

Planet Vulcan and a Moon for Venus

First came the Myths

Before man knew of science and technology he relied on legends, myths and stories told around the early campfires to explain the things he did not understand, or simply could not see. Such was the way with the planet Vulcan. In Roman religion, he was the God of Fire, which was a pretty good guess. If the planet exists, it would surely be the hottest of planets, except for perhaps Venus, which shows a temperature of over 900° F. On the surface, Vulcan was originally the God of Volcanic Fire, but has since been associated with fire, alone. Vulcan's parents, according to the myth, were Jupiter and Juno, one of whom hurled him from heaven and, thereby, lamed him. Could this be a simple way of telling us that Vulcan could have been a moon of Jupiter, or perhaps even a body of rock thrown from the asteroid belt which the Romans could have referred to as Juno? Perhaps Juno was the name of a small planetary body before it became part of an expanding main asteroid belt?

Vulcan, it is said, became the husband of Maia, the Goddess of growing Vegetation, but later myths married him to Venus, the Goddess of Love.¹ Could it have been that the mythical marriage did not last. Perhaps the Moon of Venus, discussed many times in the 18th and 19th centuries, was the planet Vulcan, but was torn from orbit by an, as of yet, undetermined event. As it turns out this Vulcan may just have been a bit more than just a myth.

Science Enters the Search

Several times during the 19th century, astronomers felt they had spotted and tracked an intra-mercurial planet, naming it Vulcan. On March 26, 1859, Dr. Lescarbault of Orgeres, France, observed a moving astronomical body "looking like a planet translating the sun" on or near the sun for one and a quarter hours. Mathematician Dr. Urbain Jean Joseph Le Verrier, then the Director of the Paris observatory and co-discoverer of the planet Neptune, visited Dr. Lescarbault in order to check on his observations, calculations and background. He did this with great skepticism and even less enthusiasm. However, Dr. Le Verrier was satisfied with the interview and concluded that an intra-mercurial planet, or at least a body large enough to be called an asteroid, had been discovered by Dr. Lescarbault.

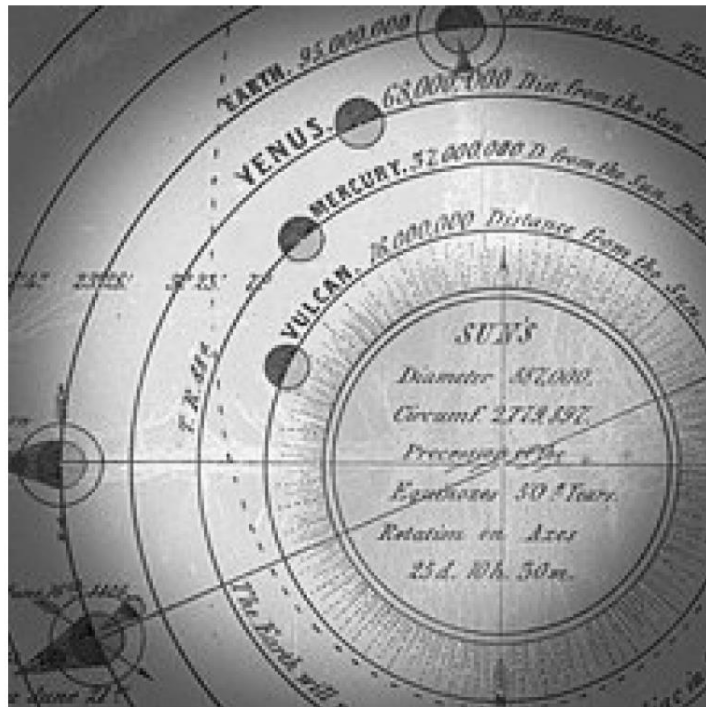
Earlier, Dr. Le Verrier had suggested that a small planet or possibly an inter-mercurial asteroid belt could account for the observed deviations of Mercury's orbit. Due to the gravitational attraction of the other planets, mercury's perihelion position of its orbit rotates by around 531 seconds of arc every century. That was some 43 seconds greater than could be accounted for without another planet's effect. Or so it was thought. However, Einstein's more powerful relativity equations showed that the effect could be accounted for far better than formal Newtonian gravitational theory could provide.

Dr. Le Verrier computed its mass to be one-seventeenth that of the planet Mercury, its orbit to nineteen of our days and 7 hours, and named it Vulcan for the God of Fire. Dr. Le Verrier further calculated an orbit inclination of between 5.3 and 7.3 degrees and a solar transit time of 4 hours and 30 minutes. He further estimated a mean distance from the Sun to average 0.1427 a.u. (1 a.u. is stated as the average distance of the Earth from the Sun.) from 9.1 million to 9.5 million miles from the Sun. It was immediately suggested that this very small body could be the first discovered and largest member of an inter-mercurial asteroid belt orbiting very near the Sun.

He felt the best chances for observing any of these suggested bodies would be during a total solar eclipse or when the objects moved in front of the Sun in relation to the Earth. The year after 'discovery' announcement found the French astronomical community ready for the challenge. In 1860 a total solar eclipse was observed with all of the resources the astronomers could bring to focus on the problem. There

was to be only disappointment when the predicted transit failed to manifest itself. Vulcan was a no-show. Dr. Le Verrier was not to be put off. After long personal work estimated that the best time to see Vulcan would be on March 22, 1877, but he was not to be rewarded, for the planet was not to be seen at that time.

At this point, the question arises as to whether or not this could have been a large sunspot and not a small body in orbit about the Sun. The year 1859 was indeed a peak in sun spot activity with an annual mean sun spot number of 96. This data would at first seem to have indicated that the object being observed was, indeed, a sun spot. It would, indeed, except that when the object was again spotted by a distinguished observer the annual mean sun spot number was at a low point of only 7!



1846 map with Vulcan

The year was 1878 and one of the better years for the observation of the planet Vulcan, if that is what it was. During that year, Professor James C. Watson of the University of Michigan and later Director of Washburn Observatory at the University of Wisconsin claimed to have observed not one, but two Vulcans inside of Mercury's orbit. He had gathered his data during the July 29, 1878 total solar eclipse and was very confident in his observations. He reported the sighting of two "small illuminated disks." His report was quickly discounted by several scientists of the day, who, it must be said, did not spend a great deal of time observing.

Nevertheless, the discoverer of 22 asteroids stuck to his claim of sighting two intra-mercurial planets in close proximity orbiting the Sun. Later that year astronomer Lewis Swift, Director of the Warner Observatory in Rochester, New York, and discoverer of over 1200 nebula and 12 comets (He is the Swift in Comet Swift-Tuttle which made its return in 1992.), saw what he called a good look at this most difficult of objects from Pikes Peak in Colorado. His sighting was in a different location than either of Professor Watson's "illuminated disks". By now the Vulcan problem was becoming quite complicated. Were these trained observers seeing different objects or were they all being fooled by sunspots and near Earth asteroids?



253 Mathilde, a C-type asteroid measuring about 30 miles across

Another astronomer during the year of 1878 who saw the planet included, Professor Rudolf Wolf, Director of the Bern Observatory and an expert on sun spots. He stated that the object he saw had no relation to any sun spots he had observed during his studies of the subject.³ He was convinced that he had spotted the planet. 1878 would be the last anyone would report seeing ‘planet’ Vulcan. Despite many later searches Vulcan was gone!

During May 1929 a total solar eclipse occurred across Sumatra. Erwin Freundlich from Germany photographed the event with the hope of locating any objects near the Sun. Six months later the same region of the sky was imaged for comparison. When compared the photographic plates showed there existed no unknown objects near the Sun. It is of course possible to say that Vulcan was in front of or behind the Sun as viewed from Earth at the time, but the odds were growing longer for Vulcan.

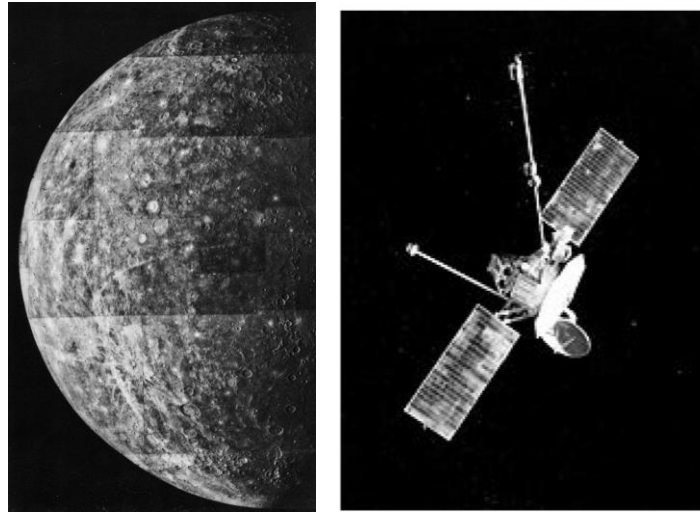
Most of the references dealing with planet Vulcan come to us by way of the 19th century and little science can be gained from them other than of a historically challenging nature. Although we have no reason to doubt the honesty of the men such as Dr. Le Verrier and Dr. Lescarbault, it must be said that science has gained little from their observations. What science demands in order to solve this problem are hard core facts from which to base a theory. So far there has been little to go on other than a few disjointed sightings of a possible intra-mercurial object or objects.

In order to state beyond a doubt that intra-mercurial objects do exist, it would probably be necessary to place in close orbit about the Sun an unmanned probe to scout the area of interest for just such a group of objects. And even though many prominent papers have discounted the possibility of this planet, (and that should never be done) science must continue to search beyond what we already know. The science magazine *Omni* stated that beyond a shadow of a doubt “Vulcan does not exist”.⁴

Vulcan in the Age of Space

We might just as well stop the investigation right there if it were not for the flight of *Mariner 10*. United States planetary probe *Mariner 10* was launched from Cape Kennedy, Florida on November 3, 1973. The spacecraft was sent on a voyage to fly past Venus and then using that planet’s gravity was sling-shot towards a rendezvous with the planet Mercury. The probe arrived on station near Mercury for its first of three operational flybys for what was to be a close-up study of its sun-baked surface for the first time in late March 1974. Much to the surprise of NASA engineers at the Jet Propulsion Laboratory in Pasadena, California, *Mariner 10* detected on March 27th “a glimpse of Charley.” What the spacecraft detected and imaged was an object as a very small blur. The object had been detected two days prior to closest approach to the planet. The engineers and scientists had not expected to find anything in the area and began to speculate about the possibility that the object could be a small moon in orbit around

Mercury. There was also the possibility that it could have been a fast moving object inside Mercury's orbit, itself orbiting the Sun. Was this the same body which had been last seen nearly 100 years earlier? Was this planet Vulcan?



Mercury - *Mariner 10*

The next day, only one day out from its close-encounter the object could not be re-located. The cameras, and the instrument designed to register emissions in the extreme UV were used and even as the spacecraft nursed a serious short-circuit in its electrical system the search continued. As the spacecraft retreated at some 25,000 mph it swept the area above the planet hoping to confirm the existence of the proposed moonlet, but to no avail. It could not re-acquire the target.

Back in Pasadena engineers and planetary scientists had worked out that the object, if it was indeed real, was moving at 4 km/s. It was a speed which suggested a small moon in orbit around Mercury and not a solitary body closer to the Sun. At the press conference no one wanted to announce any new discoveries with only a single point of data so an official non-committed position was taken.

On April 12, 1974 JPL reported the following information. "*Mariner 10's* television cameras swept the heavens near Mercury two days ago in search of a mysterious moving object which scientists said may be a tiny moon. The first hint of the phantom object came from the space probe's ultraviolet spectrometer, which detected radiation invisible to ordinary telescopes or cameras."⁶ Dr. A. Lyle Broadfoot of the Kitt Peak National Observatory near Tucson, Arizona reported *Mariner 10's* instruments had definitely spotted "an object near the planet moving away at a fairly regular rate." He also reported that there wasn't enough data on the moving objects path to determine whether it was circling the planet or just passing by.

The object had been detected several times, but the scientist had been unable to determine whether or not it was in orbit. Dr. Bruce Murray, then head of the Mariner television team, and soon to be director of JPL, reported the object was "small, roughly estimated to be only 15 miles in diameter". With no further data to work with NASA decided that a moon could not be confirmed and settled on a hot UV star named 31 Crateris as the most likely object spotted. However, these determinations could only account for the sightings as the spacecraft was moving away from Mercury not the ones as *Mariner10* was approaching the planet!

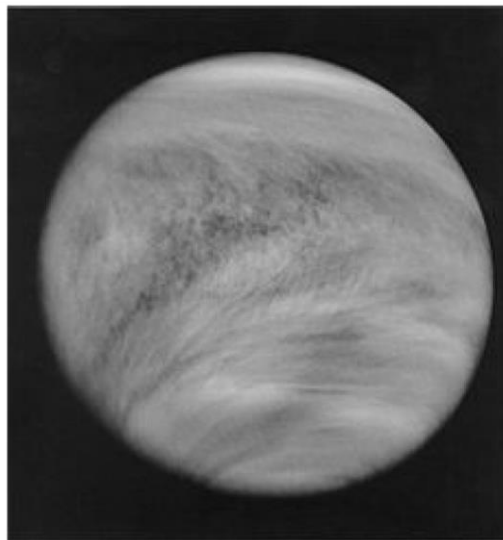
It was finally suggested that if an asteroid were to become captured by Mercury's gravitational field that it would be a short lived visit. It would be celestial tug-of-war between Mercury and the Sun's massive gravitational field. The "new moon" would be either thrown off or fall to the surface of Mercury in a relatively short period of time.

In conclusion, it must be stated that there is no absolute, strong data to prove there is an intra-mercurial planet named Vulcan, but while there is a possibility, we must continue to search in the area indicated, for man must always explore to advance.

A Moon for Venus

Giovanni Domenico Cassini was a well known and respected 17th century astronomer. He is perhaps best known for the major gaps seen in the ring system of Saturn he first reported and which were named the Cassini divisions. In 1672 however, he had turned his attentions to observations of Venus. In that year the astronomer had noticed what he felt was a small moon in orbit around or an object very near Venus. However, having seen this ‘moon’ only once was not enough for Cassini to make a general announcement. He was content to simply make a notation of his observation in his journal.

The notation was soon forgotten as the great astronomer pressed on to other weighty matters. Fourteen years would pass before Cassini was again able to spot his moon and this time the object showed the same phase as Venus itself: a most compelling piece of evidence that the body did indeed orbit the planet. Cassini estimated the object to have a diameter of at least $\frac{1}{4}$ of Venus and it was easily viewed. Despite these clues from this 1686 sighting Cassini himself never again reported seeing his then lost moon of Venus.



Cloud structure in the Venusian atmosphere in 1979, revealed by observations in the ultraviolet band by Pioneer Venus Orbiter

The moon of Venus would not be reported again until the middle of the 18th century. In 1740 astronomer James Short reported that he had relocated Cassini’s moon of Venus, but gave little detail. Then, beginning in 1759 several astronomers reported sightings. In that year astronomer Andreas Mayer reported that he had spotted a small moon in orbit around Venus. 1761 proved to be a grand year for observations as no fewer than five astronomers reported 18 individual sightings.

Joseph Louis Lagrange, French mathematician and astronomer, who has been called the greatest mathematician of the 18th century, and would later become director of the Berlin Academy, reported his sighting and included information which placed the moon’s orbit perpendicular to the ecliptic.

On June 6, 1761, astronomer Scheuten reported that he had witnessed Venus in transit across the disk of the Sun followed by a “smaller dark spot on one side.” He reported that he had no doubt that he had witnessed both Venus and her moon. It has also been reported that British astronomer Samuel Dunn

at Chelsea was also viewing the transit of Venus, but did not report seeing the moon. It must be stated however, that he may not have been looking for any additional objects while he investigated Venus. It would be three more years before the object was again sighted. In 1764 two astronomers reported no fewer than 8 observations, and yet several other workers were unable to spot this elusive astronomical target.

The astronomical community in Europe had a problem. Did the moon really exist and if it did not what were some very prominent observers really seeing? Many were quick to publish on one side of the question or the other. While several published that the moon existed Jesuit priest Rudolf Maximilian Hell, then director of the Vienna Observatory, declared that all observations had merely been optical illusions. In his 1766 paper the good Father wrote that Venus was so bright under telescopic observation that the so-called moon was merely a secondary image seen at a smaller size. He gave no explanation for any of the observations of the moon as it transited across the face of the Sun following closely behind Venus!

Eleven years later Professor Johann Heinrich Lambert published his orbital elements for the “new moon of Venus” in Germany. His 1777 dissertation reported an inclination of 64 degrees to the ecliptic, a mean distance of 66.5 Venus radii and an orbital period of 11 days, 3 hours. Yet at a distance of 66.5 Venus radii no astronomical body could have expected to orbit Venus in as little a time period of 11 or so days. Despite this problem it was hoped that the moon would once again show itself when Venus transited the Sun’s disk on June 1, 1777. However, there were no reported sightings during that event. It is of course possible that the moon was on the other side of Venus during the transit.

In 1887 the Belgian Academy of Sciences tried to put an end to any talk of a moon in orbit about Venus. The academy published a report which seemed to indicate that all known sightings of a moon of Venus were simply observations of known background stars in the vicinity of the planet; not of a new moon. In fact, the academy published a list of background stars which seemed to match a good many of the reported sightings. There was once again a slight problem. As before, there was no way to explain away the objects seen to follow behind Venus as both crossed in front of the Sun as viewed from Earth. That problem remained an open question not discussed. The report was able to put to rest the moon problem despite the August 13, 1892 sighting reported by astronomer Edward Emerson Barnard. Barnard reported a 7th magnitude object near Venus and there is no star known in the position he recorded! And Barnard was an excellent observer of the heavens.

What did these men see? Stars, asteroids passing by at just the right time, or did Venus really have a small moon at one point if only for a short period of time? Perhaps the best way to answer that question is to place one more spacecraft into orbit around Venus and have a very good look!

1- Graves, Robert - *The Greek Myths*, Vol. 1, pp. 86-88, Baltimore, 1955.

2- Leonard, George - *Somebody Else Is On The Moon*, pp 194-195, Simon & Schuster, Inc. N.Y., 1977

3- *The Encyclopedia Americana*, page 24, vol. 29, American Corp., N.Y., 1973

4- *Omni*, Vol. 1, Number 9, page 22, Omni Pub. Int., N.Y., 1979

5- *Moon is Hunted*, Pasadena, California. (UPI) April 1, 1974, via L.A. Times

6- *Moon over Mercury?* Pasadena, California. (AP) April 12, 1979, via L.A. Times