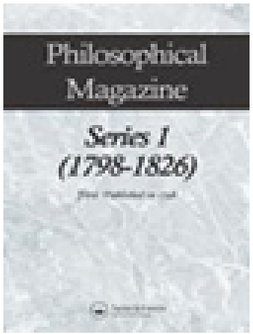

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Professor J.E. Bode

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XXXVIII. *On the Diſappearance of Saturn's Ring in the Year* 1803. *By Profeſſor* J. E. BODE*.

THE plane of Saturn's ring, as is well known, during the whole of his revolution of thirty years round the ſun, retains its parallelifm, and interſects the plane of the ecliptic in 17 degrees of Piſces and of Virgo at an angle of $31\frac{1}{2}°$. The neceſſary conſequence, therefore, is, that the northern ſide of the ring is illuminated for fifteen years by the oblique rays of the ſun, and then the ſouthern for the ſame period. It muſt alſo happen, that in the above places the plane of the ring paſſes twice through the ſun in each revolution, at which time the edge of the ring only is illuminated. But the edge or thickneſs of the ring being too ſmall to admit of its being ſeen from the earth on account of the great diſtance of Saturn, the ring becomes inviſible. For fifteen years the earth and the ſun are on the ſame ſide of the ring, which is the illuminated ſide, and therefore the ring during that period is always viſible; but a little before, and at that period when the plane of the ring paſſes through the ſun, or when Saturn's heliocentric place is in 17° of ♓ or of ♍ in the aſcending or deſcending nodes of the ring, the earth and the ſun may firſt be on one ſide and then on the other ſide of the ring. In the firſt caſe, as long as its plane does not paſs through the ſun it will be viſible from the earth; but in the other caſe it will be inviſible. The earth, therefore, can then paſs ſeveral times through the plane of the ring, at which time the ring will appear like a right line, or be entirely inviſible; the conſequence of which is, that the ring will be alternately viſible and inviſible.

This alternation of diſappearing and reappearing will be exhibited by the ring in the year 1803. The ſun, having illuminated the ſouth ſide of the ring ſince October 1789, will paſs through the plane of it in the month of June 1803, and will illuminate the northern ſide, when Saturn paſſes heliocentrically the aſcending node of his ring; and in the mean time the plane of the ring will paſs three times through the earth, which will be firſt on the ſide illuminated by the ſun, and then on the oppoſite or darkened ſide; in conſequence of which the ring ſeen from the earth will be twice viſible and inviſible in the courſe of a few months.

Theſe phænomena will be better comprehended by inſpecting the annexed figure, which ſuppoſes the obſerver to be

* From his *Aſtronomiſch Jahr Buch* for 1803.

placed

placed in Saturn. This figure, then, exhibits the exact inclination of the plane of the ring to the ecliptic; the apparent motion of the earth and the ſun, as ſeen from Saturn, together with the time of the paſſage of theſe planets through the aſcending node of his ring. (See Plate V. fig. 2.)

AB is the ecliptic ſeen from Saturn in the ſign of Piſces, and divided into degrees. The aſcending node of Saturn's ring ſeen from thence is placed in 17° 6′, in which point the plane of the ring interſects the ecliptic at an angle of 31° 20′. The eye is then in that plane. Thus the ring appears as a ſtraight line; *nn* is the north ſide, and *zz* the ſouth ſide of it. The dotted line CD is the ſolar orbit ſeen from Saturn; and the ſun's place is marked in it on the firſt day of each month, from November 1802 to October 1803. Theſe places of the ſun are directly oppoſite to the heliocentric places of Saturn: the longitude thus differs ſix ſigns, and the northern latitude of Saturn ſeen from thence changes into the ſouthern of the ſun. In this manner, the ſun in November, December, January, and to the month of June, illuminates the ſouth ſide of the ring; but always in a fainter manner, the nearer he comes to the plane of it. On the 15th of June he paſſes through the plane in *e*. The ring at that time is illuminated on the edge, and can be ſeen only by powerful teleſcopes as a fine luminous line.

The longitude of the point *e*, reduced to the ecliptic, falls in *f*, or 20° 42′ of Piſces. The ſun, then, about the middle of June begins to illuminate the northern ſide of the ring; in July, Auguſt, September, October, &c. he recedes more and more from the plane of the ring, and the illumination of it then becomes ſtronger.

The elliptical line is the earth's orbit as ſeen from Saturn, according to its direct and retrograde motion from the 1ſt of November 1802 to the 1ſt of October 1803, and its place is marked on the firſt of each month. Its longitude is ſix ſigns leſs or more than the geocentric longitude of Saturn; and the northern latitude of Saturn is changed into the ſouthern of the earth.

Now, as the figure clearly ſhows, the earth in November and December 1802 is repreſented on the ſouth ſide, or turned towards the ſun, and therefore on the illuminated ſide of the ring. But afterwards the earth approaches more and more to the plane of the ring; and, as the ring receives the ſolar rays in a more and more oblique manner, the ring not only becomes narrower but even decreaſes in light. On the 13th of December, as may be ſeen by this ſmall figure, the earth enters the plane of the ring, and paſſes to the northern

Fig. 1.

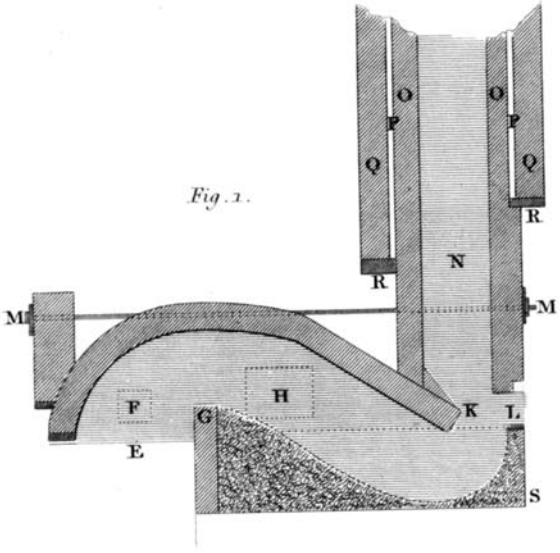


Fig. 3.

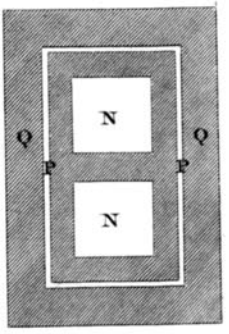
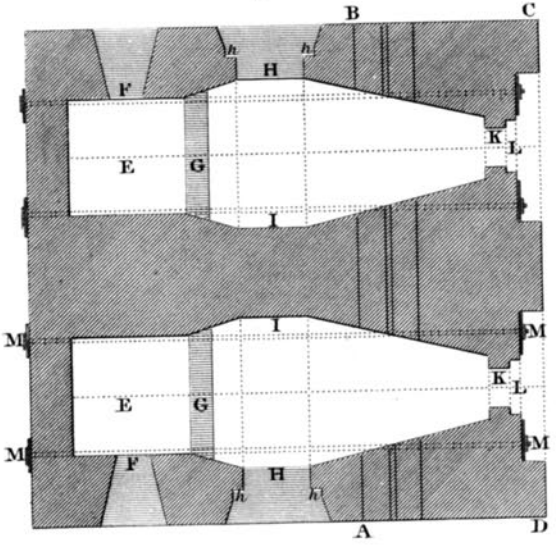


Fig. 2.



Lowry sculp.

northern ſide of it, which is turned from the ſun. The ring then, for the firſt time, becomes to us inviſible: but this inviſibility is not of long continuance; for, as may be ſeen by the figure, the earth on the 1ſt of January, by its Saturniocentric apparent retrograde motion, paſſes a ſecond time through the plane of the ring, and goes to the ſouthern or illuminated ſide, and the ring then begins to appear again as a ſtraight line. In February, March, and April, the earth recedes more and more from the plane, and the ring becomes broader and more perceptible. But the ſun during theſe months approaches nearer to the plane of the ring, and by theſe means it is illuminated in a more oblique direction. In the month of May the earth is at its greateſt diſtance from the plane of the ring, while the ſun approaches it more and more till the middle of June, when he paſſes through the plane in *e*, and the ring for the ſecond time becomes totally inviſible to the earth, which is then on its dark ſide. From this period, during the month of July and till Auguſt, the ring will remain in this ſtate. About the 18th of Auguſt the earth will paſs, for the third time, through the plane of the ring, as it will then be on the northern, which is now the illuminated ſide of the ring: it will again appear as a ſtraight line, and be viſible when viewed through good teleſcopes: it will increaſe in light and breadth in September and October in proportion as the earth and the ſun recede from the plane.

Between the 1ſt of November 1802 and the 1ſt of October 1803 the ring of Saturn twice diſappears and twice reappears. At the firſt diſappearance on the 13th of December 1802, Saturn in the morning will be in the eaſtern part of the heavens; and the firſt reappearance will be about the 7th of January 1803; Saturn in the night-time being on the ſame ſide of the heavens.

At the ſecond diſappearance in the middle of June, Saturn in the night will be in the weſt, and, as he ſets half an hour after midnight, the phænomenon may be obſerved. But at the ſecond and laſt diſappearance in Auguſt, Saturn will be after the ſun, and therefore the phænomenon cannot be ſeen. In the month of October, when Saturn emerges from the ſun's rays, he may be ſeen before ſun-riſe in the eaſt, and the ring then will be very viſible.

In regard to the above calculation of the times of the diſappearance and reappearance of Saturn's ring, the accuracy of them, and the correſpondence of them with the phænomena, muſt depend on the accuracy of the tables and the theory hitherto adopted in regard to the poſition of the ring.

The

The ſtate of the atmoſphere alſo, and the different power of the teleſcopes and of the eyes of the obſervers, may occaſion ſome variation. The diſappearance and reappearance of the ring, which are occaſioned by the earth paſſing through its plane, can be better and more conveniently obſerved than thoſe which take place in conſequence of the paſſage of the ſun through that plane, becauſe the earth, on account of its quicker motion, paſſes ſooner through the plane of the ring than the ſun.

As the ſix firſt ſatellites of Jupiter move in the ſame plane with the ring, when the ring diſappears, or becomes like a luminous line, theſe ſatellites muſt appear on both ſides of Saturn in a right line, and can then be more readily diſcovered and diſtinguiſhed from fixed ſtars.

XXXIX. *On the Diſappearance of the Ring of Saturn. By* VAN BEECK CALKOEN, *Profeſſor of Aſtronomy at Leyden* *.

THE plane of Saturn's ring, according to aſtronomical obſervations, has always a direction parallel to itſelf, ſo that it interſects the ecliptic in 17° 18′ of ♍ and ♓, at an angle of $31\frac{1}{2}°$, and the orbit of Saturn at 20° 42′ of ♍ and ♓. Now, if Saturn as ſeen from the ſun be in longitude 20° 42′ of ♓, the plane of the ring will paſs through the centre of the ſun; by which the edge of the ring being illuminated, while the northern and ſouthern ſurface receive no light, it muſt become inviſible, and can be ſeen only by the moſt powerful teleſcopes as a fine luminous line. On the 15th of June next Saturn will be in this ſituation; and as this planet employs about thirty years in its revolution round the ſun, this phænomenon takes place only once in 15 years. Other phænomena, however, in conſequence of which the ring before the 15th of June will alternately diſappear and reappear, are connected with this ſtate of the planet. Theſe phænomena ariſe from the different poſitions of the earth, which in the courſe of its revolution is at one time above and at another below the plane of the ring; ſo that from the 1ſt of November 1802 to October 1803 the ring will be twice inviſible and twice viſible; firſt the ſouthern and then the northern, then the ſouthern and afterwards the northern ſurface will be alternately ſeen from the earth within the courſe of ten months. For determining and calculating theſe phænomena with more accuracy, Lambert in-

* From *Algemeene Konſt en Letter-Bode*, No. 13, for 1803.

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