Hypothetical Objects

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Chapter 1

Hypothetical Objects

1.1 Index of Hypothetical Objects

Throughout history, there have been a number of planets or solar system objects that astronomers have believed to exist at one time, but whose existence are now doubted.

1.2 Lilith - a second moon for the Earth?

In 1846, Frederic Petit, director of the observatory in Toulouse, France boldly stated that a second moon of the Earth had been discovered. He mentioned that three observers had reported seeing the object during the early evening of March 21, 1846. Petit used these observations to calculate a possible orbit for this object. He came up with a highly elliptical orbit with an apogee 3570 km above the surface of the Earth, and a perigee only 11 km above. The French mathematician Leverrier mentioned that for an object to come that low, air resistance should be taken into account, but nobody at the time knew how to do it. It now seems ridiculous to even contemplate a Moon which at closest approach would barely scrape the top of Mount Everest, but at the time some astronomers thought it possible. Petit became obsessed with the idea, and stated how such an object would be able to cause some peculiarities in the Moon’s orbit which at the time had not been satisfactorily explained.

Years later, scientists had still not explained these peculiarities and amateur astronomers everywhere began an all out search to find such an object. However, all searches remained fruitless. Several astrologers got into the act, claiming that the object was merely very dark and hence hard to see. The hypothetical object soon became known as "Lilith".

Even professional astronomers began to search for Lilith. A camera was set up to take pictures of the sky, moving at the rate that would follow such a moon if it were to exist. Stars would show up as streaks in the photograph, and a

positive identification of a moon would reveal it as a simple dot. No such objects were identified, though when the first artificial satellites were launched in 1957 and 1958, the camera succeeded in picking them up.

In 1956, the Polish astronomer Kordylewski claimed to have seen faint patches of light orbiting the Earth 60 degrees before and after the Moon. These stable regions (known as Lagrangian points) exist in any orbit, and it was suspected that interplanetary dust could collect there. In fact, some moons of the outer planets were observed to exist in the Lagrangian points of other moons.

In 1975 and 1990, these clouds of dust were photographed, both from the ground and by satellite. They are extremely difficult to observe, but do exist. However, they are not in any way like the hypothetical "Lilith" which had captured the public's imagination for so long.

It is now widely accepted that no large natural objects other than the Moon orbit the Earth, though it is possible that meteorites and the like could be captured by the Earth and remain in orbit a short time (10 days or so) before burning up in the atmosphere.

1.3 Nemesis - a companion star to the Sun?

When examining the Earth's geological record, it appears that a mass extinction occurs every 30 million years or so. In an effort to explain this phenomenon, some scientists have postulated the existence of a companion star to the Sun - too dim to be seen. This hypothetical object became known as "Nemesis".

Astronomers have calculated that if such an object were to exist in a highly elliptical orbit varying between 20,000 and 90,000 A.U. from the Sun, every 30 million years it would pass through the Oort Cloud - a theoretical cloud of matter surrounding the solar system from which comets are born. Such an event would greatly affect the orbit of matter in the cloud, causing a dramatic increase in the number of comets reaching the inner solar system. The chances of a comet colliding with the Earth would be much greater - and if it did, a mass extinction could result.

The biggest problem with Nemesis is that although it seems good in theory, there has been no evidence to suggest that such an object really exists. A study of the entire sky in the far infrared by the IRAS satellite has failed to detect any such object. This failure has caused many astronomers to doubt the Nemesis hypothesis.

1.4 Neith - a moon for Venus?

In 1672, the French astronomer Jean Domenique Cassini noticed what he thought to be a small companion next to Venus. He thought he may have discovered a moon of Venus, but decided not to enter the observation into his journal until 1686 when he saw the object for a second time. He said that the moon appeared to be 1/4 the diameter of Venus, and exhibited the same phase (which was necessary for it to be a moon). Throughout the following century, a number of individuals declared to have seen the object as well. However, a greater number of people tried to find the moon and failed in their attempts.

In 1766, Father Hell, the director of the Vienna Observatory, published a paper in which he declared that all observations of the moon were optical illusions. He said that Venus is so bright that its image is reflected in the eye and back into the telescope, creating a small, secondary apparent object. Others published papers declaring that the moon was real. J. H. Lambert of Germany even went so far as to publish orbital elements for the object in the "Berliner Astronomischer Jahrbuch of 1777". Astronomers tried to detect the object in a transit of Venus across the Sun on June 1, 1777, but failed. Several other searches by prominent astronomers also turned up empty handed.

In 1887, the Belgian Academy of Sciences published a paper where every reported observation was investigated in detail. It was found that almost all of the sightings turned out to have been stars seen in the same field of view as Venus.

It is now known that no sizeable objects orbit Venus as a moon - and definitely none are big or bright enough to have been seen from the Earth. With the 25 or so spacecraft to have visited the planet, no such object has ever been detected.

1.5 Vulcan - an intra-Mercurial planet?

In the 19th century, it was observed that the perihelion of Mercury's orbit precesses around the Sun at a slow rate. In other words, the point in space at which Mercury makes its closest approach to the Sun changes with time. Astronomers of the time were unable to explain this effect using classical Newtonian mechanics.

In a lecture on January 2, 1860, the French mathematician Urbain Leverrier announced that this problem could be solved by assuming that either a planet or an asteroid belt orbited between Mercury and the Sun. But since the object or objects were to lie quite close to the Sun, it became apparent that the only way to observe them was during a transit of the Sun, or during a total solar eclipse. As a result, many astronomers began trying to detect transits. A total of two dozen spots were reported to move across the disk of the Sun and were classed as potential candidates.

In 1859, Leverrier received a letter from the amateur astronomer Lescarbault. He had reported seeing a round black spot appear to transit the solar disk. After computing an orbit and mass for this reported object, Leverrier discovered that it would have been too small to account for the deviations in Mercury's orbit. However, it could still be a large asteroid in the hypothetical asteroid belt. Leverrier named this object "Vulcan".

In 1860, there was a total eclipse of the Sun. Leverrier encouraged astronomers all over the world to try and use this event to find Vulcan and settle the debate once and for all. Despite a wide participation in the project, nobody succeeded.

More spots were seen to move across the surface of the Sun, and were believed by some to be a transit of a planet or asteroid within the orbit of Mercury. Then after another total solar eclipse on July 29, 1878, two observers reported seeing small disks near the Sun. However, none of these observations were found to agree with Leverrier's Vulcan.

After this, nobody saw Vulcan again, despite a great deal of effort at subsequent solar eclipses. In 1916, Albert Einstein published his "General Theory of Relativity" which explained the irregularities in Mercury's orbit without the need for postulating a hypothetical planet or asteroid belt. In addition, several photographs were taken of objects in the vicinity of the Sun during solar eclipses, but all could be identified as stars.

Though the deviations in Mercury's orbit have been explained without the requirement for objects orbiting the Sun inside the orbit of Mercury, the question of what the various astronomers saw still remains. It is possible that Lescarbault happened to see a small asteroid passing close to the Earth that appeared to be an object passing near the Sun. And the various individuals who reported seeing objects during solar eclipses could have simply misidentified stars as planets during the rush to do observations before totality ended.

For a brief period in the early 1970s, the concept of Vulcan was briefly revived when researchers again detected faint objects near the Sun during a solar eclipse. It is thought, however, that these objects might have been comets in a close orbit or on a collision course with the Sun.

1.6 Planet X

In the 1840s, scientists realized that the orbit of Uranus was not behaving exactly as theory predicted. It appeared as though another planet might orbit the Sun further from Uranus, causing the observed deviations. John Adams and Urbain Leverrier began an exhaustive search to locate such an object. The result of their efforts was the discovery of Neptune.

It soon became evident that the effects of the estimated mass of Neptune were not sufficient to account for the deviations in Uranus, so yet another planet was suspected. On February 18, 1930, Clyde Tombaugh discovered Pluto, but it was too small to account for the deviations. Throughout the following years a great deal of astronomers (including Tombaugh himself) continued to search for this elusive "Planet X". By 1943, Tombaugh completed an exhaustive study of the sky, and concluded that no further planetary objects brighter than magnitude 16.5 existed, though many astronomers continued the search.

Although no planets were discovered further than Pluto, several small asteroids were detected. In fact, a small asteroid belt was discovered. But all of these objects were too small to account for the deviations observed with Neptune.

It was hoped that by analyzing the trajectories of Pioneer 10, Pioneer 11, Voyager 1, and Voyager 2, the gravitational influences of a previously undetected planet could be observed. But there have been no unpredictable motions of the spacecraft. Additionally, when Voyager 2 made its flyby of Neptune in 1989, astronomers were able to accurately determine Neptune's mass. According to Dr. Myles Standish at JPL, when the improved value for mass is taken into account, the irregularities in the orbit of Uranus are completely accounted for, resulting in predictable motions for the outer planets going back to the early 1800s (when accurate observations of these objects began). Thus, it would seem as though Planet X does not exist, at least not as a single large body. Dr. Standish's analysis is presented in the May 1993 issue of the

"Astronomical Journal".