

XXXVIII. *An Account of the Eclipse of the Sun, April 1, 1764: In a Letter to the Right Honourable George Earl of Macclesfield, Pres. R. S. from Mr. James Ferguson, F. R. S.*

My Lord,

Read Nov. 17, 1763. **I** Beg leave to present to the Royal Society a projection of the eclipse of the Sun, which will be on the 1st of April 1764. The diagram shews the time and phases of that eclipse, for the Royal Observatory at Greenwich, and the calculation is from Meyer's Tables.

According to Flamsteed's Tables, and Dr. Halley's, and M. De la Caille's, the eclipse should be annular at London; and De la Caille, in a map in his Ephemerides, makes it almost Central. But, according to Meyer's Tables, the appearance will be very different; for the southern limb of the Moon will be about the 20th part of a digit over the southern limb of the Sun; and Meyer makes the beginning, greatest obscuration, and ending, to be at least a quarter of an hour sooner than Flamsteed, Halley, and M. De la Caille do.

As the passage of the shadow will be north-eastward over Europe, and all these authors make it's center to pass more or less eastward of London and Greenwich; and since there is such a great difference in Meyer's time from that of all the others, and in
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the phasis at the greatest obscuration ; a clear sky is much to be wished for : and it might be proper to have observers placed about ten or twelve miles from one another, all the way between Greenwich and Deal, that the truth may be found by observation. For, if Meyer's tables are right, all the others must want much correction.

About five years ago, I delineated the path of the Moon's shadow over all the parts of the earth, where it will pass in this eclipse, from sun-rising till sun-setting, according to mean or equal time. I constructed the map much upon the same principle with that of Manfredi and De la Caille, and took most of the lunar elements from Meyer's tables.

According to this projection, the center of the penumbra will first touch the earth at sun-rise, in the Atlantic Ocean, between the Caribbee Islands and those of Cape Verd ; in 47 degrees west longitude from Greenwich, and 18 degrees north latitude ; from which it will go on, almost parallel to the equator, for about 20 degrees eastward : then it will bend north-eastward, and pass over the south of Portugal, near Cape St. Vincent : from thence, in its progress, it will go over Valadolid, cross the Bay of Biscay a little west of Bayonne, pass over Rochelle, then midway between Rouen and Paris, go over Holland a little west of Amsterdam, cross the German Sea about 40 miles west of the mouth of the river Elbe, enter Denmark, cross the Baltic by Gottenburg, travel over Sweden west of Stockholm, pass close by the west side of the Gulph of Bothnia, go a little west of Torneo, enter the Frozen Sea at Wardhuys, cross over to Nova Zembla, and a little to the east thereof

it will end in the North Sea with the setting Sun, in 105 degrees east longitude, and 72 degrees north latitude.

If the motions of the Sun and Moon were equable, any given eclipse would always return in a course of 223 lunations, which would consist of 18 years 11 days 7 hours 43 minutes 20 seconds (as was observed by the antients) for 1388 years; and would for ever do so, if, at the end of each period, the Sun and Moon should be in conjunction either in the same node, or at the same distance from it as before. But that is not the case: for, if the Sun and Moon are once in conjunction at 18 degrees distance from the node, which is the greatest distance at which the Moon's shadow can touch the earth, at the next period of 18 years 11 days, &c. the Sun and Moon will be 28 minutes 12 seconds of a degree nearer the same node than they were at the period last before. And so by falling gradually nearer and nearer the same node every time, the Moon's shadow will pass over the center of the earth's enlightened disc, at the end of the 38th periodical return of the eclipse from the time of its first coming in at either of the earth's poles; because the conjunction falls in the node at the end of the 38th period.

In each succeeding period, the conjunctions of the Sun and Moon will be gradually farther and farther from the node, by the quantity of 28 minutes 12 seconds of a degree; which will cause the Moon's shadow to pass over the disc of the earth, farther and farther on the opposite side from its centre, till it quite leaves the earth, and travels *in expansion* for about 12,492 years, before it can come upon the earth again at the same pole as before.

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The reason of this will be plain, when we consider, that 18 degrees from either of the nodes of the Moon's orbit is the greatest distance, at which her shadow can touch the earth at either of its poles. And as there are 18 degrees on each side of the node, within the limits of a solar eclipse; and twice 18 make 36, these are all of the 360 degrees of the Moon's orbit about either of the nodes, within which there can be an eclipse of the Sun: and as these eclipses shift through 28 minutes 12 seconds of these 36 degrees, in every Chaldean or Plinian period, they will shift through the whole limit in 77 periods, which include 1388 years and 3 months. And then, the periods have the remaining 324 degrees of the Moon's orbit to shift through, at the rate of only 28 minutes 12 seconds of a degree in each period, before they can be near enough to the same node again, for the Moon's shadow to touch the earth; and this cannot be gone through in less than 12,492 years: for, as 36 is to 1,388, so is 324 to 12,492.

The eclipse, April 1st, 1764, fell in the open space, quite clear of the earth at each return, ever since the creation till A. D. 1295, June 13th old stile, at 12^h 52' 59'' *p. m.* when it first touched the earth at the north pole, according to the mean (or supposed equable) motions of the Sun and Moon; their conjunction being then 17° 48' 27'' from the moon's ascending node, in the northern part of her orbit. In each period since that time, the conjunction of the Sun and Moon has been 28' 12'' nearer and nearer the same node; and the Moon's shadow has therefore gone more and more southerly over the earth. In the year 1962, July 18th, old stile, at 10^h 36' 21'' *p. m.*

the same eclipse will have returned 38 times ; and as the conjunction will then be only 24' 45'' from the node, the center of the Moon's shadow will fall but a little northward of the center of the earth's enlightened disc. At the end of the next following period, the conjunction of the Sun and Moon will have receded back 3' 27'' from the Moon's ascending node, into the southern part of her orbit ; which will cause the center of her shadow to pass a very small matter south of the center of the earth's disc. After which, in every following period, the conjunction of the Sun and Moon will fall 28' 12'' farther and farther back from the node, and the Moon's shadow will go still further and further southward on the earth, until A. D. 2665, September 12, old stile, at 23^h 46' 22'' *p. m.* when the eclipse will have finished its 77th period, and will finally leave the earth at the south pole ; and cannot begin the same course over the earth again in less than 12,492 years, as above mentioned.

And thus, if the motions of the Sun and Moon were equable, the same eclipse would always return in 18 Julian years 11 days 7 hours 43 minutes 20 seconds, when the last day of February in leap years is four times included in the period : but when it is five times included, the period is one day less ; or 18 years 10 days 7 hours 43 minutes 20 seconds.

But, on account of the various anomalies of the Sun and Moon, arising from their moving in ecliptic orbs, and the effects of the Sun's different attractions of the Moon in different parts of her orbit, the conjunctions of the Sun and Moon never succeed one

another at equal intervals of time ; but differ sometimes by no less than 14, 15, or 16 hours ; and therefore, in order to know the true times of the returns of any eclipse, recourse must be had to long and tedious calculations.

In order to shew both the mean and true times of the above mentioned eclipse, through all its periods, whilst it is visible on this earth, together with the mean anomalies of the Sun and Moon, the true distance of each conjunction from the ascending node, with the true latitude of the Moon at the time of each of her true conjunctions with the Sun, according to the old Stile, I have calculated the four following tables, of which I beg the Royal Society's acceptance.

According to the mean (or supposed equable) motions of the Sun, Moon, and nodes, the moon's shadow in this eclipse would have first touched the earth at the north pole, on the 13th of June, A. D. 1295; and would quite leave the earth at the south pole, on the 12th of September, A. D. 2665, at the completion of its 77th period ; as shewn in the first and second tables.

But, on account of the true (or unequable) motions of the Sun, Moon, and nodes, the true lines of conjunctions of the Sun and Moon, and the Sun's true distance from the Moon's ascending node, are as set down in the third and fourth tables : and the Moon's true latitude is too great at the end of the first mean period, to allow her shadow to touch the earth. So that the first time of the coming-in of this eclipse was at the end of its second mean period ; and the true time was on the 24th of June, A. D. 1313,
at

at $3^h 57' 3''$ past noon at London : and it will finally leave the earth on the 31st of July, A.D. 2593, at $10^h 25' 31''$ past noon, at the completion of its 72d period. So that, the true motions do not only alter the true times from the mean, but they also cut off five periods from those of the mean returns of this eclipse.

In this, and all other eclipses of the Sun, which happen about the ascending node of the Moon's orbit, the Moon's shadow first touches the earth at, or about, the north pole ; and goes more and more southerly over the earth in each return, till it quite leaves the earth at, or near, the South pole. But when eclipses happen about the descending node, (as that of July 14th, A.D. 1748 did) the Moon's shadow first touches the earth at, or near, the south pole ; and goes gradually more and more northward in each periodical return, till it finally leaves the earth at the north pole. And as the obliquity of the Moon's orbit to the ecliptic is the same about both the nodes, there must be the same number of eclipses about the one as about the other.

But I beg pardon, for mentioning things to your Lordship, and the Royal Society, which must be much better known to you all, than they can be to me ; who am, with the highest degree of respect,

My LORD,

Your Lordship's

most obliged, and

most obedient humble servant,

James Ferguson.

Mortimer-Street,
Nov. 16, 1763.

T A B L E

TABLE I.

The mean time of new Moon, with the mean anomalies of the Sun and Moon, and the Sun's mean distance from the Moon's ascending node, at the mean time of each periodical return of the Sun's eclipse, March 21st, 1764, from the time of it's first coming upon the earth since the creation, till it falls right against the earth's center, according to the old stile.

Periods.	Years of Christ.	Mean time of new Moon.				Sun's mean Anomaly.				Moon's mean Anomaly.				Sun's mean Distance from the node.			
		M.	D.	H.	"	S.	o	'	"	S.	o	'	"	S.	o	'	"
0	1277	June	2	5	9	39	11	17	57	41	1	26	31	0	18	16	40
1	1295	June	13	12	52	58	11	28	27	38	1	23	40	0	17	48	27
2	1313	June	23	20	36	19	0	8	57	35	1	20	48	0	17	20	15
3	1331	July	5	4	19	39	0	19	27	32	1	17	57	0	16	52	2
4	1349	July	15	12	2	59	0	29	57	29	1	15	6	0	16	23	50
5	1367	July	26	19	46	19	1	10	27	26	1	12	14	0	15	55	37
6	1385	Aug.	6	3	29	39	1	20	57	23	1	9	23	0	15	27	25
7	1403	Aug.	17	11	12	59	2	1	27	20	1	6	32	0	14	59	12
8	1421	Aug.	27	18	56	19	2	11	57	17	1	3	40	0	14	31	0
9	1439	Sept.	8	2	39	39	2	22	27	14	1	0	49	0	14	2	47
10	1457	Sept.	18	10	2	59	3	2	57	11	0	27	57	0	13	34	35
11	1475	Sept.	29	18	6	19	3	13	27	8	0	25	6	0	13	6	22
12	1493	Oct.	10	1	49	39	3	23	57	5	0	22	15	0	12	38	10
13	1511	Oct.	21	9	32	59	4	4	27	2	0	19	23	0	12	9	57
14	1529	Oct.	31	17	16	19	4	14	56	59	0	16	32	0	11	41	45
15	1547	Nov.	12	0	59	40	4	25	26	56	0	13	40	0	11	13	32
16	1565	Nov.	22	8	43	0	5	5	56	53	0	10	49	0	10	45	20
17	1583	Dec.	3	16	26	20	5	16	26	50	0	7	58	0	10	17	7
18	1601	Dec.	14	0	9	40	5	26	56	47	0	5	6	0	9	48	55
19	1619	Dec.	25	7	53	0	6	7	26	44	0	2	15	0	9	20	42
20	1638	Jan.	4	15	36	20	6	17	56	41	11	29	24	0	8	52	30
21	1656	Jan.	15	23	19	40	6	28	26	38	11	26	32	0	8	24	17
22	1674	Jan.	26	7	3	0	7	8	56	35	11	23	41	0	7	56	5
23	1692	Feb.	6	14	46	20	7	19	26	32	11	20	49	0	7	27	52
24	1710	Feb.	16	22	29	40	7	29	56	29	11	17	58	0	6	59	40
25	1728	Feb.	28	6	13	0	8	10	26	26	11	15	7	0	6	31	27
26	1746	Mar.	10	13	56	20	8	20	56	53	11	12	15	0	6	3	15
27	1764	Mar.	20	21	39	40	9	1	26	20	11	9	24	0	5	35	2
28	1782	April	1	5	23	0	9	11	56	17	11	6	32	0	5	6	50
29	1800	April	11	13	6	20	9	22	26	14	11	3	41	0	4	38	37
30	1818	April	22	20	49	40	10	2	56	11	11	0	50	0	4	10	25
31	1836	May	3	4	33	0	10	13	26	8	10	27	58	0	3	42	12
32	1854	May	14	12	16	20	10	23	56	5	10	25	7	0	3	14	0
33	1872	May	24	19	59	40	11	4	26	2	10	22	16	0	2	45	47
34	1890	June	5	3	43	0	11	14	55	59	10	19	24	0	2	17	35
35	1908	June	15	11	26	20	11	25	25	56	10	16	33	0	1	49	22
36	1926	June	26	19	9	40	0	5	55	53	10	13	41	0	1	21	10
37	1944	July	7	2	53	0	0	16	25	50	10	10	50	0	0	52	57
38	1962	July	18	10	36	21	0	26	55	47	10	7	59	0	0	24	45

TABLE

TABLE II.

The mean time of new Moon, with the mean anomalies of the Sun and Moon, and the Sun's mean distance from the Moon's ascending Node, at the mean time of each periodical return of the Sun's eclipse, March 21st, 1764, from the time of it's falling right against the earth's center, till it finally leaves the earth; according to the old stile.

Periods.	Years of Christ.	Mean Time of new Moon.				Sun's mean Anomaly.				Moon's mean Anomaly.				Sun's mean distance from the node.				
		M.	D.	H.	"	S.	o	"	"	S.	o	"	"	S.	o	"	"	
39	1980	July	28	18	19	41	1	7	25	44	10	5	7	45	11	29	56	33
40	1998	Aug.	9	2	3	1	1	17	55	41	10	2	16	22	11	29	8	20
41	2016	Aug.	19	9	46	21	1	28	25	38	9	29	24	59	11	29	0	8
42	2034	Aug.	30	17	29	41	2	8	55	36	9	26	33	36	11	28	31	55
43	2052	Sept.	10	1	13	1	2	19	25	33	9	23	42	13	11	28	3	43
44	2070	Sept.	21	8	56	21	2	29	55	30	9	20	50	50	11	27	35	30
45	2088	Oct.	1	16	39	41	3	10	25	27	9	17	59	27	11	27	7	18
46	2106	Oct.	13	0	23	1	3	20	55	24	9	15	8	4	11	26	39	5
47	2124	Oct.	23	8	6	21	4	1	25	21	9	12	16	41	11	26	10	53
48	2142	Nov.	3	15	49	41	4	11	55	18	9	9	25	18	11	25	42	40
49	2160	Nov.	13	23	31	1	4	22	25	15	9	6	33	56	11	25	14	28
50	2178	Nov.	25	7	16	21	5	2	55	12	9	3	42	33	11	24	46	15
51	2196	Dec.	5	14	59	41	5	13	25	9	9	0	51	10	11	24	18	3
52	2214	Dec.	16	22	43	1	5	23	55	7	8	27	59	47	11	23	49	50
53	2232	Dec.	27	6	26	21	6	4	25	4	8	25	8	24	11	23	21	38
54	2251	Jan.	7	14	9	41	6	14	55	1	8	22	17	1	11	22	53	25
55	2269	Jan.	17	21	53	1	6	25	24	58	8	19	25	38	11	22	15	13
56	2287	Jan.	29	5	36	21	7	5	54	55	8	16	31	15	11	21	57	0
57	2305	Feb.	8	13	19	41	7	16	24	52	8	13	42	52	11	21	28	48
58	2323	Feb.	19	21	3	1	7	26	54	49	8	10	51	29	11	21	0	35
59	2341	Mar.	2	4	46	21	8	7	24	46	8	8	0	6	11	20	32	23
60	2359	Mar.	13	12	29	42	8	17	54	43	8	5	8	43	11	20	4	10
61	2377	Mar.	23	20	13	2	8	28	24	40	8	2	17	20	11	19	35	58
62	2395	April	4	3	56	22	9	8	54	37	7	29	25	57	11	19	7	45
63	2413	April	14	11	39	42	9	19	24	34	7	26	34	34	11	18	39	33
64	2431	April	25	19	23	2	9	29	54	31	7	23	43	11	11	18	11	20
65	2449	May	6	3	6	22	10	10	24	28	7	20	51	48	11	17	43	8
66	2467	May	17	10	49	42	10	20	54	25	7	18	0	25	11	17	14	54
67	2485	May	27	18	33	2	11	1	24	22	7	15	9	2	11	16	46	43
68	2503	June	8	2	16	22	11	11	54	19	7	12	17	39	11	16	18	31
69	2521	June	18	9	59	42	11	22	24	17	7	9	26	16	11	15	50	18
70	2539	June	29	17	43	2	0	2	54	14	7	6	34	53	11	15	22	6
71	2557	July	10	1	26	22	0	13	24	11	7	3	43	30	11	14	53	54
72	2575	July	21	9	9	42	0	23	54	8	7	0	52	7	11	14	25	41
73	2593	July	31	16	53	2	1	4	24	5	6	28	0	44	11	13	57	28
74	2611	Aug.	12	0	36	22	1	14	54	2	6	25	9	21	11	13	29	16
75	2629	Aug.	22	8	19	42	1	25	23	59	6	22	17	58	11	13	1	3
76	2647	Sept.	2	16	3	2	2	5	53	56	6	19	26	35	11	12	32	51
77	2665	Sept.	12	23	46	22	2	16	23	53	6	16	35	12	11	12	4	38
0	2683	Sept.	24	7	29	42	2	26	53	50	6	13	43	39	11	11	36	26

T A B L E III.

The true time of new Moon, with the Sun's true distance from the Moon's ascending node, and the Moon's true latitude, at the true time of each periodical return of the Sun's eclipse, March 21st, 1764, old stile, from the time of it's first coming upon the earth since the creation, till it falls right against the earth's center.

Periods.	Years of Christ.	True time of new Moon.				Sun's true Distance from the node.				Moon's true latitude.			
		M.	D.	H.	"	S.	°	'	"	°	'	"	North.
0	1277	June	2	15	9	36	0	19	5	40	1	37	50 N. A.
1	1295	June	13	21	54	32	0	18	40	54	1	33	45 N. A.
2	1313	June	24	3	57	3	0	17	20	22	1	29	34 N. A.
3	1331	July	5	10	42	8	0	16	29	35	1	25	20 N. A.
4	1349	July	15	17	14	15	0	15	34	18	1	20	45 N. A.
5	1367	July	26	23	49	24	0	14	46	8	1	16	39 N. A.
6	1385	Aug.	6	6	41	17	0	13	59	43	1	12	43 N. A.
7	1403	Aug.	17	13	32	19	0	13	16	44	1	9	3 N. A.
8	1421	Aug.	27	20	30	17	0	12	37	4	1	5	42 N. A.
9	1439	Sept.	8	3	51	46	0	12	1	54	1	2	41 N. A.
10	1457	Sept.	18	10	23	11	0	11	30	27	0	58	53 N. A.
11	1475	Sept.	29	17	57	7	0	11	3	56	0	57	43 N. A.
12	1493	Oct.	10	1	44	3	0	10	41	55	0	55	49 N. A.
13	1511	Oct.	21	9	29	53	0	10	25	11	0	54	28 N. A.
14	1529	Oct.	31	17	9	18	0	10	21	27	0	53	12 N. A.
15	1547	Nov.	12	0	51	25	0	10	1	10	0	52	19 N. A.
16	1565	Nov.	22	8	54	56	0	9	52	49	0	51	46 N. A.
17	1583	Dec.	3	16	48	17	0	9	48	4	0	51	11 N. A.
18	1601	Dec.	14	0	51	5	0	9	43	42	0	50	49 N. A.
19	1619	Dec.	25	8	54	59	0	9	40	23	0	50	31 N. A.
20	1638	Jan.	4	16	56	1	0	9	34	57	0	50	3 N. A.
21	1656	Jan.	15	0	54	41	0	9	29	24	0	49	57 N. A.
22	1674	Jan.	26	8	48	24	0	9	19	44	0	48	44 N. A.
23	1692	Feb.	6	16	36	28	0	9	8	58	0	47	49 N. A.
24	1710	Feb.	17	8	8	37	0	8	54	20	0	45	43 N. A.
25	1728	Feb.	28	7	43	40	0	8	34	53	0	44	52 N. A.
26	1746	Mar.	10	13	14	33	0	8	10	37	0	42	46 N. A.
27	1764	Mar.	20	22	30	26	0	7	42	14	0	40	18 N. A.
28	1782	April	1	5	37	4	0	7	9	27	0	37	28 N. A.
29	1800	April	11	12	36	38	0	6	35	30	0	34	31 N. A.
30	1818	April	22	19	27	34	0	5	51	48	0	30	43 N. A.
31	1836	May	3	2	12	7	0	5	5	5	0	26	40 N. A.
32	1854	May	14	8	50	40	0	4	19	45	0	22	42 N. A.
33	1872	May	24	15	28	15	0	3	26	3	0	18	1 N. A.
34	1890	June	4	22	8	0	0	2	35	5	0	13	34 N. A.
35	1908	June	15	4	38	23	0	1	41	43	0	8	54 N. A.
36	1926	June	26	11	13	5	0	0	47	38	0	4	10 N. A.
37	1944	July	6	17	50	35	11	29	55	28	0	0	24 N. A.
38	1962	July	18	0	31	38	11	29	2	35	0	5	2 S. A.

By the true motions of the Sun, Moon, and nodes, the Moon's shadow falls even with the earth's center two periods sooner than by their mean motions.

T A B L E I V.

The true time of new Moon, with the Sun's true distance from the Moon's ascending Node, and the Moon's true latitude, at the true time of each periodical return of the Sun's eclipse, March 21st, 1764, old stile, from the time of it's falling right against the earth's center, till it finally leaves the earth for upwards of 12,492 years.

Periods.	Year of Christ.	True Time of new Moon.				Sun's true distance from the node.				Moon's true lati- tude.			
		M.	D.	H.	"	S.	o.	"	"	o.	"	South.	"
39	1980	July	28	7	18	53	11	28	11	32	0	9	29 S. A.
40	1998	Aug.	8	14	12	22	11	27	26	41	0	13	25 S. A.
41	2016	Aug.	18	21	14	53	11	26	42	16	0	17	18 S. A.
42	2034	Aug.	30	4	25	45	11	26	2	0	0	20	48 S. A.
43	2052	Sept.	9	11	45	17	11	25	26	46	0	23	53 S. A.
44	2070	Sept.	20	19	17	26	11	24	55	4	0	26	39 S. A.
45	2088	Oct.	1	2	57	8	11	24	27	43	0	28	58 S. A.
46	2106	Oct.	12	10	47	39	11	24	4	38	0	31	2 S. A.
47	2124	Oct.	22	18	37	39	11	23	48	28	0	32	26 S. A.
48	2142	Nov.	3	2	56	19	11	23	35	11	0	33	53 S. A.
49	2160	Nov.	13	11	11	20	11	23	22	22	0	34	42 S. A.
50	2178	Nov.	24	19	36	14	11	23	18	57	0	35	0 S. A.
51	2196	Dec.	5	4	4	9	11	23	14	40	0	35	22 S. A.
52	2214	Dec.	16	12	35	48	11	23	10	43	0	35	43 S. A.
53	2232	Dec.	26	20	29	9	11	23	6	47	0	36	1 S. A.
54	2251	Jan.	7	5	42	9	11	23	4	27	0	36	16 S. A.
55	2269	Jan.	17	14	14	8	11	23	0	41	0	36	35 S. A.
56	2287	Jan.	28	22	43	34	11	22	53	58	0	37	10 S. A.
57	2305	Feb.	8	7	8	30	11	22	44	44	0	37	59 S. A.
58	2323	Feb.	19	15	7	10	11	22	31	1	0	39	8 S. A.
59	2341	Mar.	2	0	6	5	11	22	17	46	0	40	28 S. A.
60	2359	Mar.	13	7	59	17	11	21	55	29	0	42	9 S. A.
61	2377	Mar.	23	15	51	59	11	21	39	40	0	43	41 S. A.
62	2395	April	3	23	45	7	11	21	0	53	0	46	58 S. A.
63	2413	April	14	7	32	40	11	20	26	22	0	49	48 S. A.
64	2431	April	25	15	12	57	11	19	47	34	0	53	17 S. A.
65	2449	May	5	22	45	14	11	19	6	22	0	56	50 S. A.
66	2467	May	17	6	17	30	11	18	21	16	1	0	40 S. A.
67	2485	May	27	13	46	30	11	07	34	20	1	4	42 S. A.
68	2503	June	7	21	10	31	11	16	43	17	1	9	3 S. A.
69	2521	June	18	4	24	42	11	15	51	48	1	13	26 S. A.
70	2539	June	29	11	58	46	11	15	1	12	1	17	43 S. A.
71	2557	July	9	19	24	7	11	14	9	13	1	22	6 S. A.
72	2575	July	21	2	52	34	11	13	19	22	1	26	16 S. A.
73	2593	July	31	10	25	31	11	12	13	43	1	31	44 S. A.
74	2611	Aug.	11	17	58	39	11	11	45	13	1	36	13 S. A.
75	2629	Aug.	22	1	41	37	11	11	1	49	1	39	50 S. A.
76	2647	Sept.	2	9	29	37	11	10	22	59	1	42	0 S. A.
77	2665	Sept.	12	17	25	13	11	9	46	48	1	45	45 S. A.
78	2683	Sept.	24	1	29	1	11	9	15	49	1	47	58 S. A.

The true motions carry off the eclipse four periods sooner than the mean.

XXXIX. An