Towards the 2012 Transit of Venus
Report on a Talk by Darren Bellingham,
Section Director ASV Solar Section

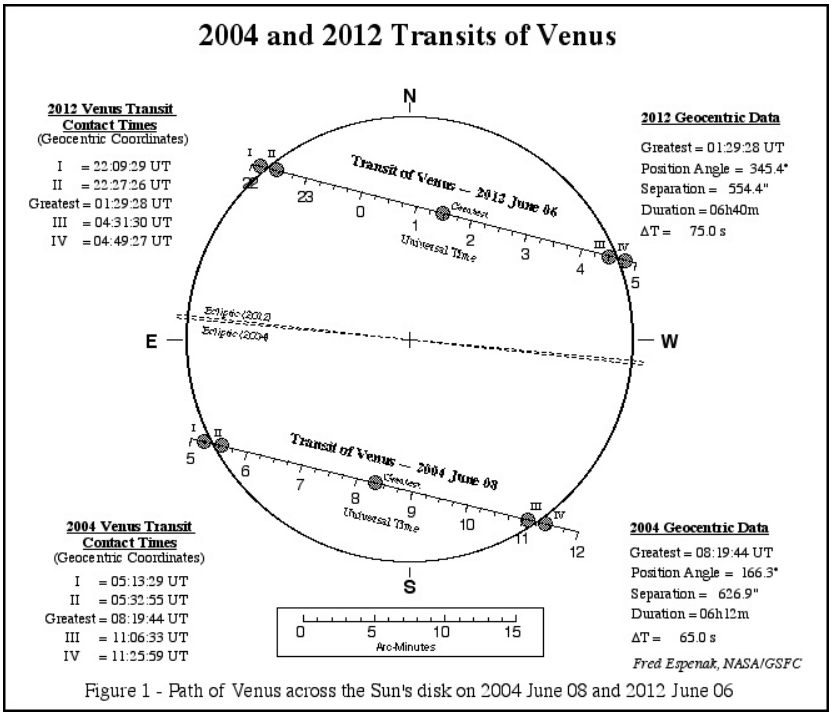
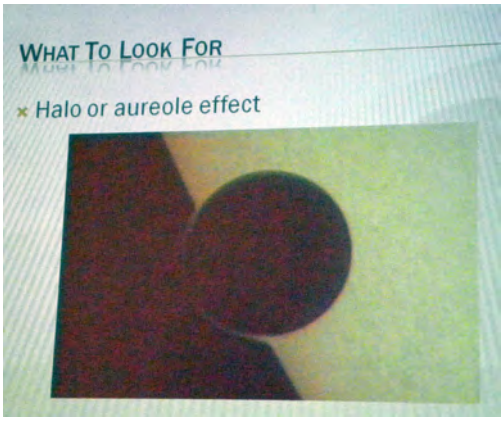


Figure 1 - Path of Venus across the Sun's disk on 2004 June 08 and 2012 June 06

A Venus Transit, we call when we can see the planet Venus passing directly in front of the Sun. That is, when the Sun, Venus and Earth are exactly in line. This is similar to when the Moon passes in front of the Sun on a solar eclipse. But unlike the Moon, which covers most of the Sun, Venus does not eclipse the Sun because it is so much further away. It appears only as a small dot, slowly crossing the face of the Sun. A transit (sometime called a passage) can only occur with the inner planets – Mercury and Venus – because they are the only planets that during their orbits can pass between the Earth and Sun. The astronomical term for it is 'inferior conjunction'.

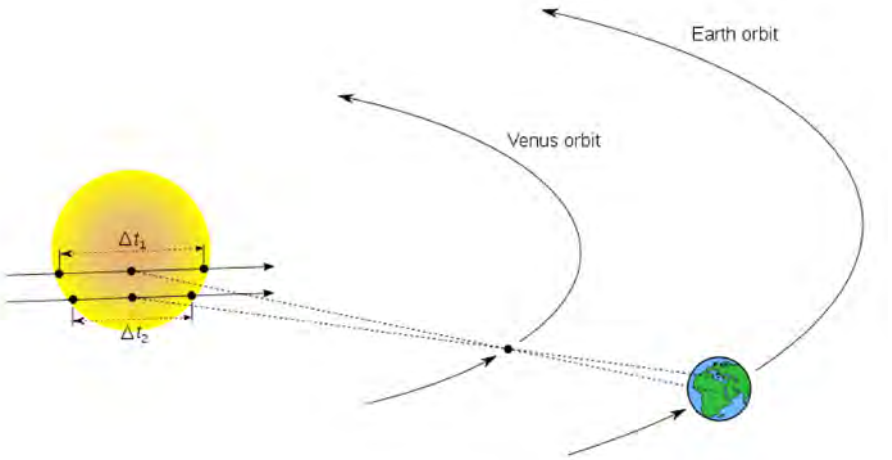
Transits of Venus are amongst the rarest of solar-system alignments, a rare, once in a life time event. Only seven have occurred since Galileo first pointed his telescope towards the heaven. Because the orbit of Venus is tilted 4.3 degrees with respect to the Ecliptic (Earth's orbit), alignment occurs only when both meet at the nodes (the up and down crossing points) of the two orbits. Usually the alignment lasts for two successive meets at that

point, 8 years apart. The current 2004 - 2012 pair occurs at the descending node. The previous Venus transit (pair) occurred at the upward node 129.5 years ago in 1874 and 1882. The next pair will start 113.5 years from now, in 2117 and 2125, again at the ascending node. It does take 243 years between successive Venus and Earth line-ups at the same orbit node.

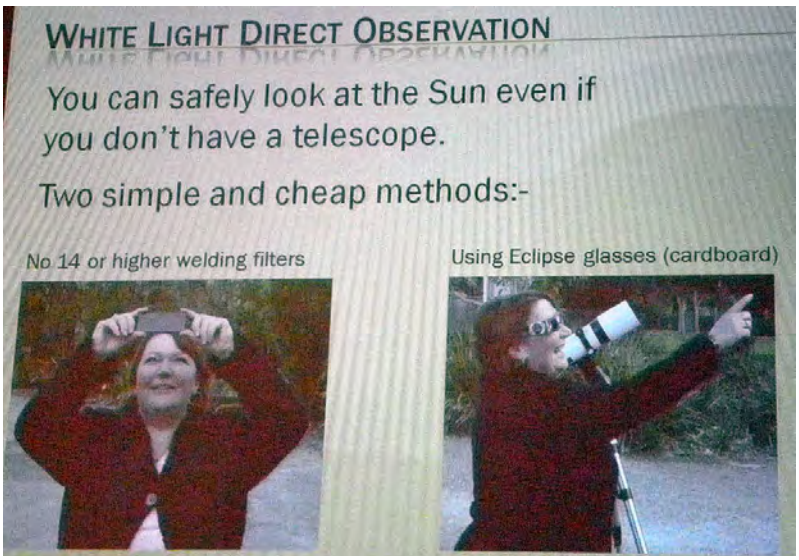


Johannes Kepler in 1631 was the first person to accurately predict a transit of Venus. Jeremiah Horrocks caught the second of that pair in 1639 and estimated the apparent size of Venus at one arcminute. It was Edmond Halley who in 1716 hit on the idea to use transits of Venus to determine the Sun's actual distance from us, and give for the first time a true picture of the scale of our solar system. This was a central problem at the time, comparable to the 20th century's struggle to find the true value of the Hubble constant and the age and extend of the Universe.

While the relative distances of planets from the Sun and from each other was known from Kepler's laws, the yardstick to it all, the Sun - Earth distance (today called the astronomical unit) was embarrassingly unknown. His recommendations for careful timings of transit contacts on the next pair of transits set the scene for what amounted to an international "Space-Race" in the 18th and 19th century. The parallax difference of the length of transit measured from widely separated points on Earth established the distance to Venus, and Kepler's and Newton's laws did the rest.



At the upcoming transit on 5 - 6 June Venus will be 58 arc/seconds wide and as close to us as ever gets. The transit will last for 6 hours and 40 minutes, but most of the action will occur in the two 18 minute periods as Venus enters and leaves the face of the Sun. The determination of the four reference point is critical: 'first contact' is when Venus touches the edge of the Sun, 'second contact' comes when Venus leaves the incoming edge of the Solar face. The 'third contact' is as Venus touches the edge of the solar disk on leaving the face of the Sun, and the 'fourth contact' ends the transit when Venus detaches itself from the disk of the Sun on departure. To some degree these points are subject to seeing conditions and individual acumen, and Darren showed pictures of the 'halo-' and the 'black-drop' effect, that can introduce a timing uncertainty of several seconds. Today there are more accurate ways to determine the length of the Astronomical Unit (the distance from the Earth to the Sun) and a transit of Venus no longer holds the scientific value of previous centuries. But it remains a rare and stunning event that attracts a great following. The transit will be visible in its entirety in eastern Asia and Australia and Alaska. The world map shows the areas and respective visibilities



As with all daylight astronomy of and near the Sun, watching a transit of Venus is dangerous and proper precautions must be taken. There are suitable filters readily available for watching the Sun directly and for fitting to telescopes. Some of the latter ones, like the hydrogen alpha filter, allow monitoring activity on the Sun at the same time, but can be quite expensive.

Venus is the Roman name for the Greek Aphrodite, goddess of love, grace and beauty. The planet has also been variously called the jewel of the sky; Eosphorus (bringer of light) as the morning star and Hesperus (his brother) as the evening star; from a modern day astronomer's view, "Earth's sister planet"; and from an astrologer's view, the "compliment to Mars."

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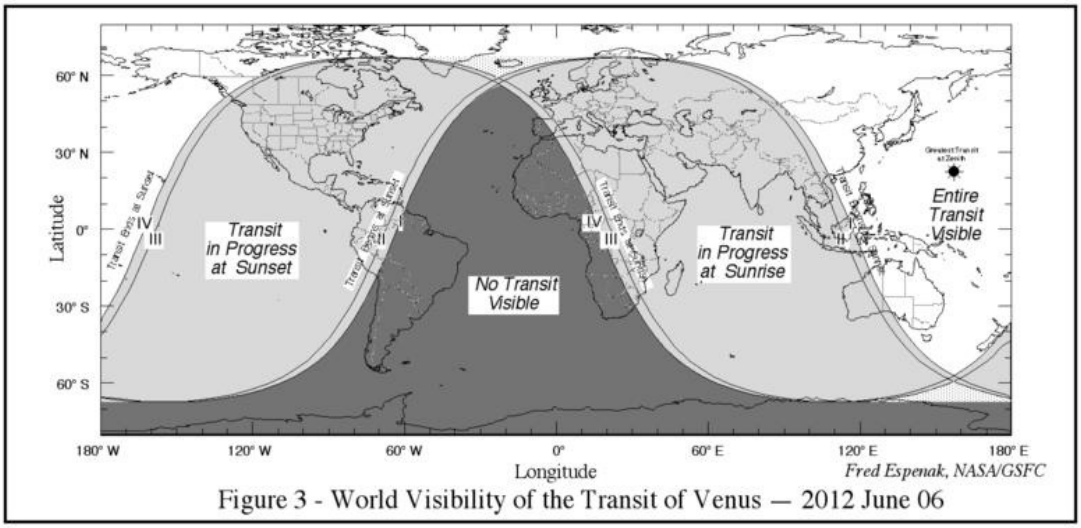

Figure 3 - World Visibility of the Transit of Venus — 2012 June 06