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The following communications were read: —

I. On the Satellites of *Uranus*. By Sir J. Herschel.

This paper, dated from Portsmouth, on the eve of the author's departure for the Cape of Good Hope in November last, contains an investigation of the motions of two of the satellites of *Uranus*.

Notwithstanding the remarkable peculiarities presented by the satellites of this planet, in the great inclinations of their orbits to the orbit of the primary planet, and their retrograde motions, they have never been observed, or even seen (so far as the author is aware), except in the telescope with which they were originally discovered. In a paper of the late Sir William Herschel, published in the *Philosophical Transactions* for 1815, and containing the whole series of his observations on these satellites, the existence of at least two of them appears to be placed beyond a doubt. But since that time the unfavourable situation of the planet, to the south of the equator, has opposed a serious obstacle to their re-observation, even with telescopes of the highest optical capacity. Since the year 1828, the author has made repeated observations upon two of the satellites with the 20-feet reflector at Slough, from which he has deduced an approximate determination of their orbits.

There being no eclipses of these satellites, and the measurement of their distances from the planet with any approach to exactness being hopeless in its present situation, the only *data* by which a knowledge of the elements of their orbits can be obtained are their angles of position with the meridian, which are susceptible of tolerably correct determination. For the investigation of the elements, the author considers the best method to be that which he has used for determining the orbits of revolving double stars from *data* of the same nature. The application of this process to the case of the satellites, however, is greatly facilitated by the approximate knowledge already possessed of their periods, and the situations of the planes in which they revolve. In that of the double stars, these elements are wholly unknown. But in the case of the satellites, by using the approximate node and inclination, the observed angles of position, as seen projected on the heavens, may be reduced to the plane of the orbit, thereby simplifying the computations considerably. And a knowledge of the periodic time enables positions, observed in different revolutions, to be used as if they had been observed consecutively in a single revolution. In order, however, to justify this mode of proceeding, it is necessary, in the first instance, to shew that a sufficient approximation to the values of the elements is already possessed. The author has at present limited himself to this preliminary verification, as he had not sufficient time to investigate the subject more completely.

There are given 49 observed angles of position of the first of the two satellites, and 59 of the second; 31 of the first, and 32 of the second, having been observed by Sir William Herschel between 1787 and 1798; and the remainder by the author, between 1828 and 1832. Assuming the position of the nodes of the satellites' orbits, and their inclinations to the orbit of the planets, as given by Sir W. Herschel (viz. longitude of ascending node of each 165° 30′, and inclination 101° 2′), the observed angles of position are reduced to the plane of the satellites' orbits: and supposing that the orbits are circular, and assuming the times of revolution as delivered by Sir W. Herschel, two epochs are determined at which the satellites pass through the ascending node; the first being in the year 1787, and the second in the year 1828. And, the number of revolutions performed in the interval being known from the approximate periods, the following correct values of the times of revolution are obtained, viz.:

	d	h	m	s
First Satellite	8	16	56	31·3
Second Satellite . . .	13	11	7	12·6

The first being 26s·1 greater, and the second being 1m 46s·4 less, than the times given by Sir William Herschel in his paper above mentioned.

On comparing the angles of position, computed from the corrected elements, with those actually observed, the errors for the first satellite seldom exceed 10°, and for the second 7°; and they are, for the most part, inferior in amount. This the author considers a reasonable degree of precision under the circumstances. There is reason to suspect an ellipticity in the orbit of the first satellite, corresponding to an excentricity of 0·035.

The author gives formulæ for determining the positions of the two satellites at any time, and tables for facilitating their application to the first. And he concludes with remarking, that of other satellites than these two he has no evidence; but if any exist, he hopes soon to procure a sight of them. Neither has he ever seen any appearance about the planet which gives ground for the least suspicion of a ring.

II. Continuation of Researches into the Mass of *Jupiter*, by Observations of the Elongations of the Fourth Satellite. By Professor Airy.

(See *Memoirs*, vol. vi. p. 83; *Monthly Notices*, vol. ii. p. 171).

The results of this paper are founded on six sets of measures, made in the same manner as the last, and with the same instrument, before the opposition of *Jupiter*. The unfavourable state of the weather after the opposition prevented any more being made. By observation of δ *Ursæ Minoris* in different positions of the instrument, the errors of the line of collimation, and the declination and polar axes, were found to be very small, as was also the rate of the clock. In every instance, twelve transits over three wires were obtained, both of the planet and satellite.

The mode of calculation in this paper differs from that in the preceding, in a correction applied to the observed difference of right