

VI. *Account of some Particulars observed during the late Eclipse of the Sun.* By William Herschel, LL.D. F. R. S.

Read January 9, 1794.

IT will be proper to remark that my attention, in observing this eclipse, was not directed to the time of the several particulars which are usually noticed in phænomena of this kind ; such as the beginning, the end, and the digits eclipsed. I was very well assured that the care of other astronomers would render my endeavours, in that respect, perfectly unnecessary. The only view I had was, to avail myself of the power and distinctness of my telescopes, in order to see whether any appearances would arise that might deserve to be recorded ; and the following particulars will, at least, serve to point out the way for similar observations to be made in other eclipses, where different circumstances may chance to afford an opportunity for gathering some addition to our knowledge, with regard to the nature and condition of the moon, or of the sun, and perhaps of both these heavenly bodies.

Sept. 5, 1793. 8^h 40' 3'' by the clock.* My attention being directed to the place where I supposed the first impression would be made, I perceived two mountains of the moon enter the disk of the sun, as delineated at *a, b*, fig. 1, Tab. VII. The

* By account, my sidereal time-piece was about 5' 1",7 too forward ; but, as no transits had been lately taken, there may be an error of some seconds.

time of their beginning to appear, when I saw them first, might be one or two seconds past.

9^h 5'. 7-foot reflector; power 287. The internal, luminous angle made on the sun, by the intersection of the limb of the moon, which is now but little more than a rectangle, is perfectly sharp up to the very point. It is not in the least disfigured by the refraction of the lunar atmosphere. The present shape of the angle, however, is not favourable for shewing the effects of that atmosphere.

9^h 17'. The luminous angles of the sun's preceding and following limbs, which are now acute, remain perfectly sharp. One of them, indeed, was disfigured, a little while ago, by the entrance of a mountain of the moon, but is now restored to its sharpness.

10^h 5'. I delineated the appearance of the limb of the moon upon the sun, and found its mountains as in fig. 2. At *a* was a large *table mountain*, as it may be called, from its flat appearance; at *b* and *c* were elevated, pointed rocks. Their appearance changing pretty fast, no great accuracy can be expected in their expressed relative situation.

I suppose the height of the most elevated of these mountains not to exceed a mile and an half; for, on drawing several of them upon the segment of a large circle, so as to look like what they appeared when projected upon the sun, I found them to be from the 1500th to the 2000th part of the diameter of that circle. Then, putting the moon's diameter, as M. DE LA LANDE states it, at 782 French leagues, or 2151 English miles, we find the 1500th part of this to be less than one mile and an half for the highest; and the 2000th part, not quite one mile and a tenth for the lowest.

I attended all this time to the appearance of the sharp limb *a b c* of the sun, fig. 3, and suspected, sometimes, a little bending of the cusps outwards, as expressed at *b* in fig. 4; but upon long, and attentive inspection, I could not satisfy myself of its reality. If there was a bending, it did probably not amount to one second of a degree; for, having formerly been much in the habit of measuring the moon's mountains,* the quantity of one second, on its disk, was still familiar enough to me to estimate it pretty exactly.

10^h 15'. I looked out with the natural eye for the planet Venus, and soon perceived her. In the telescope, with 287, she appeared very sharp and well defined, and was a little gibbous.

It may seem, perhaps, extraordinary that in the trial above mentioned, the eye should be able to ascertain the proportion of a quantity so little as the fifteen hundredth, or two thousandth part of the diameter of the moon; but the experiment may be easily repeated in the following manner:

Upon a line, six or eight inches long, drawn on a sheet of paper, make several small marks, representing mountains on the projected circumference of a large globe. The paper being then placed in a proper light and situation, withdraw the eye to the distance of 7, 8, or 9 feet, and take notice which of the marks appear of the same size, and distinctness, with the

* In the years 1779, 1780, and 1781. I did not measure, I suppose, less than an hundred mountains of the moon, in which I used three different methods: the projection of the tops of these mountains beyond the enlightened part of the disk; the length of their shadow on the surface of the moon; and their perpendicular projection on the full edge of the moon's limb. Some of these observations are contained in a former paper (see *Phil. Trans. Vol. LXX. Part II. page 507*); but most of them remain uncalculated in my journal, till some proper opportunity.

mountains they represent. Then, from the known angular magnitude of the moon, calculate its diameter, at the distance of your situation ; this, multiplied by the power of the telescope, gives the diameter of a circle, to the circumference of which belongs the line, upon which are placed the marks above described. Now, measure the elevation of these marks, above that line, and you will obtain the proportion they bear to the diameter of the circle.

In my experiment, I found that I could plainly see some small protuberances at 9 feet distance, which were no higher than the 50th part of an inch. Then putting the diameter of the moon at 30', we have the sum of the logarithms of the tangent of 30' ; of the power 287 ; and of the 50ths of an inch contained in 9 feet ; which, taken from the logarithm of the diameter of the moon in miles, gives the logarithm of ,16. By which we find, that so small a mountain as the $\frac{1}{100}$ dth, or not much more than the sixth part of a mile, may be perceived and estimated, by the telescope and power that was used upon this occasion ; and that, consequently, the estimation of mountains, near a mile and an half high, must become a very easy task.

Slough, near Windsor,
Dec. 30, 1793.

WM. HERSCHEL.

