
V. DETERMINATION *of the* LATITUDE *and* LONGITUDE *of the*
OBSERVATORY *at* ABERDEEN : *In Two* LETTERS *from*
ANDREW MACKAY, LL. D. & F. R. S. EDIN. to JOHN
PLAYFAIR, F. R. S. EDIN. *and Professor of Mathematics*
in the University of Edinburgh.

L E T T E R I.

[*Read 2d Dec. 1793.*]

DEAR SIR,

Aberdeen, 18th September 1793-

SOME time ago I promised to send you the result of a series of observations, made to determine the situation of this place. Having, however, been much hurried of late, I am only able at present to transmit you the determination of the latitude, deduced from a series of observations of the sun's meridian zenith distances. With respect to the longitude, as soon as it is in my power, I will reduce some observations of occultations, and of the late solar eclipse, and send you the results.

THE following observations of the sun's meridian zenith distances were made with a moveable quadrant of two feet radius, constructed by Mr MACCULLOCH of London. This quadrant has two separate sets of divisions: the quadrantal arc of the inner set is divided into ninety degrees as usual; and the exterior arc is divided into ninety-six primary divisions; each of
which

which is subdivided into eight equal parts; and the vernier gives one thirty-second part of a subdivision, or $13'',18$. A micrometer screw is attached to the vernier, which serves to regulate the motion of the index, and by which, the excess in seconds above the next less division of the vernier is shown.

EACH zenith distance was read off, at least, three times, both from the ninety and ninety-six arcs, and the means of each were taken. These served as a check on each other; however, the zenith distance, as given by the ninety-six arc only, is used for obvious reasons. The ninety-six arc was found to be about $12''$ less than 90° ; and the error of the line of collimation at the vertical radius was about a second and a half, subtractive.

As the transit instrument and quadrant were placed in adjacent rooms, it was therefore in my power to observe both the sun's transit and zenith distance the same day; however, the passage of the sun's west limb over the fifth wire, and that of the east limb over the first wire, were by this means lost. Hence, also, the zenith distance of one limb only of the sun could be observed; and the true zenith distance will be affected by the error of the sun's semidiameter, as given in the *Nautical Almanac*, and by the irradiation, which according to M. DU SEJOUR, exceeds three seconds.

THE middle wire in the telescope of the quadrant subtended an angle of no less than $20'',6$; therefore, as it was scarce possible to bring the sun's limb exactly to the middle of the wire, I constantly made the lower edge of the wire a tangent to the sun's apparent lower limb. The zenith distances in the following table are the differences between those observed and the semidiameter of the wire, the tenths of a second being neglected.

THE fifth column of the table contains the error of the line of collimation, combined with that of the ninety-six arc, taking it for granted that this arc is accurately divided. In column sixth is the sun's semidiameter, from the *Nautical Almanac*, to the nearest

nearest second. The next column contains the aggregate of the three preceding columns, and is the sun's apparent central zenith distance. The eighth column contains the mean refraction, answering to the apparent zenith distance of the sun's limb; hence the allowance for the contraction of the semidiameter at low altitudes is avoided. The next column contains the mean refraction reduced to the true, by the application of the corrections depending on the heights of the barometer and thermometer, as they are found in Table VIII. of my book on the Longitude: In column tenth is the sun's parallax; and the quantities in the two last columns, applied to those in column seventh, give these in column eleventh, being the true zenith distances of the sun's centre. The following column contains the sun's declination, reduced to the meridian of this place; and in the last column is the latitude.

Observed Distances of the Sun's Upper Limb from the Zenith of the Observatory.

1786.	H. of Bar.	Th.	Zen. dist.	Err. Qua. +	Sun's Semid. add.	Appar. Zen. distance.	M. Ref.	Red. Ref.	Par. —	True Zenith distance.	Declination.	Latitude.
♂ May 17.	29.78	48°	37° 26' 46"	3"	15' 51"	37° 42' 40"	0' 44"	0' 44"	5"	37° 43' 19"	19° 25' 49"	57° 9' 8"
h June 3.	30.15	62½	34 29 55	3	15 49	34 45 47	0 39	0 39	5	34 46 21	22 28 49	57 9 10
⊙ — 4.	30.26	60	34 22 56	3	15 48	34 38 47	0 39	0 39	5	34 39 21	22 29 52	57 9 13
⊙ — 5.	30.36	61	34 16 14	3	15 48	34 32 5	0 38	0 38	5	34 32 38	22 36 31	57 9 9
⊙ — 7.	30.23	59	34 4 0	3	15 48	34 19 51	0 38	0 38	5	34 20 24	22 48 39	57 9 3
♂ — 8.	29.99	55½	33 58 45	3	15 48	34 14 36	0 38	0 38	5	34 15 9	22 54 7	57 9 16
h — 10.	29.83	54½	33 49 0	3	15 48	34 4 51	0 38	0 37	5	34 5 23	23 3 50	57 9 13
⊙ — 11.	30.00	53	33 44 40	3	15 48	34 0 31	0 38	0 38	5	34 1 4	23 8 4	57 9 8
⊙ — 12.	29.98	54½	33 40 47	3	15 48	33 56 38	0 38	0 38	5	33 57 11	23 11 55	57 9 6
♂ — 15.	30.05	58	33 31 36	3	15 47	33 47 26	0 38	0 38	5	33 47 59	23 21 1	57 9 0
⊙ — 18.	30.06	55	33 26 20	3	15 47	33 42 10	0 37	0 37	5	33 42 42	23 26 24	57 6 6
⊙ — 19.	30.05	56	33 25 30	3	15 47	33 41 20	0 37	0 37	5	33 41 52	23 27 22	57 9 14
♂ — 20.	30.08	60	33 24 45	3	15 47	33 40 35	0 37	0 37	5	33 41 7	23 27 56	57 9 3
♂ — 21.	30.05	63	33 24 37	3	15 47	33 40 27	0 37	0 37	5	33 40 59	23 28 5	57 9 4
♂ — 22.	29.89	65	33 24 53	3	15 47	33 40 43	0 37	0 36	5	33 41 14	23 27 49	57 9 3
h — 24.	29.70	65	33 26 42	3	15 47	33 42 32	0 37	0 36	5	33 43 3	23 26 2	57 9 5
⊙ — 25.	29.86	66	33 28 10	3	15 47	33 44 0	0 37	0 36	5	33 44 31	23 24 32	57 9 3
♂ — 27.	29.65	58	33 32 28	3	15 47	33 48 18	0 38	0 37	5	33 48 50	23 20 16	57 9 6
⊙ July 2.	30.00	57	33 50 13	3	15 47	34 6 3	0 38	0 38	5	34 6 36	23 2 28	57 9 4
⊙ — 3.	29.71	63	33 54 56	3	15 47	34 10 46	0 38	0 37	5	34 11 18	22 57 42	57 9 0
♂ — 5.	30.29	61½	34 5 52	3	15 47	34 21 42	0 38	0 38	5	34 22 15	22 46 58	57 9 13
h — 15.	30.31	66	34 22 36	3	15 47	34 38 26	0 39	0 39	5	34 39 0	21 29 59	57 8 59
♂ — 18.	30.31	63	35 52 56	3	15 47	36 8 46	0 41	0 41	5	36 9 22	20 59 35	57 8 57
⊙ — 21.	30.02	57	36 26 30	3	15 48	36 42 21	0 42	0 42	5	36 42 58	20 26 0	57 8 58
⊙ — 23.	29.55	65	36 50 43	3	15 48	37 6 34	0 43	0 42	5	37 7 11	20 1 53	57 9 4
♂ Aug. 3.	30.00	58	39 26 25	4	15 49	39 42 18	0 47	0 47	5	39 43 0	17 26 12	57 9 12
♂ — 4.	29.86	60	39 42 13	4	15 50	39 58 7	0 48	0 47	5	39 58 49	17 10 16	57 9 5
h — 5.	29.49	59	39 58 26	4	15 50	40 14 20	0 48	0 47	5	40 15 2	16 54 4	57 9 6
h — 26.	29.94	64	46 34 11	5	15 53	46 50 9	1 0	0 59	6	46 51 2	10 18 0	57 9 2
♂ — 30.	29.36	58	47 59 20	5	15 54	48 15 19	1 3	1 2	6	48 16 15	8 52 49	57 9 4
♂ — 31.	29.22	58	48 20 49	5	15 55	48 36 49	1 4	1 2	6	48 37 45	8 31 9	57 8 54
h Sept. 2.	29.44	60½	49 4 44	5	15 55	49 20 44	1 5	1 3	6	49 21 41	7 47 27	57 9 8
♂ — 5.	29.93	54	50 11 15	5	15 51	50 27 16	1 9	1 10	7	50 28 19	6 40 58	57 9 16
♂ — 20.	30.24	56	55 55 8	6	16 0	56 11 14	1 24	1 25	7	56 12 32	0 56 30	57 9 2
♂ — 21.	29.87	57	56 18 42	6	16 0	56 34 48	1 25	1 25	7	56 36 6	0 33 6	57 9 12
♂ — 27.	29.68	48	58 39 7	6	16 1	58 55 14	1 33	1 33	8	58 56 39	1 47 33	57 9 6
♂ Oct. 18.	30.34	47	66 37 58	7	16 7	66 54 12	2 13	2 17	8	66 56 21	9 47 18	57 9 3
♂ — 26.	30.42	44	69 26 57	8	16 10	69 43 15	2 31	2 37	8	69 45 44	12 36 48	57 8 56
h Dec. 2.	29.53	40	78 51 12	9	16 17	79 7 38	4 43	4 50	9	78 12 19	22 3 25	57 8 54
⊙ — 10	29.34	44	79 46 27	9	16 18	80 2 54	5 9	5 11	9	80 7 56	22 59 8	57 8 48
♂ — 15.	29.36	37	80 6 29	9	16 19	80 22 57	5 19	5 27	9	80 28 15	23 19 17	57 8 58
⊙ — 17.	29.54	34	80 11 7	9	16 19	80 27 35	5 21	5 34	9	80 33 0	23 24 5	57 8 55
♂ — 21.	30.02	28	80 14 50	9	16 19	80 31 18	5 23	5 45	9	80 36 54	23 28 3	57 8 51
⊙ — 24.	30.24	35	80 12 55	9	16 19	80 29 23	5 22	5 41	9	80 34 55	23 26 4	57 8 51
⊙ — 25.	30.08	28	80 11 19	9	16 19	80 27 47	5 21	5 43	9	80 33 21	23 24 27	57 8 54
1787.												
♂ Apr. 30.	29.56	44	42 2 15	4	15 55	42 18 14	0 51	0 52	6	42 19 0	14 50 3	57 9 3
♂ May 4.	29.81	52	40 50 53	4	15 54	41 6 51	0 49	0 49	6	41 7 34	16 1 25	57 8 59
⊙ — 14.	30.06	46½	38 11 40	4	15 52	38 27 36	0 44	0 45	5	38 28 16	18 40 40	57 8 56
♂ — 22.	29.87	59½	36 26 33	3	15 50	36 42 26	0 42	0 41	5	36 43 2	20 25 49	57 8 51
♂ June 12.	30.12	60	33 41 35	3	15 48	33 57 26	0 38	0 38	5	33 57 59	23 10 59	57 8 58
♂ — 15.	29.61	56	33 32 11	3	15 47	33 48 1	0 38	0 37	5	33 48 33	23 20 23	57 8 56
♂ — 16.	29.66	60	33 29 53	3	15 47	33 45 43	0 38	0 37	5	33 46 15	23 22 42	57 8 57
h Sept. 1.	30.52	64	48 37 8	5	15 55	48 53 8	1 4	1 4	6	48 54 6	8 14 40	57 8 46
♂ — 19.	29.25	56	55 26 8	6	15 59	55 42 13	1 22	1 20	7	55 43 26	1 25 23	57 8 49
♂ — 22.	29.49	56	56 36 9	6	16 0	56 52 15	1 26	1 25	7	56 53 33	0 15 16	57 8 49
⊙ — 23.	29.49	57	56 59 32	6	16 1	57 15 39	1 28	1 27	7	57 16 59	0 10	57 8 49
♂ — 24.	29.71	57	57 23 0	6	16 1	57 39 7	1 29	1 28	7	57 40 28	0 31 35	57 8 53
♂ — 28.	29.98	54	58 56 38	6	16 2	59 12 46	1 35	1 36	8	59 14 14	2 5 16	57 8 58
♂ Oct. 18.	29.48	50	66 32 51	7	16 7	66 49 5	2 11	2 10	8	66 51 7	9 42 7	57 9 0
♂ — 23.	29.41	48	68 19 49	7	16 9	68 36 5	2 23	2 23	8	68 38 20	11 29 27	57 8 53
⊙ Dec. 16.	29.59	35	80 8 21	9	16 19	80 24 49	5 20	5 33	9	80 30 13	23 21 16	57 8 57
♂ — 21.	29.93	35	80 14 48	9	16 19	80 31 16	5 23	5 39	9	80 36 46	23 27 58	57 8 48
h — 22.	29.85	32	80 14 55	9	16 19	80 31 23	5 23	5 40	9	80 36 54	23 27 54	57 9 0
1788.												
♂ Sept. 8.	30.04	62	51 30 10	5	15 56	51 46 11	1 11	1 10	7	51 47 14	5 21 41	57 8 55

Latitude,
or 57 9 0.9
57 9 1

HAVING the following observations of fixed stars reduced, I have also sent them.

Observed Distances of Fixed Stars from the Zenith of the Observatory.

1786.	Bar.	Th.	Name of Stars.	Zen. dist.	Error Quad.	Mean Ref.	True Ref.	T. Zen. dist.	M. Declina.	Ab.	Nut.	App. Decl.	Latitude.
24 June 22.	29.82	55	Arcturus	36° 50' 14"	+ 3"	0' 43"	0' 43"	36° 51' 0"	20° 18' 2"	+ 6"	- 7"	20° 18' 1"	57° 9' 1"
9 Sept. 1.	29.49	55	α Lyra.	18 32 37	1	0 19	0 19	18 32 57	38 35 45	16	+ 8	8 36 9	57 9 6
8 Oct. 25.	30.37	44	Altair.	48 48 31	5	1 5	1 8	48 49 44	8 19 20	- 9	0	8 19 11	57 8 55
21 — 26.	30.42	44	—	48 48 29	5	1 5	1 8	48 49 42	8 19 20	9	0	8 19 11	57 8 53
5 Dec. 2.	29.50	37	Pole Star.	31 1 0	2	0 34	0 35	31 1 37	88 10 8	+ 17	7	88 30 32	57 8 55
10 — 24.	29.93	24	γ Cas. arc Excess.	87 35 12	1	0 2	0 2	87 35 13	59 33 53	17	3	59 34 13	57 9 0
10 — —	—	—	α Cassiopeia.	88 1 23	1	0 2	0 2	88 1 24	59 7 12	16	5	59 7 33	57 8 57
8 — 27.	28.95	36	α Cassiopeia.	1 46 47	1	0 2	0 2	1 46 48	55 51 59	16	3	55 52 19	57 9 7
Latitude,													57 8 59½

THE declinations of the above stars were taken from M. DE LA LANDE's catalogue of the declinations of 350 stars, adapted to the beginning of the year 1790.

I SHALL conclude by observing, that the differences in the above latitudes are to be attributed to the error of observation, to the inaccuracy of the division of the quadrant, and to the uncertainty of the refraction, especially at low altitudes. If the refraction at 45° be assumed a little greater than that by Dr BRADLEY, the results will agree much better. It must also be observed, that the smoke of the town will increase the refraction.

I am,

Dear Sir,

Your obedient servant,

ANDREW MACKAY.

L E T T E R II *

DEAR SIR,

Aberdeen, 20th September 1796.

HAVING finished the comparifon of a confiderable number of obfervations, made in this place, in order to determine its longitude, with correfponding obfervations made at Greenwich, I now fend you the feveral refults. The obfervations ufed for this purpofe are, eclipfes of the fatellites of Jupiter, particularly thofe of the firft and fecond fatellites, folar and lunar eclipfes, occultations, &c. Thefe obfervations were made with one of DOLLOND's three and a half foot achromatic telescopes, and powers of about feventy, and one hundred and fifteen, were applied to the telescope, according to circumftances. The obfervations at Greenwich were made with one of DOLLOND's forty-fix inch achromatic telescopes.

As the refults, deduced from a comparifon of the correfponding obfervations of the firft and fecond fatellites of Jupiter, are
much

* COMMUNICATED 7th November 1796.

much more to be depended on than those inferred from the observations of the third and fourth satellites, I have therefore rejected the observations of the two last. This I was inclined to do, partly from the disagreement of the results of the corresponding observations of these two satellites, and partly upon account of the smallness of the number of corresponding observations. Indeed, as these two satellites take a considerable time to immerge into, and emerge out of the shadow of Jupiter, and as the state of the atmosphere, at the times of observation at Greenwich and Aberdeen, may be very different, and as powers will be applied to the telescopes according to the state of the atmosphere, it is not wonderful, that there should be a considerable difference between the results of the actual observations; and hence the propriety of rejecting the observations of the third and fourth satellite will be obvious; especially in the case when the corresponding observations are very few, and the number of immersions unequal to that of the emersions. The longitude of this place, as deduced from the comparison of the actual observations of the first and second satellites of Jupiter, made here and at Greenwich, seems to be less than the truth, or, at least, less than what I had been accustomed to state it; but the near agreement of the final results of each of these satellites is really surprising.

OF all the other observations which I have compared, I have sent you only two, as being the most to be relied on, namely, a solar eclipse, and an occultation, besides a lunar eclipse, which I had published formerly in my *Treatise on the Longitude*, and which is not far from being a mean between the results of the other observations. I had, indeed, only one other occultation, of which the observations at Greenwich and Aberdeen were complete, namely, that of β of 15th October 1790; my other observations of that kind, being either incomplete, or having no corresponding observations at Greenwich.

I HAVE made the calculations for the longitude from the solar eclipse and occultation, first, on the supposition that the figure of the earth is a perfect sphere; and, secondly, upon Sir ISAAC NEWTON's spheroidal hypothesis, in which the equatorial diameter is to the axis of the earth as 230 : 229; between which limits, it is probable, is the real figure of the earth. In the rules which I gave, in my *Treatise on the Longitude*, for making the calculations by means of the nonagesimal, I followed the method of calculating the parallaxes in latitude and longitude, which had been given by M. DE LA LANDE, in the first and second editions of his *Astronomie*: But, in the present calculations, I have used the method which was given for the first time by M. MAYER, in the second volume of the *Memoirs of Gottingen*, published in the year 1753; and, again, in his *Solar and Lunar Tables*, printed at London, by order of the Board of Longitude, in the year 1770. This same method has also been employed by Messrs LEXELL, DE LA GRANGE, and DE LAMBRE: And it has been adopted by M. DE LA LANDE, in the second volume of the third edition of his *Astronomie*, printed at Paris in the year 1792*. It may also be proper to mention, that I have followed M. DU SEJOUR, and M. DE LA LANDE, in using an irradiation of $3\frac{1}{2}''$ for the sun's semidiameter, and an inflexion of the same quantity for the moon's. See SEJOUR's *Traité Analytique*, &c. vol. I. p. 253 and 264; and DE LA LANDE's *Astronomie*, third edition, vol. II. p. 445.

As some perhaps will be inclined to repeat the calculations for the longitude, from the observations of the solar eclipse and occultation, it will therefore be necessary to
inform

* IN making these calculations, I was led to discover an error in the method I had given in my *Treatise on the Longitude*, for finding the longitude of a place by an occultation. That error, and several others, will be corrected in a new edition of that work.

inform them what tables I used for that purpose. The logarithmic tables were TAYLOR's, CALLET's, and SHERWIN's. From TAYLOR's *Tables* were taken the logarithm fines and tangents of arches, and conversely. The logarithm fines, and conversely of the parallaxes, were taken from CALLET's *Tables*; and the logarithms of numbers from SHERWIN's. By this means much time was saved in these extensive calculations. The natural versed fines were taken from my *Treatise on the Longitude*; and the augmentation of the moon's semidiameter was taken from M. DE LAMBRE's *Tables*, for finding it by means of the altitude and longitude of the nonagesimal, which, therefore, saved the trouble of calculating the altitude of the moon. The sun's parallax was taken from the *Connoissance des Temps*; and, as I had not the *Nautical Almanac* for the year 1788, the elements for the solar eclipse were taken from the *Connoissance des Temps* for that year; but the elements for the occultation were taken from the *Nautical Almanac* for 1787.

DETER-

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DETERMINATION of the Longitude of the Observatory at
Aberdeen, by the Eclipses of the First and Second Sa-
tellites of Jupiter.

FIRST SATELLITE.

Year, Month, and Day.	Apparent Time of Observation at				Longitude in Time, by	
	Greenwich.		Aberdeen.		Immer.	Emer.
	Immer.	Emer.	Immer.	Emer.		
	h. ' "	h. ' "	h. ' "	h. ' "	' "	' "
♂ Jan. 3. 1786.		8 15 54		8 7 39		8 15
♂ Sept. 18. —	16 7 37		15 58 57		8 40	
♀ — 20. —	10 36 38		10 27 40		8 58	
♂ Dec. 30. —		9 45 20		9 37 43		7 37
♀ Jan. 31. 1787.		6 15 32		6 7 8		8 24
♀ Feb. 23. —		6 31 57		6 23 46		8 11
♂ Dec. 14. 1788.	8 34 55		8 27 12		7 43	
♂ Mar. 1. 1791.	9 14 8		9 5 23		8 45	
♂ Apr. 9. —		10 4 48		9 56 49		7 59
					126	26
					8 315	8 5.2
						8 31.5
						8 18.3

Longitude,

Mean,

SECOND SATELLITE.

	h. ' "	h. ' "	h. ' "	h. ' "	' "	' "
♂ Nov. 7. 1786.	9 10 27		9 1 23		9 4	
♂ Mar. 8. 1787.		7 48 3		7 40 14		7 49
♀ Dec. 21. —		5 14 30		5 6 27		8 3
♂ Nov. 9. 1789.	14 23 42		14 15 24		8 18	
					17 22	15 52
					8 41	7 56
						8 41
						16 37
						8 18.5
						8 18.3
						8 18.4

Longitude,

Mean,
Mean by 1st Sat.

Mean Longitude,

DETER-

DETERMINATION of the Longitude of the Observatory at Aberdeen, from the Apparent Times of Observation of the Beginning and End of the Solar Eclipse of 3d June 1788 : Observed at Greenwich and Aberdeen.

		h. ' "		h. ' "
Apparent time of begin. at Greenwich,		19 24 46 $\frac{1}{2}$	at Aberdeen,	19 33 19
of end. -		21 1 24		20 57 37
Interval, - -		<u>1 36 37$\frac{1}{2}$</u>		<u>1 24 18</u>

COMPUTATION of the Apparent Time of Conjunction at Greenwich, on the Spherical Hypothesis.

		s. ° ' "		s. ° ' "
Moon's true longitude at beginning,		2 13 19 37	at ending,	2 14 18 59
Computed parallax in longitude, -		<u>+ 30 11</u>		<u>+ 22 32</u>
Moon's apparent longitude nearly, -		2 13 49 48		2 14 41 31
Moon's equat. hor. parallax, -		60 33.0		60 34.9
Sun's horizontal parallax, -		<u>8.7</u>		<u>8.7</u>
Difference of parallax of sun and moon,		60 24.3		60 26.2
App. time beg.	h. ' "	19 24 46 $\frac{1}{2}$		
Sun's R. A.		<u>4 51 30$\frac{1}{2}$</u>		
R. A. meridian,		0 16 17		
		6		
Arch, -	6 16 17	v. fine, 0.0297853	co-secant,	0.0010971
Latitude, -	51 28 40	co-fine, 9.7943612	secant,	0.2056388
Ob. ecliptic,	<u>23 28 3</u>	<u>fine, 9.6001327</u>		
Sum, -	74 56 43	co. v. s. 034322		
		<u>265631</u>		
		9.4242792		
Alt. nonag.	45 34 9	v. fine, 299953	fine,	<u>9.8537566</u>
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Long. nonag.	29 32 39				secant,	0.0604925
Moon's app. long.	73 49 48					
Diff. -	44 17 9	fine,	9.8440037			
Alt. nonag.	45 34 9	fine,	9.8537566	co-fine,	9.8451277	
Diff. hor. par.	60 24.3	fine,	8.2447766	fine,	8.2447766	
Par. in long.	30 7.0	fine,	7.9425369	P. in lat. 42' 17." 1,	8.0899043	
App. time end.	21 1 24					
Sun's R. A.	4 51 47					
R. A. mer.	1 53 11					
	6					
Arch, -	7 53 11	v. fine,	0.1685046	co-secant,	0.0552648	
Latitude and obl.	74 56 43	co. v. s. 0.34322	9.3944939		0.2056388	
			365593		9.5629985	
Alt. nonag.	53 7 26	v. fine,	399915	fine,	9.9030547	
Long. nonag.	46 43 15			secant,	0.1639583	
Moon's app. long.	74 41 31					
Diff. D à Non.	27 58 16	fine,	9.6711972			
Alt. nonag.	46 43 15	fine,	9.9030547	co-fine,	9.7782140	
Diff. hor. par.	60 26.2	fine,	8.2450042	fine,	8.2450042	
Par. in long.	22 34.2	fine,	7.8172561	P. in lat. 36' 16." 0,	8.0232182	
Moon's true mot. in long. in ob. int.	-	59 22.0	True mot. in lat.	5 30.3		
Sun's true mot. in long.	-	3 51.0	Par. in lat. at end.	36 16.0		
Moon's true rel. mot. in long.	-	55 31.0	Sum,	41 46.3		
Par. in long. at beginning,	-	30 7.0	Par. in lat. at begin.	42 17.1		
at ending,	-	+ 22 34.2	App. mot. in lat.	30.8		
App. rel. mot. in longitude,	-	47 58.2				

Apparent

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Apparent mot. in lat.	30.8	1.4885507		
Apparent mot. in long.	47 58.2	3.4591210		3.4591210
Apparent inclination 36' 47",	tang.	8.0294297	co-fine,	9.9999751
Moon's apparent mot. in relative orbit, 2878."3				3.4591459

Moon's femidiameter at begin.	16 30	at end.	16 30	Sun's femid.	15 48.5
Augmentation,	+ 9.0		+ 12.5	Irradiation,	3.5
Inflexion,	— 3.5		— 3.5	Cor. femid.	15 45.0
Corrected femidiameter,	16 35.5		16 39.0		
Sun's femidiameter;	15 45.0		15 45.0		
Sum,	32 20.5		32 24.0		

Sum of femid. at end.	1944.0	-	-	ar. co. log.	6.7113037
at begin.	1940.5	ar. co. log.	6.7120864		3.2879136
App. mot. in rel. orbit,	2878.3	ar. co. log.	6.5408639		
Sum,	6762.8				
Half,	3381.4	log.	3.5290965		
Remainder,	1437.4	log.	3.1575776		

19.9396244
 9.9698122

Central angle at begin.	42 13 58	-	-	fine,	9.8274625
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Central angle at end.	42 8 21			fine,	9.8266798
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Central angle at begin.	42 13 58	at end.	42 8 21		
App. inclination,	36 47	App. in.	36 47		

Arch,	42 50 45	co-s.	9.8652142	Arch,	41 31 34	co-s.	9.8742810
Sum of femidiameters,	32 20.5		3.2879136	sum fem.	32 24		3.2886963
	23 42.8		3.1531278		24 15.4		3.1629773
							Par*

Par. in long. at begin.	° ' "	30 7.0	at end.	22 34.2
Sum,	-	53 49.8	3.5091756	Diff. 1 41.2
Rel. mot. in long.	-	55 31	ar. co. 6.4774254	2.0051805
Observed interval,	1	36 37½	3.7632408	6.4774254
				3.7632408
Int. bet. beg. and conj.	h. ' "	1 33 41.4	3.7498418	bet. end & con. 2 56.1
App. time of beg.	19 24 46.5		Apparent time of ending,	21 1 24.
App. time of conj.	20 58 27.9			20 58 27.9

COMPUTATION of the Apparent Time of Conjunction at Aberdeen.

App. time of begin.	-	h. ' "	19 33 19	App. time of end.	h. ' "	20 49 29
Estimated longitude,	-	+	8 36		+	8 36
Reduced time,	-		19 41 55			20 58 5
Moon's true long.	-		2 13 30 8	at end.		2 14 16 57
Par. in long. nearly,	-	+	24 49		+	19 45
Moon's app. long. nearly,			2 13 54 57			2 14 36 42
Moon's hor. parallax,			60 33.3			60 34.8
Sun's			8.7			8.7
Diff. hor. par.	-		60 24.6			60 26.1
App. time of begin.	-		19 33 19	App. time of end.		20 49 29
Sun's right ascension,	-		4 51 34			4 51 47
Right ascen. meridian,			0 24 53			1 41 16

Now, with the right ascension of the meridian at the beginning, increased by six hours, or $6^h 24' 53''$, the latitude of the place of observation $57^\circ 9' 0''$, and the obliquity of the ecliptic $23^\circ 28' 3''$, the altitude of the nonagesimal is $41^\circ 39' 6''$, and its longitude $35^\circ 46' 6''$; hence the moon's apparent distance from the nonagesimal is $38^\circ 8' 51''$, with which the altitude of the

the nonagesimal, and difference of the horizontal parallaxes of the sun and moon, the parallax in longitude is $24' 47''.9$, and in latitude $45' 8''.2$.

AGAIN, with $7^h 41' 16''$, the sum of the right ascension of the meridian and six hours, the latitude and obliquity of the ecliptic, the altitude of the nonagesimal, is $47^\circ 17' 40''$, and longitude $48^\circ 8' 35''$; the apparent distance of the moon from the nonagesimal is, therefore, $26^\circ 28' 7''$; from whence, the altitude of the nonagesimal, and the difference of the horizontal parallaxes of the sun and moon, the parallax in longitude is $19' 47''.6$, and parallax in latitude $40' 59''.3$.

THE true motion of the moon in longitude is $46' 48''.2$, and that of the sun $3' 2''.1$; hence the moon's relative motion in longitude is $43' 46''.1$; from which, subtracting the difference of the parallaxes in longitude $5' 0''.3$, the remainder $38' 45''.8$ is the apparent relative motion of the moon in longitude.

THE true motion of the moon in latitude, in the observed interval, is $4' 20''.4$; from which, subtracting $4' 8''.9$, the difference of the parallaxes in latitude, the remainder is the moon's apparent motion in latitude.

Now, with the apparent motions of the moon in longitude and latitude, the apparent inclination is found to be $17' 0''$, and the apparent motion of the moon in its relative orbit is $2325''.8$.

WITH the altitude and longitude of the moon at the beginning and end of the eclipse, the augmentation of the moon's semidiameter at the beginning is $9''.0$, and at the end $11''.4$; hence the moon's semidiameter, corrected by the augmentation and inflexion, is $16' 35''.5$ at the beginning of the eclipse, and $16' 37''.9$ at the end; and the sum of the semidiameters of the sun and moon, at those times, are $32' 20''.5$, and $32' 22''.9$ respectively; with which, and the moon's apparent motion in relative orbit, the central angle at the beginning of the eclipse is

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$53^{\circ} 15' 20''$, and at the end $53^{\circ} 9' 39''$; hence arch first is $53^{\circ} 32' 20''$, and arch second $52^{\circ} 52' 39''$.

WITH these arches, and the sum of the semidiameters of the sun and moon at the beginning and end of the eclipse, arches third and fourth will be found equal to $19' 13''.2$ and $19' 32''.6$ respectively. Now, the sum of arch third, and the parallax in longitude at the beginning is $44' 1''.1$, and the difference between arch fourth, and the parallax in longitude at the end, is $15''.0$. Now, with this sum and difference, the moon's true relative motion in longitude, and the observed interval, the difference between the beginning of the eclipse and the conjunction is $1^h 16' 36''.1$, and between the end and the conjunction $26''.1$. Hence the apparent time of conjunction, inferred from the beginning, is $20^h 49' 55''.1$, and from the end it is also $20^h 49' 55''.1$. But the apparent time of conjunction at Greenwich is $20^h 58' 27''.9$; hence the longitude of Aberdeen in time is $8' 32''.8$ west.

COMPUTATION of the Apparent Time of Conjunction, on the Spheroidal Hypothesis, at Greenwich.

	h. ' "		h. ' "
Appt. time of beginning,	19 24 46 $\frac{1}{2}$	Appt. time of ending,	21 1 24
Sun's right ascension,	4 51 30 $\frac{1}{2}$		4 51 47
	<hr/>		<hr/>
Right ascen. meridian,	0 16 17		1 53 11
Moon's true long.	2 13 19 37		2 14 18 59
Ecl. par. in long.	+ 30 20		22 51
	<hr/>		<hr/>
Estimated app. long.	2 13 49 47		2 14 41 50
Moon's hor. par.	60 33.0		60 31.9
Reduction,	— 9.6		9 6
	<hr/>		<hr/>
Reduced hor. par.	60 23.4		60 25.3
			Sun's

And LONGITUDE of ABERDEEN.

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	°	'	"		°	'	"
Sun's hor. par.			8.7				8.7
Difference,	-	60	14.7		60	16.6	
Altitude nonag.	-	45	46 19		53	20 35	
Long. nonag.	-	29	21 19		46	35 16	
Par. in long.	-		30 14.6			22 46.9	
Par. in lat.	-		42 1.2			35 19.1	
Moon's true rel. mot. in lon.		55	31.0	Moon's true mot. in lat.		5	30.3
Diff. par. in longitude,		7	27.7	Diff. par. in latitude,		6	2.1
<hr/>				<hr/>			
☽'s app. rel. mot. in long.		48	3.3	App. mot. in lat.			31.8
App. inclination,	-	37	55	App. mot. in rel. orbit,		48	3.5
Moon's semidiameter,		16	30.0			16	30.0
Augmentation,	-	+	9.0			+	12.5
Inflexion,	-	-	3.5			-	3.5
<hr/>				<hr/>			
Corrected semidiameter,		16	35.5			16	39.0
Sun's semid. — Irrad.		15	45.0			15	45.0
<hr/>				<hr/>			
Sum,	-	32	20.5			32	24.0
Central angle,	-	42	7 6		42	1 30	
App. inclination,		37	55			37	55
<hr/>				<hr/>			
Arch first,	-	42	45 1	Arch second,		41	23 35
Arch third,		23	44.9	Arch fourth,		24	18.4
Par. in long. at beginning,		30	14.6	At end.		22	46.9
<hr/>				<hr/>			
Sum,	-	53	59.5	Difference,		1	31.5
Hence interval between	h.	'	"	Interval between the end and	h.	'	"
the beg. and conj.		1	33 58.3	conjunction,		0	2 39.2
App. time of begin.		19	24 46.5	App. time of ending,		21	1 24.0
<hr/>				<hr/>			
App. time of conj.		20	58 44.8			20	58 44.8

At Aberdeen.

	h. ' "		h. ' "
App. time of beginning,	19 33 19	App. time of end.	20 49 29
Sun's right ascension, -	4 51 34		4 51 47
	<hr/>		<hr/>
Right ascen. of meridian,	0 24 53		1 41 16
			Moon's

DETERMINATION of the LATITUDE

	s.	°	'	"		s.	°	'	"
Moon's true longitude,	2	13	30	8		2	14	16	57
Estimate par. in longitude,	+		24	55		+		19	54
<hr/>									
Estimated apparent long.	2	13	55	3		2	14	36	51
Moon's hor. parallax,			60	33.3				60	34.8
Reduction,	-			11.1		-			11.1
<hr/>									
Reduced parallax,	-		60	22.2				60	23.7
Sun's hor. par.	-			8.7					8.7
<hr/>									
Difference,	-		60	13.5				60	15.0
Altitude nonag.	-		41	50 6				47	29 32
Longitude nonag.	-		35	33 53				47	59 26
Par. in longitude,	-			24 55.4					19 54.2
Par. in latitude,	-			44 52.2					40 42.6
Moon's true rel. mot. in long.			43	46.1	Moon's true mot. in lat.			4	20.4
Diff. par. in longitude,	-		5	1.2	Diff. par. in latitude,			4	9.6
<hr/>									
App. mot. in longitude,	-		38	44.9	App. mot. in latitude,				10.8
App. inclination,	-		15	58	App. mot. in rel. orbit,			38	44.9
Moon's femidiameter,			16	30.0				16	30.0
Augmentation,	-		+	9.2				+	11.6
Inflexion,	-			3.5					3.5
<hr/>									
Corrected femidiameter,			16	35.7				16	38.1
Sun's femid. — Irrad.			15	45.0				15	45.0
<hr/>									
Sum,	-		32	20.7				32	23.1
Central angle,	-		53	16 36				53	10 55
App. inclination,	-		15	58				15	58
<hr/>									
Arch first,	-		53	32 34	Arch second,			52	54 57
Arch third,	-		19	13.2	Arch fourth,			19	31.7
Par. in longitude,	-		24	55.4				19	54.2
<hr/>									
Sum,	-		44	8.6	Difference,				22.5

Hence

	h. ' "		h. ' "
Hence the interval between the beg. and conj. is	- 1 16 49.2	Interval between the end and conjunction is	39.2
App. time of beginning,	19 33 19.	App. time of ending,	20 49 29.
	<hr/>		<hr/>
App. time of conj.	20 50 8.2		20 50 8.2
App. time of conj. at Green.	20 58 44.8		
	<hr/>		
Longitude in time,	8 36.6		

DETERMINATION of the Longitude of the late Observatory at Aberdeen, from the Apparent Times of Observation of the Immersion and Emergence of η II: Observed at Greenwich and Aberdeen, 2 November 26. 1787.

	h. ' "		h. ' "
App. time of immer. at Gr.	11 22 51.7	At Aberdeen,	11 18 8
Emer.	12 31 45.		12 23 12
	<hr/>		<hr/>
Observed interval,	- 1 8 53.3		1 5 4

COMPUTATION of the Apparent Time of Conjunction in the Spherical Hypothesis, at Greenwich.

	h. ' "		h. ' "
App. time of immer.	11 22 51.7	App. time of emer.	12 31 45
Sun's right ascension,	16 10 56.7		16 11 8
	<hr/>		<hr/>
Right ascen. of meridian,	3 33 48.4		4 42 53
	<hr/>		<hr/>
	s. ° ' "		s. ° ' "
Moon's true longitude,	2 29 50 23		3 0 33 32
Estimate par. in long.	+ 23 9.		+ 13 3.
	<hr/>		<hr/>
Eft. apparent longitude,	3 0 13 32		3 0 33 32
Moon's true latitude,	0 20 3.5		0 24 1.8
Estimate par. in latitude,	+ 32 9.5		+ 30 5.2
	<hr/>		<hr/>
Eft. apparent latitude,	0 52 14. S.		0 54 7. S.
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	°	'	"		°	'	"
Horizontal parallax,	-	61	11.3		61	10.6	
Alt. nonag.	-	58	49 53		61	4 57	
Long nonag.	-	64	18 46		76	24 45	
Par. in longitude,	-	22	52.7		13	17.0	
Par. in latitude,	-	32	22.7		30	13.6	
Moon's true rel. mot. in long.	43	8 4		Moon's true mot. in latitude,	3	58.3	
Diff. par. in longitude,	9	35.7		Diff. par. in latitude,	1	59.1	
<hr/>				<hr/>			
Moon's appt. mot. in long.	33	32.7		Appt. mot in latitude,	1	59.2	
Appt. inclination,	-	3	23 22	Appt. mot. in orbit,	33	36.2	
Moon's semidiameter,		16	40.1		16	39.9	
Augmentation,	-	-	13.7		+	15.2	
Inflection,	-	-	3.5		-	3.5	
<hr/>				<hr/>			
Corrected semidiameter,		16	50.3		16	51.6	
Central angle at immer.	4	18 24		At emerſion,	4	18 4	
Apparent inclination,	3	23 22			3	23 22	
<hr/>				<hr/>			
Arch firſt,	-	7	41 46	Arch ſecond,	0	54 42	
Arch third,	-	16	41.2	Arch fourth,	16	51.5	
Parallax in longitude,		22	52.7		13	17.0	
<hr/>				<hr/>			
Sum,	-	39	33.9	Difference,	3	34.5	
Hence interval between				Interval between the emerſion			
immer. and conj.	1	3 10.8		and conjunction,	5	42.5	
Appt. time of immer.	11	22 51.7		Appt. time of emer.	12	31 45.	
<hr/>				<hr/>			
Appt. time of conjunct.	12	26 2.5			12	26 2.5	

AT Aberdeen.

	h.	'	"		h.	'	"
Appt. time of immer.	11	18 8		Appt. time of emerſion,	12	23 12	
Sun's right aſcenſion,	16	10 57.4			16	11 9	
<hr/>				<hr/>			
Right aſcen. of meridian,	3	29 5.4			4	34 21	
	s.	°	'		s.	°	'
Moon's true longitude,	2	29 52 48.8			3	0 33 33.6	
							121.

And LONGITUDE of ABERDEEN.

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Est. par. in longitude,	$\begin{array}{c} 0' \\ + 20' 45.2'' \end{array}$		$\begin{array}{c} 0' \\ + 12' 38.4'' \end{array}$
Est. appt. longitude,	$\begin{array}{c} 3 0 13 34 \end{array}$		$\begin{array}{c} 3 0 46 12. \end{array}$
Moon's true latitude,	$\begin{array}{c} 20 16.9 \end{array}$		$\begin{array}{c} 24 2.0 \end{array}$
Est. par. in latitude,	$\begin{array}{c} - 37 6.1 \end{array}$		$\begin{array}{c} 35 18.0 \end{array}$
Approx. appt. latitude,	$\begin{array}{c} 57 23.0 \text{ S.} \end{array}$		$\begin{array}{c} 59 20.0 \text{ S.} \end{array}$
Horizontal parallax,	$\begin{array}{c} 61 11.3 \end{array}$		$\begin{array}{c} 61 10.6 \end{array}$
Alt. nonag. -	$\begin{array}{c} 53 8 59. \end{array}$		$\begin{array}{c} 55 17 2 \end{array}$
Longitude nonag.	$\begin{array}{c} 65 29 36 \end{array}$		$\begin{array}{c} 76 3 32 \end{array}$
Par. in longitude,	$\begin{array}{c} 20 29.1 \end{array}$		$\begin{array}{c} 12 46.2 \end{array}$
Par. in latitude,	$\begin{array}{c} 37 24.9 \end{array}$		$\begin{array}{c} 35 40.4 \end{array}$
Moon's true mot. in long.	$\begin{array}{c} 40 44.8 \end{array}$	Moon's true mot. in latitude,	$\begin{array}{c} 3 45.1 \end{array}$
Diff. of par. in longitude,	$\begin{array}{c} 7 42.9 \end{array}$	Diff. of par. in latitude,	$\begin{array}{c} 1 44.5 \end{array}$
Moon's appt. mot. in long.	$\begin{array}{c} 33 1.9 \end{array}$	Appt. mot. in latitude,	$\begin{array}{c} 2 0.6 \end{array}$
Appt. inclination,	$\begin{array}{c} 3 28 56 \end{array}$	Appt. mot. in orbit,	$\begin{array}{c} 33 5.5 \end{array}$
Moon's semidiameter,	$\begin{array}{c} 16 40.1 \end{array}$		$\begin{array}{c} 16 39.9 \end{array}$
Augmentation, -	$\begin{array}{c} + 12.9 \end{array}$		$\begin{array}{c} 14.1 \end{array}$
Inflexion, -	$\begin{array}{c} - 3.5 \end{array}$		$\begin{array}{c} 3.5 \end{array}$
Moon's corrected semid.	$\begin{array}{c} 16 49.5 \end{array}$		$\begin{array}{c} 16 50.5 \end{array}$
Central angle, -	$\begin{array}{c} 10 35 40 \end{array}$		$\begin{array}{c} 10 35 2 \end{array}$
Appt. inclination,	$\begin{array}{c} 3 28 56 \end{array}$		$\begin{array}{c} 3 28 56 \end{array}$
Arch first, -	$\begin{array}{c} 7 6 44 \end{array}$	Arch second,	$\begin{array}{c} 14 3 58 \end{array}$
Arch third, -	$\begin{array}{c} 16 41.7 \end{array}$	Arch fourth,	$\begin{array}{c} 16 20.8 \end{array}$
Par. in longitude, -	$\begin{array}{c} 20 29.1 \end{array}$		$\begin{array}{c} 12 46.2 \end{array}$
Sum, -	$\begin{array}{c} 37 10.8 \end{array}$	Difference,	$\begin{array}{c} 3 34.0 \end{array}$
Hence the interval between im. and conj.	$\begin{array}{c} \text{h. } 0 59 22.3 \end{array}$	Interval between the emer. and conjunction,	$\begin{array}{c} \text{h. } 0 5 41.7 \end{array}$
Appt. time of immer.	$\begin{array}{c} 11 18 8 \end{array}$	Appt. time of emerion,	$\begin{array}{c} 12 23 12 \end{array}$
Appt. time of conj.	$\begin{array}{c} 12 17 30.3 \end{array}$		$\begin{array}{c} 12 17 30.3 \end{array}$
At Greenwich,	$\begin{array}{c} 12 26 2.5 \end{array}$		
Longitude in time,	$\begin{array}{c} 8 32.2 \end{array}$		

T 2:

Com-

COMPUTATION of the Apparent Times of Conjunction in the Spheroidal Hypothesis, at Greenwich.

	s. ° ' "		s. ° ' "
Moon's true long. at im.	2 29 50 23	At emerfion,	3 0 33 32
Eft. parallax in longitude,	+ 22 57		13 19
	<hr/>		<hr/>
Appt. longitude nearly,	3 0 13 20		3 0 46 51
Moon's true latitude,	20 35		24 1.8
Eft. parallax in latitude,	32 5 5		30 5.2
	<hr/>		<hr/>
Appt. latitude nearly,	52 9.		54 7.
Horizontal parallax,	61 11.3		61 10.6
Reduction,	9.8		9.8
	<hr/>		<hr/>
Reduced parallax,	61 1.5		61 0.8
Latitude of Greenwich,	51 28 40		
Reduction,	14 37		
	<hr/>		
Reduced latitude,	51 14 3		
Alt. nonagesimal,	59 3 56		61 19 24
Longitude nonagesimal,	64 14 2		76 22 15
Par. in longitude,	22 56.2		13 19.3
Par. in latitude,	32 4.8		30 5.5
Moon's true mot. in long.	43 8.4	Moon's true mot. in latitude,	3 58.3
Diff. of par. in long.	9 36.9	Diff. par. in latitude,	1 59.3
	<hr/>		<hr/>
Appt. mot. in longitude,	33 31.5	Appt. mot. in latitude,	1 59.0
Appt. inclination,	3 23 8	Appt. mot. in orbit,	33 35.0
Central angle at immer.	4 44 16	At emerfion,	4 43 54
Arch first,	8 7 24	Arch fecond,	1 20 46
Arch third,	16 40.2	Arch fourth,	16 51.3
Parallax in longitude,	22 56.2		13 19.3
	<hr/>		<hr/>
Sum,	39 36.4	Difference,	3 32.0
Hence the interval between h. ' "		Interval between the emer.	
the immer. and conj.	1 3 14.8	and conjunction,	5 38.5
Appt. time of immer.	11 22 51.7	Appt. time of emer.	12 31 45.
	<hr/>		<hr/>
Appt. time of conj.	12 26 6.5		12 26 6.5

At

At Aberdeen.

	s. ° ' "		s. ° ' "
Moon's true long. at immer.	2 29 52.49	At emer.	3 0 33.34
Eft. par. in long.	- + 20.45		12 34
App ^t . longitude nearly,	3 0 13.34		3 0 46.8
Moon's true latitude,	20 17		24 2
Estimated par. in latitude,	37 6		35 18
App ^t . latitude nearly,	- 57 23		59 20
Moon's horizontal parallax,	61 11.3		61 10.6
Reduction,	- 11.3		- 11.3
Reduced parallax,	- 61 0.0		60 59.3
Latitude Aberdeen,	- 57 9 0		
Reduction,	- 13 41		
Reduced latitude,	- 56 55 19		° ' "
Altitude nonag.	- 53 21 52		55 30 30
Longitude nonag.	- 65 24 42		76 0 36
Par. in longitude,	- 20 32.8		12 48.3
Par. in latitude,	- 37 7.2		35 22.1
☽'s true mot. in long.	- 40 44.8	True mot. in latitude,	3 45.1
Diff. of par. in longitude,	7 44.5	Diff. parallax in latitude,	1 45.1
App ^t . mot. in longitude,	33 0.3	App ^t . mot. in latitude,	2 0.0
App ^t . inclination,	- 3 28 4	Mot. in app ^t . orbit,	33 3.9
Central angle at immer.	10 51 14	At emer.	10 50 35
Arch first	7 23 10	Arch second,	14 18 39
Arch third,	- 16 41.1	Arch fourth,	16 19.2
Par. in longitude,	- 20 32.8		12 48.3
Sum,	- 37 13.9	Difference,	3 30.9
Interval between the immer. h. ' "		Interval between the emer. h. ' "	
and conj.	- 0 59 27.2	and conj.	0 5 36.8
App ^t . time of immer.	11 18 8	App ^t . time of emer.	12 23 12
App ^t . time of conj.	12 17 35.2		12 17 35.2
App ^t . time of conj. at Gr.	12 26 6.5		

Longitude

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		' "		"
Longitude in time, -	8 31.3	Long. on spherical hyp. by occult.	8 32.2	
Long. by solar eclipse, -	8 36.6	by eclipse,	8 32.8	
	<hr/>		<hr/>	
Mean, - -	8 33.9	Mean,	8 32.5	

If we suppose, with Messrs DU SEJOUR and LA LANDE, that the difference between the equatorial and polar diameters is $\frac{1}{300}$ of the equatorial diameter, in that case the longitude will be 8' 33'.6.

DETER-

And LONGITUDE of ABERDEEN.

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DETERMINATION of the Longitude of the Observatory at Aberdeen, by Observations of the Lunar Eclipse of 10th September 1783, made at Aberdeen and at Chislehurst in Kent, 19' in Time East of the Royal Observatory at Greenwich,

	Names of Spots.	Apparent Time of Observation at		Diff. of Mer.
		Aberdeen.	Chislehurst.	
		h. ' "	h. ' "	' "
INGRESS.	Aristarchus,	9 42 42.5	9 50 55	8 12.5
	Kepler,	9 44 9.6	9 52 20	8 10.4
	Copernicus,	9 54 8.7	10 2 24	8 15.3
	Manilius covered,	10 7 35.8	10 15 30	7 54.2
	Tycho covered,	10 8 57.8	10 17 5	8 19.2
	Menelaus covered,	10 10 51.9	10 19 10	8 18.1
	Dionysius covered,	10 13 46.9	10 21 38	7 51.1
	Plinius covered,	10 14 55.9	10 22 40	7 44.1
	Mare Crisium E. end,	10 25 51.0	10 34 34	8 43.0
	W. end,	10 30 53.0	10 39 45	8 52.0
	Total darkness,	10 36 39.0	10 46 34	9 55.0
			Sum, -	254.9
			Mean, -	8 23.17
EGRESS.	Aristarchus,	12 24 4.3	12 33 52	9 47.7
	Kepler,	12 27 5.3	12 37 26	10 20.7
	Copernicus,	12 35 34.4	12 45 52	10 18.6
	Plato E. end,	12 38 32.4	12 47 22	8 49.6
	Tycho E. end,	12 40 4.4	12 48 30	8 25.6
	W. end,	12 41 5.4	12 49 58	8 53.6
	Menelaus,	12 53 0.6	13 1 40	8 39.4
	Dionysius,	12 54 45.6	13 3 18	8 32.4
	Plinius,	12 56 48.6	13 5 40	8 51.4
	Mare Crisium E. end,	13 7 10.7	13 16 35	9 24.3
	W. end,	13 12 20.8	13 20 53	8 32.2
	Sum,	-	-	95.5
	Mean per egress,	-	-	9 8.68
	Mean per ingrefs,	-	-	8 23.17
				17 31.85
Diff. mer. Aber. and Chislehurst in time nearly,				8 45.92
Longitude of Chislehurst in time E.				19.
Longitude of Aberdeen nearly,				8 26.92
Change of equation of time in 8' 26".9				.12
Longitude of Aberdeen,				8 26.8 W.

DETER-

DETERMINATION of the Longitude of the Observatory at Aberdeen by a Chronometer, constructed by Mr ARNOLD of London*.

THE chronometer was set to mean solar time at Greenwich, 16th June 1788, and lost $7''.5$ in eleven days. It was sent to Aberdeen by sea; and being compared with the Observatory clock, 15th July, it was found to be $7' 26''.6$ fast, and was losing $6''.4$ daily: It is hence probable that the motion of the ship had altered its rate. Now, supposing this alteration to have commenced when the ship left London, which was on the 8th of July, its error at that time, for the meridian of Greenwich, would therefore be $15''.0$; from this time, till 15th July, it lost $44''.8$, ($= 6''.4 \times 7$), its rate being supposed uniform. Hence its error, for the meridian of Greenwich, 15th July at noon, was $-59''.8$. But its error, for the meridian of the Observatory at Aberdeen, at the same time, was $+ 7' 26''.6$. Hence the longitude of Aberdeen, in time, is $8' 26''.4$ west.

THIS last method of ascertaining the longitude of Aberdeen, although it agrees very well with the former, yet it is not to be so much depended on, as there are some suppositions introduced which may be objected to.

FROM a comparison of the preceding results, it may be presumed, that the longitude of this place, in time, is probably not less than $8' 18''$, as deduced from the observations of the eclipses of the first and second satellites of Jupiter, nor greater than $8' 36''$, as inferred from the solar eclipse of 3d June 1788. The difference between these limits is only $18''$ in time; which in this latitude does not amount to two miles and an half. Upon account of the near agreement of the results of the solar eclipse and occultation, as well as from other observations, I am led to believe.

* SEE Theory and Practice of finding the Longitude, &c. vol. I. p. 208.

believe that $8' 32''$ or $2^{\circ} 8'$ is not far from the exact longitude of this place. Hence the latitude of the Girdlenefs is $57^{\circ} 8'$, and longitude $2^{\circ} 6' W.$ and the latitude of Greigfnefs $57^{\circ} 7' 20''$, and longitude $2^{\circ} 6' W.$ also.

THE latitude and longitude of Aberdeen, as determined above, differ considerably from the same as given in most books of geography and navigation, where indeed they are usually stated with great inaccuracy. Mr DOWNIE, to whom, at his request, I communicated the result of my observations, has, in his *New Pilot*, placed Aberdeen nearly as above, and of course has laid down the adjacent coast, with much more precision than had been formerly done. This was in 1793; I then supposed the longitude $2^{\circ} 9' W.$ which is $1'$ greater than the above determination.