

ROYAL ASTRONOMICAL SOCIETY.

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MR. BAILY announced to the Meeting, that His Royal Highness the Duke of Sussex, President of the Royal Society, had, on the 30th ultimo, delivered up to this Society, for their sole use, benefit, and advantage, the room on the mezzanine floor, immediately over their present meeting-room. On which it was

Resolved unanimously,

That the thanks of the Society be given to His Royal Highness, for his kind attention to the wants and wishes of this Society, in making over to them the room above mentioned.

The following communications were then read, viz. :—

I. On a remarkable phenomenon that occurs in total and annular eclipses of the sun. By Mr. Baily, Vice-President of the Society.

The author states, that, having read of certain singular appearances that are recorded as having taken place in annular eclipses of the sun, at the moment that the whole disc of the moon enters on the disc of the sun, he was desirous of witnessing those phenomena at the solar eclipse of May 15th last; and, finding that the central path of the moon's shadow would pass nearly in a straight line from Ayr, on the western coast of Scotland, to Alnwick on the eastern coast of Northumberland, he proceeded to Scotland for that express purpose. Having computed, from the elements given in the *Nautical Almanac*, that the central line of the moon's umbra would pass directly over, or very near to, Jedburgh in Roxburghshire; and having ascertained that this place was within eight or ten miles of Makerston, the seat of Lieut.-General Sir Thomas Macdougall Brisbane, Bart., who has a well-furnished observatory there, and from whom he was sure of obtaining the correct time for his chronometers, he resolved to make that town his headquarters. Mr. Baily took with him a $3\frac{1}{2}$ feet refracting telescope by Dolland, $2\frac{5}{8}$ inches aperture, and magnifying about 40 times; a 20 inch Rochon's prismatic telescope, for measuring the distances between the borders of the sun and moon; two thermometers; a burning-glass; and four pocket chronometers.

Mr. Baily took up his station at the house of Mr. Veitch, a very ingenious gentleman, residing at Inch Bonney, about half-a-mile to the southward of the town of Jedburgh; who afforded him every facility for making the observations. The morning of the

15th of May is described as being remarkably fine and clear ; not a cloud to be seen in any part of the heavens during the whole time of the eclipse. The times of the beginning and ending of the eclipse, and of the formation and dissolution of the annulus, have already been given in the preceding volume of these monthly abstracts, page 200. But Mr. Baily does not lay much stress on this part of his observations—more especially those connected with the annulus—since his attention was taken up with other more interesting phenomena. He says he was in expectation of meeting with something extraordinary at the formation of the annulus ; but imagined that it would be only momentary, and consequently that it would not interrupt the noting of the time of its occurrence. In this, however, he was deceived, as the following facts will shew. For, when the cusps of the sun were about 40° asunder, a row of lucid points, like a string of beads, irregular in size, and distance from each other, *suddenly* formed round that part of the circumference of the moon that was about to enter on the sun's disc. This he intended to note as the correct time of the formation of the annulus, expecting every moment to see the thread of light completed round the moon ; and attributing this serrated appearance of the moon's limb (as others had done before him) to the lunar mountains ; although the remaining portion of the moon's circumference was perfectly smooth and circular, as seen through his telescope. He was somewhat surprised, however, to find that these luminous points, as well as the dark intervening spaces, increased in magnitude ; some of the contiguous ones appearing to run into each other like drops of water. Finally, as the moon pursued her course, these dark intervening spaces were stretched out into long, black, thick, parallel lines, joining the limbs of the sun and moon : when, all at once, they *suddenly* gave way, and left the circumferences of the sun and moon in those points, as in all the rest, apparently smooth and circular, and the moon perceptibly advanced on the face of the sun. This moment of time Mr. Baily considers to be that which most persons would assume and record as the formation of the annulus ; but he adduces strong reasons afterwards to shew that the true formation of the annulus was some seconds prior to that event.

After the formation of the annulus, as thus described, the moon preserved her circular outline during its progress across the sun's disc, till her opposite limb again approached the border of the sun, and the annulus was about to be dissolved. When, all at once (the limb of the moon being at some distance from the edge of the sun), a number of long, black, thick, parallel lines, exactly similar in appearance to the former ones above mentioned, *suddenly darted forward*, and joined the two limbs as before : and the same phenomena were repeated, but in an inverse order. For, as those dark lines got shorter, the intervening bright parts assumed a more circular shape, and at length terminated in a fine, curved line of bright beads (as at the commencement), till they ultimately vanished, and the annulus consequently became wholly dissolved. This re-

markable and singular phenomenon was also observed by Mr. Veitch, and also by Sir Thomas Brisbane, as well as by Mr. Henderson at Edinburgh; with some slight differences, however, in the detail. The appearance of the dark lines, or threads, was likewise noticed by Mr. Bell, at Alnwick, who sent an account of the same to the Philosophical and Literary Society at Newcastle. Mr. Baily describes them to have been as plain, as distinct, and as well-defined, as the open fingers of the human hand held up to the light; and that there could not have been any doubt as to their form and existence, since they were seen by different observers, at different places, and with different telescopes. Several drawings accompanied the paper, shewing the appearances at various stages of the annulus.

The number of these dark lines, or threads, Mr. Baily considers to have been about eight; in which opinion he was confirmed by Mr. Veitch. Sir Thomas Brisbane, however, thinks there were not more than six; whilst Mr. Bell, who noticed four at the dissolution of the annulus, says that there were only two at its formation. On these and other points Mr. Baily thinks there is ample room for a diversity of opinion, since the observer is taken, as it were, by surprise, and the phenomenon itself, during the short period of its existence, is constantly varying in some minute particulars.

Mr. Baily remarks, that the diminution of light was not so great during the existence of the annulus as was generally expected, being little more than might be caused by a temporary cloud passing over the sun: the light, however, was of a peculiar kind, somewhat resembling that produced by the sun shining through a morning mist. The thermometer in the shade fell only about three or four degrees. The birds in the hedges were in full song during the whole time of the eclipse. About twenty minutes before the formation of the annulus, Venus was seen with the naked eye; and a few minutes afterwards it was impossible to fire gunpowder, with the concentrated rays of the sun, through a lens of three inches in diameter. The same lens, likewise, had no effect on the ball of a thermometer during the existence of the annulus.

For the cause of the remarkable optical deception above described, Mr. Baily does not attempt to account; but he confesses his surprise that the phenomenon has not (with one single exception, which will be presently alluded to) been noticed, or recorded, on former occasions, since it must have been seen by every person who watched for the formation and dissolution of the annulus; and although detached portions of the phenomenon have been recorded by different observers, as seen at different places (various extracts from whose accounts are quoted by Mr. Baily), yet it is impossible from those descriptions to form an accurate idea of the whole, or to trace the origin, progress, and termination of this phenomenon, which is certainly one of the most remarkable in astronomy. M. Van Swinden is the only person who has placed on record the observation of the dark lines, or threads, which connect the borders of the sun and moon, at the formation and dissolution of the

annulus. His account is inserted in the first volume of the *Memoirs* of this Society (page 146), accompanied with drawings, which coincide almost exactly with those given by Mr. Baily. In nearly all the accounts by other observers, the description of the phenomenon is restricted to the very commencement of the annulus, or to the formation of the string of luminous points which on a sudden are seen to surround that portion of the moon's limb about to enter on the sun's disc; and no notice whatever is taken of the continuation of the phenomenon, or of the stretching out of the dark spaces into parallel lines, as above mentioned: nor of their *sudden* rupture and *disappearance*, which is by far the most remarkable part of the phenomenon.

How far any of these appearances may favour the hypothesis of a lunar atmosphere, or whether, indeed, they could be accounted for on such an assumption, the author does not stop to discuss; but, with a view to assist those who are disposed to enter on such an inquiry, he has adduced various accounts of a similar phenomenon to that of the dark lines, observed at the transits of Venus over the sun in 1761 and 1769. For, on each of those occasions, many astronomers remarked, that, at the interior contact of Venus with the sun (both on its ingress and egress), there was formed a sort of dark ligament between the border of Venus and the border of the sun, which appeared like a protuberance from the planet, and which continued several seconds. This dark ligament is represented, in the drawings which accompany the several memoirs on this subject, to be much thicker, and to continue longer, than the dark lines in a solar eclipse; so that the planet, during the progress of the ingress and egress, assumes a shape which has been variously described as resembling a pear, a Florence flask, and a skittle. But all the accounts agree in stating the *sudden* rupture of the ligament; and that immediately thereon the planet assumes its usual circular shape. Nothing of this kind, however, has been noticed at the transits of Mercury over the sun: on the contrary, we have the direct evidence of Sir William Herschel (who examined Mercury, with that special object in view, at the transit of November 9, 1802), that he could not discern any thing out of the usual course. He expressly states, that the whole disc of Mercury was as sharply defined as possible; and that there was no kind of distortion of the limb, either at its ingress or egress: the appearance of the planet remained well defined from first to last.

Mr. Baily considers, and adduces certain facts to shew, that the circular edge of the moon is always distorted at those points which are in contact (or nearly so) with the sun's circumference; and which have occasionally given rise to the supposition of lunar mountains in high relief. He thence infers, that all measures of the moon's diameter, when passing over the sun's disc, must be taken with great caution, and with due attention to the proximity of the part measured to the edge of the sun's disc (where alone the distortion seems to take place), otherwise errors and discordances

will occur. Those prodigious lunar elevations and depressions, so frequently described in solar eclipses, are seldom or never seen, except at the commencement or termination of the eclipse, or in places near the solar cusps: that is, in those points only which are near the edge of the sun; every other portion of the moon's circumference being comparatively smooth and circular. If this notion be correct, it would seem that the measurement of the solar cusps during an eclipse may be liable also to discordances from this very cause.

Mr. Baily concludes by expressing a hope, that, at the total eclipse of the sun in 1842, and the annular one in 1847 (both of which will be central in Europe), the attention of astronomers will be directed more particularly to this subject, both as to its existence and its cause; and that such a regular system of observations in various places will be adopted, as may best tend to elucidate and explain this very remarkable phenomenon.

* * There was laid on the table, for the inspection of the members present, a small floating collimator, made by M. Amici. This instrument was only $1\frac{1}{2}$ inch in length, and, together with the mercury on which it floats, was packed in a small round box, 2 inches diameter in the inside, and 2 inches high, which might be carried in the pocket. It is intended for voyagers, and other persons, to whom a larger instrument would be a great inconvenience. It was the first that had ever been made of such small dimensions.

* * There was also laid on the table a drawing, or representation, of several *shooting stars*, that were observed at Plymouth from the 11th to the 14th of November last, together with the direction which they severally took, as compared with the fixed stars then visible.