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seventeen days for the discovery of a satellite by Lassell (1799-1880) with a two-foot reflecting telescope.

Astronomers have suspected the existence of still other planets, and the belief has been expressed that such a body exists nearer to the Sun than Mercury, which, as has been seen, enjoys the reputation of being the closest of all the planets to the central luminary. The average distance of Mercury from the Sun is about 36,000,000 miles,

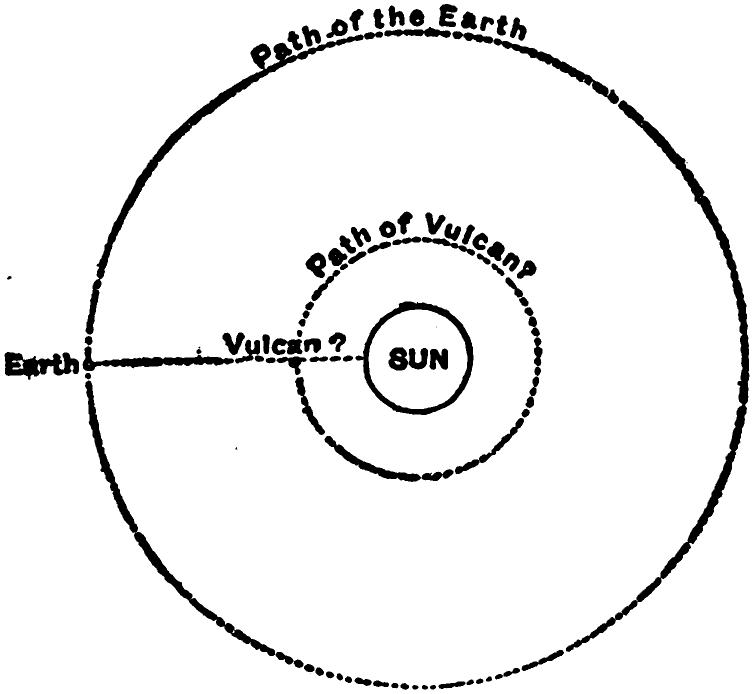

Fig. 15 —The Transit of "Vulcan," the Supposed Intramercurial Planet.

so that there would be space enough for such a planet. Its peculiar position in close proximity to the Sun, however, would act against its being observed. A small luminous point in this position would be altogether invisible, even with the best modern telescope, while its setting and rising, simultaneous almost with those of the Sun, make it invisible at these times even under the most favorable conditions. If this planet should pass across the Sun's disk just as do Mercury and Venus, it would be

seen. While from its size it would be much less of a spectacle than the two planets mentioned, it might be detected. Claims have been advanced by astronomers that they have seen such a transit of a small spot.

The first suggestion of an intra-Mercurial planet came from the distinguished French astronomer, Leverrier, who in 1859 advanced such a hypothesis in an attempt to explain the movements of the planet Mercury. His theory involved a body of about the size of Mercury revolving at somewhat less than half its mean distance from the Sun, or at a greater distance if of less mass and vice versa, whose motion in great part would explain the irregularities observed. In the same year Dr. Lescarbault at Orgères maintained that he had observed such a body crossing the Sun's disk, and the name of Vulcan was bestowed upon it. Several astronomers claimed to have seen the new planet. Their observations were not well authenticated, and on the dates fixed for the probable transits no trace of the planet could be found. The strongest test was the examination of the sky at the time of a solar eclipse, for then the light of the Sun was cut off and a strange body could be readily identified. Despite a careful watch at subsequent eclipses and an examination of photographic plates, only negative results have been obtained. To-day the belief that there is any body of considerable size within the orbit of Mercury is held only by a few astronomers and very guardedly stated.

If the search for an intra-Mercurial planet was unsuccessful, it has in no way deterred astronomers from endeavoring to find other unrecognised members of the solar system. Much interest has been aroused by a hypothetical ultra-Neptunian planet, which of course would be the furthest from the Sun of all the members of the solar system. The basis for such a hypothesis is the reduction of observations made of the positions and motions of Uranus and Neptune. Neptune has been under observation for only a small part of a revolution, so that

data thus far obtained seem to many astronomers insufficient for the purpose. Yet a number of astronomers have sought by calculation to prove the existence of such a planet. While their results are discordant, yet they indicate very closely the regions of the sky where search for the hypothetical body might be rewarded with success.

Professor W. H. Pickering, of Harvard, in 1909 evolved a method for the discovery of the distant planet, a method which he first tested by application of the data available to Adams and Leverrier for the discovery of Neptune, and found that the method would succeed. Proceeding then with his hypothetical planet, which he termed "O," he found that it was 51.9 times as far distant from the Sun as the Earth, tho its mass was but twice that of this planet, and that it had a period of revolution of 373.5 years. The problem presented by Uranus, Neptune and "O," according to Professor Pickering, is quite the same as that of Mercury, Venus and the Earth, which has been thoroly studied, so that the relative motions are well understood.

But in investigating the effect that such a hypothetical planet would have on the motion of Uranus, Professor A. Gaillot recently arrived at the conclusion that there were indications pointing to the possibility of still another and more distant planet also exercising a perturbing influence. The results of his calculations and studies therefore indicate the possible existence of two ultra-Neptunian planets, one at a distance from the Sun equal to 44 times the Earth's mean distance and having a mass about $\frac{1}{64000}$ the mass of the Sun, the other having a distance 66 times that of the Earth and a mass about $\frac{1}{140000}$ that of the Sun. While these figures disagree with those of Professor Pickering, yet the position calculated for the second planet agrees quite closely with that of the Harvard astronomer. The problem is by no means solved. It is mentioned to show that a plausible case has been made out for at least one ultra-Neptunian planet.