

## THE REVELATIONS OF ASTRONOMY.

*(Continued from North British Review.)*

At the enormous distance from the sun which we have now reached, we believed, at the commencement of this article, that the solar system terminated. The late M. Cacciatori, the successor of Piazzi, had indeed declared, as we have seen, that he had followed for three days a moving star, which, from the slowness of its motion, he suspected to be beyond Uranus; but the conjecture excited no other feeling than that of grief, that he should not have continued his search for so interesting a body. At the time we are now writing, however, the discovery of a new planet beyond Uranus, has been announced to the scientific world—a discovery which will ever be regarded as one of the grandest triumphs of astronomical science. To discover a planet by the ordinary process of observation, is an act of no greater merit than that of discovering a comet, or any other celestial object; but to predict the existence of a planet from phenomena which indicated its existence, is one of the finest achievements which philosophy has ever performed. In comparing the calculated with the observed places of Uranus, a discrepancy appeared which could not be explained by any of the perturbations produced by the other planets. The deviation in question seemed to be owing to the disturbing action of a planet more distant than Uranus. M. Le Verrier undertook the problem of computing the probable place of the supposed planet, from the nature and amount of its perturbations as affecting Uranus, and he seems to have obtained a correct solution of it. The planet was actually discovered on the 23d of September, at Berlin, by M. Galle, of the Royal Observatory, and has been since seen at Mr. Bishop's Observatory in Regent's Park. It resembles a star of the 9th magnitude, having a diameter of three seconds, and a volume 230 times that of the Earth. Mr. Hind saw the disc with a power of 320. Its motion, which is at present retrograde, amounts to two or three seconds of time daily. On the 24th of September, at 8h 54' 40".9, its right ascension was 328° 18' 14".3, and its declination 13° 24' 29".7 south. On the 30th September, at 8h 16' 21", mean time at Greenwich, its right ascension was 328° 3' 8".6, and its south declination 13° 27' 20". In conformity with Bode's law, its distance will be about 3453 millions of miles, and its periodic time about 1723 years, and if there should still be another planet, its distance would be nearly 7000 millions of miles. With a Newtonian reflecting telescope 20 feet in focal, and with an aperture of 24 inches, and powers of from 316 to 567, Mr. Lassels of Liverpool has examined this planet, and has announced in *The Times* the probability that it has a ring like Saturn, and a satellite. "On the 3d October," he says, "at about 8½ hours, I observed the planet to have apparently a very obliquely situated ring, the major axis being seven or eight times the length of the minor, and having a direction nearly at right angles to a parallel of declination. At the distance of about three diameters of the disc of the planet northwards, and not far from the plane of the ring, but a little following, there was situated a minute star, having every appearance of a satellite. I observed the planet again, about two hours later, and noticed the same appearances. \* \* \* \*"

With regard to the existence of the ring, I am not able absolutely to declare it, but I received so many impressions of it, always in the same form and direction, and with all the different magnifying powers, that I feel a very strong persuasion that nothing but a purer state of atmosphere is necessary to verify the discovery. Of the existence of a star having every aspect of a satellite, there is not the shadow of a doubt. Afterwards I turned the telescope to the *Georgium Sidus* (*Uranus*), and remarked that the brightest two of his satellites were both obviously brighter than this small star accompanying Le Verrier's planet.

Since the preceding paragraph was printed Prof. Challis, of Cambridge, has communicated to the *Athenæum* some interesting information respecting the history and discovery of the new planet. From this communication it appears that, previous to January, 1843, Mr. Adams, an under-graduate of that university, had endeavoured to account for the anomalies in the motions of *Uranus* on the hypothesis of a more distant planet. The necessity, however, of preparing himself for the examinations for the academic distinction which he obtained in January, 1843, left him no time for pursuing the research. In the course of 1843, he arrived at an approximation to the position

of the planet, but having employed only a small number of observations of *Uranus*, he obtained in February, 1844, through Prof. Challis, from the Astronomer Royal, the early Greenwich observations then in course of reduction. With these materials, Mr. Adams proceeded in this inquiry, and in September, 1845, he communicated to Mr. Challis his values of the heliocentric longitude, eccentricity, place of perihelion, and mass of the supposed planet.

On the 29th of July, 1846, Prof. Challis, guided by a paper drawn up for him by Mr. Adams, commenced with the Great Northumberland Achromatic, a systematic search for the planet. On the 30th June, he observed all the stars even to those of the 11th magnitude, in a zone 9 minutes broad. On the 12th of August, he met with a star of the 8th magnitude in the 9 minute zone which did not contain it on the 30th July. "Of course," says Prof. Challis, "this was the planet, the place of which was recorded a second time in four days of observing." The following were the positions of the planet on the 4th and 12th of August:—

Aug. 4, 13h 36m 25s	R. Ascens.	21h 58m 14".70
	N. Pol. Dist.	192° 37' 32".20
Aug. 12, 13h 3m 26"	R. Ascens.	21h 57m 26".13
	N. Pol. Dist.	103° 2m 0".2

The following elements of the planet's orbit have been deduced by Mr. Adams from these positions compared with more recent ones:—

Distance of the planet from the sun,	
the Earth being 1.	30.05
Inclination of Orbit,	1°45'
Longitude of descending node,	309°43'
Heliocentric longitude, August 4,	326°39'

The distance of the planet from the sun is less than the theory had indicated, and also less than it should be by Bode's law.

It would be presumptuous to assert that we have reached the limits of our system, especially at the present moment, when we have, since 1781, extended that system from an orb of 1800 millions of miles in diameter, namely, that which is bounded by Saturn's orbit, to one of 6906 millions of miles, or that which is included within the orbit of Le Verrier's planet,—that is when we have extended it nearly *four times* its former diameter. There is, however, a probable limit to every planetary system. When the light and heat of the central sun has become so diffuse and weakened by distance, that they are scarcely capable of producing the effects which we ascribe to them, we may reasonably conjecture that we have reached the boundaries of the system. Even on the surface of *Uranus* and of Le Verrier's planet, their influence must be feeble indeed. In the former, the light of the sun is to that which we enjoy on the earth as 3 to 1000, while in the latter it is only as 7 to 10,000, that is, on *Uranus* the light is only  $\frac{1}{333}$ , and on Le Verrier's planet only  $\frac{1}{1428}$ , of the light upon the earth. If there should still be another planet, which unexplained perturbations in Le Verrier's planet may indicate, the light upon it will be only  $\frac{1}{333}$  of the earth's light—a glimpse altogether insufficient for eyes like ours.

After an attentive examination of the preceding statement, we could scarcely anticipate any controversy respecting the honour of being the first discoverers of the planet. Mr. Adams appears, according to our present information, to have been the first to predict its existence and its place, and as M. Galle did not discover the planet till the 23d of September, while Prof. Challis observed its place on the 4th and 12th of August, seven weeks previous to the first Berlin observation of it, we should have thought it equally clear that he was the true practical discoverer of it. But Professor Challis has made such a statement near the end of his letter, as to make it appear that he was not aware of the discovery of the planet; and unless he give some explanation of his language, we are sure that as the foreign claimants first published their discovery, it will be urged against him with all the feeling of national rivalry. "A comparison," says he, "of the observation of July 30 and August 12, would, according to the principles of search which I employed, have shown me the planet. I did not make the comparison of it till after the detection of it at Berlin, partly because I had an impression that a much more extensive search was required to give any probability of discovery, and partly from the press of other occupations. The planet, however, was secured, and two positions of it recorded six weeks earlier