

XXIV. *Venus observed upon the Sun at Oxford, June 3, 1769: By Samuel Horsley, L.L.B. Rector of St. Mary, Newington, in Surrey, F.R.S.*

Read June 15, 1769. **M**Y regulator was moved to the place of observation on Wednesday evening, and set a going on Thursday; and, between that time and nine o'clock on Sunday morning, many comparisons were made of it with Mr. Hornsby's observatory clock, by which its rate of going and difference from Mr. Hornsby's clock, at the time of observation, were pretty well determined. At 10' before seven, by my regulator, I began to observe and to count the seconds, and about 3' and 3 or 4'' after seven, I descried a very small black notch on that part of the Sun's limb where I expected the Planet; but it was then so small, that I was in doubt whether it was any thing more than an appearance occasioned by the horizontal vapours, which were more copious than I could have wished, and made the Sun's edge, as usual, appear ragged in many parts. But by 5' after seven, this notch was grown so large, that no doubt remained with me that it was the Planet.

This was my observation of the external contact, which I write, however, chiefly by recollection; for, having had no experience of this observation before,  
not

not having observed the tranfit of 1761, I had conceived a prejudice that it would not be poffible to obferve the external contact with any accuracy, and therefore I neglected to make any other minute of what I faw of it, but that I was certain that the Planet was upon the Sun by 5' after feven, by my regulator. Mr. Cyril Jackson, a ftudent of Chrift Church, who obferved in the fame room with me, told me, when all was over, that he thought he had notice of the Planet's approach, by a more vehement undulation in that part of the Sun's limb where the Planet entered than in any other, which he perceived a very fhort time before he faw the Planet. I confefs that I was not fenfible of this circumftance. I obferved with an 18 inch reflector; Mr. Jackson ufed a refractor of Mr. Dollond's of nine feet. The wind was high, and very troublefome to both of us, by the motion it gave to our instruments.

When the Planet had been fo long upon the Sun's limb, and fo large a part of its circle was plainly entered, that I thought the internal contact was near at hand, I was much aftonifhed to find the fhape of the black fpot fuddenly altered from a large fegment of a circle, to what I have attempted to exprefs very rudely by a fketch, fee TAB. VII. Fig. 1. where the lower part, which ftill feemed the fegment of a circle, is connected with the Sun's limb, by a kind of ligament of darknefs terminated on each fide by right lines. The ligament detached itfelf from the Sun's limb; and the light, as I thought, was vifible, all round the Planet, at 7<sup>h</sup> 21' 52'', by my regulator, and not earlier to my eye. And this I fet down as the internal contact. The moment that I perceived the

the ligament detached from the Sun's limb, I turned my eye to the clock, to catch the minute, and to be satisfied that I was right in my counting of the seconds. And when I returned my eye to my telescope, which was before or not later than the 55th second, I found that the thread of light between the limb of Venus and the limb of the Sun had sensible breadth, and the shape of the Planet was perfectly circular. Mr. Jackson reckoned the internal contact at  $7^h 21' 51''$ , by our regulator. He judged of it as I did, by the detachment of the ligament, which he saw, as well as I, from the Sun's limb. My regulator, when it was first set a-going, seemed to gain on Mr. Hornsby's observatory clock for some hours (the pendulum, perhaps, not being come to its natural swing). But on Friday evening, about a quarter after eight, it was too slow for Mr. Hornsby's clock  $13''$ . On Saturday, half an hour after noon, it was  $18''$ , 9 too slow. And Saturday evening, at  $9^h 30'$ , it was  $27''$  too slow; and on Sunday morning, about nine o'clock, it was  $32''$  or  $33''$  too slow. So that at the time of the internal contact it was  $25'' \frac{1}{2}$  or  $26''$  too slow for Mr. Hornsby's observatory clock.

I was much surprized, upon comparing notes with Mr. Hornsby, to find that he had judged the internal contact  $14'' \frac{1}{2}$  or  $15''$  earlier than I did.

The foregoing narrative of what I saw, I have drawn up June 8th, having not conversed with any other observers, except Mr. Hornsby and Mr. Jackson, and Mr. Maskelyne, whom I met in the street this day, and talked with him very cursorily. And that my account may be purely of what I saw, as it

struck me at the time, before my own ideas were blended with those of other people, and altered (as may sometimes be the case by communication) from what they originally were in my own mind, I shall present this hasty memoir as I have drawn it up, without any correction or alteration.

June 8,  
1769.

Samuel Horsley.

N. B. The figure that I have given does not (I believe) express accurately the proportion of the ligament to the circular segment of Venus's disk. I think that the right lines, which terminated the ligament, do not go off from the limb of Venus in angles quite so sharp as my figure exhibits. Nor do I think their convergence was so great as I have drawn it.

June 10, 1769.

June 13, 1769. Since I wrote the above, I have received from Mr. Hornsby a minute of the difference of his clock from mean time, at the time of observation, which I forgot to bring away with me from Oxford, and therefore could only state my observation before in the times of my own regulator and Mr. Hornsby's clock. I now subjoin my observations reduced to mean time at Oxford, reckoning Mr. Hornsby's clock too fast for mean time by  $5'' \frac{1}{2}$  at the hour of observation.

External

	h	'	"
External contact —	7	3	23 $\frac{1}{2}$
Detachment of the ligament	7	22	12 $\frac{1}{2}$

I have likewise obtained from my brother, Mr. John Horsley, a minute of his observation made at Greenwich with an excellent refractor of Mr. Dollond's, which magnified, however, only 50 times. My brother assures me, that he did *not* see the ligament which I have described, though it was seen by Mr. Maskelyne and by others, at Greenwich. He has set down, however, two different dates of the total ingress. One, which he calls close contact without any light, appearing between the limbs of Venus and the Sun, at 7<sup>h</sup> 28' 15'', apparent time at Greenwich. Another, which he marks thus, "a thread of light, "fine as you can imagine, appearing between," at 7<sup>h</sup> 29' 28''. Here is an interval of 73'' between the close contact and the appearance of light. The time of the appearance of the light being reduced to mean time, and to the meridian of Oxford (reckoning the meridian of Oxford 5' 4'' west of Greenwich, as it is stated in Mr. Maskelyne's Tables), was 7<sup>h</sup> 22' 9'', which is only 3'' earlier than my observation of the detachment of the ligament. Now from hence I conclude, that the magnifying power of the telescope, which my brother used, was too small to *show him the shape* of the ligament, yet the ligament had its effect with respect to obstructing the Sun's light, which he perceived about the same time as others, who used glasses of greater force; which seems to be a strong confirmation of the *reality* of what we saw: or that there actually was a part of the Sun's disk, which

remained obscure (from what cause I do not at present enquire) for several seconds after the limbs of the Planet and the Sun were separated. I think this worthy of remark, because I hear that the appearance of the ligament, which I have described, has been imputed by some to an inaccurate adjustment of the glasses to the observer's eye.

S. Horsley.

In the foregoing Paper, I have given several comparisons of my clock with Mr. Hornsby's. Its difference from Mr. Hornsby's, by a mean of all the comparisons, will be found  $25''\frac{1}{2}$ , at the time of observation. But I rely chiefly on the comparisons of Saturday night and Sunday morning, which make the difference  $26''$ .

