King's College London Archives: The George III Museum Collection

K/MUS/1/1: Manuscript notebook, 'Observations on the Transit of Venus'

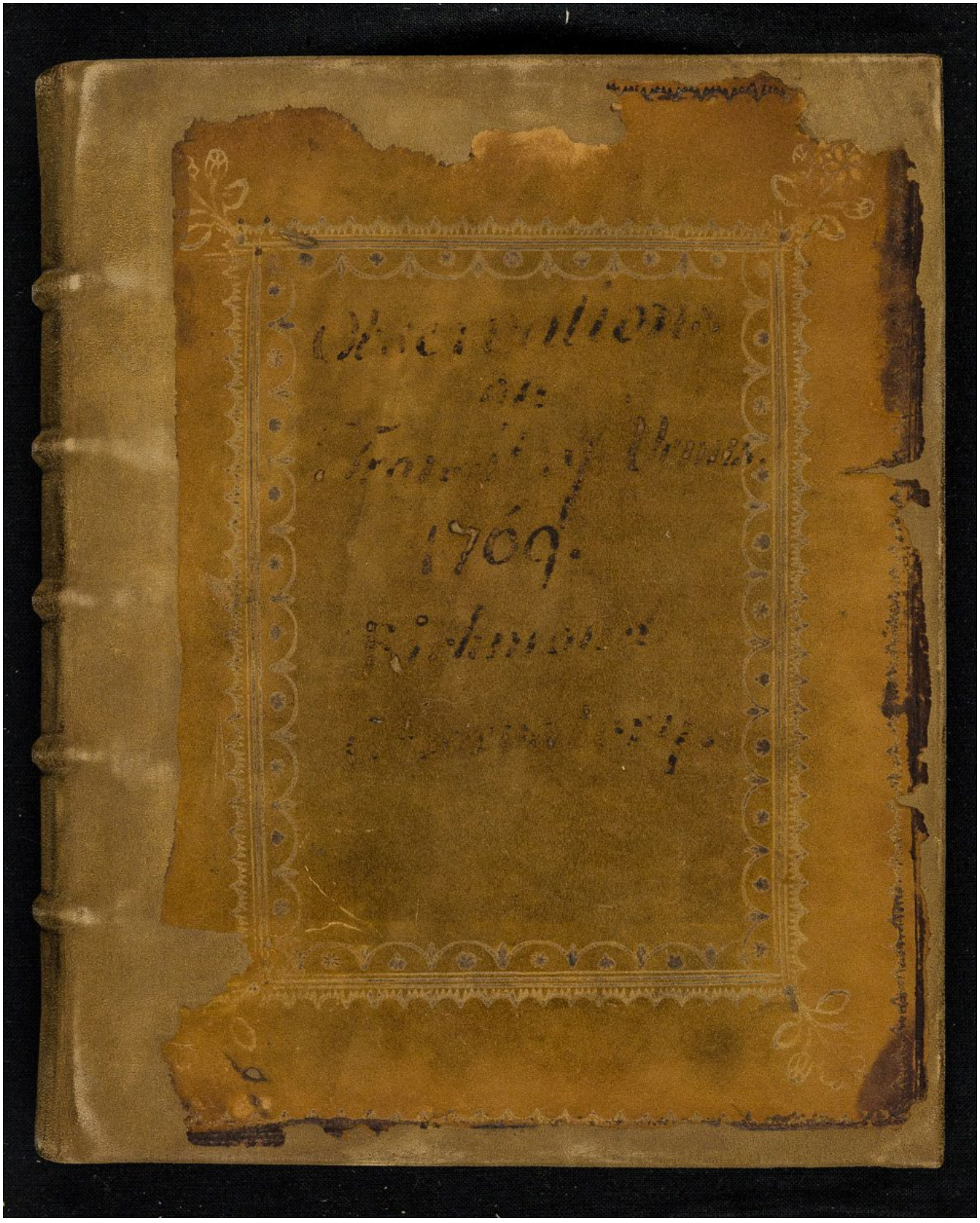
Date:

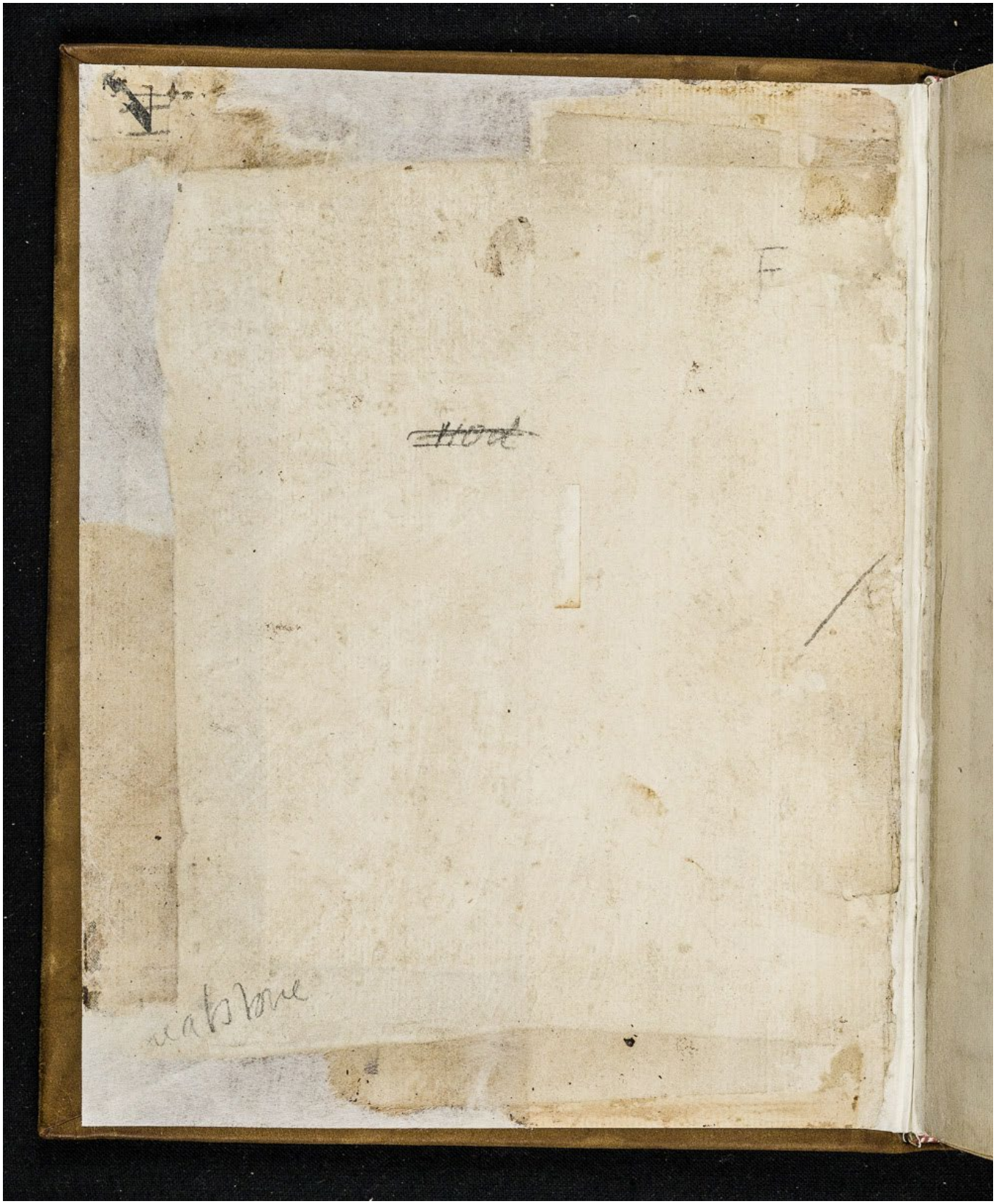
1768-1769

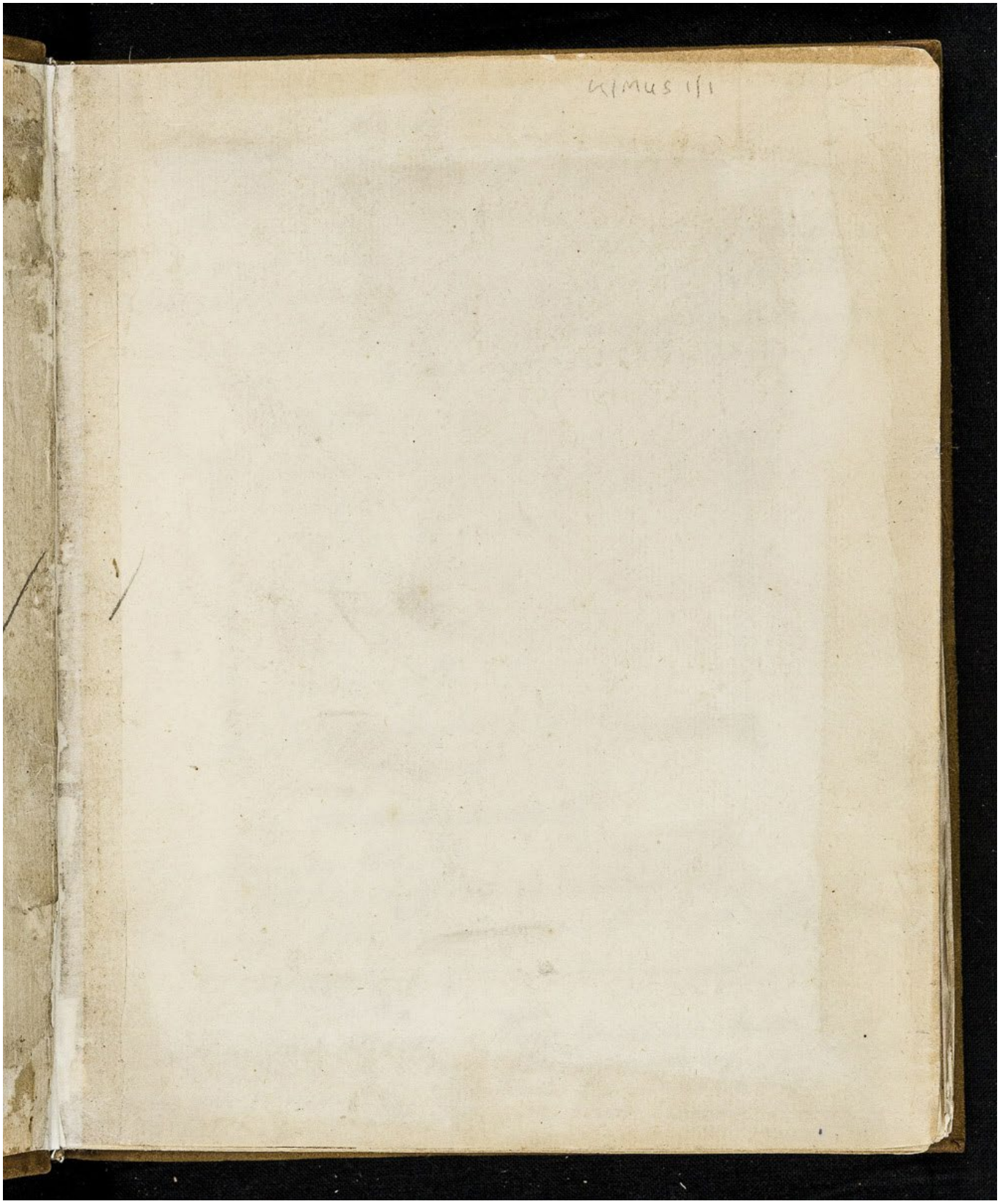
Description:

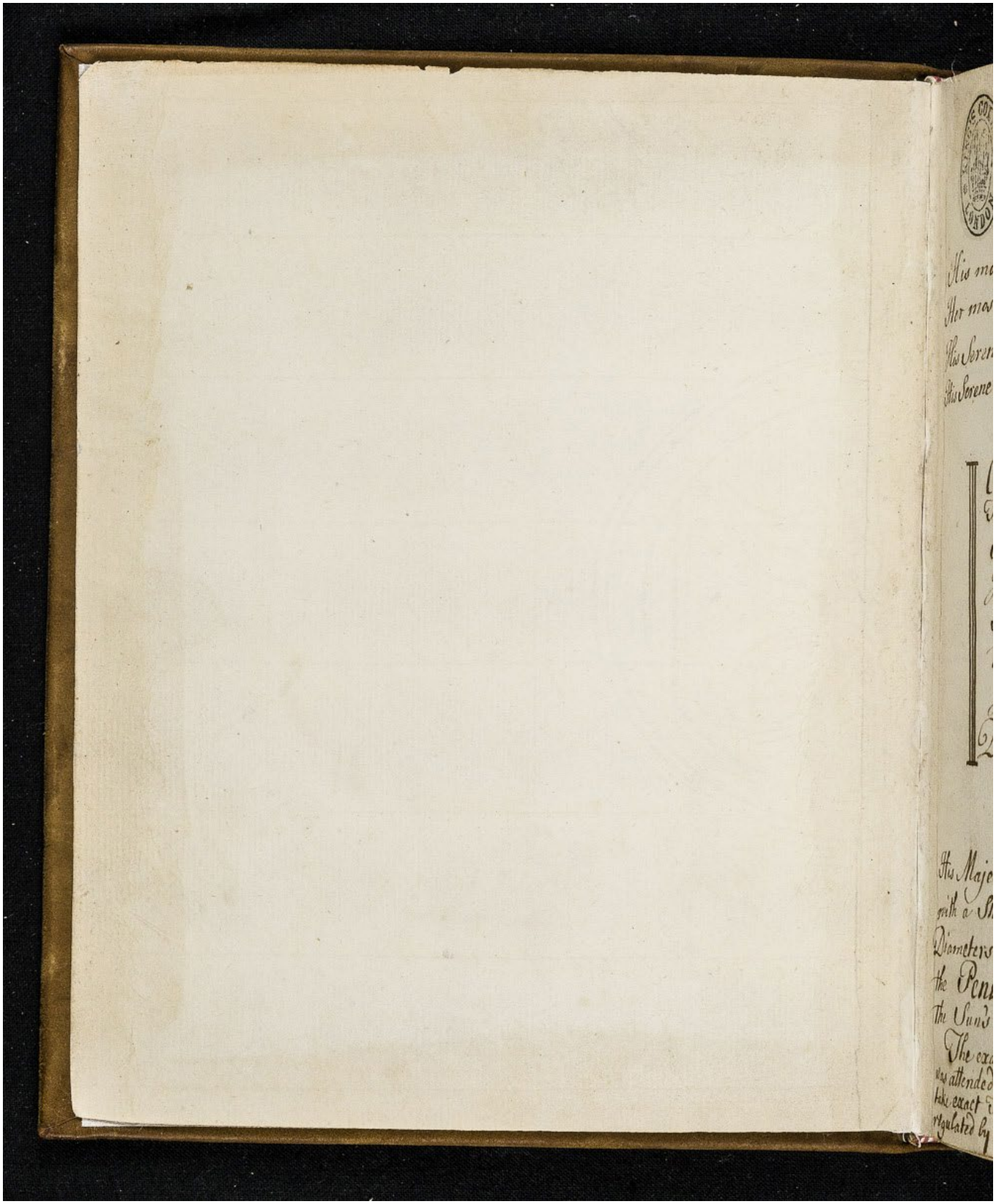
Manuscript notebook entitled 'Observations on the Transit of Venus', made at the Royal Observatory, Kew, Surrey, comprising astronomical observations with tables of viewing data, describing transit witnessed by King George III and others, 3 June 1769, with notes signed by Stephen Demainbray, astronomer. Also observations on the same transit of Venus by Abraham Gotthelf Kaestner, Professor of Mathematics and Natural Philosophy, University of Göttingen, Germany, at Göttingen Observatory, compiled 22 June 1769, and of a lunar eclipse observed by Kaestner at Göttingen, 23 December 1768.

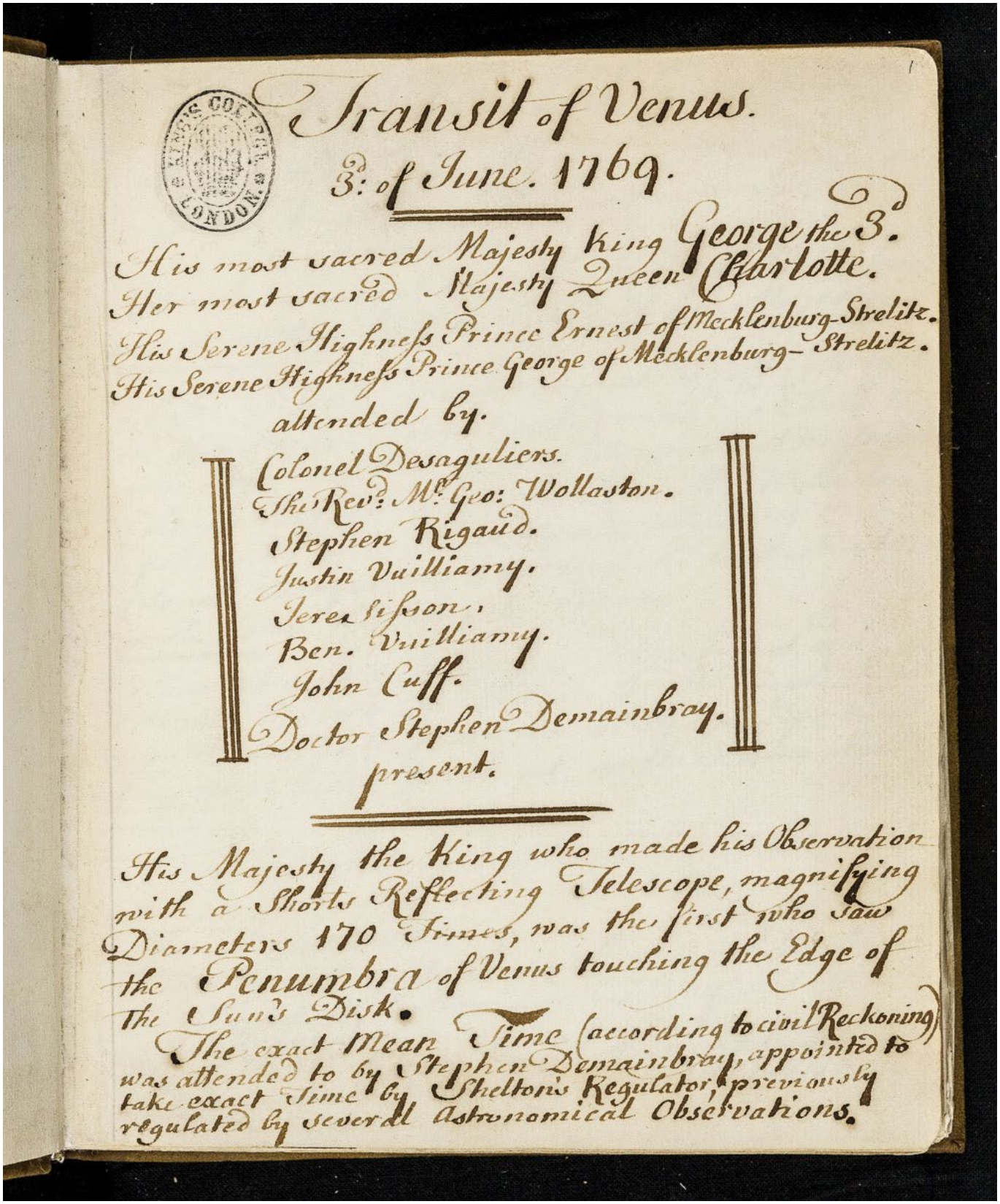
1 volume











Transit of Venus.
3: of June. 1769.

His most sacred Majesty King George the 3.
Her most sacred Majesty Queen Charlotte.
His Serene Highness Prince Ernest of Mecklenburg-Strelitz.
His Serene Highness Prince George of Mecklenburg-Strelitz.

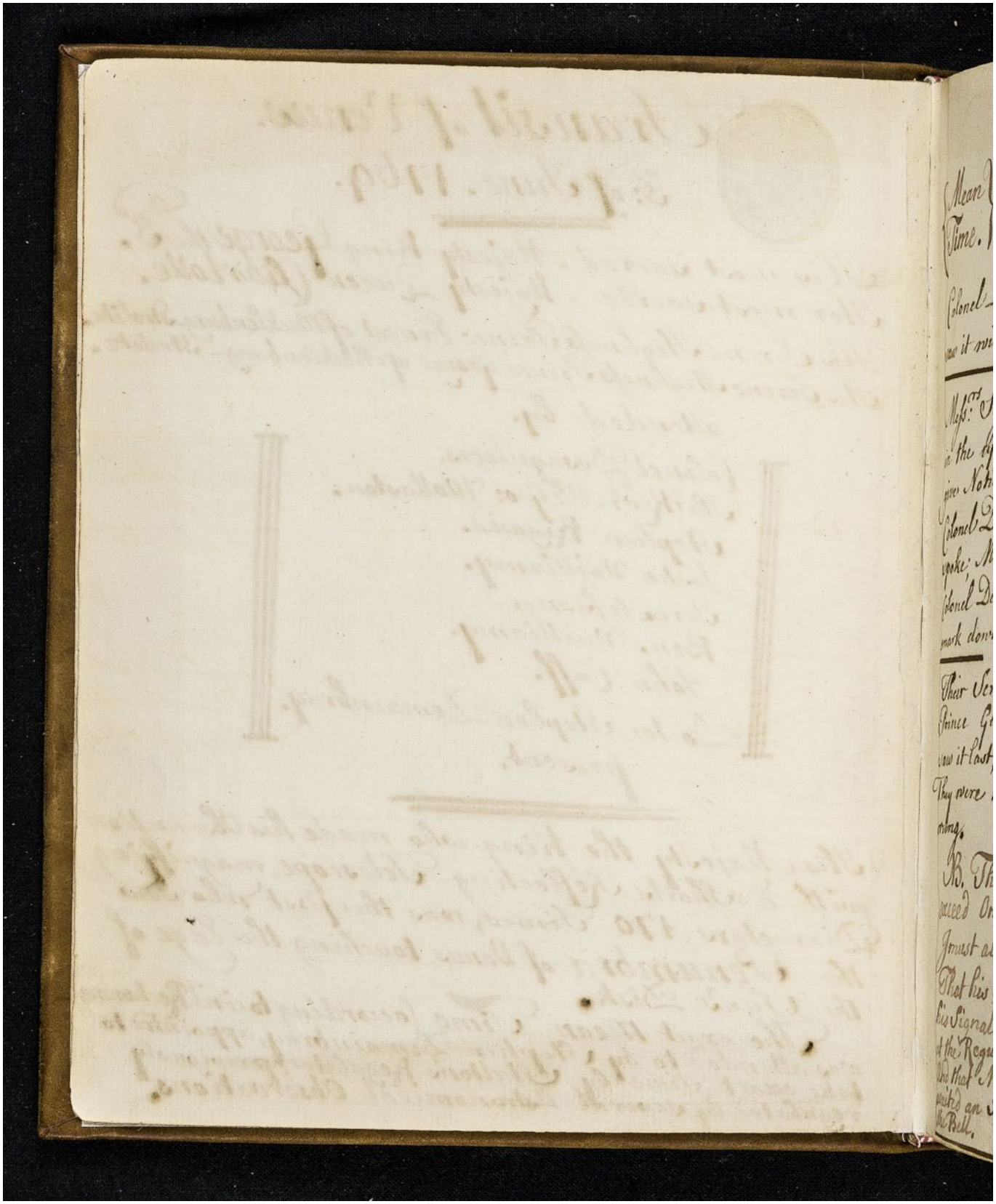
attended by.

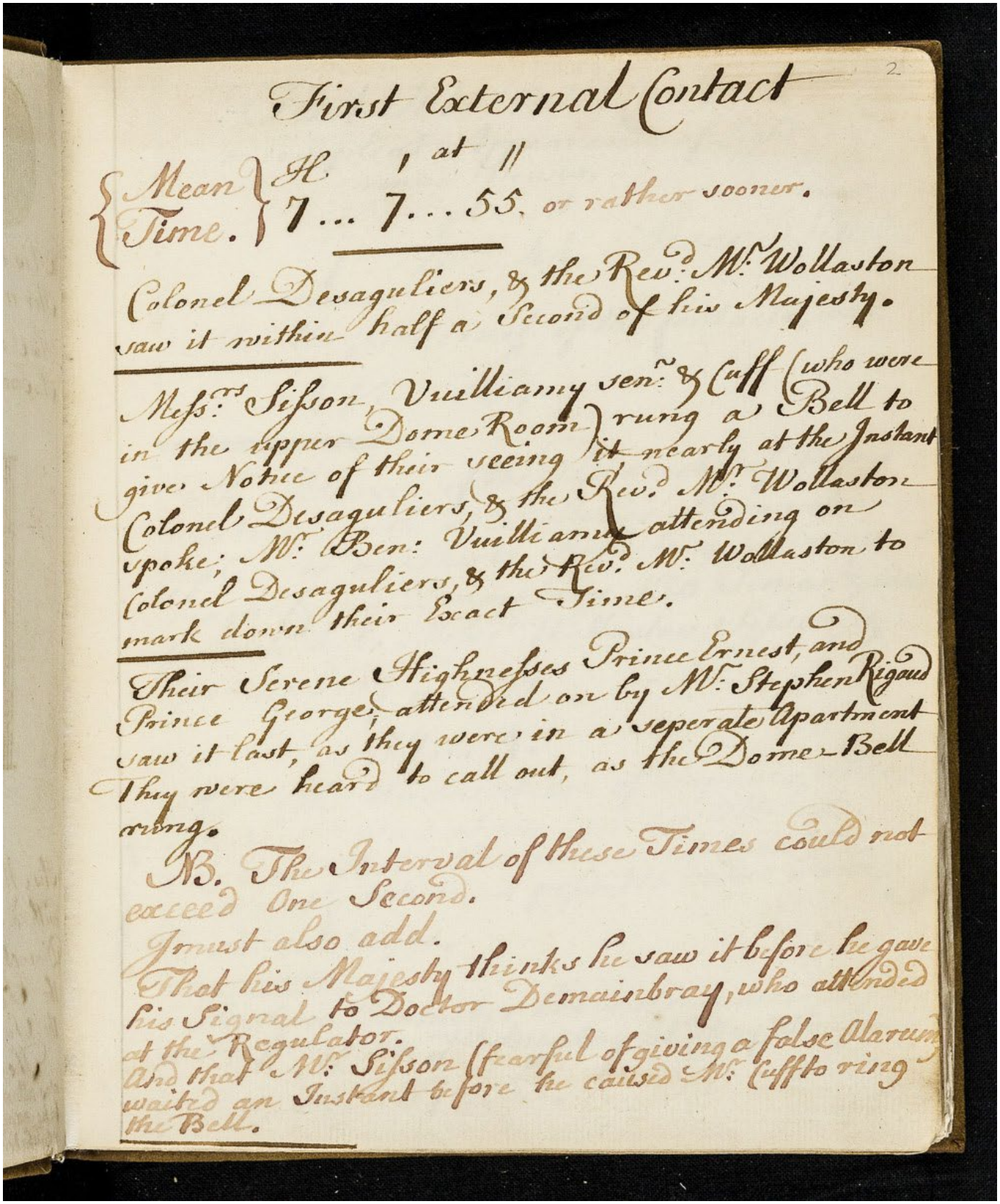
Colonel Desaguliers.
The Revd Mr Geo: Wollaston.
Stephen Rigaud.
Justin Vuilliamy.
Jerex Sisson.
Ben. Vuilliamy.
John Cuff.
Doctor Stephen Demainbray.

present.

His Majesty the King who made his Observation with a Shorts Reflecting Telescope, magnifying Diameters 170 Times, was the first who saw the Penumbra of Venus touching the Edge of the Suns Disk.

The exact Mean Time (according to civil Reckoning) was attended to by Stephen Demainbray, appointed to take exact Time by Shelton's Regulator, previously regulated by several Astronomical Observations.





First External Contact 2.

{Mean Time.} H. 7 ... 7 ... 55. 1 at 11 or rather sooner.

Colonel Desaguliers, & the Rev.d Mr. Wollaston saw it within half a Second of his Majesty.

Messrs. Sisson, Vuilliamy sen.r & Cuff (who were in the upper Dome Room) rung a Bell to give Notice of their seeing it nearly at the Instant Colonel Desaguliers, & the Rev.d Mr. Wollaston spoke; Mr. Ben: Vuilliamy attending on Colonel Desaguliers, & the Rev.d Mr. Wollaston to mark down their Exact Time.

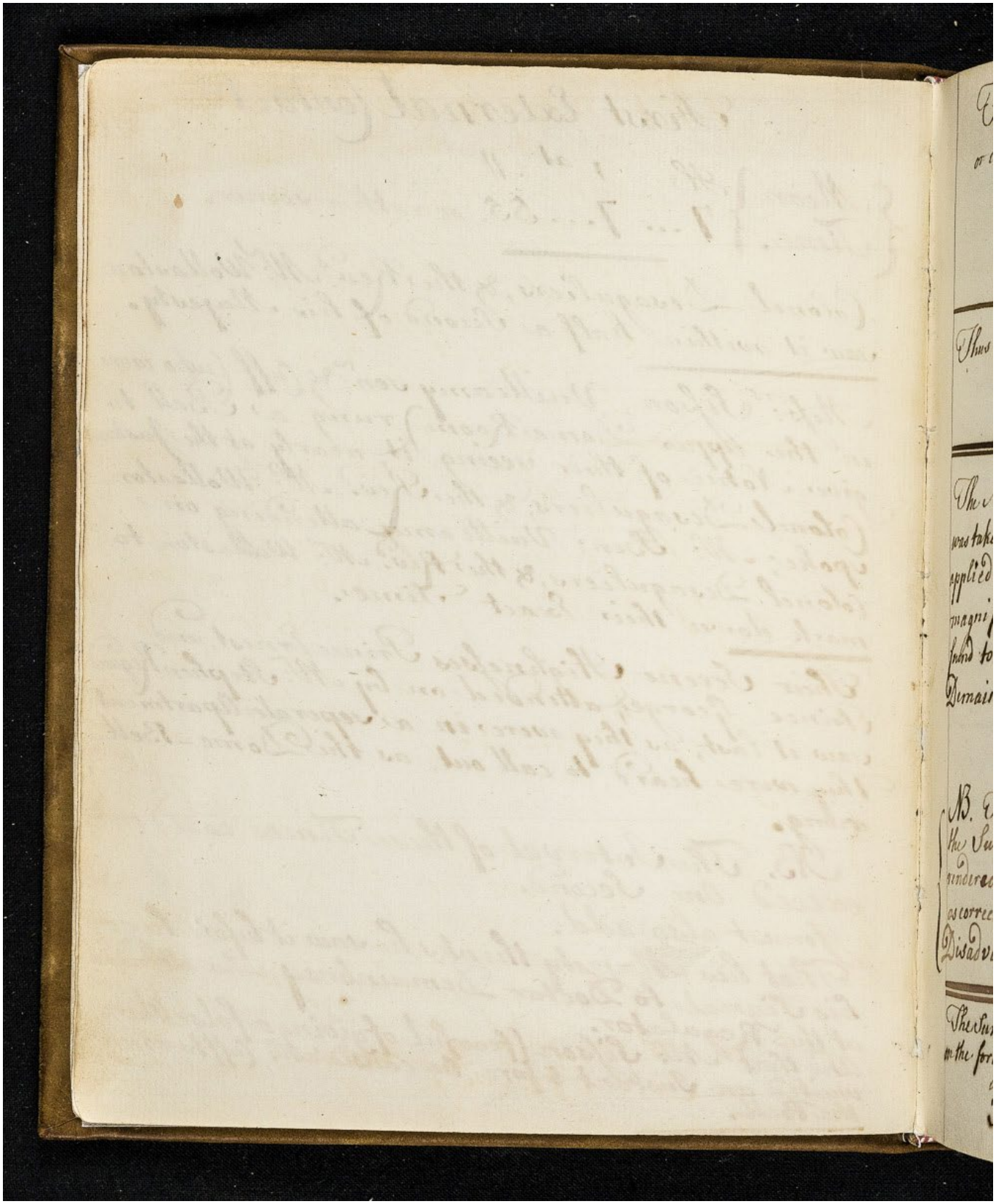
Their Serene Highnesses Prince Ernest, and Prince George, attended on by Mr. Stephen Rigaud saw it last, as they were in a seperate Apartment They were heard to call out, as the Dome Bell rung.

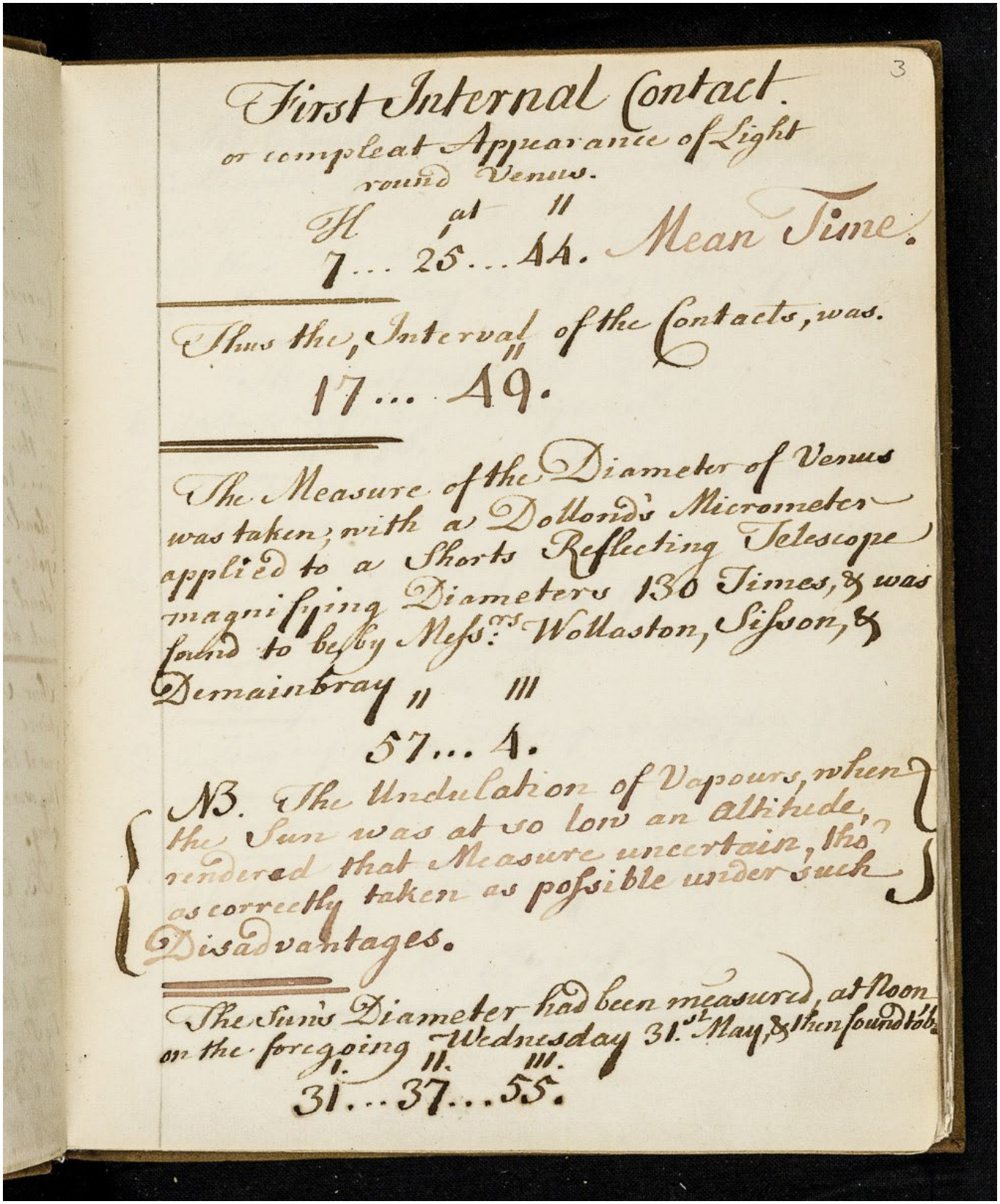
NB. The Interval of these Times could not exceed One Second.

I must also add.

That his Majesty thinks he saw it before he gave his Signal to Doctor Demainbray, who attended at the Regulator.

And that Mr. Sisson (fearful of giving a false Alarum) waited an Instant before he caused Mr. Cuff to ring the Bell.





3

First Internal Contact.
or compleat Appearance of Light
round Venus.

H. at 11
7... 25... 44. Mean Time.

Thus the Interval of the Contacts, was.

17... 49.

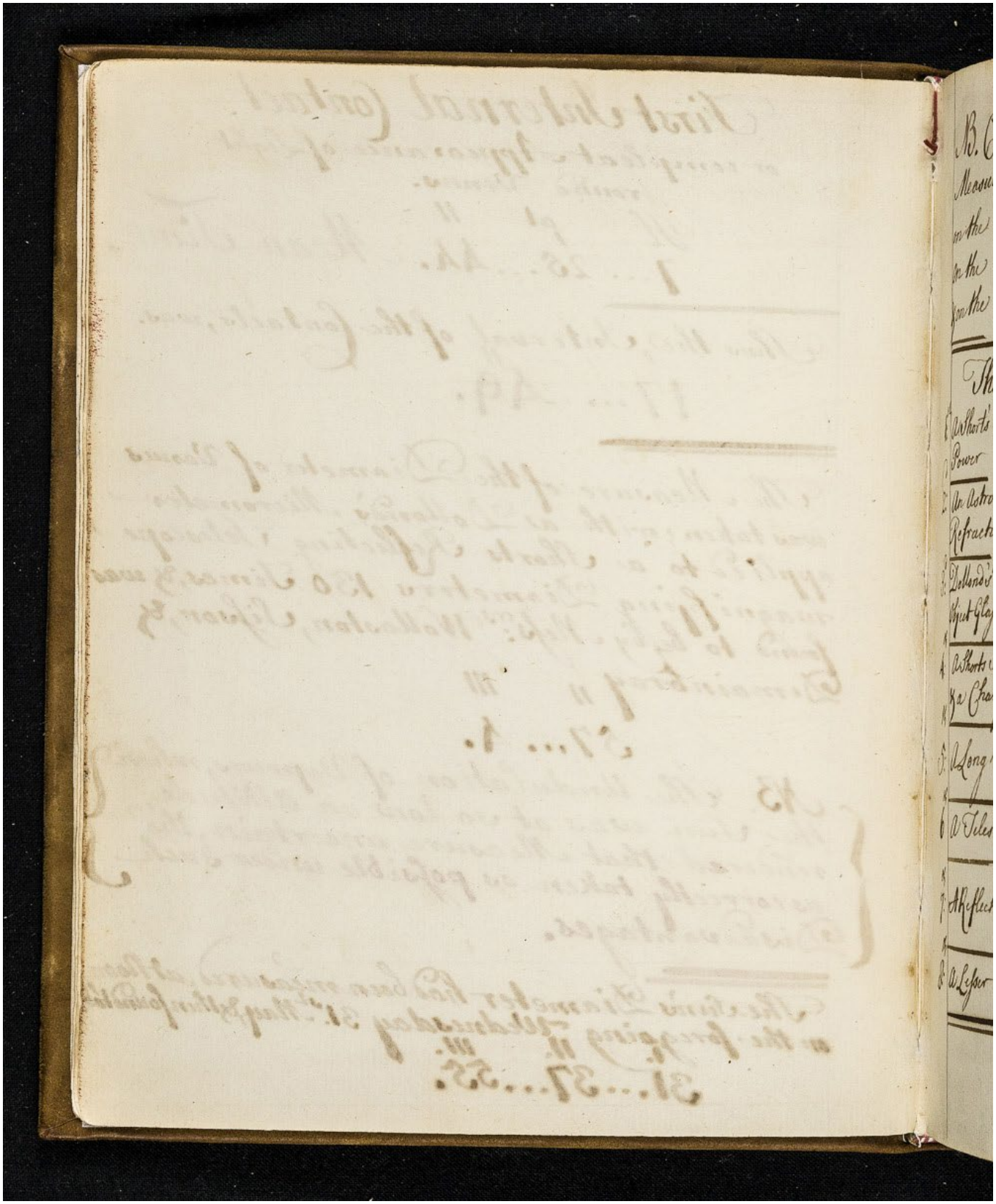
The Measure of the Diameter of Venus was taken, with a Dollond's Micrometer applied to a Shorts Reflecting Telescope magnifying Diameters 130 Times, & was found to be by Messrs. Wollaston, Sisson, & Demainbray

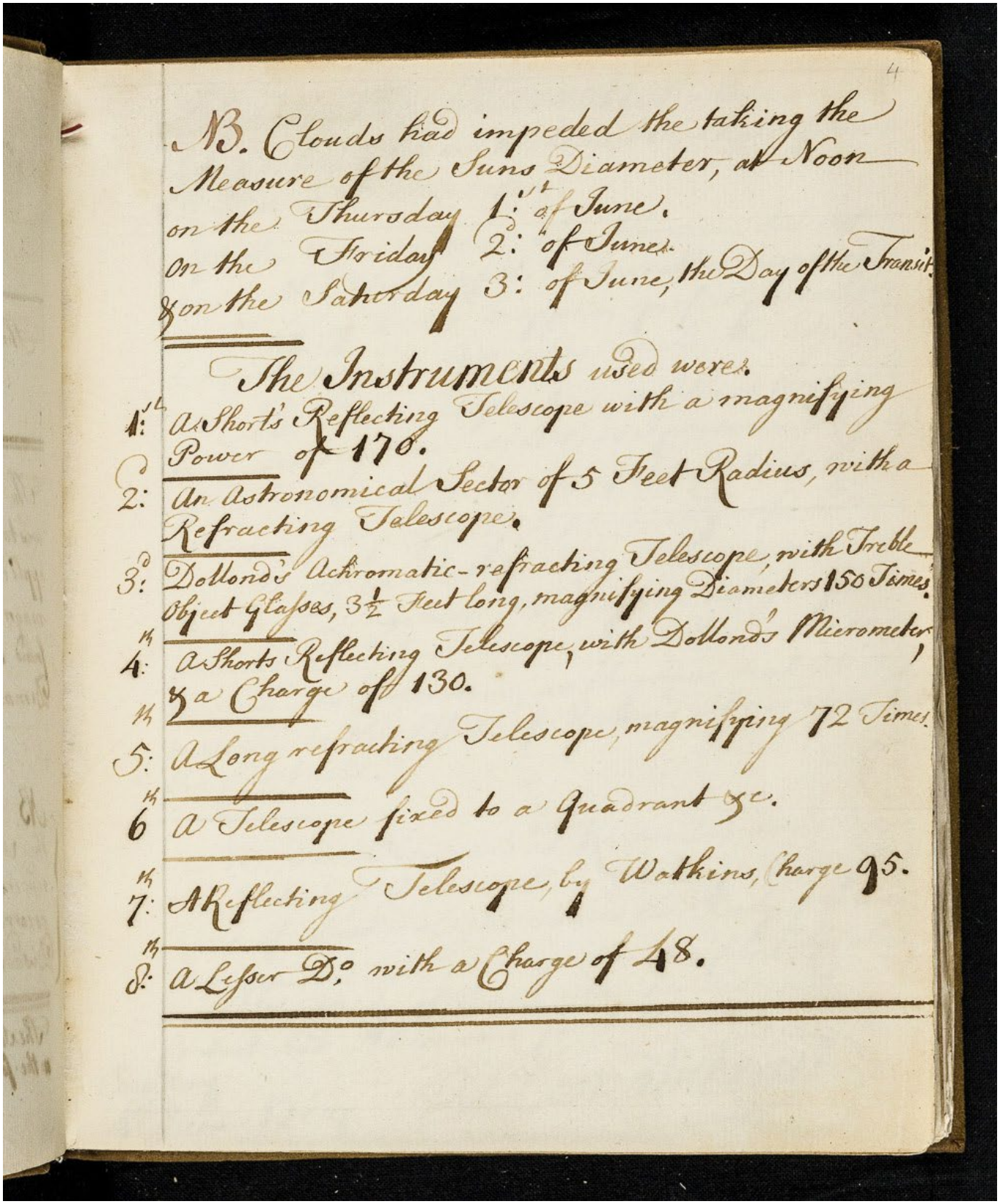
11 111
57... 4.

NB. The Undulation of Vapours, when the Sun was at so low an altitude, rendered that Measure uncertain, this as correctly taken as possible under such Disadvantages.

The Sun's Diameter had been measured, at Noon on the foregoing Wednesday 31st May, & then found to be

I. II. III.
31... 37... 55.





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N.B. Clouds had impeded the taking the Measure of the Suns Diameter, at Noon on the Thursday 1st of June. on the Friday 2d of June. & on the Saturday 3d of June, the Day of the Transit.

The Instruments used were.

1st A Shorts Reflecting Telescope with a magnifying Power of 176.

2d An Astronomical Sector of 5 Feet Radius, with a Refracting Telescope.

3d Dollonds Achromatic-refracting Telescope, with Treble Object Glasses, 3½ Feet long, magnifying Diameters 150 Times.

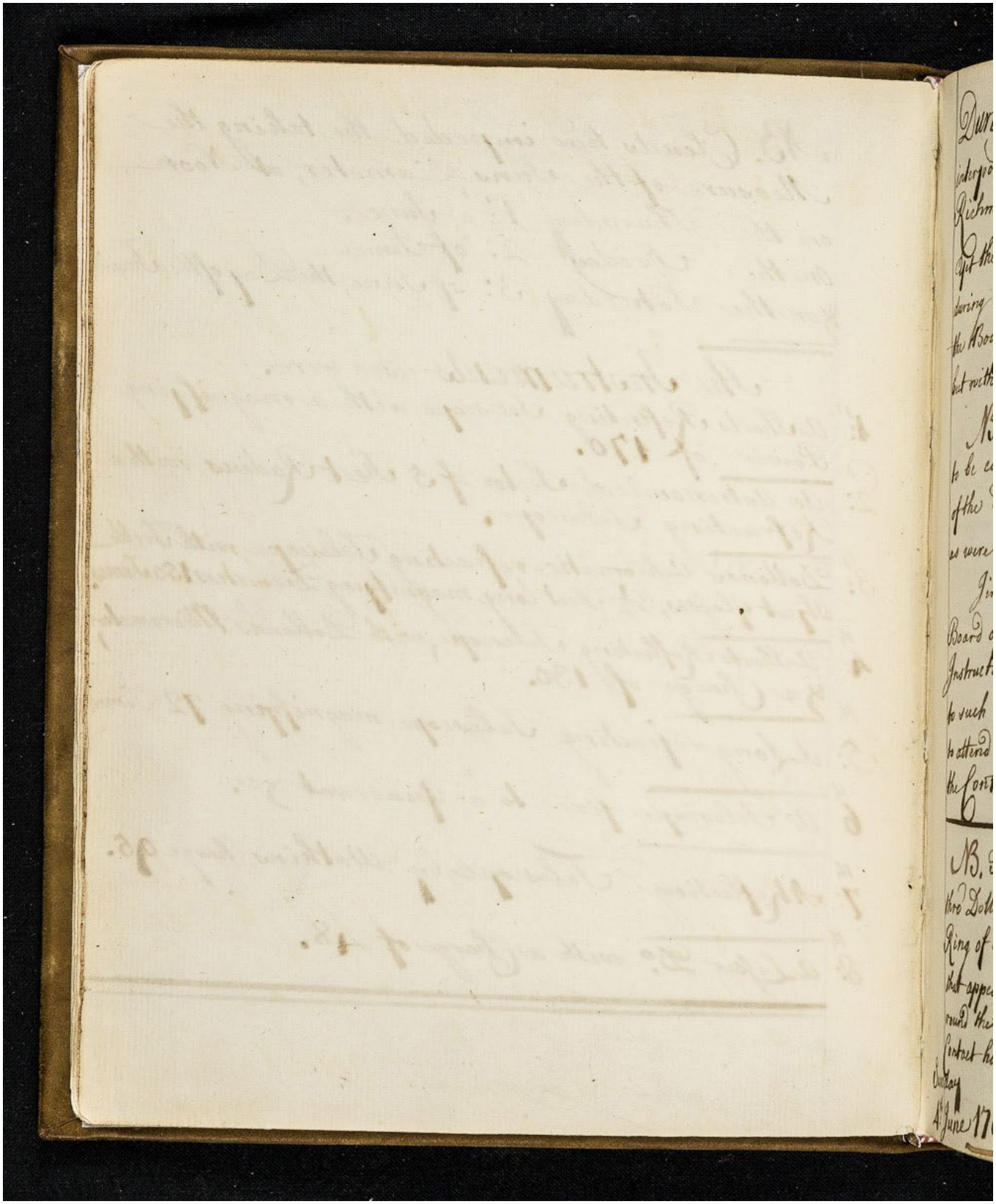
4th A Shorts Reflecting Telescope, with Dollonds Micrometer & a Charge of 130.

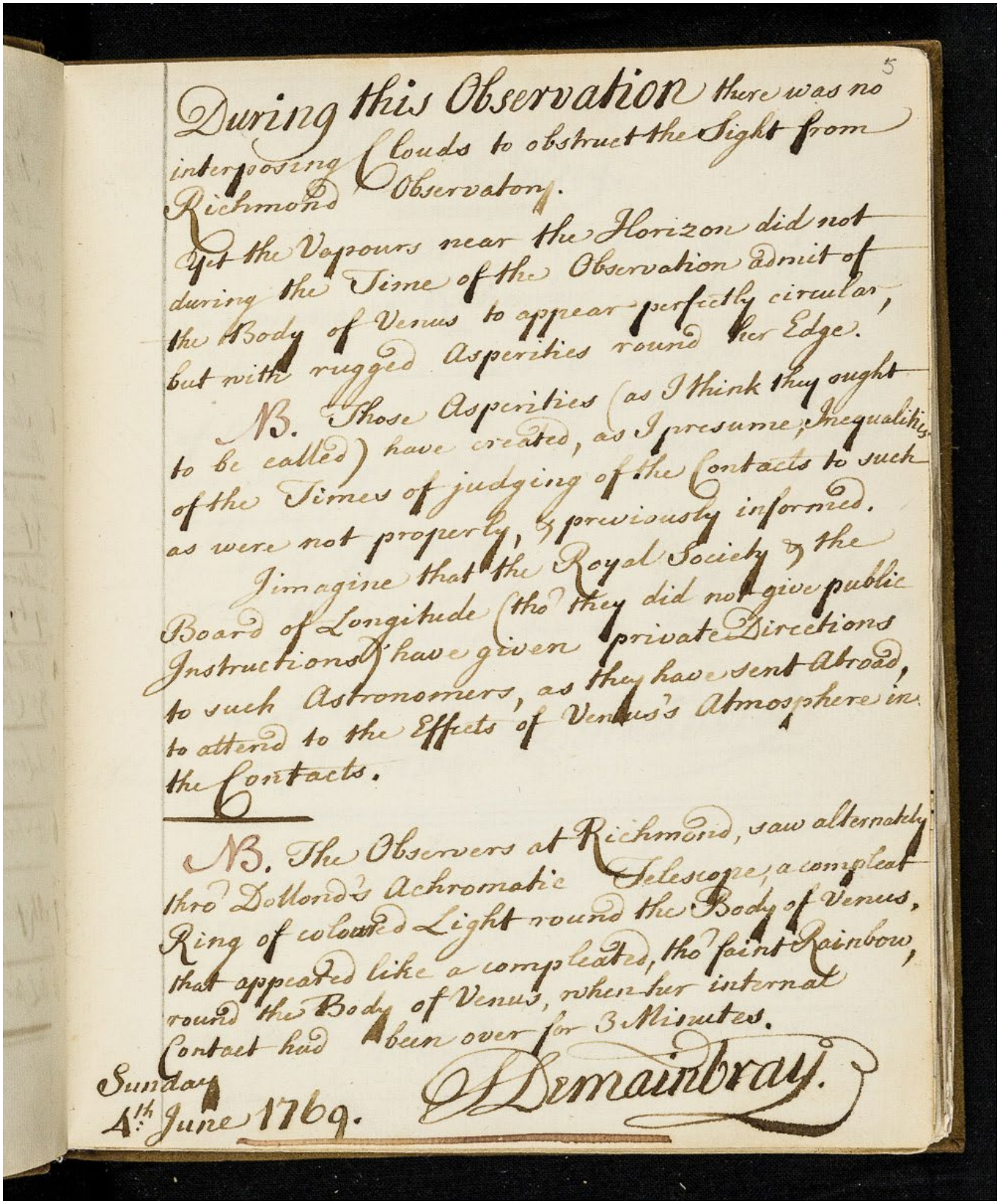
5th A Long refracting Telescope, magnifying 72 Times.

6th a Telescope fixed to a Quadrant &c.

7th A Reflecting Telescope, by Watkins, Charge 9£.

8th a Lesser Do. with a Charge of 4£.





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During this Observation there was no interposing Clouds to obstruct the Sight from Richmond Observatory.

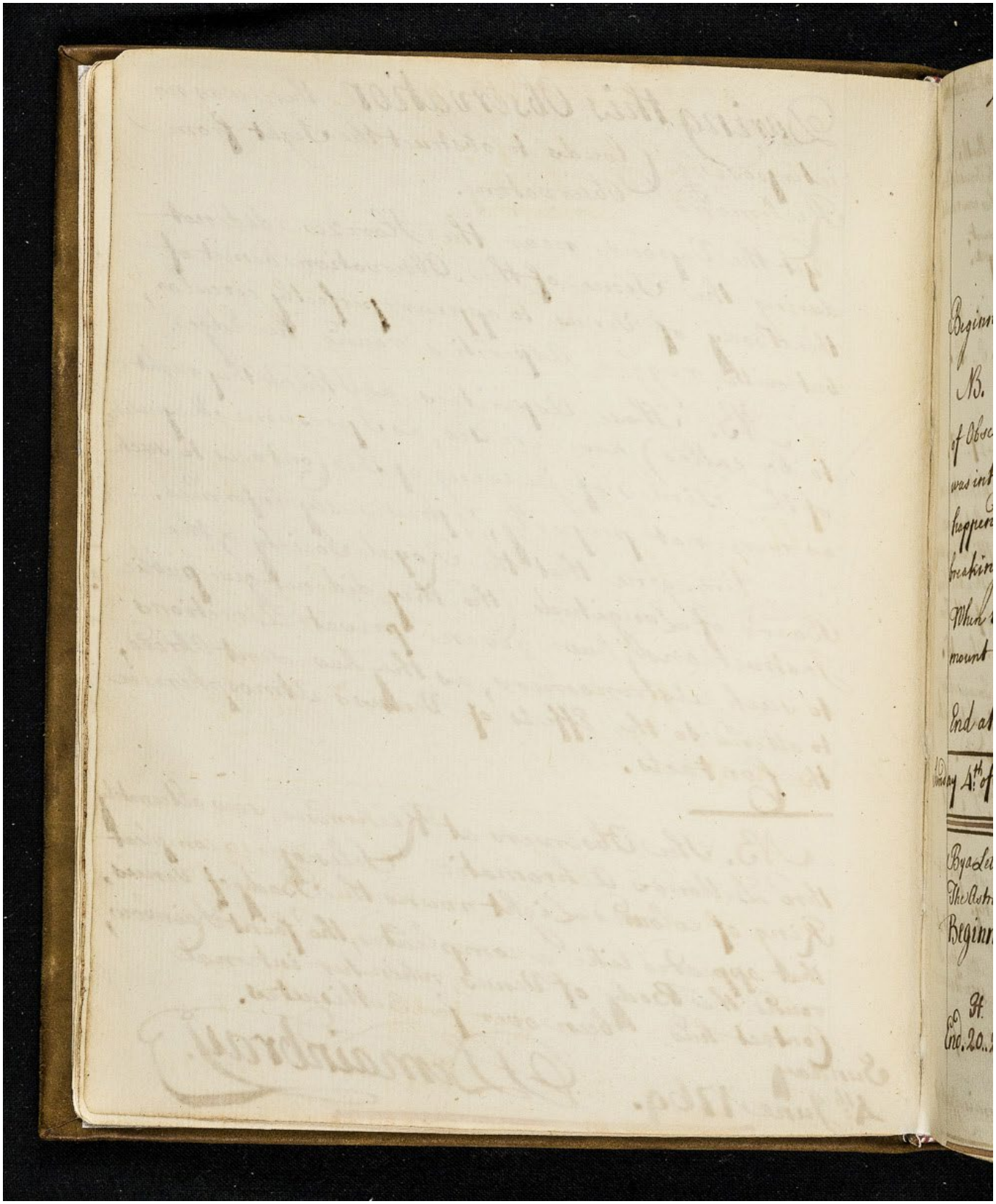
Yet the Vapours near the Horizon did not during the Time of the Observation admit of the Body of Venus to appear perfectly circular, but with rugged Asperities round her Edge.

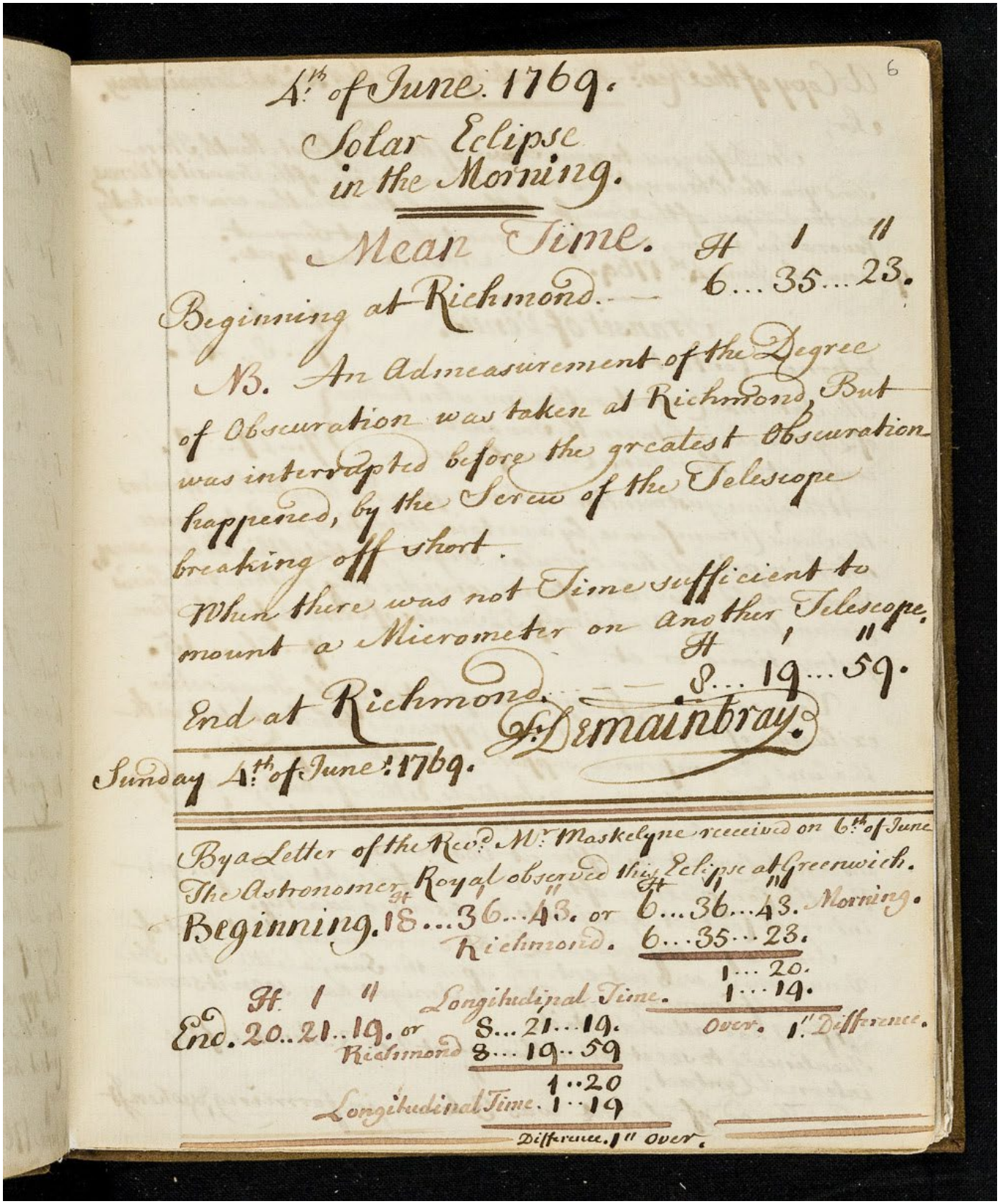
N.B. Those Asperities (as I think they ought to be called) have created, as I presume, Inequalities of the Times of judging of the Contacts to such as were not properly & previously informed.

I imagine that the Royal Society & the Board of Longitude (tho' they did not give public Instructions) have given private Directions to such Astronomers, as they have sent Abroad, to attend to the Effects of Venus's Atmosphere in the Contacts.

N.B. The Observers at Richmond, saw alternately thro' Dollond's Achromatic Telescope, a compleat Ring of coloured Light round the Body of Venus, that appeared like a compleat, tho' faint Rainbow, round the Body of Venus, when her internal Contact had been over for 3 Minutes.

Sunday 4th June 1769. Demainbray.





6

4th of June 1769.

Solar Eclipse in the Morning.

Mean Time. H 1 11

Beginning at Richmond. — 6...35...23.

NB. An Admeasurement of the Degree of Obscuration was taken at Richmond, But was interrupted before the greatest Obscuration happened, by the Screw of the Telescope breaking off short.

When there was not Time sufficient to mount a Micrometer on another Telescope.

H 1 11

End at Richmond. — 8...19...59.

J. Demainbray.

Sunday 4th of June 1769.

By a Letter of the Revd Mr Maskelyne received on 6th of June
The Astronomer Royal observed this Eclipse at Greenwich.

H 1 11

Beginning. 18...36...43. or 6...36...43. Morning.

Richmond. 6...35...23.

1...20.

1...19.

Longitudinal Time.

over. 1st Difference.

H 1 11

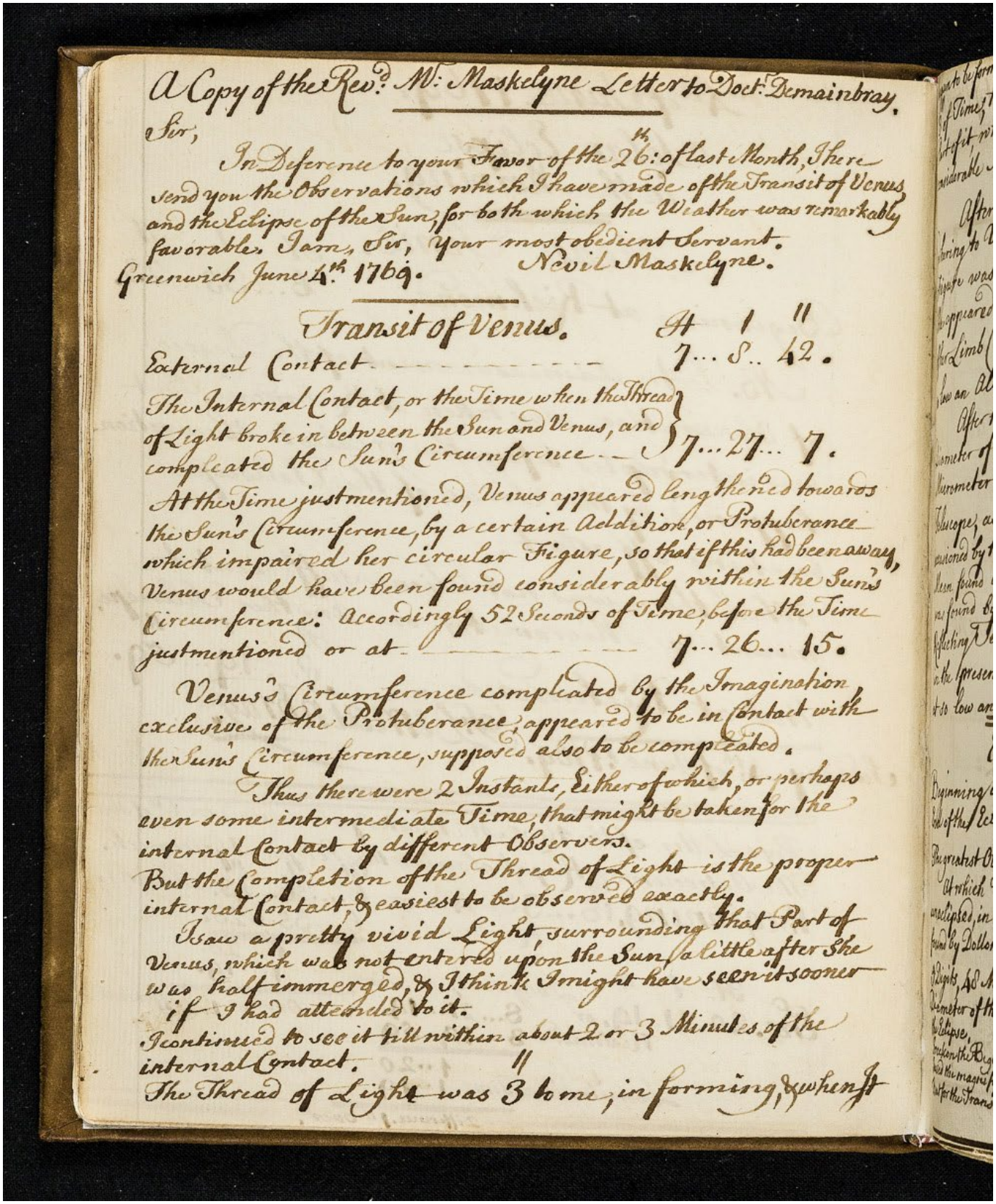
End. 20..21..19. or 8...21...19.

Richmond 8...19...59

1..20

Longitudinal Time. 1..19

Difference. 1" over.



A Copy of the Revd. Mr. Maskelyne Letter to Doct. Demainbray.

Sir,

In Deference to your Favor of the 26th: of last Month, I here send you the Observations which I have made of the Transit of Venus and the Eclipse of the Sun, for both which the Weather was remarkably favorable. I am, Sir, Your most obedient Servant.

Greenwich June 4th 1769. Nevil Maskelyne.

Transit of Venus. At 1 11

External Contact ---------- 7... 8.. 42.

The Internal Contact, or the Time when the Thread of Light broke in between the Sun and Venus, and compleated the Sun's Circumference -- 7... 27... 7.

At the Time just mentioned, Venus appeared lengthened towards the Sun's Circumference, by a certain Addition, or Protuberance which impaired her circular Figure, so that if this had been away, Venus would have been found considerably within the Sun's Circumference: Accordingly 52 Seconds of Time, before the Time just mentioned or at ---------- 7... 26... 15.

Venus's Circumference compleated by the Imagination exclusive of the Protuberance, appeared to be in Contact with the Sun's Circumference, supposed also to be compleated.

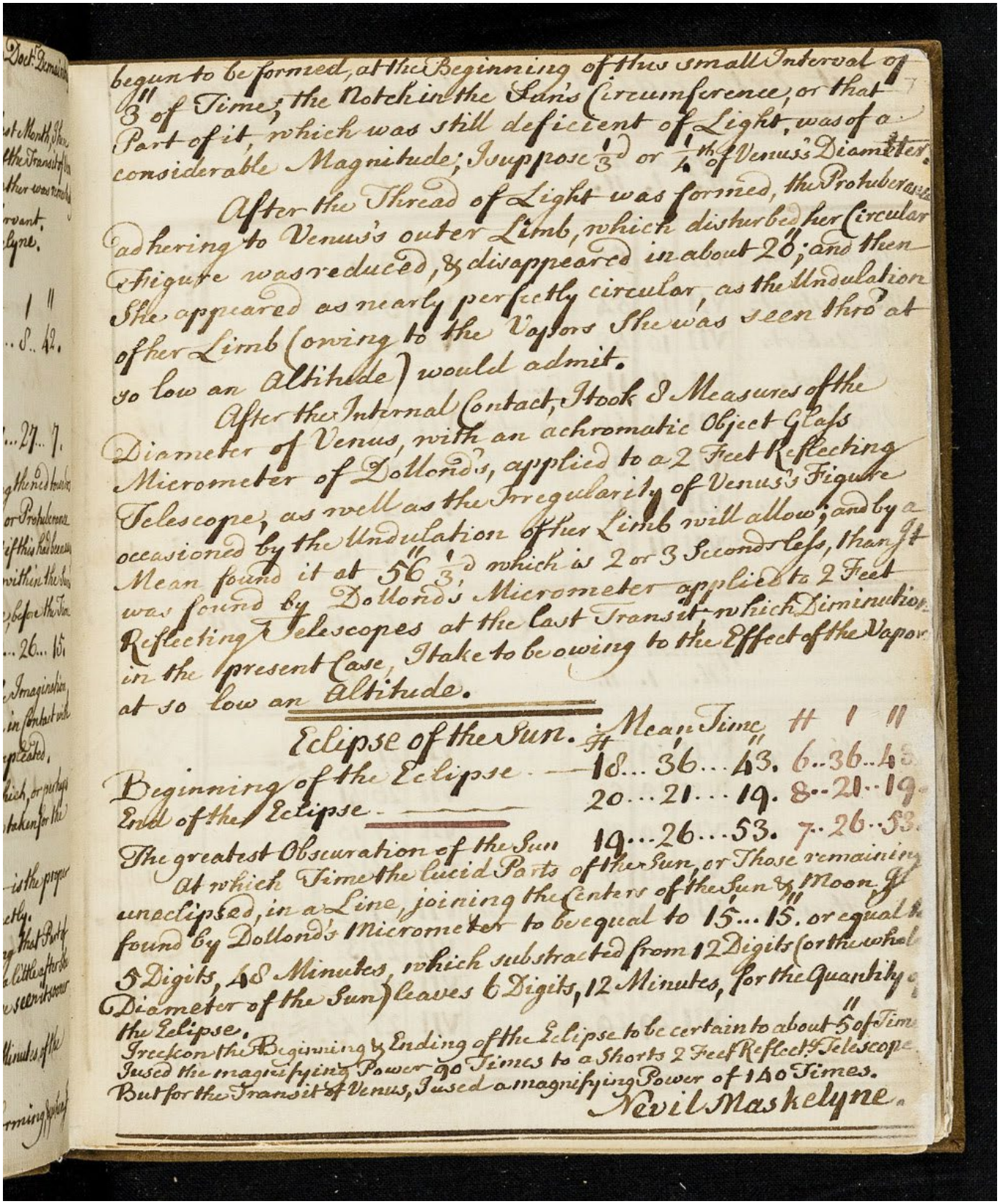
Thus there were 2 Instants, Either of which, or perhaps even some intermediate Time, that might be taken for the internal Contact by different Observers.

But the Completion of the Thread of Light is the proper internal Contact, & easiest to be observed exactly.

I saw a pretty vivid Light surrounding that Part of Venus, which was not entered upon the Sun a little after She was half immerged, & I think I might have seen it sooner if I had attended to it.

I continued to see it till within about 2 or 3 Minutes of the internal Contact. 11

The Thread of Light was 3 to me, in forming, & when it



begun to be formed, at the Beginning of this small Interval of
3 11 of Time, the Notch in the Sun's Circumference, or that
Part of it, which was still deficient of Light, was of a
considerable Magnitude; I suppose 3d or 1/4 th of Venus's Diameter.

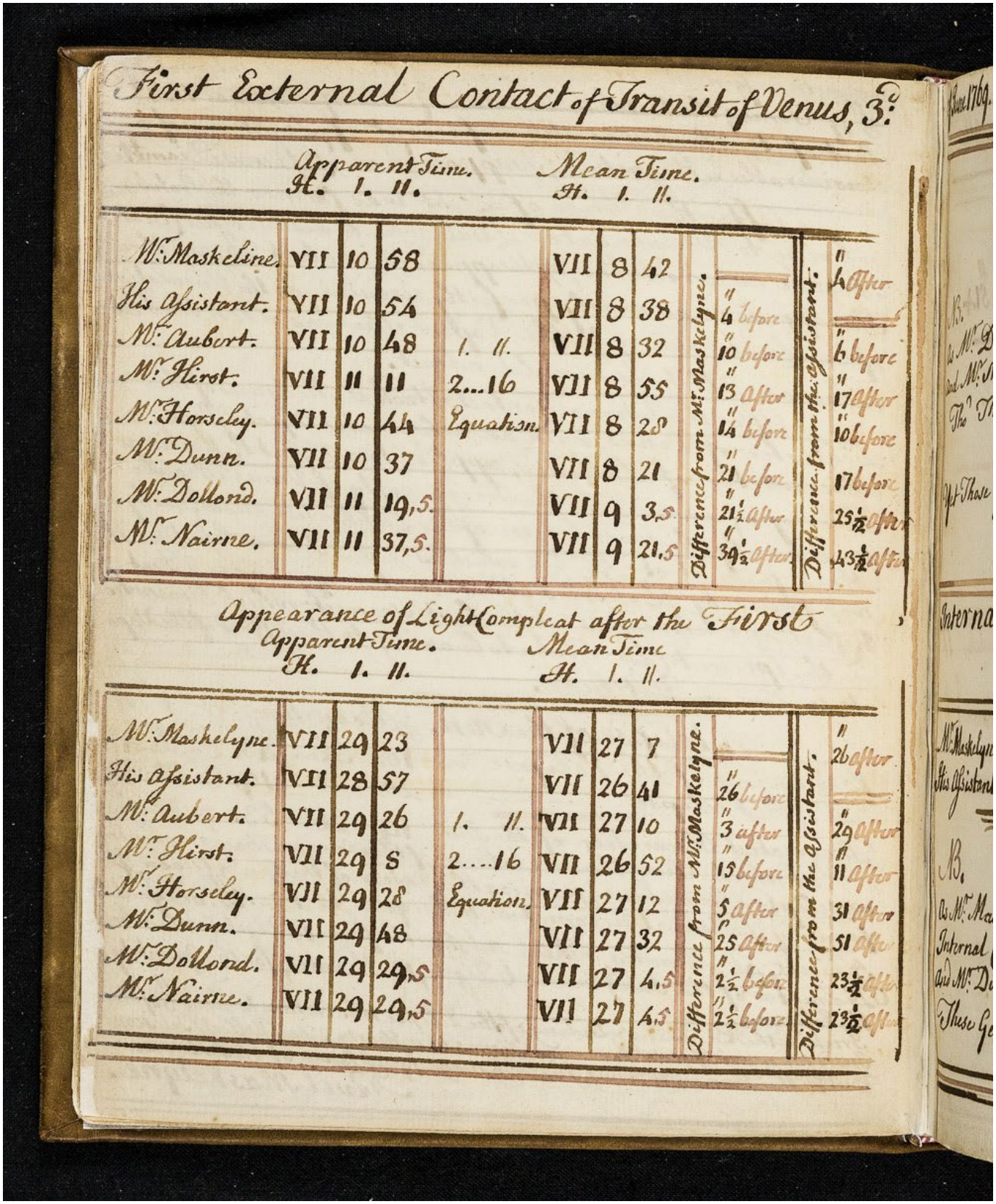
After the Thread of Light was formed, the Protuberance
adhering to Venus's outer Limb, which disturbed her Circular
Figure was reduced, & disappeared in about 28"; and then
She appeared as nearly perfectly circular, as the Undulation
of her Limb (owing to the Vapors She was seen thro' at
so low an Altitude) would admit.

After the Internal Contact, I took 3 Measures of the
Diameter of Venus, with an achromatic Object Glass
Micrometer of Dollond's, applied to a 2 Feet Reflecting
Telescope, as well as the Irregularity of Venus's Figure
occasioned by the Undulation of her Limb will allow; and by a
Mean found it at 56 3d which is 2 or 3 Seconds less, than it
was found by Dollond's Micrometer applied to 2 Feet
Reflecting Telescopes at the last Transit; which Diminution
in the present Case, I take to be owing to the Effect of the Vapor
at so low an Altitude.

Eclipse of the Sun.	Mean Time	H	′	″
Beginning of the Eclipse		18	36	43.
		6	36	43
End of the Eclipse		20	21	19.
		8	21	19
		19	26	53.
		7	26	53

The greatest Obscuration of the Sun
At which Time the lucid Parts of the Sun, or Those remaining
uneclipsed, in a Line, joining the Centers of the Sun & Moon, I
found by Dollond's Micrometer to be equal to 15″...15. or equal to
5 Digits, 48 Minutes, which substracted from 12 Digits (or the whole
Diameter of the Sun) leaves 6 Digits, 12 Minutes, for the Quantity of
the Eclipse.
I reckon the Beginning & Ending of the Eclipse to be certain to about 5 of Time
I used the magnifying Power 90 Times to a Shorts 2 Feet Reflect. Telescope.
But for the Transit of Venus, I used a magnifying Power of 140 Times.

Nevil Maskelyne.



First External Contact of Transit of Venus, 3d.

	Apparent Time. H.	I.	II.		Mean Time. H.	I.	II.	Difference from Mr. Maskelyne.		Difference from the Assistant.	
Mr. Maskeline.	VII	10	58		VII	8	42				4 after
His Assistant.	VII	10	54		VII	8	38	"	4 before		
Mr. Aubert.	VII	10	48	I. II.	VII	8	32	"	10 before	"	6 before
Mr. Hirst.	VII	11	11	2...16	VII	8	55	"	13 after	"	17 after
Mr. Horsley.	VII	10	44	Equation	VII	8	28	"	14 before	"	10 before
Mr. Dunn.	VII	10	37		VII	8	21	"	21 before	"	17 before
Mr. Dollond.	VII	11	19,5		VII	9	3,5	"	21½ after	"	25½ after
Mr. Nairne.	VII	11	37,5		VII	9	21,5	"	39½ after	"	43½ after

Appearance of Light Compleat after the First

	Apparent Time. H.	I.	II.		Mean Time H.	I.	II.	Difference from Mr. Maskelyne.		Difference from the Assistant.	
Mr. Maskelyne.	VII	29	23		VII	27	7				26 after
His Assistant.	VII	28	57		VII	26	41	"	26 before		
Mr. Aubert.	VII	29	26	I. II.	VII	27	10	"	3 after	"	29 after
Mr. Hirst.	VII	29	8	2....16	VII	26	52	"	15 before	"	11 after
Mr. Horsley.	VII	29	28	Equation	VII	27	12	"	5 after	"	31 after
Mr. Dunn.	VII	29	48		VII	27	32	"	25 after	"	51 after
Mr. Dollond.	VII	29	29,5		VII	27	4,5	"	2½ before	"	23½ after
Mr. Nairne.	VII	29	29,5		VII	27	4,5	"	2½ before	"	23½ after

# of June 1769. As taken by 8 Observers, at Greenwich Roy^l: Observatory

N.B.

	H	'	''
As Mr. Dun saw the first External Contact at	VII..	8..	21.
and Mr. Nairne saw the same at —	VII..	9..	21½

Tho' The Times taken are from the same Regulators.

Yet Those Gentlemen differ by 1 Minute & ½ a Second.

Internal Contact. Coincidence of Circumference.

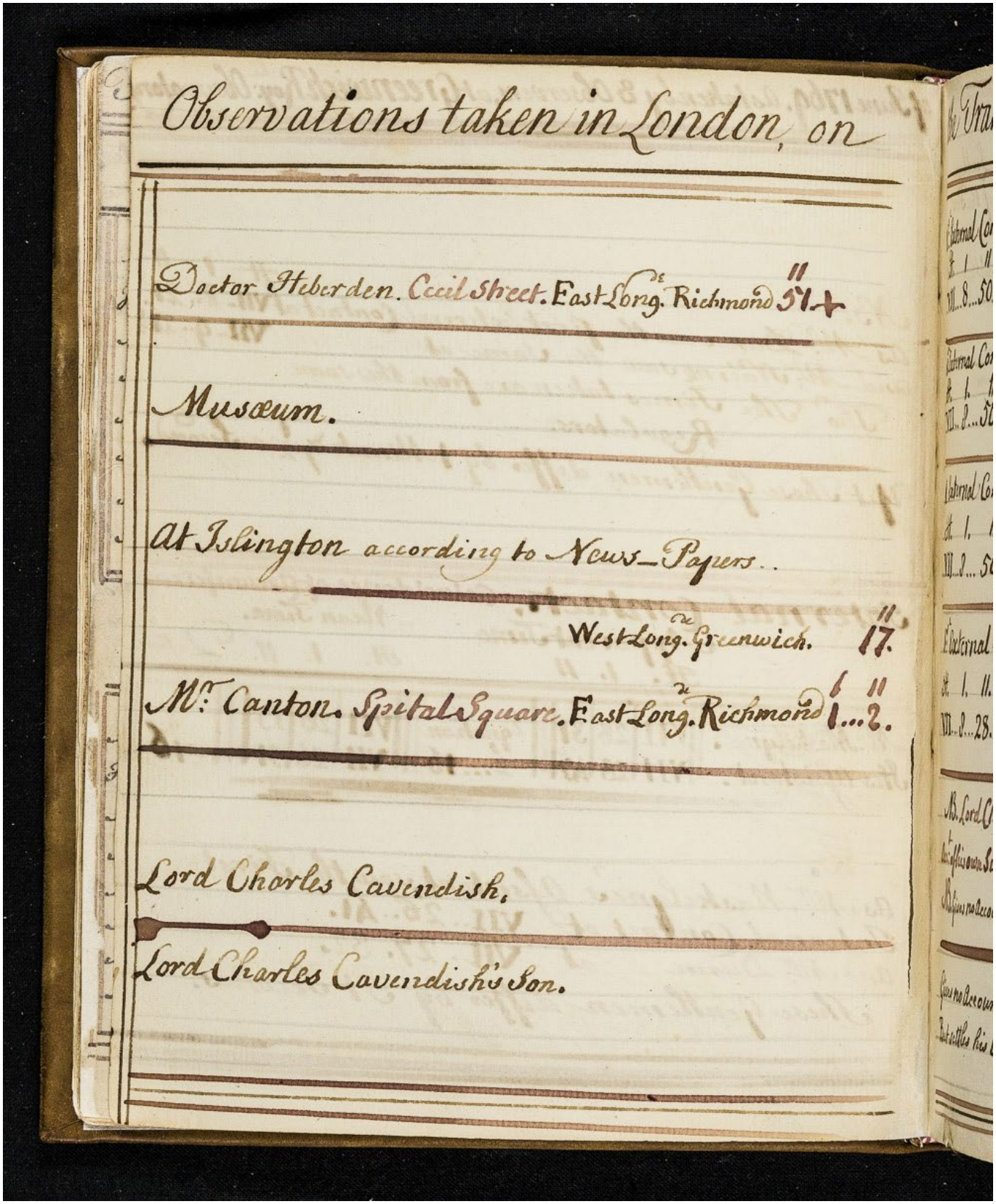
	Apparent Time H.	'	''	Equation	Mean Time H.	'	''	Difference ''
Mr. Maskelyne.	VII	28	31	2... 16	VII	26	15	16
His Assistant.	VII	28	47		VII	26	31	

N.B.

As Mr. Maskelyne's Assistant, saw the First Internal Contact at VII.. 26.. 41.

and Mr. Dunn at VII.. 27. 32.

These Gentlemen differ by 51 Seconds.



Observations taken in London, on

Doctor Heberden. Cecil Street. East Long. Richmond 5' 1"+

Musæum.

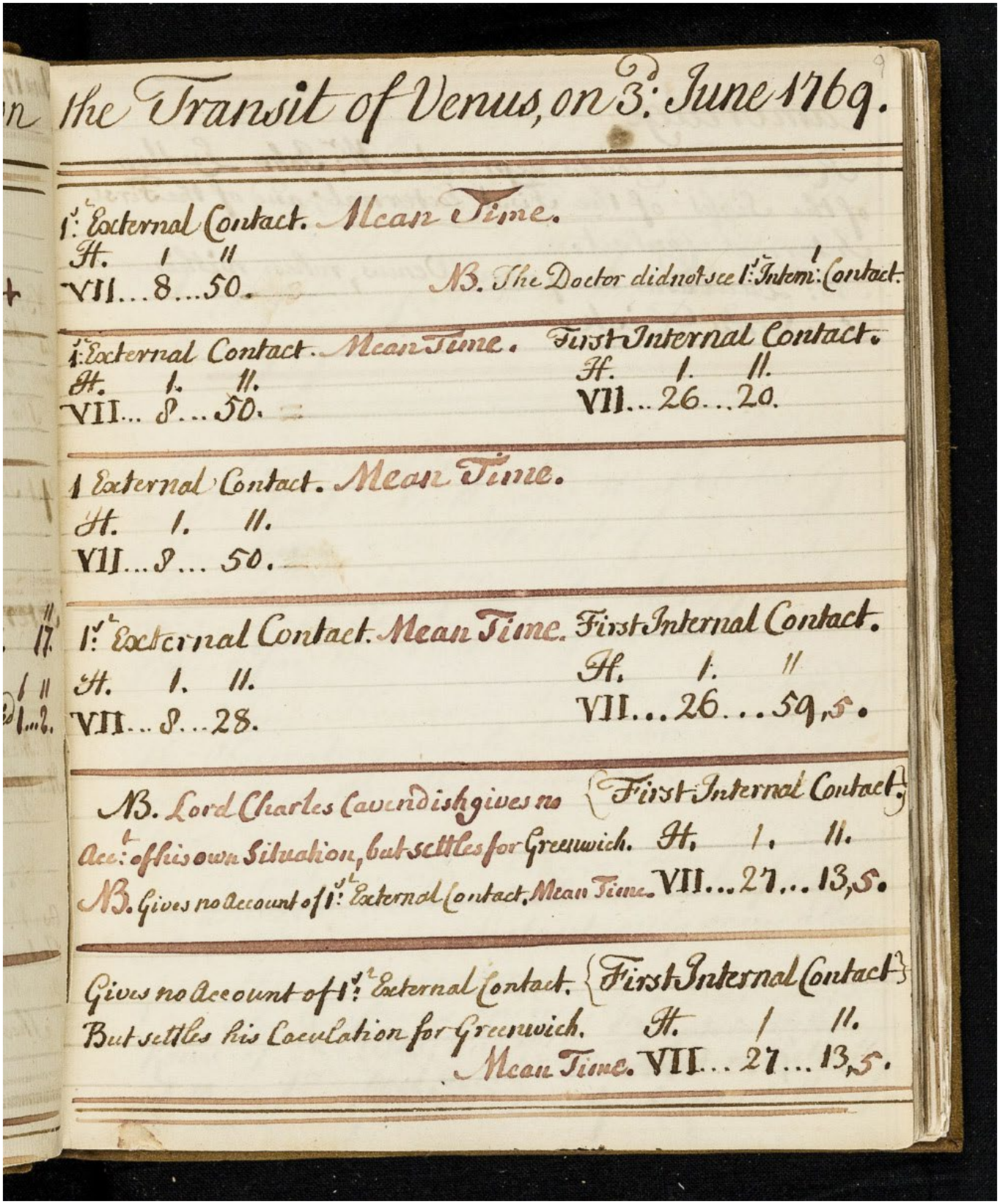
At Islington according to News-Papers..

West Long. Greenwich. 17' 1"

Mr. Canton. Spital Square. East Long. Richmond 1'...2".

Lord Charles Cavendish.

Lord Charles Cavendish's Son.



The Transit of Venus, on 3d: June 1769.

1st External Contact. Mean Time.
H. ′ ″
VII...8...50.

NB. The Doctor did not see 1st Intern: Contact.

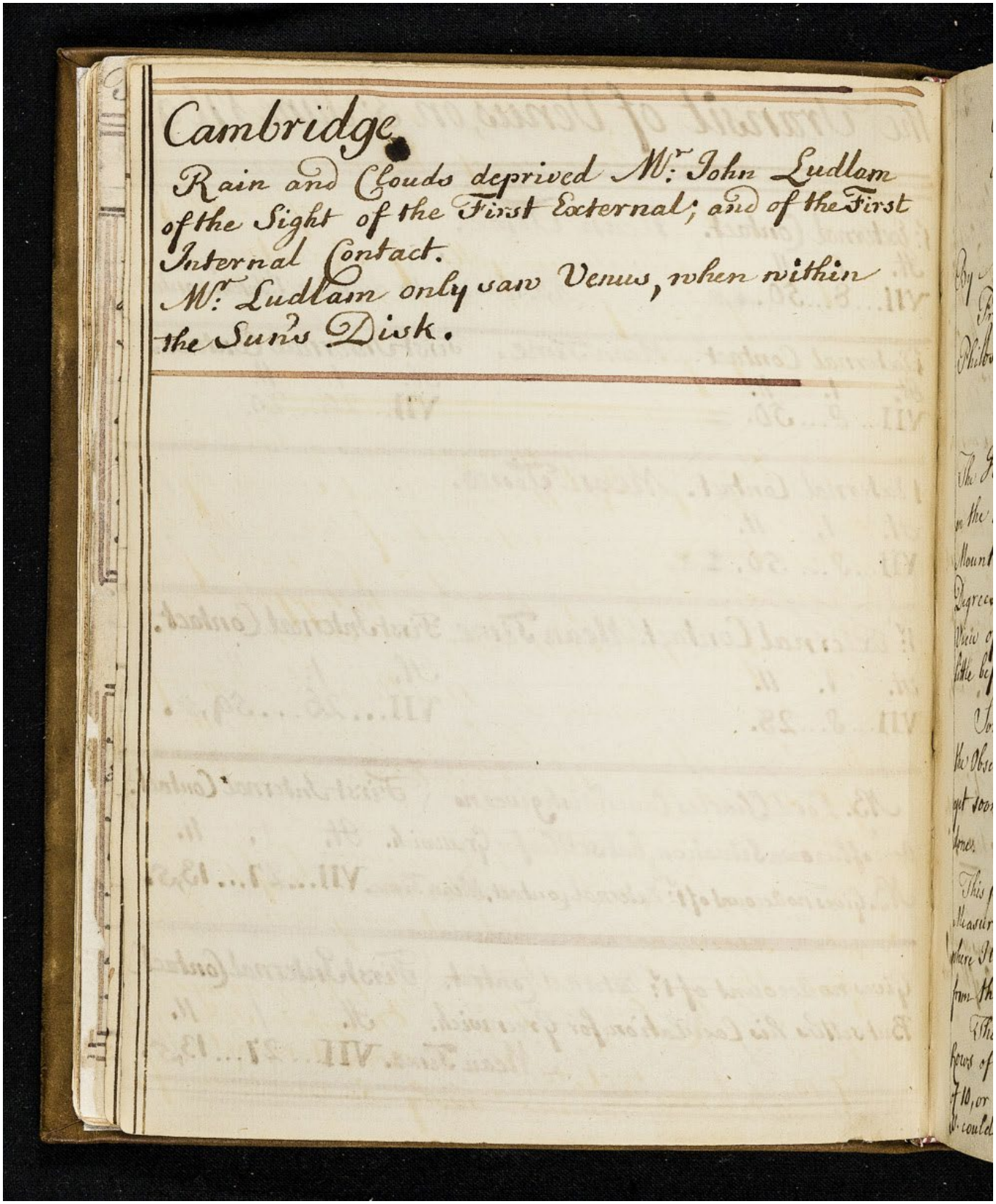
1st External Contact. Mean Time. First Internal Contact.
H. ′ ″ H. ′ ″
VII...8...50. VII...26...20.

1 External Contact. Mean Time.
H. ′ ″
VII...8...50.

1st External Contact. Mean Time. First Internal Contact.
H. ′ ″ H. ′ ″
VII...8...28. VII...26...59,5.

NB. Lord Charles Cavendish gives no Acct: of his own Situation, but settles for Greenwich. First Internal Contact.
NB. Gives no Account of 1st External Contact. Mean Time. H. ′ ″
VII...27...13,5.

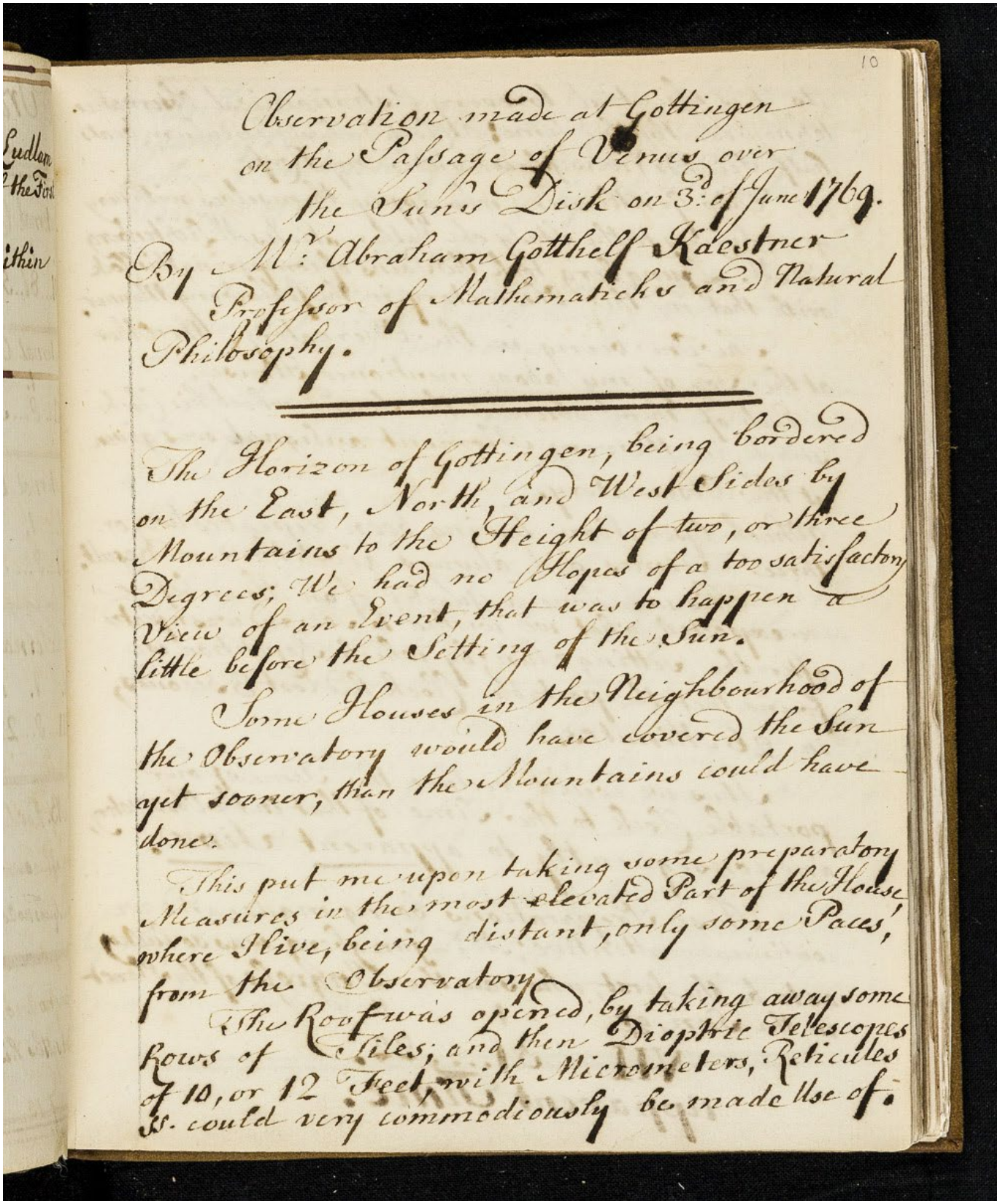
Gives no Account of 1st External Contact. First Internal Contact
But settles his Coculation for Greenwich. H. ′ ″
Mean Time. VII...27...13,5.



Cambridge.

Rain and Clouds deprived Mr. John Ludlam of the Sight of the First External; and of the First Internal Contact.

Mr. Ludlam only saw Venus, when within the Sun's Disk.



10

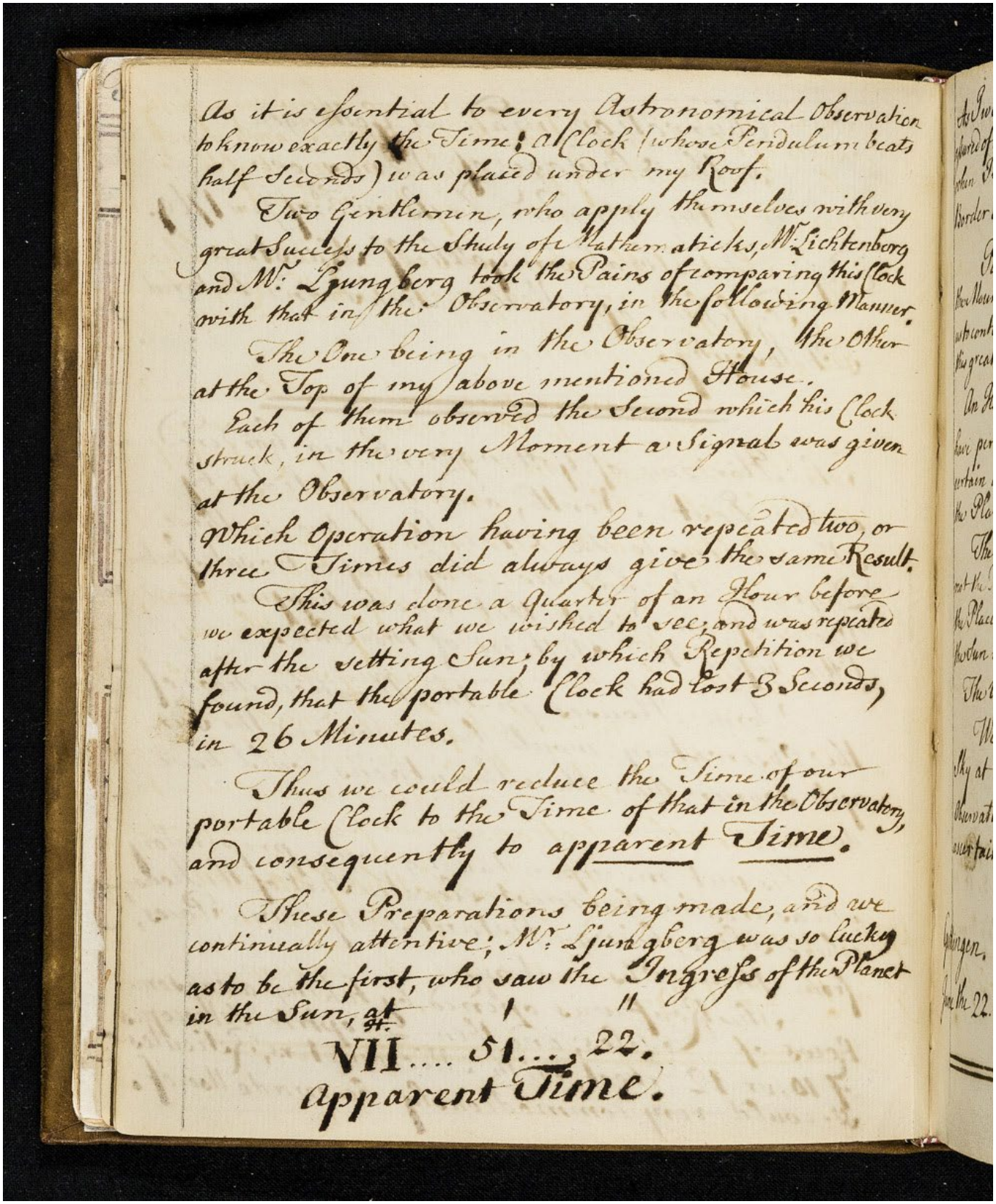
Observation made at Gottingen
on the Passage of Venus over
the Suns Disk on 3:d June 1769.
By M:r Abraham Gotthelf Kaestner
Professor of Mathematicks and Natural
Philosophy.

The Horizon of Gottingen, being bordered
on the East, North, and West Sides by
Mountains to the Height of two, or three
Degrees; We had no Hopes of a too satisfactory
View of an Event, that was to happen a
little before the Setting of the Sun.

Some Houses in the Neighbourhood of
the Observatory would have covered the Sun
yet sooner, than the Mountains could have
done.

This put me upon taking some preparatory
Measures in the most elevated Part of the House
where I live, being distant, only some Paces,
from the Observatory.

The Roof was opened, by taking away some
Rows of Tiles; and then Dioptric Telescopes
of 10, or 12 Feet, with Micrometers, Reticules
&c. could very commodiously be made Use of.



As it is essential to every Astronomical Observation to know exactly the Time; a Clock (whose Pendulum beats half Seconds) was placed under my Roof.

Two Gentlemen, who apply themselves with very great Success to the Study of Mathematicks, Mr Lichtenberg and Mr Ljungberg took the Pains of comparing this Clock with that in the Observatory, in the following Manner.

The One being in the Observatory, the Other at the Top of my above mentioned House.

Each of them observed the Second which his Clock struck, in the very Moment a Signal was given at the Observatory.

Which Operation having been repeated two, or three Times did always give the same Result.

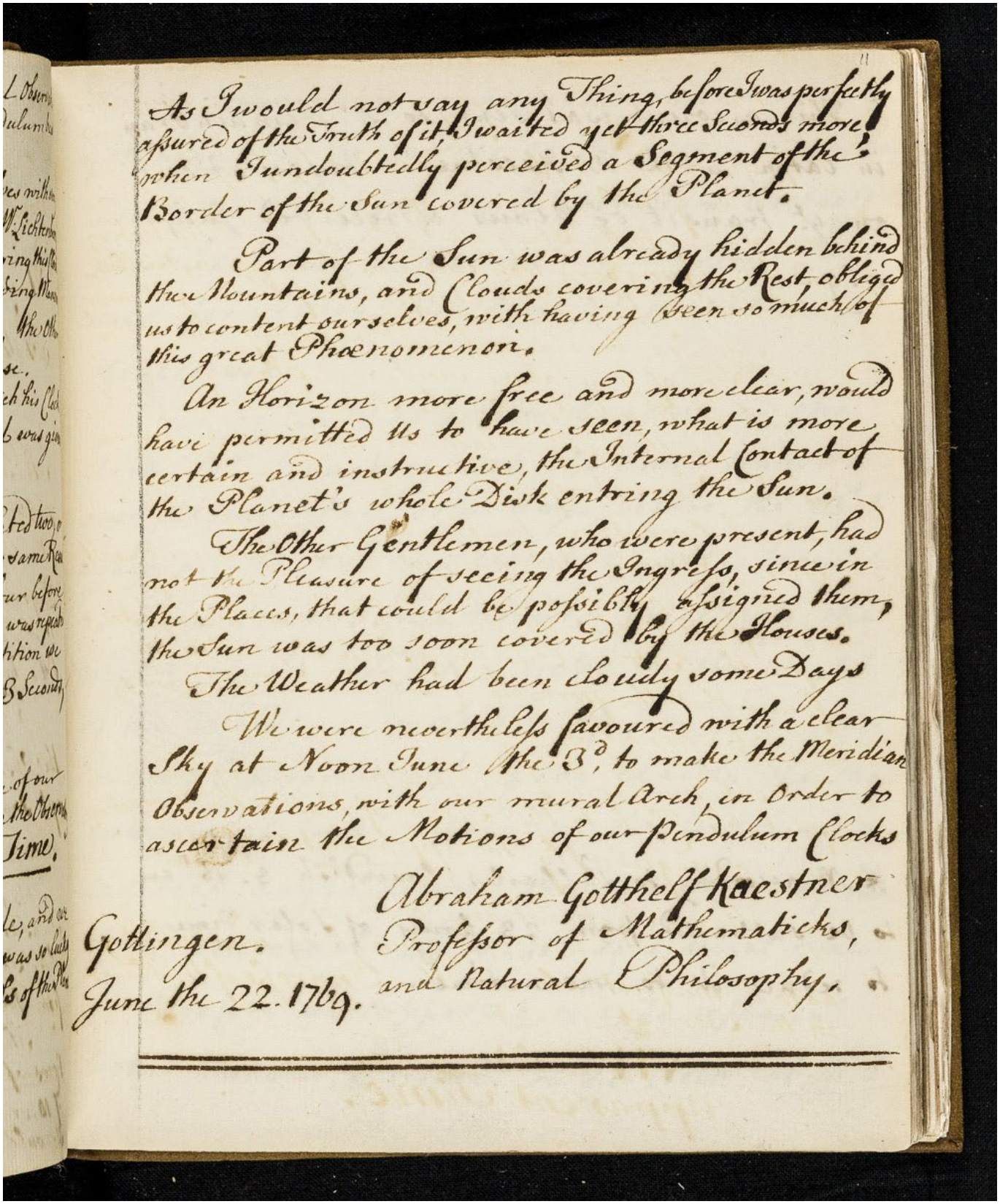
This was done a Quarter of an Hour before we expected what we wished to see, and was repeated after the setting Sun; by which Repetition we found, that the portable Clock had lost 3 Seconds, in 26 Minutes.

Thus we could reduce the Time of our portable Clock to the Time of that in the Observatory, and consequently to apparent Time.

These Preparations being made, and we continually attentive; Mr Ljungberg was so lucky as to be the first, who saw the Ingress of the Planet in the Sun, at

VII .... 51 .... 22.

Apparent Time.



As I would not say any Thing, before I was perfectly assured of the Truth of it, I waited yet three Seconds more, when I undoubtedly perceived a Segment of the Border of the Sun covered by the Planet.

Part of the Sun was already hidden behind the Mountains, and Clouds covering the Rest, obliged us to content ourselves, with having seen so much of this great Phœnomenon.

An Horizon more free and more clear, would have permitted us to have seen, what is more certain and instructive, the Internal Contact of the Planet's whole Disk entring the Sun.

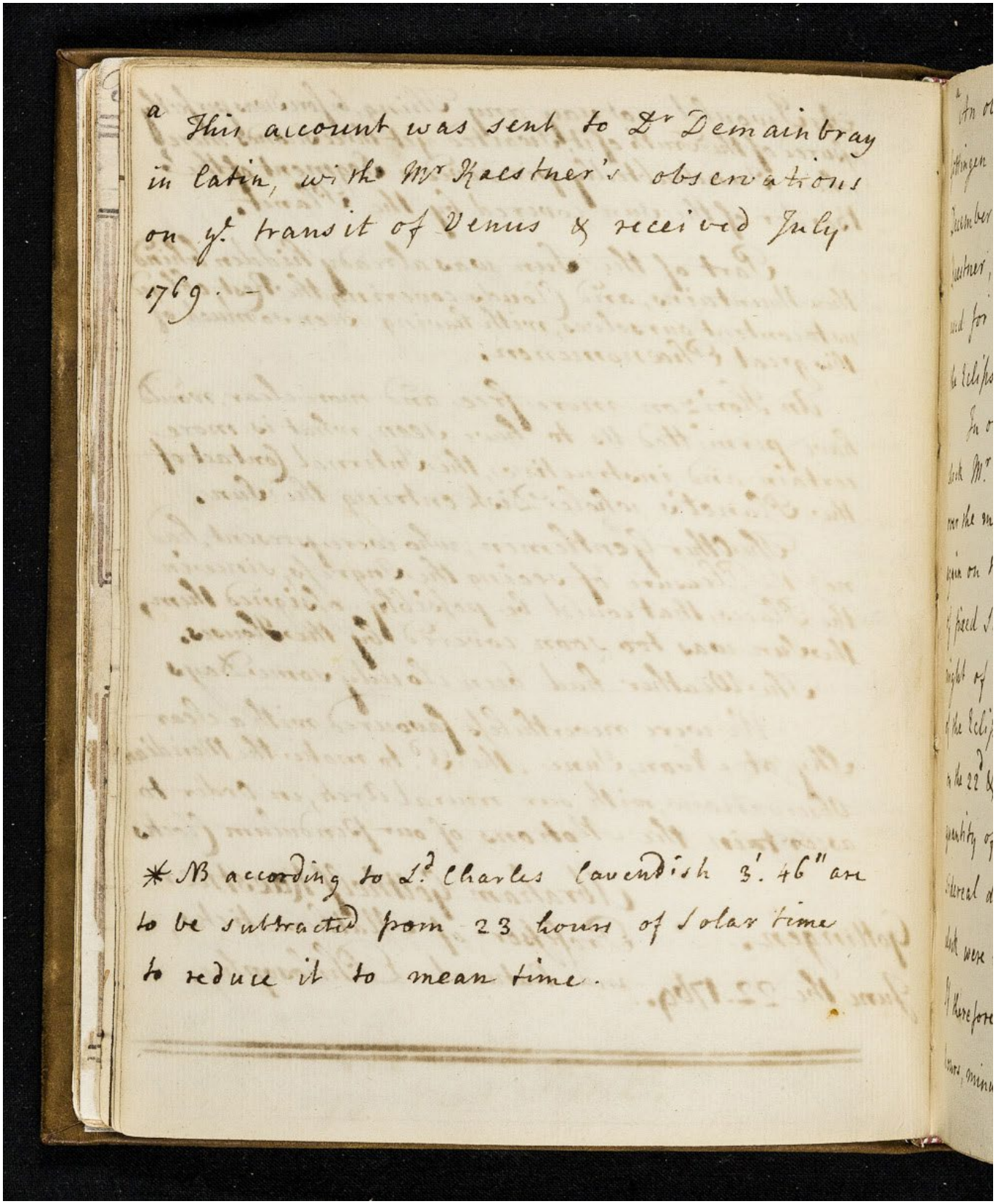
The Other Gentlemen, who were present, had not the Pleasure of seeing the Ingress, since in the Places, that could be possibly assigned them, the Sun was too soon covered by the Houses.

The Weather had been cloudy some Days

We were nevertheless favoured with a clear Sky at Noon June the 3d, to make the Meridian Observations, with our mural Arch, in order to ascertain the Motions of our Pendulum Clocks

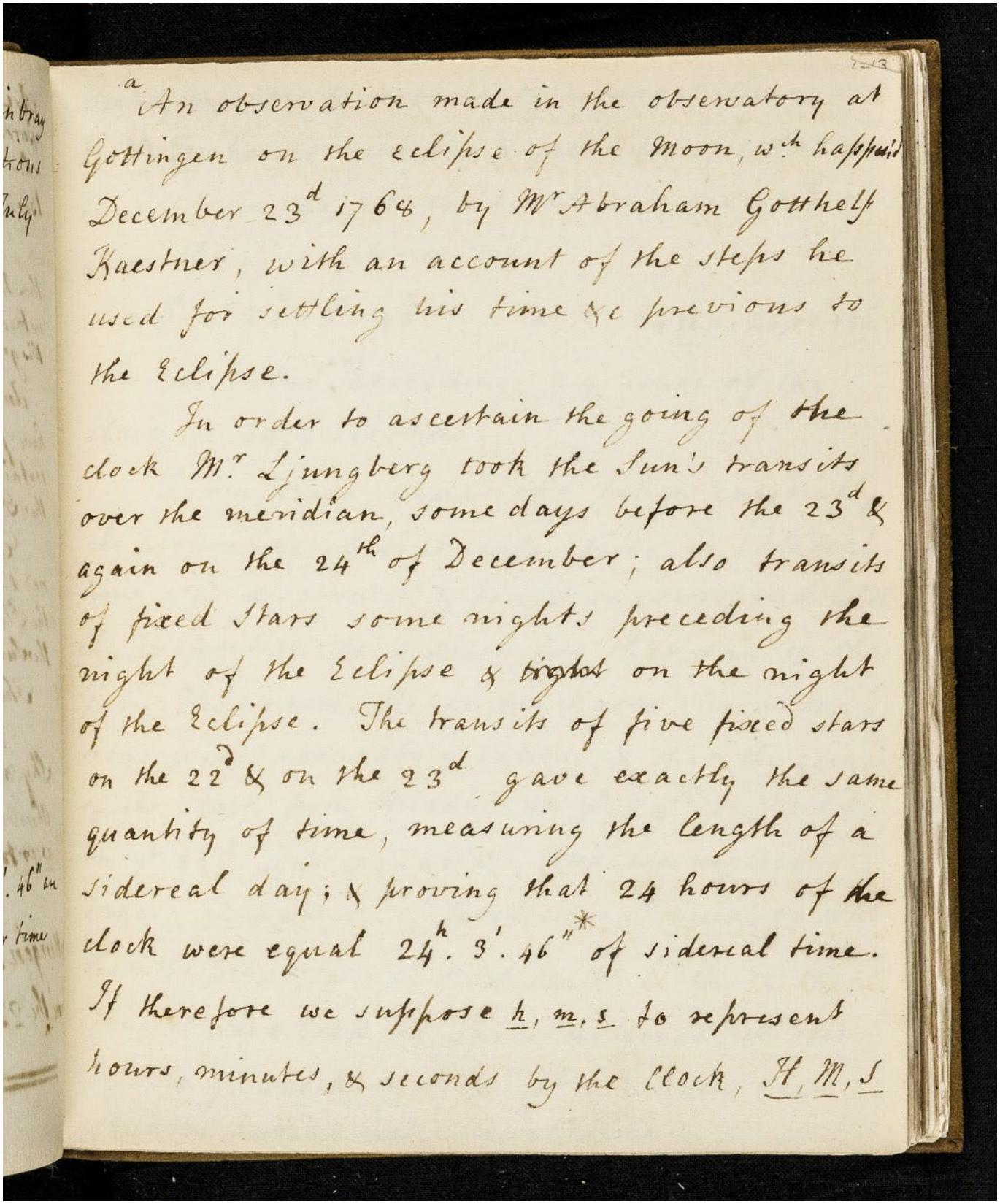
Abraham Gotthelf Kaestner
Professor of Mathematicks,
and Natural Philosophy.

Gottingen.
June the 22. 1769.



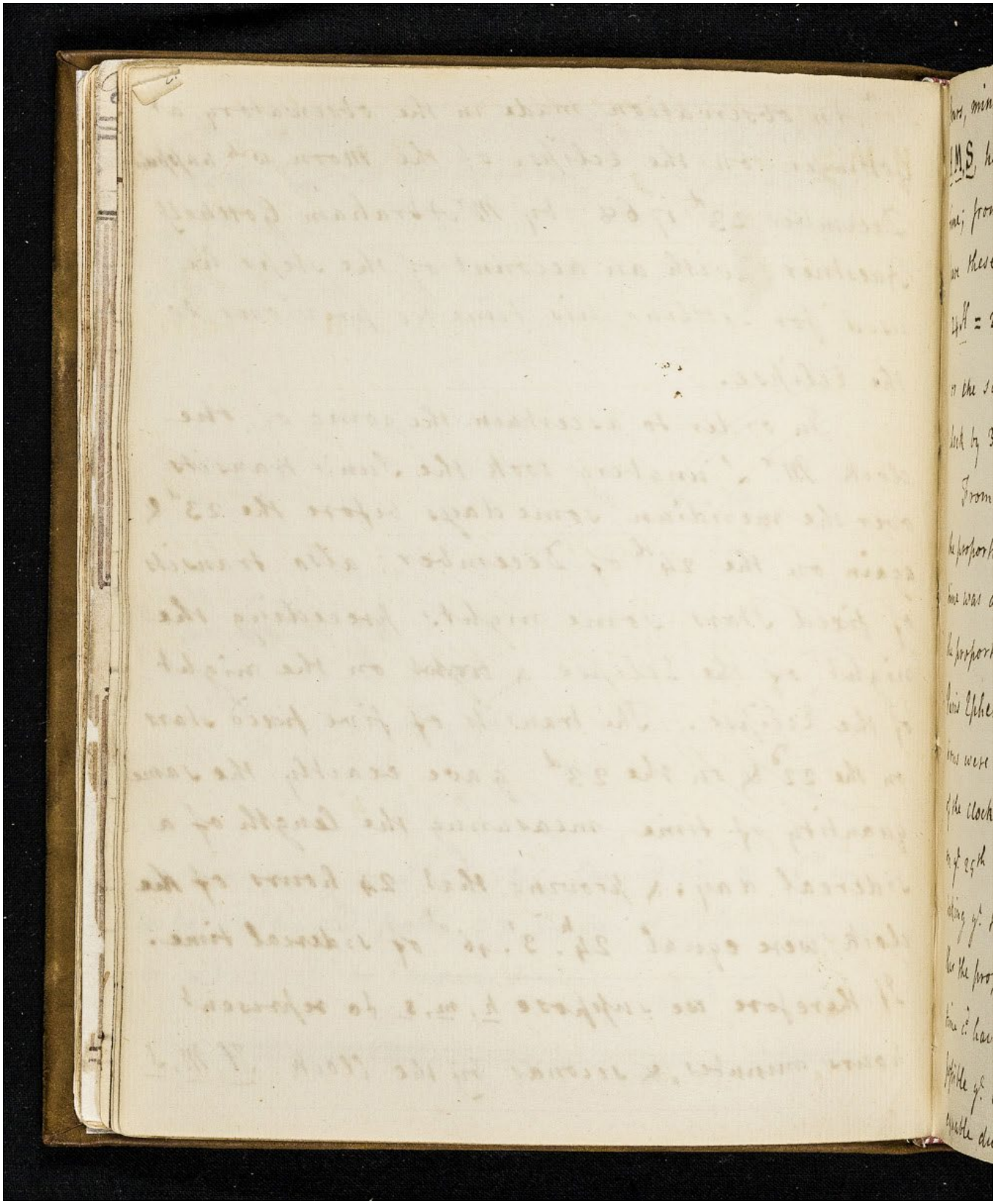
a This account was sent to Dr Demainbray in Latin, with Mr Kaestner's observations on ye transit of Venus & received July 1769. –

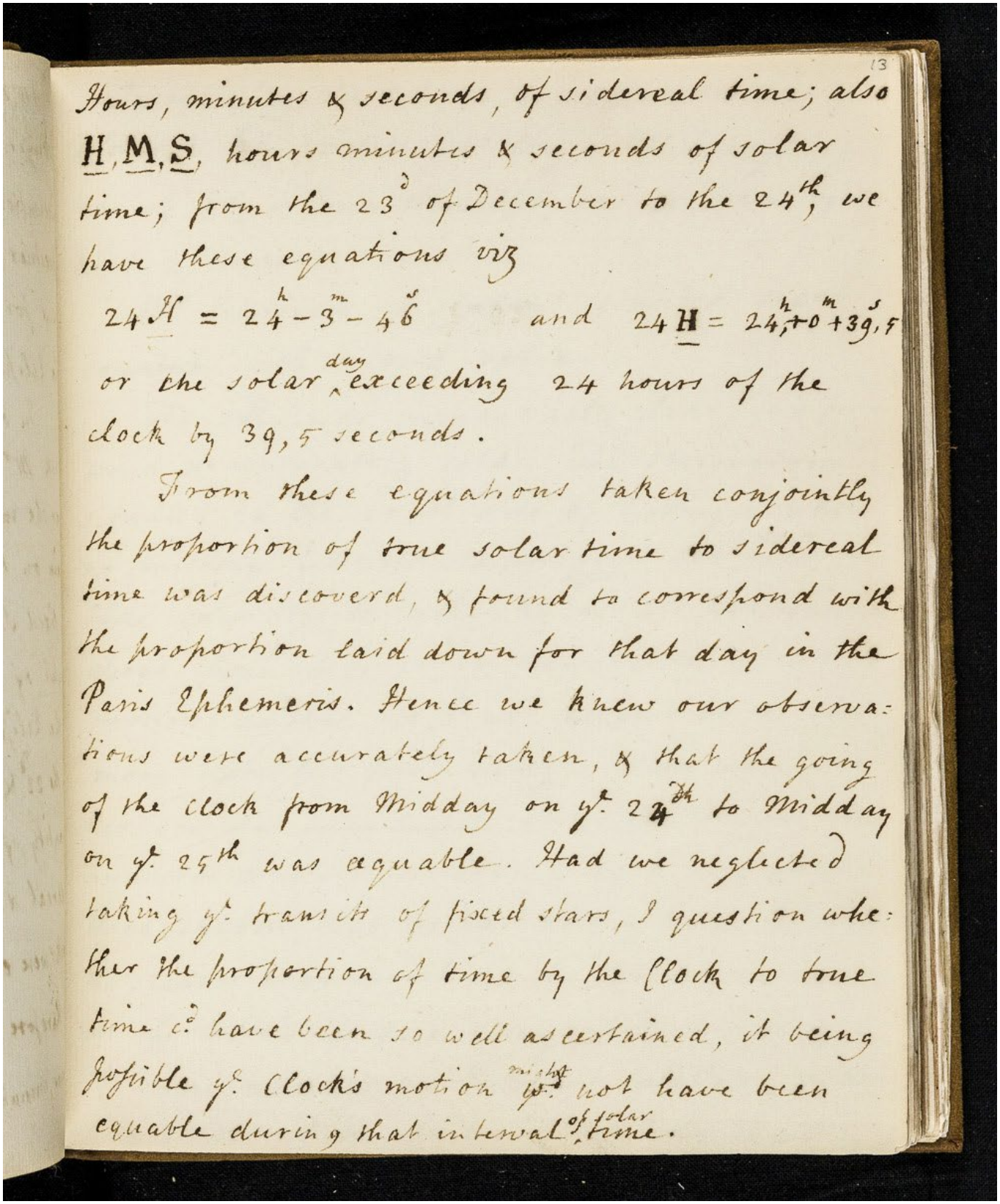
* N B according to Ld Charles Cavendish 3'. 46" are to be subtracted from 23 hours of Solar time to reduce it to mean time.



a An observation made in the observatory at Gottingen on the eclipse of the Moon, wch happen'd December 23d 1764, by Mr Abraham Gotthelf Kaestner, with an account of the steps he used for settling his time &c previous to the Eclipse.

In order to ascertain the going of the clock Mr Ljungberg took the Sun's transits over the meridian, some days before the 23d & again on the 24th of December; also transits of fixed stars some nights preceding the night of the Eclipse & twelve on the night of the Eclipse. The transits of five fixed stars on the 22d & on the 23d gave exactly the same quantity of time, measuring the length of a sidereal day; & proving that 24 hours of the clock were equal 24h. 3'. 46"* of sidereal time. If therefore we suppose h, m, s to represent hours, minutes, & seconds by the clock, H, M, S





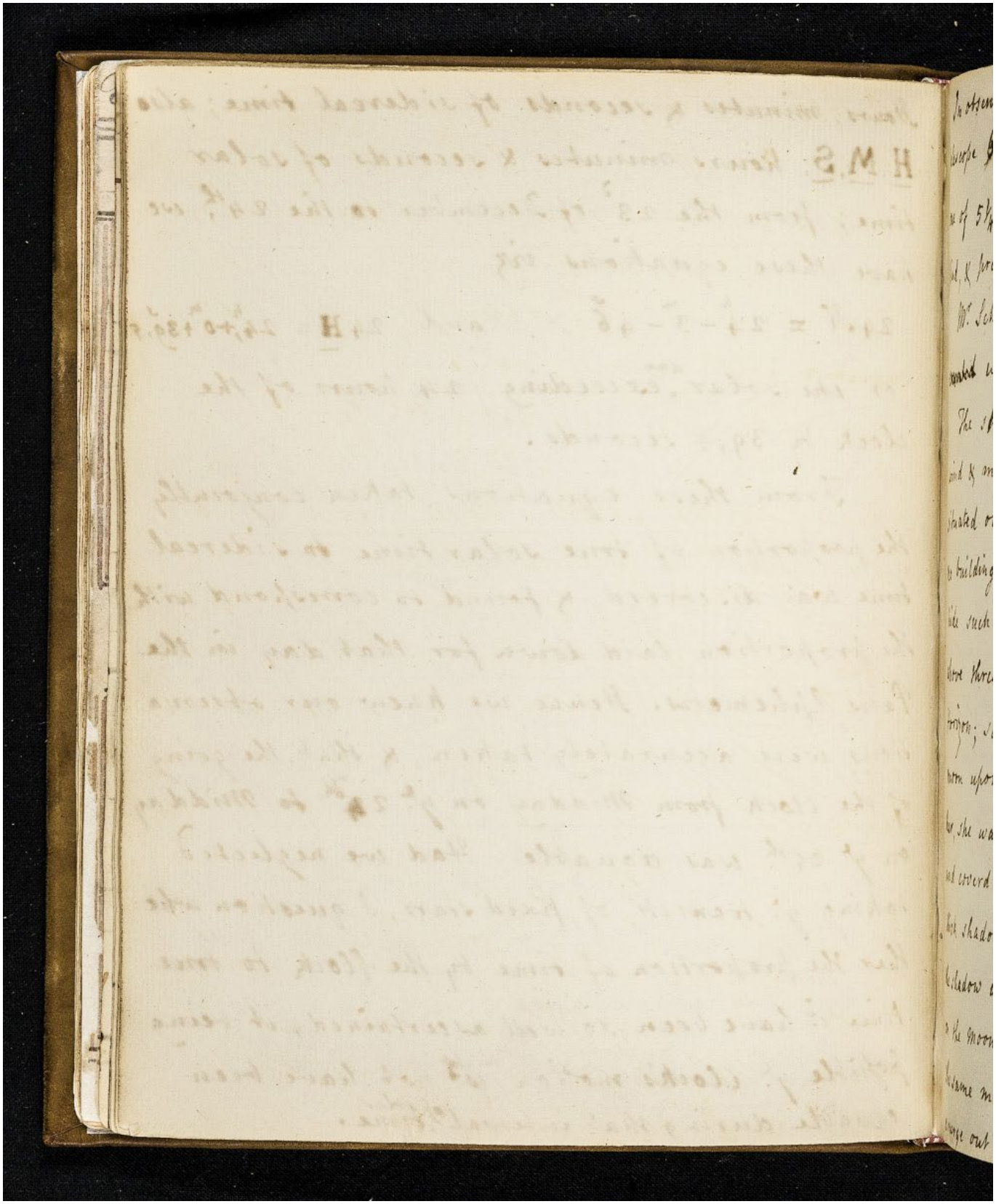
13

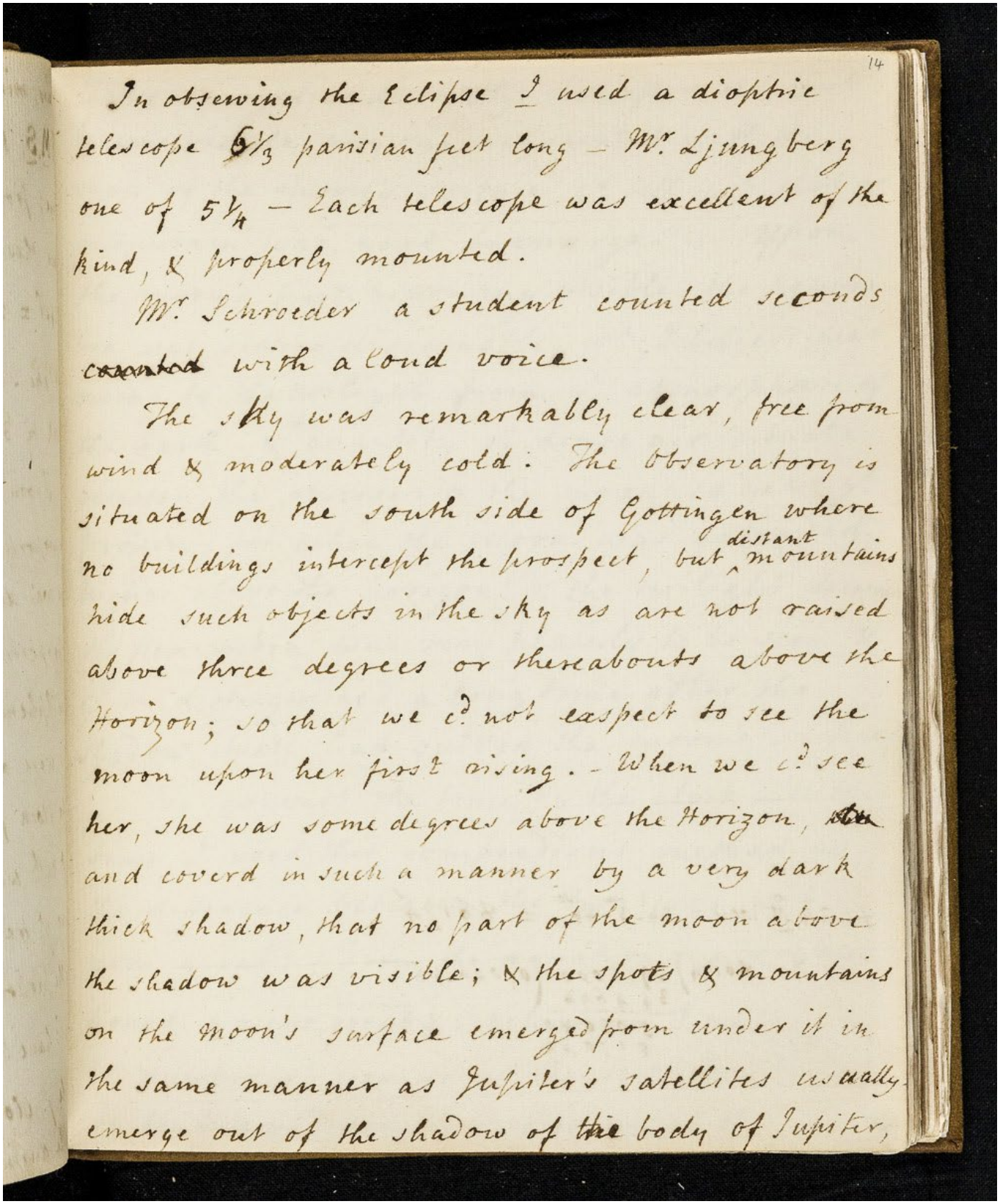
Hours, minutes & seconds, of sidereal time; also H, M, S, hours minutes & seconds of solar time; from the 23d of December to the 24th, we have these equations viz

$24\,H = 24^h - 3^m - 46^s$ and $24\,H = 24^h + 0^m + 39,5^s$

or the solar day exceeding 24 hours of the clock by 39,5 seconds.

From these equations taken conjointly the proportion of true solar time to sidereal time was discoverd, & found to correspond with the proportion laid down for that day in the Paris Ephemeris. Hence we knew our observations were accurately taken, & that the going of the clock from Midday on yr. 24th to Midday on yr. 25th was equable. Had we neglected taking yr. transits of fixed stars, I question whether the proportion of time by the clock to true time cd. have been so well ascertained, it being possible yr. clocks motion might yet not have been equable during that interval of solar time.



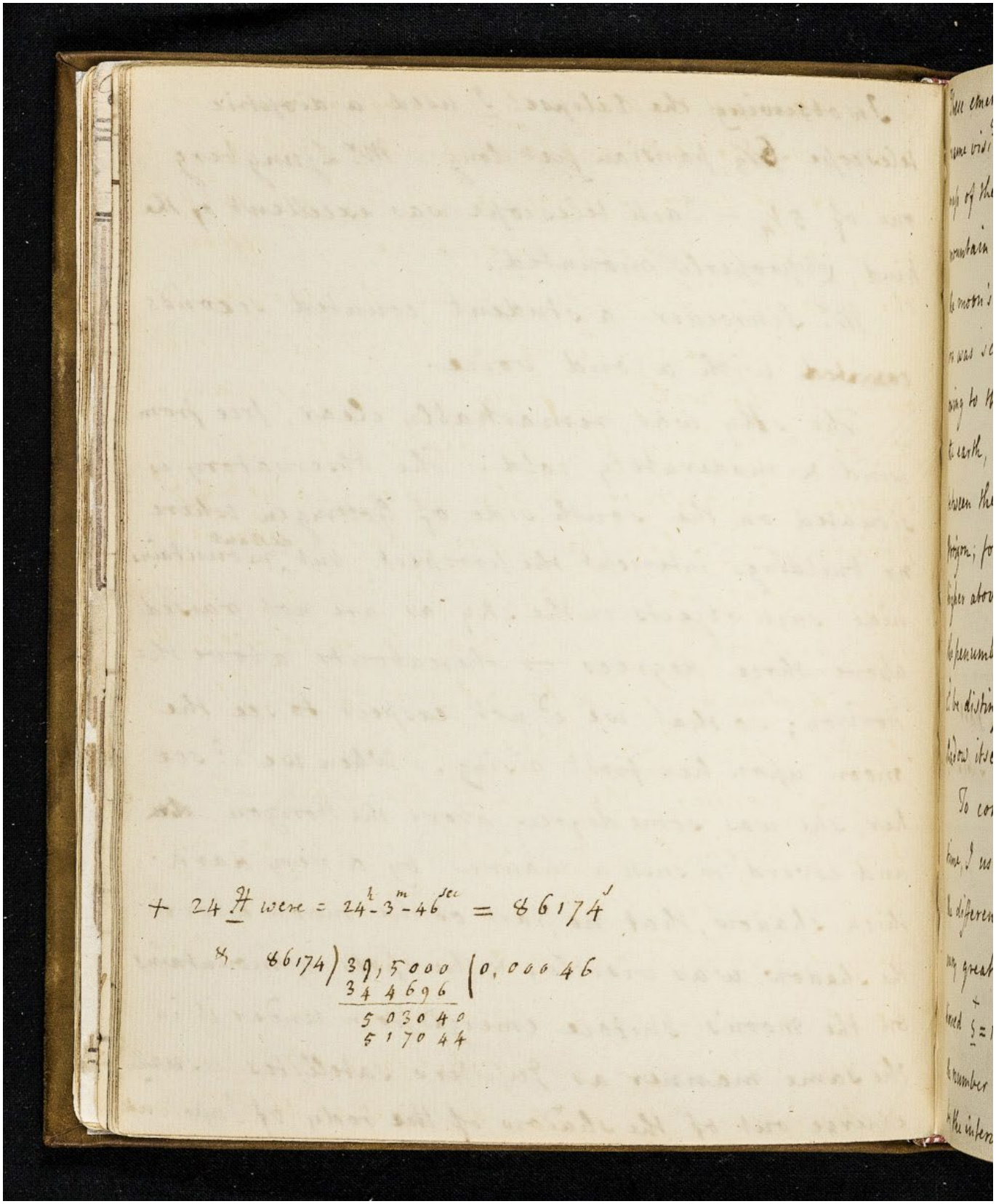


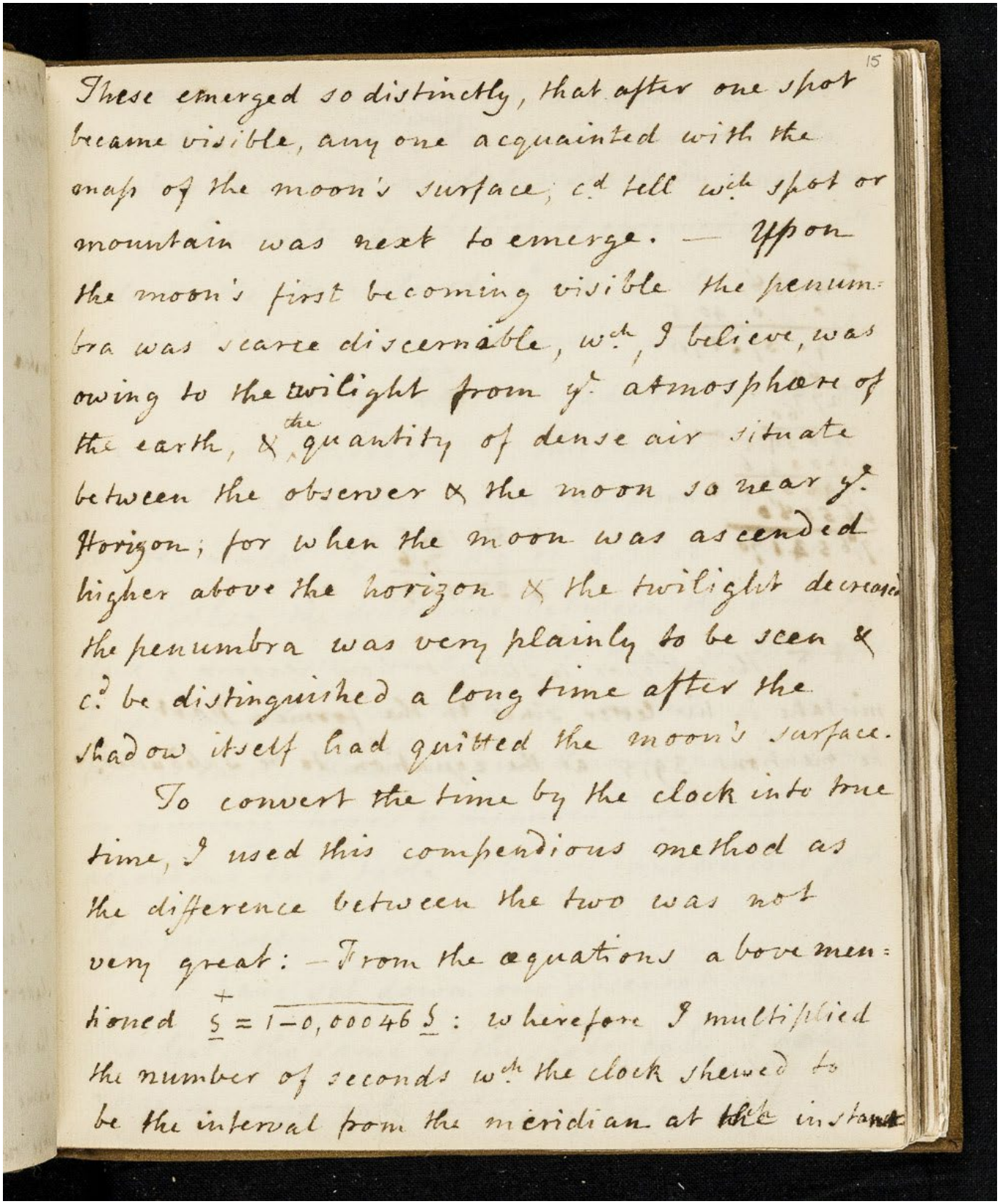
14

In obsewing the Eclipse I used a dioptric telescope 6 1/3 parisian feet long — Mr. Ljungberg one of 5 1/4 — Each telescope was excellent of the kind, & properly mounted.

Mr. Schroeder a student counted seconds ~~counted~~ with a loud voice.

The sky was remarkably clear, free from wind & moderately cold: The observatory is situated on the south side of Gottingen where no buildings intercept the prospect, but distant mountains hide such objects in the sky as are not raised above three degrees or thereabouts above the Horizon; so that we cd not expect to see the moon upon her first rising. — When we cd see her, she was some degrees above the Horizon, ~~&~~ and coverd in such a manner by a very dark thick shadow, that no part of the moon above the shadow was visible; & the spots & mountains on the moon's surface emerged from under it in the same manner as Jupiter's satellites usually emerge out of the shadow of the body of Jupiter,

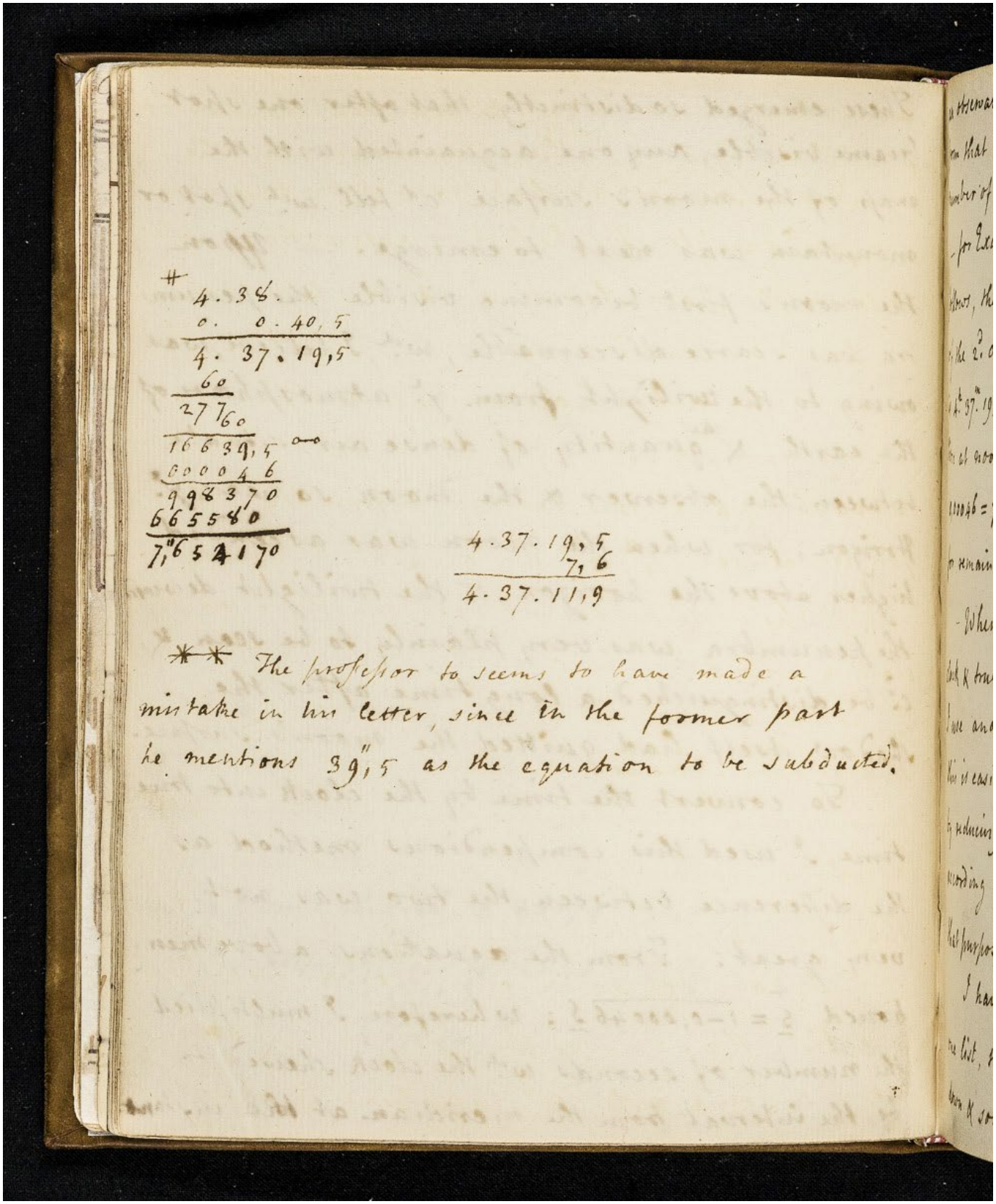




15

These emerged so distinctly, that after one shot became visible, any one acquainted with the maps of the moon's surface; cd tell wch spot or mountain was next to emerge. — Upon the moon's first becoming visible the penumbra was scarce discernable, wch, I believe, was owing to the twilight from yr atmosphere of the earth, & the quantity of dense air situate between the observer & the moon so near yr Horizon; for when the moon was ascended higher above the horizon & the twilight decreased the penumbra was very plainly to be seen & cd be distinguished a long time after the shadow itself had quitted the moon's surface.

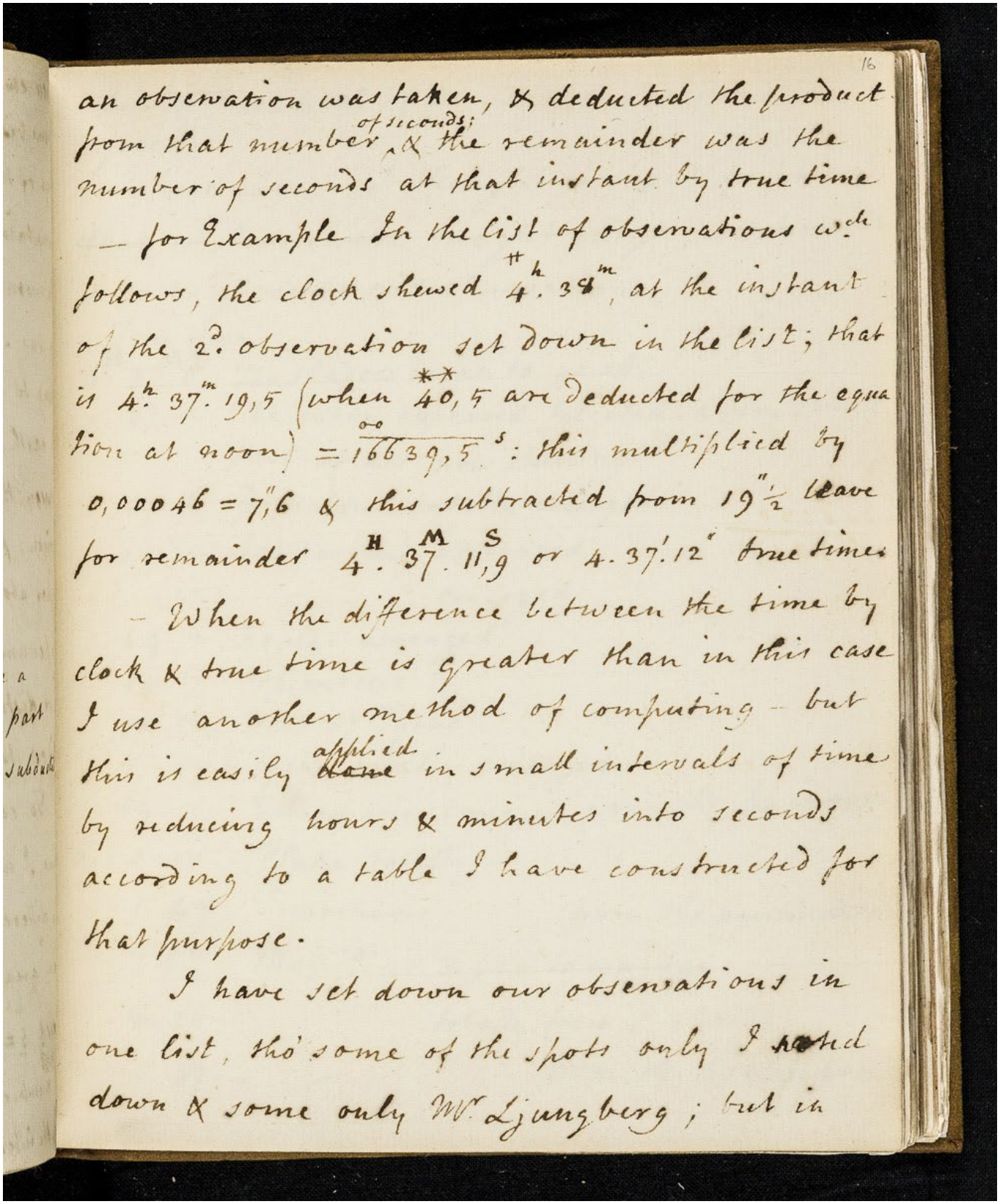
To convert the time by the clock into true time, I used this compendious method as the difference between the two was not very great: — From the equations above mentioned $\underline{\underline{\odot}} = \overline{1 - 0,00046}\,\underline{\odot}$: wherefore I multiplied the number of seconds wch the clock shewed to be the interval from the meridian at this instant



4. 36.
0. 0. 40, 5
4. 37. 19,5
60
27760
166395
600046
998370
665580
7,"654170

4. 37. 19, 5
7, 6
4. 37. 11,9

** The professor to seems to have made a mistake in his letter, since in the former part he mentions 39",5 as the equation to be subducted.



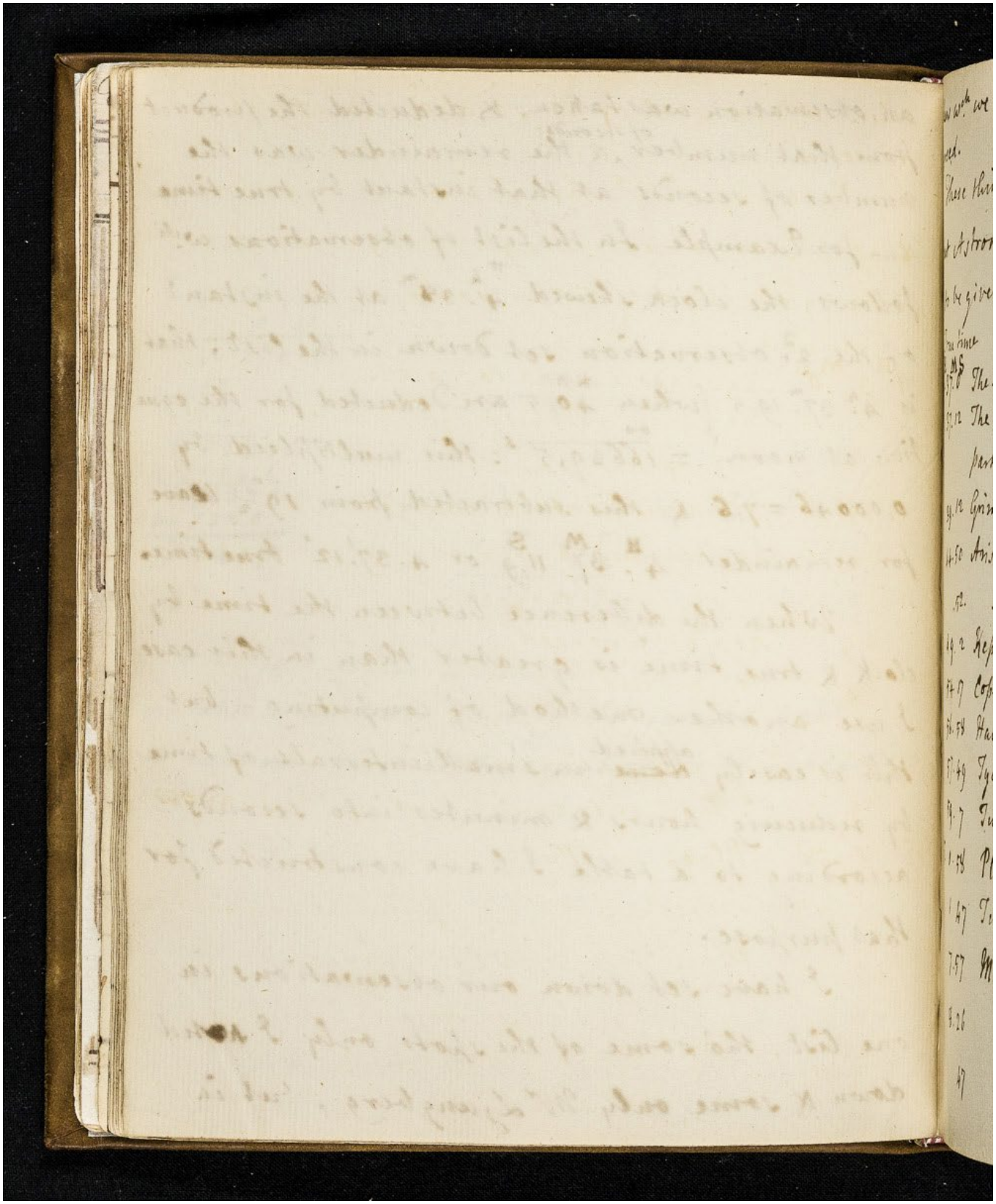
16

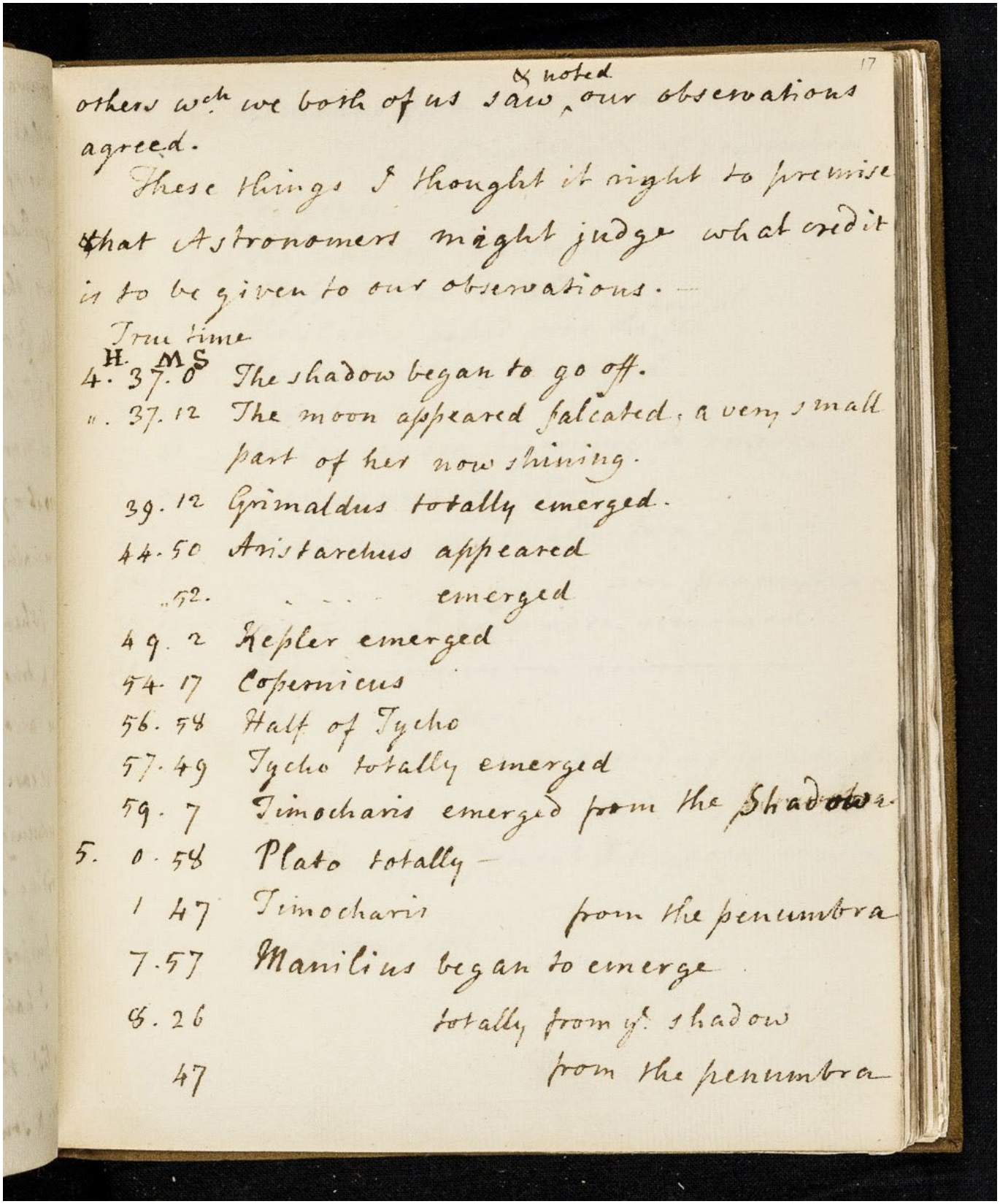
an observation was taken, & deducted the product from that number of seconds; & the remainder was the number of seconds at that instant by true time

– for Example In the list of observations wch follows, the clock shewed $4^{h}.38^{m}$, at the instant of the 2d. observation set down in the list; that is $4^{h}.37^{m}.19,5$ (when 40,5 are deducted for the equation at noon) $= 16639,5^{s}$: this multiplied by $0,00046 = 7,6$ & this subtracted from $19''\frac{1}{2}$ leave for remainder $4^{H}.37^{M}.11,9^{S}$ or 4.37'.12" true times

– When the difference between the time by clock & true time is greater than in this case I use another method of computing – but this is easily applied in small intervals of time by reducing hours & minutes into seconds according to a table I have constructed for that purpose.

I have set down our observations in one list, tho' some of the spots only I noted down & some only Mr Ljungberg; but in



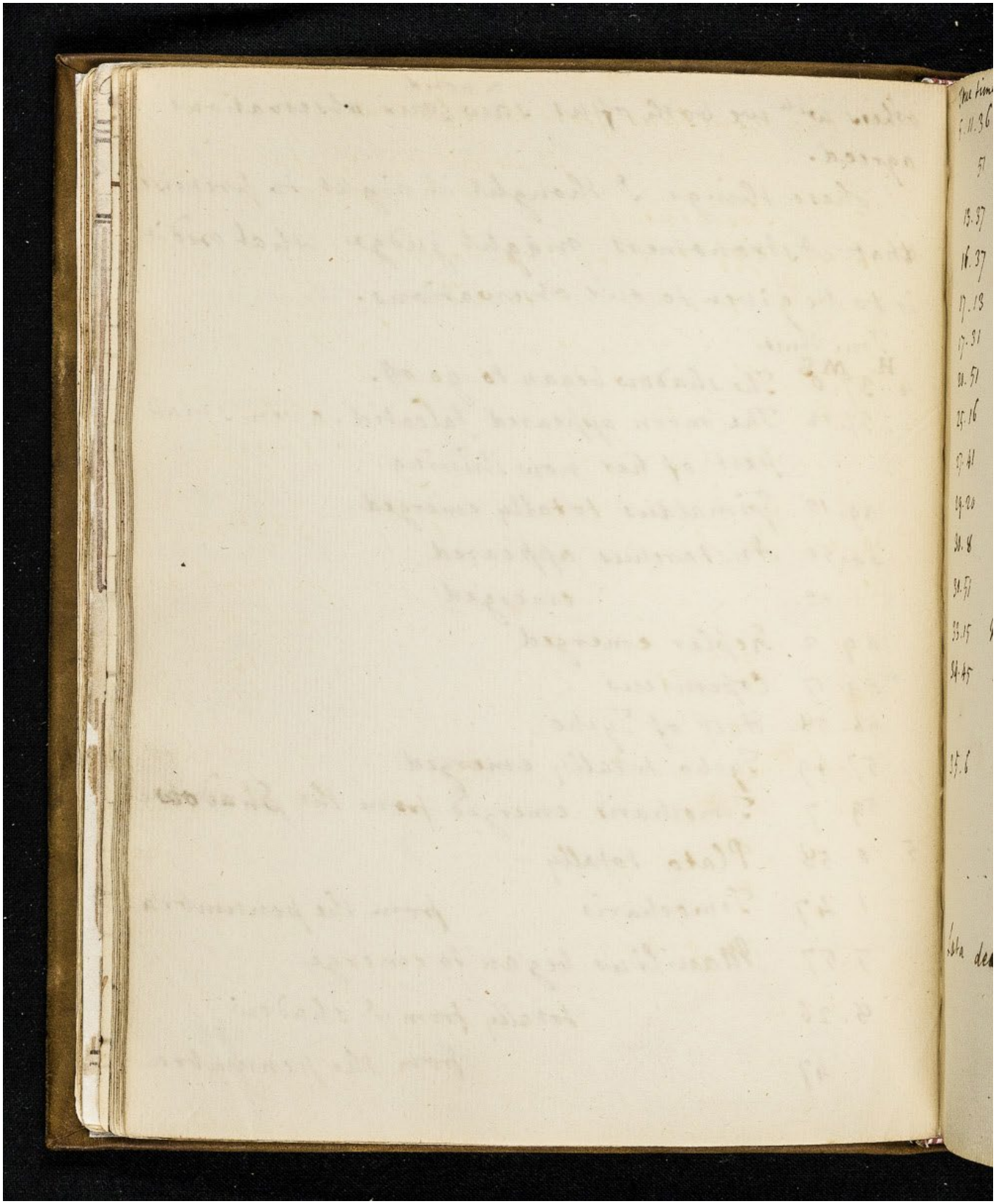


17

others wch we both of us saw & noted our observations agreed.

These things I thought it right to premise that Astronomers might judge what credit is to be given to our observations. —

True time H. M. S.	
4. 37. 0	The shadow began to go off.
" 37. 12	The moon appeared falcated, a very small part of her now shining.
39. 12	Grimaldus totally emerged.
44. 50	Aristarchus appeared
" 52.	" emerged
49. 2	Kepler emerged
54. 17	Copernicus
56. 58	Half of Tycho
57. 49	Tycho totally emerged
59. 7	Timocharis emerged from the Shadow
5. 0. 58	Plato totally —
1 47	Timocharis from the penumbra
7. 57	Manilius began to emerge
8. 26	totally from y^e^ shadow
47	from the penumbra



True time
5.11.36 Menelaus from the shadow
51 at ye extremity of penumbra
13.37 Sosigenes.
16.37 The half of Possidonius
17.13 Possidonius totally
17.31 The shadow passed over the tranquil sea
20.51 The promontary Emerged
25.16 Proclus
27.41 The Crisian sea beginning to emerge
29.20 Langrenus totally
30.8 The Crisian sea totally from shadow
30.51 - - - - from penumbra
33.15 Now only ye penumbra remained
34.45 End of penumbra according to
Mr Ljungberg
35.6 - - - according to myself.

- - modo qua poterat Diti quoque maesta videri
Laeta deae frons est
Metam. v. 569.