \\
 +1.1961 - 1.12 & = +1.1849 & - 1 & = +1.1848 & = 0 \\
 +1.2128 - 2.78 & = +1.1850 & - 2 & = +1.1848 & = 0 \\
 20.4723 - 1.79 & & - 2 & & = 19.2715
 \end{array}$$

$$\begin{array}{lclcl}
 \text{Table 1: } a = -0.0 & c = -1.5 & a - c = +1.5 & b + a = -1.5 \\
 \text{Obs } a = -4.0 & c = +0.1 & a - c = -4.1 & b + a = -4.0
 \end{array}$$

kt	pos. 4	resid.
1	257.02	-119
2	270.0	+6
3	284.4	+12
4	299.9	-46
5	315.7	-18
6	335.2	-16
7	28	+35
8	31.8	+2
9	44.3	-45
10	75.7	+12

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Lunar Center

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	148156	-2.0774	-0	4.3156	4.5393	-155
2	147592	-2.1338	0	4.5531	4.5531	-17
3	148247	-2.0683	+1	4.2774	4.5551	+3
4	150427	-1.8503	+2	3.4229	4.5511	-37
5	154008	-1.4922	+2	2.2261	4.5581	+33
6	160000	-0.8930	+3	0.7969	4.5597	+49
7	170000	+0.1070	+3	0.0115	4.5642	+94
8	180000	+1.1070	+3	1.2261	4.5611	+63
9	183841	+1.4911	+2	2.2240	4.5560	+12
10	189622	+2.0692	+1	4.2820	4.5597	+49

$$\text{Comp. } R^2 = 4.5548$$

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.0000	-0.4730	0	0.2237
2	20.4730	0.0000	0	0.0000
3	21.0000	+0.5270	0	0.2777
4	21.5351	+1.0621	+1	1.1282
5	22.0000	+1.5270	+1	2.3320
6	22.4126	+1.9396	+2	3.7628
7	22.6065	+2.1335	+2	4.5527
8	22.2990	+1.8260	+2	3.3350
9	22.0000	+1.5270	+1	2.3320
10	21.0000	+0.5270	0	0.2777

Appl. Center

$$y = 220 \quad x = 15.4008$$

$$\begin{array}{r} 183841 \\ 33.7849 \end{array}$$

$$x_0 = 16.8924$$

$$x - \text{min} = 14.7592$$

$$R = 2.1332$$

$$y - \text{max} = 22.6065$$

$$y_0 = 20.4733$$

$$y = 21 \quad x = 14.8247$$

$$\begin{array}{r} 18.9622 \\ 33.7869 \end{array}$$

$$16.8934$$

$$\text{Center } \begin{cases} X_1 = 16.8930 \\ Y_0 = 20.4730 \end{cases}$$

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Linear Center

6

	x	$x - x_0$	Δx	$(x - x_0)^2$	$(x - x_0)(y - y_0)$	$y - y_0$
1	14.8156	-2.0774	-0	4.3156	4.5393	-1.55
2	14.7592	-2.1338	0	4.5531	4.5531	-1.7
3	14.8247	-2.0683	+1	4.2774	4.5551	+1.3
4	15.0427	-1.8503	+2	3.4229	4.5511	-1.37
5	15.4008	-1.4922	+2	2.2261	4.5581	+3.5
6	16.0000	-0.8930	+3	0.7969	4.5597	+4.9
7	17.0000	+0.1070	+3	0.0115	4.5642	+4.4
8	18.0000	+1.1070	+3	1.2261	4.5611	+6.3
9	18.3841	+1.4911	+2	2.2240	4.5560	+1.2
10	18.9622	+2.0692	+1	4.2820	4.5597	+4.9

Comp. Σ 4.5548

	y	$y - y_0$	Δy	$(y - y_0)^2$
1	20.0000	-0.4730	0	0.2237
2	20.4730	0.0000	0	0.0000
3	21.0000	+0.5270	0	0.2777
4	21.5351	+1.0621	+1	1.1282
5	22.0000	+1.5270	+1	2.3320
6	22.4126	+1.9396	+2	3.7628
7	22.6065	+2.1335	+2	4.5527
8	22.2990	+1.8260	+2	3.3350
9	22.0000	+1.5270	+1	2.3320
10	21.0000	+0.5270	0	0.2777

Appl. Center

$$y = 220 \quad x = 15.4008$$

$$18.3841$$

$$33.7849$$

$$x_0 = 16.8929$$

$$x = \text{mean} = 14.7592$$

$$R = 2.1332$$

$$y = \text{mean} = 22.6065$$

$$y_0 = 20.4733$$

$$y = 21 \quad x = 14.8247$$

$$18.9622$$

$$33.7869$$

$$16.8934$$

$$\text{Center } \{ X = 16.8930$$

Summation of Normals

	ab	an	bu
1	+ 0.06	+ 20.3	+ 4.6
2	- 0.00	+ 36.2	- 0.0
3	- 1.10	- 6.2	+ 1.6
4	- 1.96	+ 68.4	- 39.2
5	- 2.28	- 49.2	+ 50.5
6	- 1.73	- 43.6	+ 95.0
7	+ 0.23	+ 10.3	+ 200.0
8	+ 2.03	+ 70.0	+ 115.0
9	+ 2.28	+ 19.9	+ 18.4
10	+ 1.10	+ 101.5	+ 26.0
	- 1.37	+ 225.7	+ 471.9

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Conditional Equations

	a	b	c	0 - c	
1	-2.08	-0.47	-1.55	-23 - 13 = -36	-119
2	-2.13	+0.00	-1.7	-23 + 0 = -23	+6
3	-2.07	+0.53	+3	-23 + 14 = -9	+12
4	-1.85	+1.06	-37	-20 + 29 = +9	-46
5	-1.49	+1.53	+33	-16 + 41 = +25	+8
6	-0.89	+1.94	+49	-10 + 53 = +43	+6
7	+0.47	+2.13	+94	+1 + 58 = +59	+35
8	+1.11	+1.83	+63	+12 + 49 = +61	+2
9	+1.49	+1.53	+12	+16 + 41 = +57	-45
10	+2.07	+0.53	+49	+23 + 14 = +37	+12

Normal Equations

$$+24.10 - 1.37 = +226$$

$$- 1.37 + 18.05 = +472$$

$$+ 1.37 - 0.08 = +13$$

$$+ 17.97 = +485$$

$$+24.10 = +226 + 37 = +263$$

Average = 29
Excluding (1) 13

$$b = +27.0$$

$$a = +10.9$$

1698

Conditional Equations

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	aa	ab	ac	ad	ae	af	ag	ah	ai	aj	ak	al	am	an	ao	ap	aq	ar	as	at	au	av	aw	ax	ay	az	ba	bb	bc	bd	be	bf	bg	bh	bi	bj	bk	bl	bm	bn	bo	bp	bq	br	bs	bt	bu	bv	bw	bx	by	bz	ca	cb	cc	cd	ce	cf	cg	ch	ci	cj	ck	cl	cm	cn	co	cp	cq	cr	cs	ct	cu	cv	cw	cx	cy	cz	da	db	dc	dd	de	df	dg	dh	di	dj	dk	dl	dm	dn	do	dp	dq	dr	ds	dt	du	dv	dw	dx	dy	dz	ea	eb	ec	ed	ee	ef	eg	eh	ei	ej	ek	el	em	en	eo	ep	eq	er	es	et	eu	ev	ew	ex	ey	ez	fa	fb	fc	fd	fe	ff	fg	fh	fi	fj	fk	fl	fm	fn	fo	fp	fq	fr	fs	ft	fu	fv	fw	fx	fy	fz	ga	gb	gc	gd	ge	gf	gg	gh	gi	gj	gk	gl	gm	gn	go	gp	gq	gr	gs	gt	gu	gv	gw	gx	gy	gz	ha	hb	hc	hd	he	hf	hg	hh	hi	hj	hk	hl	hm	hn	ho	hp	hq	hr	hs	ht	hu	hv	hw	hx	hy	hz	ia	ib	ic	id	ie	if	ig	ih	ii	ij	ik	il	im	in	io	ip	iq	ir	is	it	iu	iv	iw	ix	iy	iz	ja	jb	jc	jd	je	jf	jj	jh	ji	jj	jk	jl	jm	jn	jo	jp	jq	jr	js	jt	ju	jv	jw	jx	ky	kz	la	lb	lc	ld	le	lf	lg	lh	li	lj	lk	ll	lm	ln	lo	lp	lq	lr	ls	lt	lu	lv	lw	lx	ly	lz	ma	mb	mc	md	me	mf	mg	mh	mi	mj	mk	ml	mm	mn	mo	mp	mq	mr	ms	mt	mu	mv	mw	mx	my	mz	na	nb	nc	nd	ne	nf	ng	nh	ni	nj	nk	nl	nm	nn	no	np	nq	nr	ns	nt	nu	nv	nw	nx	ny	nz	oa	ob	oc	od	oe	of	og	oh	oi	oj	ok	ol	om	on	oo	op	oq	or	os	ot	ou	ov	ow	ox	oy	oz	pa	pb	pc	pd	pe	pf	pg	ph	pi	pj	pk	pl	pm	pn	po	pp	pq	pr	ps	pt	pu	pv	pw	px	py	pz	qa	qb	qc	qd	qe	qf	qg	qh	qi	qj	qk	ql	qm	qn	qo	qp	qq	qr	qs	qt	qu	qv	qw	qx	qy	qz	ra	rb	rc	rd	re	rf	rg	rh	ri	rj	rk	rl	rm	rn	ro	rp	rq	rr	rs	rt	ru	rv	rw	rx	ry	rz	sa	sb	sc	sd	se	sf	sg	sh	si	sj	sk	sl	sm	sn	so	sp	sq	sr	ss	st	su	sv	sw	sx	sy	sz	ta	tb	tc	td	te	tf	tg	th	ti	tj	tk	tl	tm	tn	to	tp	tq	tr	ts	tt	tu	tv	tw	tx	ty	tz	ua	ub	uc	ud	ue	uf	ug	uh	ui	uj	uk	ul	um	un	uo	up	uq	ur	us	ut	uu	uv	uw	ux	uy	uz	va	vb	vc	vd	ve	vf	vg	vh	vi	vj	vk	vl	vm	vn	vo	vp	vq	vr	vs	vt	vu	vv	vw	vx	vy	vz	wa	wb	wc	wd	we	wf	wg	wh	wi	wj	wk	wl	wm	wn	wo	wp	wq	wr	ws	wt	wu	wv	ww	wx	wy	wz	xa	xb	xc	xd	xe	xf	xg	xh	xi	xj	xk	xl	xm	xn	xo	xp	xq	xr	xs	xt	xu	xv	xw	xx	xy	xz	ya	yb	yc	yd	ye	yf	yg	yh	yi	yj	yk	yl	ym	yn	yo	yp	yq	yr	ys	yt	yu	yv	yw	yx	yy	yz	za	zb	zc	zd	ze	zf	zg	zh	zi	zj	zk	zl	zm	zn	zo	zp	zq	zr	zs	zt	zu	zv	zw	zx	zy	zz
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Normal Equations

$$+ 24.10 - 1.37 = + 22.6$$

$$- 1.37 + 18.05 = + 4.72$$

$$- 1.37 - 0.08 = + 1.3$$

$$+ 17.97 = + 4.85$$

$$+ 24.10 = + 22.6 + 37 = + 26.3$$

$$\text{Average} = 29$$

$$\text{Excluding (1)} = 63$$

$$b = + 27.0$$

$$a = + 10.9$$

1698 Moon's Mean Position (1912.0)

8

$$\begin{array}{r} X_0 = 16.8930 \\ \text{corr} = + 5 \\ \hline 16.8935 \end{array}$$

$$\begin{array}{r} Y_0 = 20.4730 \\ \text{corr} = + 14 \\ \hline 20.4744 \end{array}$$

From Plate Constants $X = 19.4528''$ $Y = 19.2715''$

$$z = +1.4518''$$

$$\eta = -2.7285''$$

$$\begin{array}{r} \log \xi = 0.16191 \\ \text{cos } \xi = 999265 \\ \text{const} = 8.50724 \end{array}$$

$$\begin{array}{r} \log \tan \delta = 9.2684 \\ 03241 \\ 70534 \\ 6.6459 \end{array}$$

$$(\alpha - A) = 1.66202''$$

$$\eta_1 = +4$$

$$\eta_0 = -2.7289''$$

$$\alpha - A + 45.92'' \log \eta_0 = 0.43598''$$

$$733115$$

$$A = 104916''$$

$$(J-D) = 310483''$$

$$X_0 = 10500192''$$

$$S-D = -2113.0''$$

$$\text{Red.} = +1.54$$

$$D = +105151$$

$$X' = 10500346''$$

$$S_0 = +103038.0''$$

$$\text{Red.} = -6.1''$$

$$S' = +103031.9''$$

1698 Moon's Mean Position (1912.0)

8

$$\begin{array}{r} X_0 = 168930 \\ + 15 \\ \hline 168935 \end{array}$$

$$\begin{array}{r} Y_0 = 204730 \\ + 14 \\ \hline 204744 \end{array}$$

From Plate Constants $X = 19.4578$ $Y_0 = 19.2795$

$$z = +14578$$

$$\eta = -2.7285$$

$$\begin{array}{r} \log \bar{z} = 0.16798 \\ \cos \bar{z} = 999265 \\ \sin \bar{z} = 850724 \end{array}$$

$$\begin{array}{r} \log \tan \delta = 9.2689 \\ 03241 \\ 70534 \\ 6.6459 \end{array}$$

$$(x-A) = 1.66207$$

$$\eta_1 = +4$$

$$\eta_2 = -27289$$

$$x-A + 45.92 \log \eta_0 = 0.43598$$

$$733115$$

$$A = 104916$$

$$(J-D) = 310483$$

$$X_0 = 10500192$$

$$S-D = -2113.0$$

$$Red. = +1.54$$

$$D = +105151$$

$$x' = 10500346$$

$$\delta_0 = +103038.0$$

$$Red. = -6.1$$

$$S' = +1030329$$

1698 Lunar Parallax.

$$\begin{array}{rcl}
 \alpha & = & 10^h 50^m 03.46^s \checkmark \\
 \delta & = & 12 \quad 27 \quad 323 \checkmark \\
 \delta - \alpha & = & +1 \quad 37 \quad 288 \checkmark \\
 & = & + \quad 24^\circ \quad 22' \quad 12'' \checkmark
 \end{array}$$

$$+ \quad \quad \quad 9 \quad 20 \checkmark$$

$$+ 24 \quad 12 \quad 52 \checkmark$$

$$995727 \checkmark$$

$$0.00000 \checkmark$$

$$0.04000 \checkmark$$

$$999727 \checkmark$$

$$\gamma = 44 \quad 49 \quad 12 \checkmark$$

$$+ 10 \quad 30 \quad 37 \checkmark$$

$$\gamma - \delta = 34 \quad 18 \quad 40 \checkmark$$

$$982640 \checkmark$$

$$824205 \checkmark$$

$$975104 \checkmark$$

$$0.15188 \checkmark$$

$$797137 \checkmark$$

$$\delta - \delta' = +32 \quad 11.1 \checkmark$$

$$\delta = +11 \quad 02 \quad 430 \checkmark \quad \alpha = 10 \quad 51 \quad 18.14 \checkmark$$

$$\text{Nautical } \delta = +11 \quad 02 \quad 46.8 \checkmark \quad \alpha = 10 \quad 51 \quad 17.43 \checkmark$$

$$O-C \quad \quad \quad - \quad 3.8 \checkmark \quad \quad \quad +0.71 \checkmark$$

$$\delta' = +10^\circ 30' 31.9'' \checkmark$$

$$\pi \quad 60' 01.6'' \checkmark$$

$$986913 \checkmark$$

$$824205 \checkmark$$

$$961556 \checkmark$$

$$000812 \checkmark$$

$$773486 \checkmark$$

$$\delta - \alpha' = +15' 40.18'' \checkmark$$

$$+ 1'' 14.66'' \checkmark$$

1698 Lunar Parallax.

$$\begin{array}{r}
 \alpha = 10^h 50^m 03.46 \\
 \delta = 12 \quad 27 \quad 32.3 \\
 \delta - \alpha = +1 \quad 37 \quad 28.8 \\
 = + 24^\circ 22' 12''
 \end{array}$$

$$+ \quad \quad \quad 9 \quad 20$$

$$+ 24 \quad 12 \quad 52$$

$$995727$$

$$000000$$

$$004000$$

$$999727$$

$$\delta = 44 \quad 49 \quad 12$$

$$+ 10 \quad 30 \quad 31$$

$$\delta - \delta = 34 \quad 18 \quad 41$$

$$982640$$

$$824205$$

$$975104$$

$$015188$$

$$797137$$

$$\delta - \delta = + 32 \quad 11.1$$

$$\delta = + 11 \quad 02 \quad 43.0 \quad \alpha = 10 \quad 51 \quad 18.6$$

$$\text{North Star } \delta = + 11 \quad 02 \quad 46.8 \quad \alpha = 10 \quad 51 \quad 17.43$$

$$O - C \quad \quad \quad - \quad 3.8 \quad \quad \quad + 0.73$$

$$S' = + 10^\circ 30' 31.9$$

$$\pi \quad 60' 01.6$$

$$986913$$

$$824205$$

$$961556$$

$$000812$$

$$773486$$

$$\delta - \alpha = + 15' 40.18$$

$$= + 1'' 14.55$$

Remeasures with extra slant

4

7C

$$\begin{array}{r} 8.4 \\ 25.6 \\ 15969 \\ 867177 \\ 7677 \\ 59 \\ \hline 25.7287 \end{array}$$

$$\begin{array}{r} 17789 \\ 1505758 \\ 61 \\ 77 \\ \hline 72273 \end{array}$$

$$\begin{array}{r} 16521 \\ 976961 \\ .6661 \\ 06 \\ \hline 8.3254 \end{array}$$

$$\begin{array}{r} 18819 \\ 15539 \\ 3942 \\ 02 \\ \hline 3273 \end{array}$$

$$\begin{array}{r} 1 \\ 11.1 \\ 16.6 \\ 14585 \\ 858179 \\ 71 \\ 84 \\ \hline 16.6007 \end{array}$$

$$\begin{array}{r} 16700 \\ 1265967 \\ 65 \\ 79 \\ \hline 5972 \end{array}$$

$$\begin{array}{r} 982211 \\ 10 \\ 9069 \\ \hline 11.0750 \end{array}$$

$$\begin{array}{r} 13356 \\ 12611 \\ 0403 \\ \hline 0750 \end{array}$$

$$\begin{array}{r} 3 \\ 24.8 \\ 27.3 \\ 18874 \\ 1631621 \\ 21 \\ 55 \\ \hline 27.2550 \end{array}$$

$$\begin{array}{r} 15970 \\ 888889 \\ 89 \\ 61 \\ \hline 2526 \end{array}$$

$$\begin{array}{r} 18638 \\ 1644032 \\ 30 \\ 09 \\ \hline 24.7802 \end{array}$$

$$\begin{array}{r} 15940 \\ 811111 \\ 06 \\ 30 \\ \hline 7823 \end{array}$$

$$\begin{array}{r} 3 \\ 24.8 \\ 17.8 \\ 19751 \\ 1119596 \\ 0696 \\ 40 \\ \hline 17.8543 \end{array}$$

$$\begin{array}{r} 16140 \\ 1466969 \\ 61 \\ 30 \\ \hline 8527 \end{array}$$

$$\begin{array}{r} 15121 \\ 1357976 \\ 71 \\ 00 \\ \hline 24.8457 \end{array}$$

$$\begin{array}{r} 18100 \\ 962028 \\ 22 \\ 75 \\ \hline 8456 \end{array}$$

$$\begin{array}{r} 1 \\ 2 \\ 3 \\ 4 \\ 257280 \\ 165988 \\ 27.2538 \\ 17.8535 \end{array}$$

$$\begin{array}{r} 7C \\ 8.3264 \\ 11.0750 \\ 24.7812 \\ 24.8456 \end{array}$$

1748

Stars - measures

1914 Mar 10.

15357
 11.1 936264
 16.6 64
 70
16.6002

16463
 1212529
 3934
 49
15975

16720
 1320
 15969
11.0749

10519
 976463
 67
6754

24.8 19101
 27.3 1655460
 56
 05
27.2545

19340
 1186069
 59
 39
2524

20236
 1805052
 53
 40
247815

18861
 1102118
 21
 41
7825

24.8 19910
 17.8 1136979
 72
 24
17.8549

19539
 1807973
 70
 29
8536

20029
 1847271
 77
 40
24.8442

16112
 763934
 38
 80
8448

Grade 3.

4

16.5988
 27.2534
 17.8542

11.0752
 24.7820
 24.8445

mean of measures + re-measures

16.5988.
 27.2536
 17.8538

11.0751
 24.7816
 24.8450

2
11
16

2
24
27

3
26
17

1748

Stars - measures

1914 Mar 10.

α
 $\downarrow$ 15357
 111 936264
 116 64
 70
16.6002

γ μ
 16163
 12125
 39 39
 49
.5975

α μ
 16720
 13
 15969
11.0749

α μ
 10519
 976463
 67
6.754

β
 248 19101
 273 1655460
 56
 05
27.2545

19340
 1186069
 59
 39
.2524

20236
 18050
 53 52
 40
24.7815

18861
 11021
 21 18
 41
.7825

β
 248 19910
 178 1136979
 72
 24
17.8549

19539
 1807973
 70
 29
.8536

20029
 18472
 77 71
 40
24.8442

16112
 7639
 38 34
 80
.8448

Grade 3.

1748 Moon-measures

α	α	α	α
1408078	11065	<u>reincarnate</u>	
17.0 79	971118	12200	13320
18.8 12791	11	8692	11991
		10925	7991
<u>18.8712</u>	<u>.8648</u>	18.8733	.8657

2. swatch

6.6	19901	17275	19741	17271
19.5	14579	12630	15849	11160
	70	30	65	66
	19	70	59	63
<u>19.5334</u>	<u>5358</u>	<u>16.6106</u>	<u>6101</u>	

3	18751	17355
16.5	13569	12531
20.3	58	3127
min	60	48
in	16.4806	4822
2		
4	17768	18448
16.6	13918	12289
21.0	1919	7775
	78	28
	16.6147	6156

$\begin{array}{r} 5 \\ \hline 17.0 \quad 16290 \\ 21.6 \quad 978209 \\ \quad \quad 0001 \\ \quad \quad 10 \\ \hline 21.6505 \end{array}$

<u>6</u>	15798	18840
17.4	9625	14972
22.0	1125	6071
	05	22
	17,3815	<u>3865</u>

1748 Moon measures

α	δ	α	δ
1408078	79	11065	run down
70		971118	12200
184	12791	11	8692
			10925
<u>18.8712</u>		<u>8648</u>	<u>18.8733</u>
			<u>8657</u>

2) scratch

166	19901	17275	19741	17271
195	14579	12630	15849	11160
	70	30	6549	6669
	19	70	59	63
<u>19.5334</u>		<u>5358</u>	<u>166106</u>	<u>6101</u>

3			18751	17355
165			13569	1253127
203			58	3
mm			60	48
n			<u>16.4806</u>	<u>4822</u>
2			17768	18448
4			13918	12259
166			1919	7775
21.0			78	28
			<u>16.6147</u>	<u>6156</u>

5			17109	
170	16290		1361700	
21.6	978209		02	
	0001		00	
	10		<u>6501</u>	
	<u>21.6505</u>			

6			15798	18840
174			9625	14972
220			11	6071
			05	22
			<u>17.3818</u>	<u>3865</u>

1748

lunar - measures

d

y

v

d

v

2	15670	19579
18.0	1275032	1252014
22.4	3935	21
	90	65
	<u>22.2937</u>	<u>2946</u>

8	14710	19656
18.5	1088169	1350500
22.4	71	94
may	12	60
	<u>22.3837</u>	<u>3842</u>

9	14720	19630
19.0	1128977	1304950
22.4	69	67
	36	19
	<u>22.3448</u>	<u>3432</u>

focus changed between measures
direct + reversed

1748

lucos. lucasus

d

4

N

d 20

N

7

15670

19579

180

1275032

1252014

229

3935

21

90

65

22.29372946

8

14710

19656

185

1088169

1350500

224

71

94

max

12

60

N

2238373842

7

9

14720

19630

180

11289

1304950

229

6977

67

86

19

22.34483432

Focus changed between measures
direct + reversed.

1
Ext
Cl
H
B
G
S
T
R
G

L
L
T

1748

Times etc

Exp to star	1912 Mar. 29	11 ^h	22 ^m	- 11 ^h	34 ^m
" Moon		11	27	50.6 ^v	11 27 50.8 ^v
Clock slow			1	44.8 ^v	
H. Sid T.		11	29	35.5 ^v	$\theta - \alpha = + 1^h 04^m$
H. Sid T. H. Moon		4	44	31.05 ^v	
G. Sid T.		16	14	06.55 ^v	
Sid T. H. Moon		0	26	04.45 ^v	
Intervals		15	48	02.10 ^v	
Radiation			2	35.31 ^v	
G. H. T.		15	45	26.79 ^v	

From Kant Allen

R. A.

Decl.

Moon 16 ^h	10 ^h	25 ^m	39 ^s 81	+ 14°	05' 21.0"
Kant Allen 22329				15-084	
- 14.5535			- 32.50	+ 3	39.5 ^v
Tabular place	10	25	07.31 ^v	+ 14	09 00.5 ^v

Moon's age 11 days

" parallax 59' 27.7^v

" semidiameter 16 13.7^v

934:13.38^v
979:14.5^v

R

973.7^v

Augmentation

+ 14.5^v

Irradiation (3)

- 0.7^v

R

987.5^v

R

2.1168^v $\alpha = + 1.9$

(1+2) R

2.1172^vR²4.4825^v

1748

Times etc

Ext to Star 1912 Mar 29, 11^h 22^m - 11^h 39^m
 Moon 11 27 50.6 - 11 27 50.8
 Clock slow 1 44.8

H. S. d. T. 11 29 35.5 $\theta - \alpha = +1^{\circ} 04''$
 H. S. d. T. 4 44 31.05
 G. S. d. T. 16 14 06.55
 S. d. T. H. Moon 0 26 04.45
 Intervals 15 48 02.10
 Reduction 2 35.31
 G. H. T. 15 45 26.79

From Mount Allen

R. A.

Decl.

Moon 16^h 10' 25" 39^s 81 +14° 05' 31.0
 Moon 16^h 2 23 29 15^s 084
 -14 55 35 - 32 50 + 3 39.5
 Tabular place 10 25 07.31 +14 09 00.5

Moon age 11 days.

parallax 59' 27.7"
 semidiameter 16 13.7"

$934:13.75$
 $979:17.5$

R 973.7
 Augmentation +14.5
 Irradiation (3) - 0.7
 R 987.5
 R 211.68
 $a = +1.9$ (1+a) R 211.72
 R² 9982.5

see p. 18 vol. XXXIX

mean equations.

a	b	x - 3
+ 1135 + 18.92 + 1 =		- 6.00
+ 2644 + 20.60 + 1 =		+ 5.00
+ 1918 + 15.14 + 1 =		+ 5.00
+ 18.10 + 24.37 + 1 =		- 6.00

4 - 3
- 3.50
+ 3.50
+ 1.00
- 1.00

- 15.09 - 1.68 =	- 11.00
+ 1.08 - 9.23 =	+ 11.00

- 7.00
+ 2.00

- 1.08 - 0.12 =	- 0.79
- 9.35 =	+ 10.21
b =	- 1.09

- 0.50
+ 1.50
- 0.16

- 15.09 = - 11.00 - 1.84 =	- 12.84
a =	+ 0.85

- 15.09 = - 7.00 - 0.27 =	- 7.27
	+ 0.48

- 6.0	+ 5.0	+ 5.0	- 6.0
- 9.7	- 22.5	- 16.3	- 15.4
+ 20.7	+ 22.5	+ 16.5	+ 26.6
+ 5.0	+ 5.0	+ 5.2	+ 5.2

- 3.5	+ 3.5	+ 1.0	- 1.0
- 5.4	- 12.7	- 9.2	- 6.7
+ 3.0	+ 3.3	+ 2.4	+ 3.9
- 5.9	- 5.9	- 5.8	- 5.8

c	o	o - c
+ 8 - 26 + 5 =	- 13	- 26
+ 11 - 16 + 5 =	0	+ 14
+ 21 - 27 + 5 =	- 1	+ 14
+ 23 - 17 + 5 =	+ 11	- 4

+ 5 - 4 - 6 =	- 5	0
+ 6 - 2 - 6 =	- 2	0
+ 13 - 4 - 6 =	+ 3	0
+ 13 - 3 - 6 =	+ 4	0

1748

Plato Constant

	2	3	4	1
x	11.0751 [✓]	24.7876 [✓]	24.8450 [✓]	8.3264
$\bar{x}$	12.8127 [✓]	26.3095 [✓]	26.5585 [✓]	9.8898 [✓]
$x - \bar{x}$	-1.7376 [✓]	-1.5279 [✓]	-1.7135 [✓]	1.5634
y	16.5988 [✓]	27.2536 [✓]	17.8538 [✓]	25.7280
$\bar{y}$	14.3769 [✓]	25.2915 [✓]	15.8966 [✓]	23.4497 [✓]
$y - \bar{y}$	+2.2219 [✓]	+1.9621	+1.9572 [✓]	2.2783

$x - \bar{x}$	-1.7376	-1.5279	-1.7135	-1.5634
$-x$	-11.0751	-24.7876	-24.8450	-8.3264
$-x - \bar{x}$	-12.8127	-26.3095	-26.5585	-9.8898
$-y$	-16.5988	-27.2536	-17.8538	-25.7280
$-y - \bar{y}$	-14.3769	-25.2915	-15.8966	-23.4497
$-y - \bar{y} - x - \bar{x}$	-12.8127	-26.3095	-26.5585	-9.8898
$-y - \bar{y} - x - \bar{x} - x - \bar{x}$	-14.3769	-25.2915	-15.8966	-23.4497
$-y - \bar{y} - x - \bar{x} - x - \bar{x} - x - \bar{x}$	-16.5988	-27.2536	-17.8538	-25.7280
$-y - \bar{y} - x - \bar{x} - x - \bar{x} - x - \bar{x} - x - \bar{x}$	-18.8209	-29.2651	-19.8673	-28.0560

$y - \bar{y}$	+2.2219	+1.9621	+1.9572	+2.2783
$-4y$	-6.8876	-7.8486	-7.9492	-9.1152
$-4y - 4\bar{y}$	-9.1095	-9.8807	-9.9064	-11.3935
$-4y - 4\bar{y} - 4x - 4\bar{x}$	-11.3314	-11.8428	-11.8639	-13.6719
$-4y - 4\bar{y} - 4x - 4\bar{x} - 4x - 4\bar{x}$	-13.5533	-13.8049	-13.8205	-15.9438
$-4y - 4\bar{y} - 4x - 4\bar{x} - 4x - 4\bar{x} - 4x - 4\bar{x}$	-15.7752	-15.7670	-15.7737	-18.2157
$-4y - 4\bar{y} - 4x - 4\bar{x} - 4x - 4\bar{x} - 4x - 4\bar{x} - 4x - 4\bar{x}$	-18.0000	-17.8000	-17.8000	-20.4400

$$b = +194.4$$

$$d = -192.5$$

$$c = +5 \quad f = -6$$

$$\text{Tables } a = +0.7 \quad e = -0.5 \quad a - e = +1.2 \quad b + a = -0.5$$

$$\text{Obs } a = +1.9 \quad e = +3.8 \quad a - e = -1.9 \quad b + a = +1.9$$

moon

$$18.5981 - 39.39 = 18.2042 - 35 + 2.0641 = 20.2648$$

$$20.2639 + 38.79 = 20.6218 - 77 - 2.4286 = 18.4855$$

1748

Plate constants

	2	3	4	1
x	11.0752	247826	248450	8.3264
y	128127	263095	265585	9.8898
x-3	-17376	-15279	-17135	1.5634
y	165988	272536	178538	25.7280
y	143769	252915	158966	23.4497
y-3	+22219	+19629	+19572	2.2783

$x-3$	-19554	-2	$+20646$		
-1.7376	-3245	-20621	-11	-20632	$+14$
-1.5279	-5328	-20607	-25	-20632	$+14$
-1.7135	-3490	-20625	-25	-20650	-4
-1.5634	-5030	-20664	-8	-20672	-26

y-7	+ 1 9 3 26	- 4 4	- 2 4 2 9 2
+ 2 2 2 1 9	+ 2 1 3 7	= + 2 4 3 5 6	- 6 6 = + 2 4 2 9 0 = - 2
+ 1 9 6 2 1	+ 4 7 8 3	= + 2 4 4 0 4	- 1 0 9 = + 2 4 2 9 5 = + 3
+ 1 9 5 7 2	+ 4 7 9 5	= + 2 4 3 6 7	- 7 1 = + 2 4 2 9 6 = + 4
+ 2 2 7 8 3	+ 1 6 0 7	= + 2 4 3 9 0	- 1 0 3 = + 2 4 2 8 7 = - 5

$$b = +1944$$

$$a = -1925$$

$$c = +1 \quad b = -6$$

$$\text{Tables } a = +0.7 \quad b = -0.5 \quad a - b = +1.3 \quad b + a = -0.5$$

$$\text{Obs } a = +1.9 \quad b = +3.8 \quad a - b = -1.9 \quad b + a = +1.9$$

moon

$$18.5981 - 3939 = 182042 - 35 + 2.0641 = 20.2648$$

$$20.2639 + 3579 = 206218 - 77 - 2.4286 = 18.1855$$

pt.	pos. $\angle$	resid.
1	229.1	+181
2	250.0	+4
3	270.0	-20
4	290.4	-58
5	310.9	-65
6	324.9	+51
7	343.5	-27
8	0.0	+122
9	107	+50

1748 moon center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$0 - c$
1	17.0000	-1.6050	2.5760	4.5117	+292
2	16.6104	-1.9946	3.9784	4.5046	+221
3	16.4814	-2.1236	4.5097	4.5097	+272
4	16.6152	-1.9898	3.9593	4.5069	+244
5	17.0000	-1.6050	2.5760	4.5089	+264
6	17.3842	-1.2208	1.4905	4.5181	+356
7	18.0000	-0.6050	0.3660	4.5040	+215
8	18.6050	0.0000	0.0000	4.5114	+289
9	19.0000	+0.3950	0.1560	4.4991	+166

Comp R^2 4.4825

	y	$y - y_0$	$(y - y_0)^2$
1	18.8687	-1.3913	1.9357
2	19.5346	-0.7254	0.5262
3	20.2600	0.0000	0.0000
4	21.0000	+0.7400	0.5476
5	21.6503	+1.3903	1.9329
6	22.0000	+1.7400	3.0276
7	22.2942	+2.0342	4.1380
8	22.3840	+2.1240	4.5114
9	22.3940	+2.0840	4.3431

$$x = 17.0 \quad y = 18.8687$$

$$21.6503$$

$$40.5190$$

$$y_0 = 20.2595$$

$$y - \text{max} = 22.3840$$

$$R = 2.1245$$

$$x - \text{min} = 16.4814$$

$$x_0 = 18.6059$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 18.6050 \\ y_0 = 20.2600 \end{array} \right.$$

1748 Moon Center

	x	$x - x_0$	$(x - x_0)^2$	$(x - x_0)^2 + (y - y_0)^2$	$O - C$
1	170000	-16050	25760	45117	+292
2	166104	-19946	39784	45046	+221
3	164814	-21236	45097	45097	+272
4	166152	-19898	39593	45069	+244
5	170000	-16050	25760	45089	+264
6	173842	-12208	14905	45181	+356
7	180000	-06050	3660	45040	+215
8	186050	00000	00000	45114	+289
9	190000	+03950	1560	44991	+166

Comp K^2 44825

	y	$y - y_0$	$(y - y_0)^2$
1	188687	-13913	19357
2	195346	-07254	5262
3	202600	00000	00000
4	210000	+07400	5476
5	215503	+13903	19329
6	220000	+17400	30276
7	222942	+20342	41380
8	223840	+21240	45114
9	223440	+20840	43431

$$x = 170 \quad y = 188687$$

$$\underline{216503}$$

$$405190$$

$$y_0 = 202595$$

$$y - \text{mean} = 223840$$

$$K = 2.1245$$

$$x - \text{mean} = 164819$$

$$x_0 = 186059$$

$$\text{Center } \left\{ \begin{array}{l} x_0 = 186050 \\ y_0 = 202600 \end{array} \right.$$

Formation of Normals

ab

an

bn

1	+ 2.22	- 467.0	- 406.0
2	+ 1.43	- 440.0	- 159.2
3	- 0.00	- 576.5	+ 0.0
4	- 1.47	- 486.0	+ 180.6
5	- 2.22	- 430.5	+ 367.0
6	- 2.12	- 434.0	+ 620.0
7	- 1.22	- 129.0	+ 436.5
8	+ 0.00	+ 0.0	+ 612.5
9	+ 0.83	+ 66.4	+ 345.5
	- 2.55	- 2896.6	+ 1996.9

1748 Moon Center Conditional Equations

	a	b	0		c	0-c
1	-1.60	-1.39	= +292	+220 - 109	= +111	+181
2	-1.99	-0.72	= +221	+274 - 57	= +217	+4
3	-2.12	+0.00	= +272	+292 + 0	= +292	-20
4	-1.99	+0.74	= +244	+274 + 58	= +332	-88
5	-1.60	+1.39	= +264	+220 + 109	= +329	-65
6	-1.22	+1.74	= +356	+168 + 137	= +305	+51
7	-0.60	+2.03	= +215	+ 83 + 159	= +242	-27
8	+0.00	+2.12	= +289	- 0 + 167	= +167	+122
9	+0.40	+2.08	= +166	- 55 + 171	= +116	+50

Average = 68

Normal Equations

$$\begin{aligned}
 +19.59 - 2.55 &= -2897 \\
 -2.55 + 20.96 &= +1997
 \end{aligned}$$

$$\begin{aligned}
 +2.55 - 0.33 &= -377 \\
 +20.63 &= +1620
 \end{aligned}$$

$$b = +78.5$$

$$+19.59 = -2897 + 200 = -2697$$

$$a = -137.5$$

1748 Moon Center Conditional Equations

	a	b	c		c	o-c
1	-160	-139	+292	+220 - 109 =	+111	+181
2	-199	-072	+221	+274 - 57 =	+217	+4
3	-212	+000	+272	+292 - 0 =	+292	-20
4	-199	+074	+244	+274 + 58 =	+332	-88
5	-160	+139	+264	+220 + 109 =	+329	-65
6	-122	+174	+356	+168 + 137 =	+305	+51
7	-060	+203	+215	+83 + 159 =	+242	-27
8	+000	+212	+289	- 0 + 167 =	+167	+122
9	+040	+208	+166	- 55 + 171 =	+116	+50

Average = 68

Normal Equations

$$\begin{aligned}
 +19.59 - 2.55 &= -2897 \\
 -2.55 + 20.96 &= +1997
 \end{aligned}$$

$$\begin{aligned}
 +2.55 - 0.33 &= -377 \\
 +20.63 &= +1620
 \end{aligned}$$

$$b = +78.5$$

$$+19.59 = -2897 + 200 = -2697$$

$$a = -137.5$$

1748 Moon's Mean Position (1912.0)

$$\begin{array}{r} X_0 = 186050 \\ +a = -69 \\ \hline 185981 \end{array} \quad \begin{array}{r} Y_0 = 202600 \\ +b = +39 \\ \hline 202639 \end{array}$$

From Plate constant $X = 202648$ $Y = 181855$

$$Z = +22648$$

$$\eta = -38145$$

$$\begin{array}{r} \log Z = 0.35503 \\ \log \cos \delta = 998752 \\ \hline 8.50724 \end{array}$$

$$\begin{array}{r} \log \tan \delta = 9.3914 \\ \log Z = 0.7101 \\ \hline 7.0534 \\ 7.1549 \end{array}$$

$$\log(A) = 186027$$

$$\eta_1 = +14$$

$$\alpha - A = +112.49$$

$$\eta_0 = -38159$$

$$A = 1023.03$$

$$\begin{array}{r} \log \eta_0 = 0.58160 \\ \hline 7.33115 \end{array}$$

$$\alpha^0 = 1024.1549$$

$$\log(H-D) = 325045$$

$$\text{Red} = +1.56$$

$$\delta - D = -2940.1$$

$$\alpha' = 1024.1705$$

$$D = +1409.55$$

$$\delta_0 = +1340.149$$

$$\text{Red} = -37$$

$$\delta' = +1340.112$$

P 1200

J P P E -

O J P P E

M J J P P O

I O J J S E

S O P O E

S N P O E

S O P O E

1748 Brown's Mean Position (1912.0)

$$\begin{array}{r}
 X_0 = 186050 \\
 + 69 \\
 \hline
 185981
 \end{array}
 \qquad
 \begin{array}{r}
 Y_0 = 202600 \\
 + 39 \\
 \hline
 202639
 \end{array}$$

From Plate Constant $X = 20.2648$ $Y = 18.4855$

$$3 = +22648$$

$$\eta = -3.8445$$

$$\begin{array}{r}
 \log 3 = 0.35503 \\
 + \cos 5 = 998752 \\
 \hline
 8.50724
 \end{array}$$

$$\begin{array}{r}
 \log \tan 5 = 9.3914 \\
 + 2 = 07101 \\
 \hline
 7.0539 \\
 7.1549
 \end{array}$$

$$(X-A) = 186029$$

$$\eta_1 = +14$$

$$X-A = +11249$$

$$\eta_0 = -3.8459$$

$$A = 102303$$

$$\begin{array}{r}
 \log \eta_0 = 0.58160 \\
 + 733115
 \end{array}$$

$$X'' = 10241549$$

$$(A-D) = 3.25045$$

$$Red = +1.56$$

$$\delta-D = -2940.1$$

$$X' = 102417.08$$

$$D = +140955$$

$$\delta_0 = +1346149$$

$$Red = -37$$

$$\delta' = +13490102$$

Lunar Parallax

$$\begin{array}{rcl}
 1748 & & \\
 \alpha' = 10^h & 24^m & 17.05^s \checkmark \\
 \delta = 11 & 29 & 35.5 \checkmark \\
 \delta - \alpha = +1 & 05 & 18.5 \checkmark \\
 = & +16^\circ & 19' 38'' \checkmark
 \end{array}$$

$$6 \quad 23$$

$$+16 \quad 13 \quad 15 \checkmark$$

$$\begin{array}{r}
 995727 \checkmark \\
 0.00000 \checkmark \\
 \hline
 0.01764 \checkmark \\
 997491 \checkmark
 \end{array}$$

$$\delta - \alpha = 43 \quad 20 \quad 45.5 \checkmark$$

$$\delta = 13 \quad 40 \quad 11.2$$

$$\delta - \alpha = 29 \quad 40 \quad 34.0 \checkmark$$

$$\begin{array}{r}
 982640 \checkmark \\
 823794 \checkmark \\
 969469 \checkmark \\
 \hline
 016342 \checkmark \\
 792245 \checkmark
 \end{array}$$

$$\delta - \delta' = +28 \quad 45.4 \checkmark$$

$$\delta = +14 \quad 08 \quad 56.6 \checkmark$$

$$\text{Ann Ephs } \delta = +14 \quad 09 \quad 00.5 \checkmark$$

$$O-C \quad - \quad 3.9 \checkmark$$

$$\delta' = +13^\circ 40' 11.2'' \checkmark$$

$$\pi = 59' 27.7'' \checkmark$$

$$\begin{array}{r}
 986913 \checkmark \\
 823794 \checkmark \\
 944889 \checkmark \\
 \hline
 001338 \checkmark \\
 756934 \checkmark
 \end{array}$$

$$\alpha - \alpha' = +12' 45.18'' \checkmark$$

$$= +51.01'' \checkmark$$

$$\alpha = 10 \quad 25 \quad 08.06 \checkmark$$

$$\alpha = 10 \quad 25 \quad 07.31 \checkmark$$

$$+0.75'' \checkmark$$

Lunar Parallax

$$\begin{array}{r}
 1748 \\
 \alpha' = 10^h 24^m 17.05^s \\
 \theta = 11 \quad 29 \quad 35.5'' \\
 \alpha - \alpha' = +1 \quad 05 \quad 18.5'' \\
 = +16^0 19' 38''
 \end{array}$$

$$s' = +13^0 40' 16.2''$$

$$\pi = 59' 27.7''$$

$$6 \quad 23$$

$$+16 \quad 13 \quad 15''$$

$$995727$$

$$000000$$

$$001764$$

$$997491$$

$$\delta = 43 \quad 20 \quad 45.5''$$

$$s = 13 \quad 44 \quad 16.2''$$

$$\delta - s = 29 \quad 40 \quad 34.0''$$

$$982640$$

$$823794$$

$$969464$$

$$016342$$

$$792248$$

$$s - s' = +28 \quad 45.4''$$

$$s = +14 \quad 08 \quad 56.6''$$

$$\text{Ann Eph. } s = +14 \quad 09 \quad 00.5''$$

$$O - C = -39$$

$$986913$$

$$823794$$

$$944889$$

$$001338$$

$$756934$$

$$\alpha - \alpha' = +12 \quad 45.18''$$

$$= +51.01''$$

$$\alpha = 10 \quad 25 \quad 08.06''$$

$$\alpha = 10 \quad 25 \quad 07.31''$$

$$+0.75''$$

