

et was afterward found was itself favored by the excellent star-chart drawn up by Bremiker for the Berlin Academy.\*

While among the distances of the exterior planets from the Sun, that of Saturn (9.53) is nearly double as great as the distance of Jupiter (5.20), the distance of Uranus (19.18) is, however, *more* than double that of Saturn; so the distance of Neptune (30.04) is less than that which would be required for a repeated doubling of the distance by full ten times the distance of the Earth from the Sun, *i. e.*, an entire third of Neptune's distance from the Sun. The *planetary boundaries* were at that time 2484 million of geographical miles from the central body. By the discovery of Neptune, the landmark of our planetary knowledge has been advanced more than 892 million miles further (more than 10.8 times the distance of the Sun from the Earth). According as the disturbances are recognized which each last planet experiences, so will other planets be gradually discovered which now remain invisible by means of our telescopes on account of their remoteness.†

According to the most recent determinations, Neptune's *period of revolution* is 60126.7 days, or 164 years and 226 days, and his *half major axis* 30.03628. The *eccentricity* of his orbit, next to that of Venus the smallest, is 0.00871946; his *mass*,  $\frac{1}{14446}$ ; his *apparent diameter*, according to Encke and Galle, 2".70, according to Challis even 3".07, which gives as his *density*, in comparison with the Earth, 0.230; greater, therefore, than that of Uranus 0.173.‡

Soon after the first discovery of Neptune by Galle, a *ring* was ascribed to him by Lassell and Challis. The former employed a magnifying power of 567, and endeavored to determine the considerable inclination of the *ring* to the ecliptic; but subsequent investigations have, as long before in the case of Uranus, contradicted the opinion of the existence of a ring round Neptune.

I dare scarcely allude in this work to the certainly earlier labors of the distinguished and acute English geometrician,

\* *Astr. Nachr.*, No. 580.

† Leverrier, *Recherches sur les Mouvements de la Planète Herschel*, 1846, in the *Connaissance des Temps pour l'an 1849*, p. 254.

‡ The very important element of the *mass* of Neptune has been gradually increased from  $\frac{1}{20897}$  according to Adams,  $\frac{1}{10840}$  according to Peirce,  $\frac{1}{10400}$  according to Bond, and  $\frac{1}{18780}$  according to Sir John Herschel,  $\frac{1}{15480}$  according to Lassell, to  $\frac{1}{14446}$  according to Otto and August Struve. The last result has been adopted in the text.