ASTRONOMISCHE NACHRICHTEN.

№ 596.

Second Report of proceedings in the Cambridge Observatory relating to the new Planet (Neptune). *)

In conformity with a wish expressed by the Vice-Chancellor and the Observatory Syndicate at their ordinary terminal meeting, held on March 15, I propose in this Report to carry on, for the information of members of the Senate, the account of proceedings in the Observatory relative to the new Planet, a first Report of which was made on Dec. 12 of last year. The theoretical grounds on which a search for the Planet was instituted, the manner in which the search was conducted, and the degree of success that attended it, were stated in the former Report, which brought the history of proceedings down to the date at which the Planet was discovered. I have now to give an account of the subsequent observations both of its position in the heavens, and of its physical appearance, and to state the results respecting the orbit which have been deduced from the observations by calculation.

A regular series of observations of the planet was commenced on Oct. 3, 1846, and continued at all available opportunities, partly with the meridian instruments, and partly with the Northumberland Equatoreal, to Dec. 4, soon after which the planet became too faint to observe on the meridian on account of day-light. The observations were subsequently carried on with the Equatoreal to Jan. 15. The series was much interrupted by cloudy weather, particularly in the months of December and January. On the whole I have obtained 28 positions of the Planet with the meridian instruments, and 25 positions with the Northumberland Equatoreal by means of 92 differential observations of Right Ascension and as many of North Polar Distance. The Equatoreal measures were all referred to the same star, No. 7648 of the British Association Catalogue, the exact place of which was determined by 16 observations with the Transit, and 8 observations with the Mural Circle. I have reason to think that the positions obtained with the Equatoreal are entitled to very nearly the same weight as those obtained on the meridian. All the above observations I have completely reduced, and have placed the results at the disposal of Mr. *Adams* for deducing elements of the Planet's orbit.

On Jan. 12, I had for the first time a distinct impression that the Planet was surrounded by a ring. The appearance noticed was such as would be presented by a ring like that of Saturn, situated with its plane very oblique to the direction of vision. I felt convinced that the observed elongation could not be attributed to atmospheric refraction, or to any irregular action on the pencils of light, because when the object was seen most steadily I distinctly perceived a symmetrical form. My assistant, Mr. *Morgan*, being requested to pay particular attention to the appearance of the Planet, gave the same direction of the axis of elongation as that in which it appeared to me. I saw the ring again on the evening of Jan. 14. In my note-book I remark. „The ring is very apparent with a power of 215, in a field considerably illumined by lamp-light. Its brightness seems equal to that of the Planet itself." On that evening, Mr. *Morgan*, at my request, made a drawing of the form, which on comparison coincided very closely with a drawing made independently by myself. The ratio of the diameter of the Ring to that of the Planet, as measured from the drawings, is about that of 3 to 2. The angle made by the axis of the Ring with a parallel of declination, in the south-preceding or north-following quarter, I estimated at 60°. By a measurement taken with the position-circle on January 15, under very unfavourable circumstances, this angle was found to be 65°. I am unable to account entirely for my not having noticed the Ring at an earlier period of the observations. It may, however, be said that an appearance like this, which it is difficult to recognize except in a good state of the atmosphere, might for a long time escape detection, if not expressly and repeatedly looked for. To force itself on the attention, it would require to be seen under extremely favourable circumstances. Previous to the observations in January, the Planet had been hid for more than three weeks by clouds. The evenings of Jan. 12 and 14 were particularly good, and the Planet was at first looked at in strong twilight. Under very similar circumstances I have twice seen with the Northumberland Telescope the second division of Saturn's Ring.

*) Von Herrn Professor *Challis* mir zum Einrücken übersandt. *S.*

I communicated to Mr. *Lassell* of Liverpool, who was the first to suspect the existence of a Ring, my observations upon it, accompanied with a drawing; and I have received from him in return a drawing of the appearance presented in his twenty-feet reflector, closely resembling mine both as to the form and the position of the Ring. Mr. *Lassell* writes, „I cannot refuse to consider that your observation puts beyond reasonable doubt the reality of mine.“ In this conclusion I concur, and accordingly in communications to the Royal Astronomical Society and to *Schumacher's* Astronomische Nachrichten, containing my reduced observations, I have ventured to express my conviction of the existence of a Ring.

By micrometer measures taken with the Northumberland Telescope, I find the apparent diameter of the body of the Planet to be very nearly 3″.

The above account includes all the observations on the Planet I could obtain before its disappearance in the Solar Rays. By the kindness of Mr. *Adams* I am able to add some particulars respecting its orbit, which he has derived by calculation from the reduced places with which I furnished him. As was stated in the former Report, Mr. *Adams* calculated first approximations to the elements, by employing the places I obtained on Aug. 4. and Aug. 12 in the course of searching for the planet, with observations since the discovery extending to Oct. 13. For the sake of comparison with the second approximations, I now give the first results.

Heliocentric Longitude	326°39′	Aug. 4. 1846.
Longitude of the Descending Node	309 43	
Inclination of the Orbit	1 45	
Distance of the Planet from the Sun	30,05	

In calculating the following second approximations Mr. *Adams* used the mean of the two places of August as a single place, and of the others he selected nine which seemed to be the best determined, and which were separated by convenient intervals. All the results are calculated for the epoch of 1846, Aug. 8,0, mean time at Greenwich.

Heliocentric Longitude of the Planet referred to the mean Equinox of 1847,0	326°41′ 12″3
Heliocentric motion in Longitude in 100 days	36 5,52
Heliocentric Latitude South	30 34,4
Change of Heliocentric Latitude in 100 days	1 4,44
Longitude of the Descending Node...	310 3 44,0
Inclination of the Orbit	1 46 49,1
Distance of the Planet from the Sun.	30,008
Half the Latus Rectum of the Orbit.	30,228

The first position on which the above results depend, that of Aug. 4, was obtained 16 days before the Planet was in opposition, and the last position, that of Jan. 15, 32 days before it was in conjunction. The great variation of the Planet's elongation from the Sun in this interval, is favourable to the correctness of the above determinations, which, although they cannot pretend to extreme accuracy on account of the short period over which the observations extend, are yet entitled to considerable weight. Mr. *Adams* has in fact calculated the probable errors of the above results by supposing each observation of Right Ascension or of North Polar Distance to be liable to an error of 3″, and he finds that there is little probability of their receiving any great amount of correction by taking account of future observations. It may be remarked that the first and second approximations do not differ by any large quantities. Hence it may be inferred that the places of August are deserving of confidence, and that, on account of the extension given to the period of observation by including those places, this second approximation to the elements is more accurate than it would have been if it depended solely on observations made since the discovery of the Planet.

The calculations give 59′8″ for the Planet's Heliocentric motion from Aug. 4 to Jan. 15. This is so small an arc that it is not possible to deduce with any degree of certainty those elements the determination of which depends on change of the heliocentric distance. Mr. *Adams* has, however, discussed the observations with this object in view, and has obtained certain limiting results, which, as possessing considerable interest, I here subjoin.

The eccentricity of the orbit cannot exceed 0,18. The most probable value is 0,06, which differs but little from the eccentricities of the orbits of Jupiter, Saturn, and Uranus.

The most probable longitude of perihelion is 49°58′, and the probable true anomaly 276°43′, according to which the Planet is near the extremity of the latus rectum and is descending towards perihelion. These results are extremely uncertain.

The mean distance is 30,35, with a probable error of 0,25; and the corresponding sidereal period is 167 years, with a probable error of about 2 years. It is remarkable that the periodic time is very nearly double that of Uranus; so that these two bodies will offer an instance of mutual perturbations of large amount, differing in character from those of the other planets, but analogous to the mutual perturbations of the first and second, and second and third satellites of Jupiter.

According to *Bode's* law of the planetary distances, the mean distance of the New Planet should be nearly 38. The actual mean distance differs so much from this, that we are compelled to conclude that this singular law fails in this instance.

Since the apparent diameter of the New Planet is to that of Uranus nearly in the ratio of 3 to 4, according to the foregoing determination of the distance its bulk is to that of Uranus in the ratio of 8 to 5.

The above is the sum of the results derivable from the first series of observations. For further and more exact information we must wait till the Planet emerges from the solar rays. Before concluding this Report, I am desirous of saying a few words respecting the Name of the Planet. I recently had the satisfaction of receiving from M. *Struve* the copy of a communication read by him at the general annual meeting of the Imperial Academy of Sciences of St. Petersburg on Dec. 29, in which he states the reasons that have induced himself and the other Poulkova astronomers to adhere to the name of Neptune, which name was first proposed by the French Board of Longitude, shortly after the discovery of the Planet. These reasons are thus briefly expressed in a note addressed to me personally: „The Poulkova astronomers have resolved to maintain the name of Neptune, in the opinion that the Name of Leverrier would be against the accepted analogy, and against historical truth, as it cannot be denied that M. *Adams* has been the first theoretical discoverer of that body, though not so happy as to effect a direct result of his indications.“ M. *Struve's* communication has been published in this country by the Astronomer Royal, who has expressed his assent to the reasons therein contained, and his determination to adopt the name of Neptune. Professor *Gauss* and Professor *Encke* have also, as I understand, adopted this name. I have only to add that it is my intention (and I am permitted to say, the intention of Mr. *Adams* also) to follow the example set by these eminent astronomers.

Cambridge Observatory 1847. March 22.

J. Challis.

Beobachtungen des von Herrn *Hind* am 6ten Februar entdeckten Cometen.

	Mittl. Bonn. Zt.	AR. ☄ =	δ. ☄ =		Vergleichstern
März 10	7h40′ 8″9	358°29′ 27″5	+43° 9′ 13″7	(4 Beob.)	μ
—	8 14 44,6	358 30 29,7	+43 7 20,1	(6 „)	„ ν
11	7 40 0,4	359 11 44,1	+41 50 10,7	(6 „)	„ ξ
15	7 42 4,1	1 47 1,7	+35 57 12,1	(6 „)	„ ο
16	7 30 21,7	2 21 48,4	+34 32 42,3	(6 „)	„ π
17	7 34 27,1	2 55 37,2	+32 54 28,9	(5 „)	„ ρ
18	7 28 35,9	3 27 24,0	+31 12 52,4	(6 „)	„ σ

Diese Beobachtungen sind, wie auch die früheren, sämmtlich an den Kreismikrometern des 5füſs. Refractors angestellt, und vom Einflusse der Refraction so wie der eigenen Bewegung befreit. Die scheinbaren Oerter der Vergleichsterne habe ich folgendermaſsen angenommen.

μ	359° 6′ 32″4	+42°57′ 26″2	Bes. Zone	383
ν	359 15 16,3	+43 7 16,9	——	383
ξ	359 58 32,4	+41 51 27,2	——	382
ο	2 11 11,4	+35 38 17,3	——	386
π	2 34 59,5	+34 16 26,9	——	439
ρ	2 55 55,5	+32 31 15,7	——	438
σ	3 50 57,1	+31 59 59,1	——	390

Was das äuſsere Ansehen des Cometen anlangt, so habe ich an verschiedenen Abenden, wenn Zeit und Umstände es erlaubten, die folgenden Bemerkungen aufgezeichnet. Seit dem Anfange des März war der Comet dem freien Auge sichtbar, anfangs sehr schwach, einem Stern der 6ten Gröſse ähnlich, dann, gegen den 15. und 16ten März dem Sterne ς Andromedæ nahe gleich, am 18ten die Helligkeit von π Andromedæ erreichend. Den Schweif, so wie überhaupt das Nebelartige des Cometen konnte ich mit unbewaffneten Augen nicht erkennen. Er glich ganz einem Sterne der 4ten Gröſse, und hatte ein äuſserst intensives weiſses Licht. In schwachen Vergröſserungen erschien der hellste Punkt sternartig, wurde aber bei 300mal. Vergröſserung ganz in Nebel aufgelöst. Der sehr matte, völlig gerade Schweif war anfangs höchstens eine bis zwei Minuten breit, und wurde seit dem 17ten März fächerförmig. Die Coma, nach allen Seiten anfangs völlig verwaschen, und kugelförmig, wurde späterhin nach der, der Sonne zugewendeten Seite schärfer begrenzt, und nahm, in dem sie in den Schweif überging, eine parabolische Gestalt an.

März 5	8h5	Schweiflänge	= 0°12′
8	8,5		= 0 30
9	8,7		= 0 40
10	8,0		= 0 50
11	8,0		= 0 56
15	8,2		= 1 50
16	8,0		= 3 33
17	8,0		= 4 0
18	8,0		= 4 20

Den Durchmesser der Coma schätzte ich zwischen 4 und 6′. Späterhin schien derselbe abzunehmen. Am 22sten März 16h30′, da ich den Cometen zuletzt sah, erschien er wegen