

Moon's Place on April 13, 31 A.D. sunset.  
Date =  $0 + 31^y 103^d 6^h$  G.M.T. = 31.2828. Int. fact. = +.04

31 A.D.

Tab	Arg.	D	1	2	3	4	5	6	7	12	16	17	18	19	
2	0	6.8709	9.425	12.576	38.00	67.63	52.70	115.23	39.44	14.34	185.563	40.36	20.16	3.95	
2	S.V.	-	16	+	5	+	4	-	8	-	4	+	1	+	3
3	1931	26.0251	135.742	43.54	74.97	78.85	85.78	31.92	60.90	15.78	79.422	19.30	26.40	4.71	
4	103 <sup>d</sup>	14.6582	34.199	71.40	3.18	85.43	24.03	92.43	26.99	23.25	54.000	26.07	27.60	22.50	
3	-Period	-29.5306	+11.400	23.80	1.06	27.81	8.01	30.81	9.00	7.75	18.000	8.69	9.20	7.50	
3	-Periods		141	156	116	124	128	132	100	24	251	51	38	76	
	Sums	18.0220	49.767	108.48	1.25	4.64	42.49	6.35	36.36	13.11	85.9	43.43	7.35	38.69	

Tab	Arg.	23	24	25	26	27	28	29							
2	0	5.5	410.1	7.5	106.7	1.5	152.7	26.5	116.95	13.5	65.1	3.5	48.7	16.0	188.9
2	S.V.	-	2.0	-	.5	-	3.8	-	3.3	+	5.1	-	.2	+	3.5
3	1931	7.5	302.3	14.0	14.6	24.5	31.1	14.0	32.50	27.0	223.9	2.0	62.5	7.5	202.9
4	103 <sup>d</sup>	10.5	211.	3.5	53.	26.0	51.	13.5	26.	33.0	158.	4.0	94.	15.0	87.
3	0.25		300		84		95		71		129		89		104
3	-Per.	-15	-464	-14	-64	-25.5	-46	-29.5	-86	-34.5	-179.	-9.5	-133	-29	-109
3	Adj.	+ .5	-599	+ .5	-167	+ .5	-189	+ .5	-142	+ 1.				+ 1.	-414
	Sums	9.0	158.4	11.5	26.8	1.5	45.0	25	15.15	4.5	223.1	0.0	161	10.5	63.3

Tab	Arg.	30	31	32	33	34	35	36							
2	0	27.0	159.631	6.5	218.10	15.0	110.15	6.5	72.70	105.0	11.77	4.0	201.97	15.0	38.5
2	S.V.	-	7.14	-	.9	+	6.1	-	.3	-	3.9	-	2.67	+	2.1
3	1931	19.5	160.286	7.0	194.57	24.5	209.90	11.0	4.45	192.5	8.26	2.0	27.75	12.5	90.9
4	103 <sup>d</sup>	20.0	222.	14.0	240.	7.5	43.	14.0	80.	103	0	6.5	201.	7.5	15.
3	0.25		165		147		168		49		7.		139		59
3	-Per.	-27.5	-36	-14.5	-156	-31.5	-209	-29.5	-6	-205.5	-11	-9.5	-63	-15.5	-95
3	Adj.	+ .5	-930	+ 1.	-588			+ 1.	-196			+ .5	-277		
	Sums	12.0	297.77	14.0	54.77	14.5	328.15	3.0	3.85	195.0	11.83	3.5	227.05	4.0	15.5

Tab	Arg.	37	38	39	40	41	42	43							
2	0	9.5	0.1	3.0	92.6	5.0	21.9	4.0	19.43	144.0	0.4	8.0	81.6	2.5	36.0
2	S.V.	+	1.4	-	3.8	-	.2	+	.05	+	.8	+	3.2	-	1.3
3	1931	5.0	247.9	6.5	75.7	5.5	5.5	5.5	291.50	119.5	17.9	19.0	124.5	1.0	156.4
4	103 <sup>d</sup>	12.	189.	3.0	132	4.0	1	7.5	160.	103	0	22.0	111.	11.5	157.
3	0.25		198		150		16		156.		11.		76		95.
3	-Per.	-10.0	-67	-7.0	-76	-5.5	-20.	-19.5	-66.	-173.	-13	-26.5	-115	-9.0	-41.
3	Adj.	+ .5	-396	+ .5	-299			+ .5	-311			+ .5	-152	+ .5	-189
	Sums	7.0	106.4	6.0	71.5	3.5	4.2	4.0	249.98	20.5	4.1	23.0	129.3	7.0	24.1

Tab	Arg.	44	45	46	47	53	54	55							
2	0	5.0	140.7	7.0	97.5	1.5	50.7	31.0	14.37	8.0	15.5	11.5	42.2	10.0	62.27
2	S.V.	-	.2	+	.7	-	.7	-	.03	-	.3	-	.3	-	.92
3	1931	1.0	111.9	4.0	124.5	5.5	63.6	88.5	10.91	14.0	38.9	26.5	5.0	12.5	127.05
4	103 <sup>d</sup>	3.5	131.	7.5	53.	7.0	22.	103.	0	32.0	14	14.0	2.	6.0	41.
3	0.25		90.		67.		34.		13.		20.		24.		65.
3	-Per.	-7.0	-29	-9.5	-8.	-6.5	-47.	-36.5	-13	-35	-32	-29.5	-15	-32	-73
3	Adj.	+ .5	-179	+ 1.	-266			+ .5	-25	+ .5	-39	+ .5	-47	+ 1.	-260
	Sums	3.5	86.4	10.0	68.7	1.5	7.6	223	13.25	19.5	17.1	23.0	10.9	29.5	34.40

Tab	Arg.	56	57	58	59	60	61	62							
2	0	7.5	68.5	12.5	49.3	349.4	126.0	367	4.5	16.0	23.0	14.7	2.5	141 <sup>c</sup>	
2	S.V.	-	.3	+	.6	+	.9	-	.53	-	2.6	-	2.3	-	3
3	1931	1.5	1.6	6.5	96.3	279.9	153.0	230	1.5	91.5	2.0	50.5	8.0	28	
4	103 <sup>d</sup>	11.5	51.	6.5	82.	103.	103.	0	13.5	105.	19.0	30.	6.0	180	
3	0.25		40.		56		3		86.		27.			103	
3	-Per.	-10.0	-21.	-16.	-5	-2190.5	-188.0	-2.	-14.5	-125.	-27.5	-43.	-9.5	-64	
3	Adj.	+ .5	-80	+ 1.	-224				+ .5	-53					
	Sums	1.0	38.8	10.5	55.2	733.5	6.0	4.4	5.0	170.9	17.0	23.9	7.5	180	

Tab	Arg.	71	72	73	74	76	77	82							
2	0	27.0	106.42	15.0	35.84	4.0	202.0	5.5	48.6	3.0	18.3	9.5	0.0	6257 <sup>d</sup>	
2	S.V.	-	4.77	+	1.99	-	2.7	-	.2	-	.7	+	.2	+	0
3	1931	19.5	106.36	0.5	99.05	4.0	251.2	11.5	14.0	1.0	33.2	7.5	43.4	1329	
4	103 <sup>d</sup>	20.0	148.	7.5	14.	6.5	201.	10.5	25.	3.0	26.	12.0	31.	103	
3	0.25		110		55		139		36		30		33		
3	-Per.	-27.5	-24.	-31.5	-36.	-9.5	-63.	-15.0	-55.	-7.0	-15.	-10.0	-11.	-6800	
3	Adj.	+ .5	-220	+ .5	-109	+ 1.	-554			+ .5	-59	+ .5	-65		
	Sums	12.0	198.01	23.5	96.88	6.0	173.5	12.5	68.4	0.5	32.8	9.5	30.6	889	

Tab	Arg.	83	84	L	-δ	ω					
2	0	6178 <sup>d</sup>	6185 <sup>d</sup>	295401"	1192540"	310177"					
2	S.V.	+	2	+	2	-	83	+	86	+	426
3	1931	4933	3218	153150	1225860	560322					
4	103 <sup>d</sup>	103	103	997808	14635	41309					
3	0.25			11859	48	100					
3	-Per.	-6800	-6800	-1296000	-1296000	-1296000					
	Sums	4416	2708	162135	1142169	912334" = 253° 25' 34"					

111	Tab	Arg.	17.5	18.0	18.5	Date
1	50	57	54	51		
2	109	8	6	5		
3	1	3	3	2		
4	5	11	11	12		
5	42	9	7	5		
6	6	10	11	11		
7	36	2	3	3		
Sum	100	95	89			
16	86	58	58	58		
17	43	1	2	2		
Sum	159	155	149			
Int. fact. +.04					0	
k x 1st sum					5	
Σ <sub>1</sub> = sum					160	
40	4.0	250 <sup>c</sup>	232			
41	20.5	4	97			
42	28.0	129	67			
43	7.0	24	68			
44	3.5	86	0			
45	10.0	69	18			
46	1.5	8	5			
47	223.0	13	157			
Σ <sub>10</sub>					76	
Σ <sub>3</sub> { Sum					880	
Σ <sub>3</sub> { k x 1st sum					7	
Σ <sub>3</sub> { Sum					880	
Σ <sub>3</sub> { k x 1st sum					41	
Σ <sub>3</sub>					887	
Longitude = sum					53° 36' 41"	

For Tab. P23 VI  
Date = 1900-31 = -1869  
Date = 31.282  
7 Per. = 7 x 270.95 = 1896.65  
Arg. = 1896.65 + 31.282 = 1927.93  
k = -.0000248 x -1869 = +.0464

For Tab. P24 VI  
Date = 31.282  
8 Per. = 8 x 257.14 = 2057.12  
Arg. = 2057.12 + 31.282 = 2088.402

IV	Tab	Arg.	17.5	18.0	18.5	Date
1	49.7	110	108	105		
2	108.5	36	32	28		
3	1.2	44	43	40		
4	4.6	13	14	15		
5	42.4	16	13	11		
6	6.4	9	10	10		
7	36.4	6	7	7		
Sum	234	227	216			
12	85.9	150	153	155		
13	43.4	140	140	140		
14	7.4	1	1	2		
15	38.7	153	161	168		
Sum	678	682	681			
Int. fact. +.04					0	
k x 1st sum					11	

Moon's Place on April 13, 31 A.D., sunset.  
Date = 0 + 31<sup>d</sup> 103<sup>h</sup> 6<sup>m</sup> G.M.T. = 31<sup>d</sup> 2828. Int. fact. = +.04

Tab	Arg.	D	1	2	3	4	5	6	7	12	16	17	18	19
2	0	6.8709	9.425	12.576	38.00	67.63	52.70	115.23	39.44	14.34	195.563	40.36	20.16	3.95
2	S.V.	-10	+1	-5	+4	-8	+9	-4	+3	-1	+84	+1	-1	+3
3	1931	26.0251	135.742	43.54	74.97	73.85	85.78	31.92	60.90	15.78	79.422	19.30	26.40	4.71
4	103 <sup>d</sup>	14.6582	34.199	71.40	3.18	89.43	24.03	92.43	26.99	23.25	54.000	26.07	27.60	22.50
3	0.25	29.5306	11.400	23.80	1.06	27.81	8.01	30.81	9.00	7.75	18.000	8.61	9.20	7.50
3	-Periods		141	156	116	124	128	132	100	24	251	51	38	76
	Sums	18.0220	49.767	108.48	1.25	4.64	42.49	6.35	36.36	13.11	85.9	43.43	7.35	38.69

Tab	Arg.	23	24	25	26	27	28	29							
2	0	5.5	410.1	7.5	106.7	1.5	152.7	26.5	116.95	13.5	65.1	3.5	48.7	16.0	188.9
2	S.V.	-2.0	-	.5	-	3.8	-	3.3	-	5.1	-	.2	-	3.5	-
3	1931	7.5	302.3	14.0	14.6	24.5	31.1	14.0	32.50	27.0	223.9	2.0	62.5	7.5	202.9
4	103 <sup>d</sup>	10.5	211.	3.5	53.	26.0	51.	13.5	26.	39.0	158.	4.0	94.	15.0	87.
3	0.25		300		84		95		71		129		89		104
3	-Per.	-15	-464	-14	-64	-25.5	-46	-29.5	-86	-34.5	-179.	-9.5	-133	-29	-109
3	Adj.	+ .5	-599	+ .5	-167	+ .5	-189	+ .5	-142	+ 1.	-	+ 1.	-	414	-
	Sums	9.0	158.4	11.5	26.8	1.5	45.0	25	15.15	4.5	223.1	0.0	161	10.5	63.3

Tab	Arg.	30	31	32	33	34	35	36							
2	0	27.0	159.631	6.5	218.10	15.0	110.15	6.5	72.70	105.0	11.47	4.0	201.97	15.0	38.5
2	S.V.	-	7.14	-	.9	+ 6.1	-	.3	-	3.9	-	2.67	-	2.1	-
3	1931	19.5	160.286	7.0	194.57	24.5	209.90	11.0	4.45	192.5	8.26	2.0	27.75	12.5	90.9
4	103 <sup>d</sup>	20.0	222.	14.0	240.	7.5	43.	14.0	80.	103	0	6.5	201.	7.5	15.
3	0.25		165		147		168		44		7.		139		59
3	-Per.	-27.5	-36	-14.5	-156	-31.5	-209	-29.5	-6	-205.5	-11	-9.5	-63	-15.5	-95
3	Adj.	+ .5	-390	+ 1.	-588	+ 1.	-196	+ 1.	-196	+ .5	-277	+ .5	-277	-	-
	Sums	12.0	297.77	14.0	54.77	14.5	328.15	3.0	3.85	195.0	11.83	3.5	227.05	4.0	15.5

Tab	Arg.	37	38	39	40	41	42	43							
2	0	9.5	0.1	3.0	92.6	5.0	21.9	4.0	194.3	144.0	0.4	8.0	91.6	2.5	36.0
2	S.V.	-	1.4	-	3.8	-	.2	+ .05	-	.8	-	3.2	-	1.3	-
3	1931	5.0	247.9	6.5	75.7	5.5	5.5	5.5	291.50	119.5	17.9	19.0	124.5	1.0	156.4
4	103 <sup>d</sup>	12.	189.	3.0	132	4.0	1	7.5	160.	103	0	22.0	111.	11.5	157.
3	0.25		198		150		16		156.		11.		76		95.
3	-Per.	-10.0	-67	-7.0	-76	-5.5	-20.	-13.5	-66.	-173.	-13	-26.5	-115	-9.0	-41.
3	Adj.	+ .5	-396	+ .5	-299	+ .5	-311	+ .5	-311	+ .5	-152	+ .5	-152	+ .5	-189
	Sums	7.0	106.4	6.0	71.5	3.5	4.2	4.0	249.98	20.5	4.1	23.0	129.3	7.0	24.1

Tab	Arg.	44	45	46	47	53	54	55							
2	0	5.0	140.7	7.0	97.5	1.5	50.7	31.0	14.37	8.0	15.5	11.5	42.2	10.0	62.27
2	S.V.	-	.2	+ .7	-	.7	-	.03	-	.3	-	.3	-	.92	-
3	1931	1.0	111.9	4.0	124.5	5.5	63.6	88.5	10.91	14.0	38.9	26.5	5.0	12.5	127.05
4	103 <sup>d</sup>	3.5	131.	7.5	53.	7.0	22.	103.	0	32.0	14	14.0	5.0	6.0	41.
3	0.25		90.		67.		34.		13.		20.		24.		65.
3	-Per.	-7.0	-29	-9.5	-8.	-6.5	-47.	-36.5	-13	-35	-32	-29.5	-15	-	-5
3	Adj.	+ .5	-179	+ 1.	-266	+ .5	-25	+ .5	-39	+ .5	-47	+ .5	-47	+ 1.	-260
	Sums	3.5	86.4	10.0	68.7	1.5	7.6	22.3	13.25	19.5	17.1	23.0	10.9	29.5	34.40

Tab	Arg.	56	57	58	59	60	61	62						
2	0	7.5	68.5	12.5	49.3	349.4	126.0	5.67	4.5	16.0	23.0	14.7	2.5	141
2	S.V.	-	.3	+ .6	+ .9	-	.53	-	2.6	-	2.3	-	8.0	3
3	1931	1.5	1.6	6.5	96.3	279.9	153.0	2.30	1.5	91.5	2.0	50.5	6.0	28
4	103 <sup>d</sup>	11.5	51.	6.5	82.	103.	0	13.5	105.	19.0	30.	12.0	31.	103
3	0.25		40.		56		3		86.		27.		103	
3	-Per.	-10.0	-21.	-16.	-5	-26.5	-188.0	-2.	-14.5	-125.	-27.5	-49.	-9.5	-64
3	Adj.	+ .5	-80	+ 1.	-224	+ .5	-554	+ .5	-59	+ .5	-65	+ .5	-65	-
	Sums	1.0	38.8	10.5	55.2	733.5	6.0	4.4	5.0	170.9	17.0	23.9	7.5	180

Tab	Arg.	71	72	73	74	76	77	82						
2	0	27.0	106.42	15.0	35.84	4.0	202.0	5.5	48.6	9.0	18.3	9.5	0.0	62.57
2	S.V.	-	4.77	+ 1.99	-	2.7	-	.2	-	.7	-	+ .2	-	0
3	1931	19.5	106.36	0.5	99.05	4.0	251.2	11.5	14.0	1.0	33.2	7.5	43.4	132.9
4	103 <sup>d</sup>	20.0	148.	7.5	14.	6.5	201.	10.5	25.	3.0	26.	12.0	31.	103
3	0.25		110		55		139		36		30		33	
3	-Per.	-27.5	-24.	-31.5	-35.	-9.5	-63.	-15.0	-55.	-7.0	-15.	-10.0	-11.	-6800
3	Adj.	+ .5	-220	+ .5	-109	+ 1.	-554	+ .5	-59	+ .5	-65	+ .5	-65	-
	Sums	12.0	198.01	23.5	96.88	6.0	173.5	12.5	68.4	0.5	32.8	9.5	30.6	859

Tab	Arg.	83	84	L	-P	W
2	0	6178 <sup>d</sup>	6185 <sup>d</sup>	295401"	1192540"	310177"
2	S.V.	+ 2	+ 2	- 83	+ 86	+ 426
3	1931	4933	3218	153150	1223860	560322
4	103 <sup>d</sup>	103	103	997808	19635	41309
3	0.25			11859		100
3	-Per.	-6800	-6800	-1296000	-1296000	-1296000
	Sums	4416	2708	162135	-1142169	912334" = 253° 25' 34"

III	Arg.	17.5	18.0	18.5
1	50	57	54	51
2	109	8	6	5
3	1	3	3	2
4	5	11	11	12
5	42	9	7	5
6	6	10	11	11
7	36	2	3	3
Sum	100	95	89	
16	86	58	58	58
17	43	1	2	2
Sum	159	155	149	
Int. fact. +.04				0
k x 1st sum				5
Σ <sub>1</sub> = sum		160		
40	4.0	250	232	
41	20.5	4	97	
42	23.0	129	67	
43	7.0	24	68	
44	3.5	86	0	
45	10.0	69	18	
46	1.5	8	5	
47	223.0	13	157	
Σ <sub>10</sub>			76	
Σ <sub>3</sub> { Sum		880		
Tab. 47 x k = 7				

IV	Arg.	d	Date	d
1	49.7	170	108	105
2	108.5	36	32	28
3	1.2	44	43	40
4	4.6	13	14	15
5	42.4	16	13	11
6	6.4	9	10	10
7	36.4	6	7	7
Sum		234	227	216
12	85.9	150	153	155
13	43.4	140	140	140
14	7.4	1	1	2
15	38.7	153	161	168
Sum		678	682	681
Int. fact. +.04				0
k x 1st sum				11
Σ <sub>4</sub> = sum		693		
Σ <sub>2</sub>		192114		
P34 ÷ 10		45		
P35 (P35-10 <sup>3</sup> )		-6		
19 + 9k		19		
-Ω		1142169		
S = sum		1335034"		
		1296000		

IV	Arg.	at Date	Value
19	19.5	17.1	19
20	23.0	10.9	130
21	29.5	34.4	9877
22	1.0	38.8	64
23	10.5	55.2	31
24	733.5	96	96
25	6.0	4.4	683
26	5.0	170.9	101

April 13 sunset, 31 A.D. 31 A.D.

"ss" = 6:00 G.M.T. Tr. Per. = 3.19

Arguments (Simon Newcomb)

Sun

Constant	Mercury I	Venus II	Mars III	Jupiter IV	Saturn V	Moon's Anomaly VI	Earth's Anom. VII	VIII	IX	k	Mean Obliquity ε	(a)
Tab. I 0	23.4	89.14	145.42	150.70	30.9	21.87	1.6	10.0	9.0	-1.822	+ 0° 14' 35.51"	+ 2.08
" II 1931	0.4	177.91	66.97	43.20	32.4	11.64	1.1	7.2	6.7	-0.822	23 26 53.74	
" V												
" VI						8.61		11.4	11.59			
Total	23.8	267.05	212.39	193.90	63.3	42.12	2.7	28.6	27.29	-2.644	23° 41' 29.25"	+2.08
Per. of Arg.		180	180	180	60	30		24	24			
		87.05	32.39	13.90	3.3	12.12		4.6	3.29			
						(30)		(12)	(12)			

Variable	M	A	D	U	B	N	2C	D	L	τ
Tab. I 0	31.3185	320.50	6.805	4.01	4.3	6253.0	5.08	6.2	-1° 47' 46.17"	- <sup>h</sup> 7 <sup>m</sup> 11.078 <sup>s</sup>
" II 1931	2.7740	574.56	13.495	8.14	21.2	6628.4	3.32	8.75	0 20 56.91	1 25.628
" III	103.	103	103.	103.	103.	103.	103.	103.	20 21 18.03	1 21 25.202
" IV	.25	.25	.25	.25	.2	.2	.25	.25	14 47.08	59.139
" V										
Total	137.3425	998.31	123.550	115.40	128.7	12984.6	111.65	118.20	19° 9' 15.85"	1 16 38.89
Per. of Arg.		583.92	-118.122	-108.85	96.8	6798.4	109.07	109.29		
	(188)	414.39	5.428	6.55	31.9	6186.2	2.58	8.91		

Longitude				
g	120	128	136	144
Tab. VII, Arg. I	.06	.06	.06	.07
" VIII, " II	7.75	7.96	8.15	8.34
" IX, " III	7.07	7.34	7.57	7.77
" X, " IV	6.08	7.51	9.02	10.50
" XI, " V	.53	.51	.52	.53
Σ	21.49	23.38	25.32	27.21
		+ .96		
Δ'	+189	+ 5	+ 194	- 5
Δ''				+ 189
Sum for g = 131.97		<b>24.34</b>		
D	4	5	6	7
Tab. XIII, Arg. VI	1.14	1.07	1.00	.95
" XIV, " VII	.24	.25	.27	.30
Σ	1.38	1.32	1.27	1.25
		- .03		
Δ'	- 6	- 5	- 2	
Δ''		- 1	- 3	
Σ for D = 5.428		<b>1.29</b>		
L	19° 9' 15.85"			
Tabs. VII to XI		24.34		
" XIII and XIV		1.29		
" XII, Arg. A		6.37		
" XV, " D		10.81		
" XVI, " M	+ 3	35.07	-12.84 x (-16.75)	
" XVII, " M	1 26	56.90		
Nut.		- 12.48		
Λ		<b>20° 31' 18.15"</b>		

Nutation		
	In Long. (δψ)	In Ob. (δe)
Tab. XXXII, Arg. N	- 11.57	+ 6.73
" XXXIII, day+k (10.36)	- .70	+ .28
" XXXIV, D and IX	- .17	+ .04
" XXXV, D and IX	- .01	+ .04
" XXXVI, D and VI	- .03	+ .01
" XXXVII, C	- .03	+ .01
Σ for Nut.	<b>-12.48</b>	<b>+ 7.06</b>
Precession		

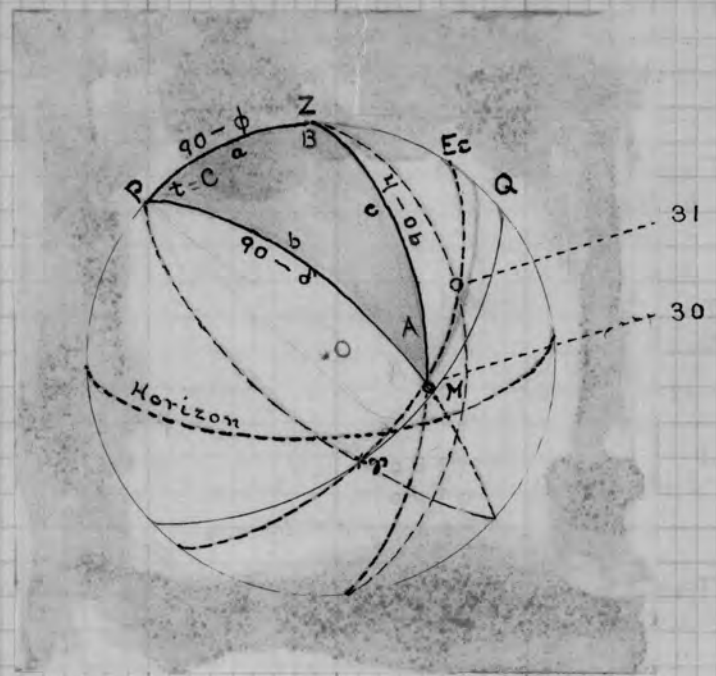
Sidereal Time		
τ =	1 <sup>h</sup> 16 <sup>m</sup> 38.89 <sup>s</sup>	
Nut. in R.A.		
Time	6 30	
L <sub>0</sub>	2 20 54	
	9 51 32	
30'	=	4.92
		9 51 37 <sup>s</sup>

Obliquity of Ecliptic	
ε (Tables I and II)	23° 41' 29.25"
(a) x fraction of cent. .31	.64
δe	7.06
ε	<b>23° 41' 36.95"</b>

17 cent. + .68 cent. + (365-103 = 262 = .717) = -17.68717 =  
 -17.70<sup>2</sup> x .003 + (-17.68717) = -16.748  
 -12.84 x (-16.76) = 215.20 = 3' 35.20"

Latitude

	9	120	128	136	144
Tab. XXVIII, Arg. II		+ .03	+ .06	+ .10	+ .13
" XXIX, " IV		- .12	- .14	- .15	- .16
$\Sigma$		- .09	- .08	- .05	- .03
$\Delta'$		- 1	"	- 3	- 2
Sum for $g = 131.97$			- .07		
Tab. XXVIII and XXIX			"		
" XXX, Arg. VIII and U			- .07		
" XXXI, " B			+ .15		
			+ .00		
Latitude			+ 0.08		



**Sun**

Equations for  $a$  and  $\delta$  (Brown)

- $\sin \delta = \sin \omega \sin \lambda \cos \beta + \cos \omega \sin \beta$
- $\cos \delta \sin a = \cos \omega \sin \lambda \cos \beta - \sin \omega \sin \beta$
- $\cos \delta \cos a = \cos \beta \cos \lambda$

1  $\sin \delta =$

$\log \sin \omega = 9.6040593$	$\log \cos \omega = 9.9617568$
$\log \sin \lambda = 9.5447643$	$\log \sin \beta = 4.6855749 - 10$
$\log \cos \beta = 0.0000000$	$4.6473317 =$
$9.1488236 =$	$0.0000044$ antilog
$0.1408717$ antilog	$0.1408717$
$\sin \delta =$	$0.1408761$
$\log \sin \delta = 9.1488373$	
$\delta = 8^\circ 5' 55''$	

2  $\cos \delta \sin a =$

$\log \sin \omega = 9.6040593$	
$\log \cos \omega = 9.9617568$	$\log \sin \beta = 4.6855749$
$\log \sin \lambda = 9.5447643$	$4.2896342 =$
$\log \cos \beta = 0.0000000$	$0.0000019$ antilog
$9.5065211 =$	sub. $0.3210118$
$0.3210118$ antilog	$0.3210099 =$
	$\log 9.5065185$
	$\log \cos \delta = 9.9956471$
	$\log \sin a = 9.5108714 = 18^\circ 55' 11''$

$\log \cos \delta = 9.9956471$	$\log \cos \beta = 0.0000000$
$\log \cos a = 9.9758791$	$\log \cos \lambda = 9.9715262$
$9.9715262$	

$a_e - a_o = 54^\circ 26' 25''$

$18 55 11$

$35^\circ 31' 14'' = 35.521 = 2.368$  (S.T.)

$\times 1.032$

$2.4437 = 2^h 26^m 37^s$

$\omega = 23^\circ 41' 37.5''$  31 A.D.

$\lambda_o = 20 31 18''$

$\beta_o = + 0.08$

$\log \sin \lambda = 9.5447643$ ✓
$\log \cos \lambda = 9.9715262$ ✓
$\log \sin \omega = 9.6040593$ ✓
$\log \cos \omega = 9.9617568$ ✓
$\log \sin \beta = 4.6855749$ ✓
$\log \cos \beta = 0.0000000$ ✓
$\log \sin \delta = 9.1488373$
$\log \cos \delta = 9.9956471$
$\log \sin a = 9.5108714$
$\log \cos a = 9.9758791$

A.D.	Hor. Par.	Tr. Per.
28, Apr. 14, 6:30 p.m.	56' 51"	1 h 1 m 13 s
30 Mar. 25, 6:00 p.m.	54' 0"	2 h 9 m 14 s
31 Apr. 13, 6:00 p.m.	54' 13"	2 h 26 m 37 s
29 Apr. 5, 6:15 p.m.		1.95

Formosa Lake  
7:00 pm Green

Moon's  $\alpha$  &  $\delta$  31 A.D.

57° 7' 33"

1  $\sin \delta = \sin \omega \sin \lambda \cos \beta + \cos \omega \sin \beta$   $\omega = 23^\circ 41' 30''$   
 2  $\cos \delta \sin \alpha = \cos \omega \sin \lambda \cos \beta - \sin \omega \sin \beta$   $\lambda = 53^\circ 36' 41''$   
 3  $\cos \delta \cos \alpha = \cos \beta \cos \lambda$   $\beta = 1^\circ 5' 12''$

1  $\sin \delta =$   
 $\log \sin \omega = 9.6040257$   $\log \cos \omega = 9.9617632$   $\log \cos \lambda = 9.7732442$   
 $\log \sin \lambda = 9.9058022$   $\log \sin \beta = 8.2779477$   $\log \sin \omega = 9.6040257$   
 $\log \cos \beta = 9.9999219$   $8.2397109 =$   $\log \cos \omega = 9.9617632$   
 $9.5097498 =$   $.0173664$   $\log \sin \beta = 8.2779477$   
 add  $.3234073$  antilog  
 $.0173664$   
 $.3407737$   
 $\log \sin \delta 9.5324661 = 19^\circ 55' 26'' (\delta)$   
 $\log \sin \lambda = 9.9058022$   $\log \cos \lambda = 9.7732442$   
 $\log \cos \alpha = 9.7999711$   $\log \cos \beta = 9.9999219$   
 $\log \sin \alpha = 9.8897787$   $\log \cos \alpha = 9.7999711$

2  $\cos \delta \sin \alpha =$   
 $\log \cos \omega = 9.9617632$   $\log \sin \omega = 9.6040257$   
 $\log \sin \lambda = 9.9058022$   $\log \sin \beta = 8.2779477$   
 $\log \cos \beta = 9.9999219$   $7.8819734 =$   
 $9.8674873 =$   $.0076203$  antilog  
 $.7370336$  antilog  
 sub.  $.0076203$   
 $.7294133 = \log 9.8629737$   
 $\log \cos \delta 9.9731950$  sub.  
 $\log \sin \alpha 9.8897787 = 50^\circ 52' 26''$

3  $\log \cos \delta = 9.9731950$   $\log \cos \beta = 9.9999219$   
 $\log \cos \alpha = 9.7999711$   $\log \cos \lambda = 9.7732442$   
 $9.7731661$   $9.7731661$

1.  $\sin \delta =$   $\omega = 23^\circ 41' 30''$  2.E.D.  
 $\log \sin \omega 9.6040257$   $\log \cos \omega 9.9617632$   $\lambda = 57^\circ 7' 33''$   
 $\log \sin \lambda 9.9242093$   $\log \sin \beta 8.3863222$   $\beta = +1^\circ 23' 41''$   
 $\log \cos \beta 9.9998713$   $8.3480854$   
 $9.5281063$   $.02228873$   
 $.3373698$   
 $.02228873$   
 $.3596585$   
 $\log \sin \delta 9.5558904 = 21^\circ 4' 45'' +$

2  $\cos \delta \sin \alpha =$   
 $\log \cos \omega 9.9617632$   $\log \sin \omega 9.6040257$   
 $\log \sin \lambda 9.9242093$   $\log \sin \beta 8.3863222$   
 $\log \cos \beta 9.9998713$   $7.9903479$   
 $9.8858438$   $.00978023$   
 $.76885385$   
 $.00978023$   
 $.7590737 = \log 9.8802839$   
 $\log \cos \delta 9.9699207$   
 $\log \sin \alpha 9.9103632 = 54^\circ 25' 25'' = 3^h 37^m 44^s$

$\log \cos \delta 9.9699207$	$\log \cos \beta 9.9998713$	10 <sup>h</sup> 22 <sup>m</sup> 34 <sup>s</sup>
$\log \cos \alpha 9.7645872$	$\log \cos \lambda 9.7346365$	9 37 32
$9.7345079$	$9.7345078$	45 2
		2 20 54
		3 5 56
		51
		2 14 56

31 A.D. April 13 sunset

1.  $\sin \delta = \sin \omega \sin \lambda \cos \beta + \cos \omega \sin \beta$   
 2.  $\cos \delta \sin \alpha = \cos \omega \sin \lambda \cos \beta - \sin \omega \sin \beta$   
 3.  $\cos \delta \cos \alpha = \cos \beta \cos \lambda$

$\omega = 23^\circ 41' 30''$   
 $\lambda = 53^\circ 36' 41''$   
 $\beta = +0^\circ 3' 57''$

1.  $\sin \delta =$   
 $\sin \omega = 9.6040257$   $\cos \omega = 9.9617632$   
 $\sin \lambda = 9.9058023$   $\sin \beta = 7.0603231$   
 $\cos \beta = 9.9999997$   $7.0220863 =$   
 $9.5098277 =$

$-\delta = 1142169''$   
 $\omega = 912334'' = 253^\circ 25' 34''$

add  $.3234653$  antilog  
 $.0010522$  antilog  
 $.3245175 =$   
 $\log \sin \delta = 9.5112381 =$   
 $+18^\circ 56' 10'' = \delta$

$\log \alpha$  34"  
 $\sin \lambda = 9.9058023$   
 $\cos \lambda = 9.7732442$   
 $\sin \omega = 9.6040257$   
 $\cos \omega = 9.9617632$   
 $\sin \beta = 7.0603231$   
 $\cos \beta = 9.9999997$   
 $\sin \delta = 9.5112381$   
 $\cos \delta = 9.9758385$   
 $\sin \alpha = 9.8914566$   
 $\cos \alpha = 9.7974097$

2.  $\cos \delta \sin \alpha =$   
 $\cos \omega = 9.9617632$   $\sin \omega = 9.6040257$   
 $\sin \lambda = 9.9058023$   $\sin \beta = 7.0603231$   
 $\cos \beta = 9.9999997$   $6.6643488 =$   
 $9.8675652 =$

$.0004617 =$  antilog

sub.  $.7371658 =$  antilog  
 $.0004617$   
 $.7367040 = 9.8672930$  sub.  
 $\cos \delta = 9.9758385$   
 $9.8914566 = \sin \alpha \therefore \alpha = 51^\circ 9' 21''$

3.  $\cos \alpha = 9.7974097$   $\cos \beta = 9.9999997$   
 $\cos \delta = 9.9758385$   $\cos \lambda = 9.7732442$   
 $9.773245647$   $9.7732439$

4.  $\cos t (H_c) = \sin 50' \sec \delta \sec \phi - \tan \delta \tan \phi$   
 $(H_c \text{ of moon at moonset})$   
 S.T. (Newcomb) - moon's  $\alpha =$  moon's  $t$   
 $\cos t =$   
 $\sin 50' = 8.1626808$   
 $\sec \delta = 0.0241635$   
 $\sec \phi = 0.0704793$   
 $8.2573236 =$

31 A.D. April 13 sunset

$\phi = 31^\circ 46'$   
 $L = -2^h 20^m 9^s$   
 $\log \alpha$   
 $\cos \delta = 9.9758385$   
 $\sec \delta = 0.0241635 = \frac{1}{\cos}$   
 $\sec \phi = 0.0704793$   
 $\tan \delta = 9.5353964$   
 $\tan \phi = 9.7918458$   
 $\sin 50' = 8.1626808$

$.0180852 =$  antilog  
 $-.2124434$   
 $-.1943572 =$   
 $\log \cos t = 9.2886006 = +78^\circ 47' 34''$   
 $t = +101^\circ 12' 26''$   
 $\tan \delta = 9.5353964$   
 $\tan \phi = 9.7918458$   
 $9.3272432 =$   
 $.2124434 =$  antilog

Angles

$\omega$ (obliquity)	$= 23^\circ 41' 30''$
$\lambda$	$= 53^\circ 36' 41''$
$\beta$	$= +0^\circ 3' 57''$
$-\delta$	$= 1142169''$
$\omega$ (perigee)	$= 912334'' = 253^\circ 25' 34''$
$\delta$	$= +18^\circ 56' 10''$
$\alpha$	$= 51^\circ 9' 21''$
$t$	$= 78^\circ 47' 34''$
$\phi$	$= 31^\circ 46'$
Long. Jer.	$= -2^h 20^m 9^s$
S.T. cor.	$= 23^s 15^m$
$\delta$	$= 153831'' = 42^\circ 43' 51''$

I	$-7^m 11.078$
II	$+1 25.628$
III	$1^h 21 25.262$
IV	$59.139$
L.M.T. 6 <sup>h</sup> 0	
$\pi = 7 16 39$	
$\alpha = 3 24 37$	
$H = 3 52 2$	