

LXVI. *A Letter from Monsieur de L'Isle, of the Royal Academy of Sciences at Paris, to the Reverend James Bradley, D. D. Astronomer Royal, and Savilian Professor of Astronomy at Oxford.*

Translated from the French.

S I R,

Paris, Nov. 30, 1752.

Read Feb. 21, 1754. **I** Have received the letter, which you did me the honour of writing to me on the 22^d of August this year, O. S. together with the observations made by you at Greenwich, which correspond with those of Monsieur de la Caille made at the cape of Good Hope, with relation to the parallax of the Moon, Venus, and Mars. I now send you, according to your desire, the comparison, which I have made between your observations and those of Monsieur de la Caille. I have, at present, only compared those of Mars; and tho' a considerable number of them have been made by you both, yet I find but six, which really correspond, that is, which have been made on the same star, and in the same night; there being between them only the interval of time necessary for passing from the meridian of the cape to that of Greenwich. From many observations of Monsieur de la Caille, compared with those made in Europe, we are assured, that the cape of Good Hope is east of Greenwich $1^{\text{h}} 14'$; and this is the difference of longitude, which I have supposed, in order to reduce your observations to those of the cape.

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As you have not set down your first observations on the superior or northern limb of Mars, as Monsieur De la Caille mention'd, that he would do on his part; I have been obliged to suppose the apparent diameter of Mars known; and, in the use of your first observations, I have considered it, as, or a little less than, you found it, when you began to observe.

The first observation, which you made corresponding with that of Monsieur De la Caille, is of August 31. in the morning, on which day you found, that the center of Mars in the meridian was $11^{\circ} 21''$ south of star 33 of Pisces. If we deduct $13''$ for the apparent semidiameter of Mars at that time, $11^{\circ} 8''$ will be the difference of the declination of the northern limb of Mars and the star in the meridian of Greenwich. The diurnal variation of Mars in the declination was, at that time, $4^{\circ} 47''$; whence we may conclude it to be $14^{\circ} 48''$ for $1^{\text{h}} 14'$, to be subtracted from the distance observed at Greenwich, in order to reduce it to what it would have been in the meridian of the Cape: So that, by your observation, the northern limb of Mars would have been south of the star $10^{\circ} 53'' 12''$. Monsieur De la Caille found, that star north of the northern limb of Mars $10^{\circ} 18'' 24''$. The difference therefore is $34^{\circ} 48''$, for the sum of the parallaxes of the height of Mars, on that day, in the meridian of Greenwich and the Cape.

Here follows what I have found, with respect to the other days.

Sept. 4. in the morning, at Greenwich, Rig-			
gel south of the centre of Mars . . .	7	50	30
Semidiameter of Mars	0	13	00
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Rigel south of the northern limb of Mars at Greenwich	8	3	30
Diurnal variation in the declination 4' 8", answering to 1 ^h 14'	0	12	47
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Rigel south of the northern limb of Mars by the observations of Greenwich re- duced to that of the Cape	8	16	17
The same distance observed at the Cape	8	51	30
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Difference or sum of the parallaxes of the height of Mars	0	35	13
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Oct. 3. in the evening, at Greenwich, the northern limb of Mars was south of the star λ of Aquarius 4 42 30

The diurnal variation of Mars in decli- nation 0' 59", answering to 1 ^h 14'	0	3	2
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On the 6th of September Mars south of the star, reduced to the meridian of the Cape	4	45	32
The distance observed at the Cape	4	9	54
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The sum of the parallaxes of the height of Mars	0	35	38
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Oct. 4. in the evening, at Greenwich, the star λ was north of the northern limb of Mars 3 26 0

The diurnal variation in declination 1' 18', answering to 1 ^h 14'	0	4	1
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The star northern Sept. 6. of Mars, re-			
duced to the meridian of the Cape	3	30	1
Observed at the Cape	2	58	12
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The sum of the parallaxes of the height			
of Mars	0	31	49

Oct. 7. in the evening, at Greenwich, the			
star λ south of the northern limb of			
Mars	2	17	0
The diurnal variation of the declination			
2' 10", answering to 1 ^h 14'	0	6	42
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The star south on the 6th of Sept. of			
Mars, reduced to the Cape	2	10	18
Observed at the Cape	2	36	36
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Sum of the parallaxes of the height of			
Mars	0	26	18

Oct. 9. in the evening, at Greenwich, the			
star λ south of the northern limb of Mars	7	35	0
Diurnal variation of the declination 2'			
49", answering to 1 ^h 14'	0	8	42
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The star λ south of the northern limb of			
Mars, reduced to the Cape	7	26	18
Observed at the Cape	7	57	24
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The sum of the parallaxes of the height			
of Mars	0	31	6
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This sum of the parallaxes, which I have found from each observation, is the angle at Mars formed by the two visual rays taken by two observers of the same point of Mars. I afterwards deduced, from every one of these six observations, the horizontal parallax of Mars, by taking it in the same ratio to the total sine, which that angle at Mars is to the sum of the sines of the apparent distance of Mars in the zenith of each observer; and I found the horizontal parallax of Mars as you see hereunder.

1751. Aug. 31.	26	42	the horizontal parallax of ζ for each observation.	$\left. \begin{array}{l} 0 \ 27 \\ 2 \ 34 \\ 2 \ 46 \\ 3 \ 20 \\ 3 \ 46 \end{array} \right\}$	additional corrections for reducing the parallaxes to what they ought to be in the opposition of Mars to the Sun.
Sept. 14.	27	10			
Oct. 3.	27	35			
4.	24	34			
7.	20	20			
9.	27	35			

As the horizontal parallax of Mars varies according to the distance of Mars from the Earth, I have calculated, by Dr. Halley's tables, the real distances of Mars from the Earth at the times of your six observations above-mentioned, and at the time of the opposition of Mars to the Sun; after which, making use of the ratio between these distances, I examined how much the horizontal parallax of Mars must be less, in each of your observations, than at the time of that opposition. These are the quantities, which comprise the small table given above, under the title of corrections. These quantities, being added to the parallax deduced simply from each observation, have given the horizontal parallax, such as it ought to be in each observation reduced to the time of the opposition.

The

The calculations being made, here follows what I have found with respect to the horizontal parallax of Mars at the time of the opposition.

By the observation of	31 Aug.	27	9	
	14 Sept.	27	11	
	3 Oct.	30	9	*
	4	27	20	
	7	23	40	*
	9	27	39	

By taking a mean or arithmetical medium between these 6 determinations, we may conclude the horizontal parallax of Mars, at the time of the opposition, to be $27'' 11'''$: but as there are two determinations, which differ from each other about $3''$, and which are those of the 3d and 7th of October; we may reject them, and then we shall find the mean between the other four to be $27'' 20'''$. Hence you see, Sir, that whether we reject those two determinations, or employ them, the horizontal parallax of Mars, at the time of the opposition, comes out near $27'' \frac{1}{4}$; and according to the ratio of the distance of the Sun and Mars from the Earth at that time, we conclude the horizontal parallax of the Sun to be about $10'' \frac{1}{3}$.

This is what I have been able hitherto to conclude from your observations of Mars, with respect to the parallax of the Sun. Having made the same calculations from my own observations, and those of other astronomers, which I could hitherto collect; I have found very near the same parallax of the Sun, by
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taking a medium between all the observations of each astronomer. But I have not always found, that the different observations of other astronomers agree so well with each other, as yours do: For which reason, I have been a little more doubtful in concluding the true parallax of the Sun; and I have no hopes of being able to determine it more precisely, than I have done from your observations, till I have verified the observations of all the other astronomers by each other, and rejected those, which shall be found evidently faulty, after a rigorous examination of them, which I intend to make.

I have not yet compared your other observations with those of Monsieur de la Caille: I propose to do it, as soon as I shall have leisure. I send you, in the mean time, his observations, which our Academy has published, in order to give other astronomers the satisfaction of comparing them with their own.

I do not doubt, that you, Sir, have thought of the transit of Mercury over the Sun, expected on the 6th of May next year. I have made a calculation of it from Dr. Halley's tables, rectified, not only by corrections given by himself after the transit in 1723, but likewise from the observations made upon the transit in 1740, at Cambridge in New England; so that I hope to be exact within a few minutes, with respect to the ingress and emergence of Mercury into and from the disk of the Sun.

I have calculated, that the ingress will be at 2^h 44' in the morning at Paris, and the emergence at 10^h 37', and, consequently, the duration of the passage 7^h 53'; and, likewise, that Mercury will pass near the centre of the Sun; which is sufficient to inform the astronomers,

nomers, of the present age, of the time, when they are to expect the transit: Whereas those, who shall make use of Cassini's tables, from which our ephemerides, and those of Italy, are calculated, will be mistaken no less than 4 hours; the transit being to happen so long sooner by those tables, than by Dr. Halley's. This difference appeared to me considerable enough to deserve, that astronomers should be acquainted with it; and this I am preparing to do by an advertisement, which will be immediately published.

In the mean time, I thought it proper to send to the East Indies, to endeavour to procure from thence exact observations of the transit in those places, where the whole duration may be observed. The emerfion may be seen, in part of North America, a little after sun-rise; and since an accurate observation, which may be made there, will serve to determine the parallax of the Sun, if those observations are compared with the others to be made in the East Indies, I am obliged to write to you, to request you to recommend to all those, who shall be able, and have an opportunity to make this observation, in your English colonies, to attend to it; and that the Royal Society will likewise make use of their interest for that purpose.

I have found, that at Cambridge near Boston, where Mr. Winthrop observed the transit in 1740, Mercury's emerfion from the Sun will be at 5^h 45' in the morning; which is 51 minutes after sun-rise: At New York it will be 5^h 32', which is 34 minutes after sun-rise; in other places, in the neighbourhood, it will be, in proportion, nearer or farther from sun-rise; as will be easily calculated. But it were to be wish'd,

wish'd, that the observation should be made principally in those places, the longitude of which is known, with the utmost exactness possible, from other observations; which would serve the better to determine the parallax of the Sun by the comparison of those observations with such, as shall be made in the East Indies. We already have a considerable number of observations relating to the longitude of Cambridge and New York, besides the new ones, which may be still made there; so that those two places would be the most proper to observe the approaching transit of Mercury over the Sun; which I desire you to recommend to the Royal Society, in order that they may exert all their interest to procure such observations. I am, with perfect esteem,

S I R,

Your most humble, and

most obedient servant,

De L'Isle.

Description of a Piece of Mechanism contrived by James Ferguson, for exhibiting the Time, Duration, and Quantity, of Salar Eclipses, in all Places of the Earth.

Read Feb. 21, 1754. **T**HE principal Parts of this machine (See Plate XIX.) are,

1. A terrestrial globe turned round, by a handle,

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