Frequently Asked Questions (FAQ)

(Click on question to jump to answers below.)

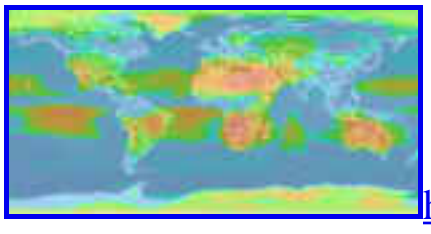
What is a transit of Venus?

A transit of Venus is the observed passage of the planet across the disk of the sun. The planet Venus, orbiting the sun "on the inside track," catches up to and passes the slower earth. Venus, appearing as a small dot in the foreground, will move from left to right across the sun. The word "transit" means passage or movement —in this case, across the face of the sun.


http://sunearth.gsfc.nasa.gov/eclipse/transit/venus/Sun2004+2012-1.GIF
Path of Venus across the sun's disk; from Fred Espenak.

When is the transit of Venus?

The next transit of Venus is June 5-6, 2012, as timed from the prime meridian at Greenwich, England. From that part of the world, the transit begins on the latter part of June 5 and continues into June 6. The exact time is dependent on your latitude and longitude because of parallax (the feature which gives the transit its scientific importance). The transit begins on June 5, 2012, around 22:09 Universal Time (U.T.) and ends June 6 around 04:49 U.T. Note that 04:49 p.m. on June 6 in Greenwich is actually late at night on June 5 for most North American time zones. For much of North America, the transit begins in the evening on June 5, 2012, but the sun sets before the transit is over.


http://home.hetnet.nl/~smvanroode/index.html
Find the times of all four contacts (that is, the four times when Venus appears to touch the inside and outside

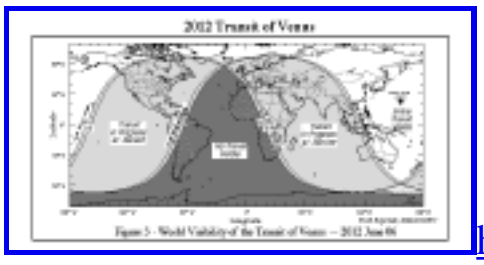
edges of the sun) for your location. If you know your latitude and longitude, local circumstances are calculated courtesy of Steven van Roode.

http://sunearth.gsfc.nasa.gov/eclipse/transit/venus/city12-1.html
Contact times (Universal Time) and corresponding altitudes of the Sun for 121 international cities; from Fred Espenak.
http://sunearth.gsfc.nasa.gov/eclipse/transit/venus/city12-2.html
Contact times (Universal Time) and corresponding altitudes of the Sun for 60 cities throughout the USA; from Fred Espenak.

Is the 2012 transit of Venus visible from my location?

Fred Espenak writes:

> The global visibility of the 2012 transit is illustrated with the world map (Low Res or High Res). The entire transit (all four contacts) is visible from northwestern North America, Hawaii, the western Pacific, northern Asia, Japan, Korea, eastern China, Philippines, eastern Australia, and New Zealand. The Sun sets while the transit is still in progress from most of North America, the Caribbean, and northwest South America. Similarly, the transit is already in progress at sunrise for observers in central Asia, the Middle East, Europe, and eastern Africa,. No portion of the transit will be visible from Portugal or southern Spain, western Africa, and the southeastern 2/3 of South America.



http://sunearth.gsfc.nasa.gov/eclipse/transit/venus/Map2012-1.GIF
World visibility map of 2012 transit of Venus; from Fred Espenak.

Is it safe to view the transit of Venus?

You may view the sun—and thus the planet Venus passing in front of the sun—***only if*** **you use proper solar filters or indirect viewing techniques.** See http://sunearth.gsfc.nasa.gov/eclipse/SEhelp/safety2.html for details, including links for purchasing solar viewing aids. For an overview of the techniques listed below, see our Safety page.

The preferred method is to view a magnified image of the sun through a telescope that has a solar filter on the large end. *Do not* look through a telescope without a solar filter on the large end. And *never* use small solar filters that attach to the eyepiece (as found in some older, cheaper telescopes).

You can project the image with binoculars, but *do not* look *through* binoculars unless you have proper solar filters on the large ends. You can also make a clever device that will project onto a viewing screen the image of the sun. Because the dot of Venus will be small relative to the sun, pinhole projection techniques—suitable for tracking eclipses—are ineffective for witnessing and timing the transit of Venus.

While it has been suggested that you can use #14 welder's glasses or darker, *do not* view through welding glasses that transmit more light. Do not consider the numbers to be additive; for example, do not use two #7 welding glasses on top of each other to make a #14.

For many observers in the North America, the transit begins near sunset on June 6, 2012. Do not be lulled into thinking the sun's intensity is significantly diminished when it is low on the horizon. *Severe eye damage*

or blindness can result if you view the sun without proper eye protection.

What can I expect to see?

A magnified view (which demands a proper solar filter) will feature the black dot of Venus slowly moving across the face of the sun from east to west. The planet Venus appears to traverse the northern half of the sun, moving from upper left to right.

The most important moment is when Venus touches the inner edge of the sun. Look for the "black drop" effect, when Venus sometimes appears to elongate near internal contact. It is a phenomena that has frustrated astronomers and explorers since 1761. Because the edge of Venus sometimes smears against the edge of the sun at this moment, observers have had a tough time estimating the exact second when contact is actually made.

When looking through solar filters, also look for sunspots scattered along the mid-section of the sun. Notice how these solar blemishes often have a dark central portion (umbra) within a less intense sunspot outline (penumbra).

When else have transits been seen?

The first recorded observation of a transit was by young Jeremiah Horrocks in 1639, about three decades after the invention of the telescope. Since then, transits have been witnessed in 1761, 1769, 1874, 1882, and 2004. Images from the last transit of Venus on June 8, 2004, are at images.htm.

Why is a transit of Venus so rare?

Transits of Venus have a strange pattern of frequency. A transit will not have happened for about 121 ½ years (prior to 2004, the last one was 1882). Then there will be one transit (such as the one in 2004) followed by another transit of Venus eight years later (in the year 2012). Then there will be a span of about 105 ½ years before the next pair of transits occur, again separated by eight years. Then the pattern repeats (121 ½ , 8, 105 ½ , 8).

If Venus and the earth orbited the sun in the same plane as the sun, transits would happen frequently. However, the orbit of Venus is inclined to the orbit of earth, so when Venus passes between the sun and the earth every 1.6 years, Venus usually is a little bit above or a little bit below the sun, invisible in the sun's glare.

A similar thing happens with our moon. Every month the moon passes between the sun and the earth, yet we do not see a solar eclipse every month. That's because the moon's orbit is also slightly inclined to earth's orbit, so the new moon is usually a little above or a little below the sun. The transit of Venus is essentially an annular eclipse of the sun by Venus.

What is the significance of a transit?

For starters, transits help us to determine our place in the cosmos.

Consider this brief history: In 1716 astronomer Edmond Halley calculated that you can quantify the distance from the sun to the earth by having observers across the globe time the passage of Venus across the sun. Knowing he would not live to see the next transit, Halley predicted global sites that would suitable for viewing a transit and called upon future generations to pursue his plan. For the 1761 transit and every transit opportunity since then, explorers sailed to distant lands to time the transit. The quest to time the transit of Venus in 1761, during the Seven Years War, marked the first time the international community cooperated to answer one of the leading scientific questions of the day.

By quantifying the distance from the sun to the earth, a simple application of Kepler's Third Law gives you

the distances of all the planets from the sun, and thus the scale of the solar system. Today, the transit of Venus as a means to measure the sun-earth distance is largely of historical interest, for tools such as radar have measured distances to planets much more accurately.

In modern times, however, astronomers seek transits of planets around distant stars. The NASA *Kepler* mission will look at 100,000 stars and try to detect earth-class planets orbiting them. Once again transits will help us to find out where we fit in the big picture of our universe.

When you look at the planet Venus passing in front of the sun, realize that you have a front row seat to the same phenomenon that the *Kepler* spacecraft is trying to witness around stars that are light years away. Realize also (especially if you have the misfortune of being on the night side of the earth opposite the direction of Venus and the sun during the transit) that somewhere out in distant space someone may be looking toward our star and could detect two planets--Venus and Earth--passing in front of the sun.

What can students do?

To recreate the historic endeavors to time transits from across the globe, several institutions have established Internet observing projects. Observers can time the transit from their location, submit the results to a collective pool of data, and calculate the distance from the sun to the earth, or the Astronomical Unit (A.U.). For a simple activity, observers may track the path of Venus to recreate the experience of Jeremiah Horrocks, who first witnessed a transit of Venus in 1639.

See the Education Resources for supporting activities and educational information.

Where do I get more information?

Glad you asked. First, this website was initially developed as a clearinghouse of information and images related to the 2004 transit of Venus. An abundant array of topics are linked from the Site Map at sitemap.htm. A few key pages, listed below, have thumbnail images and brief descriptions of what you can expect to find at the respective linked sites. Some of the material is basic, some of it is detailed or technical. Have some fun digging around.

As noted on the home page, "this website will guide you to instructions for safe viewing; interactive education and hands-on activities; global observing programs for students; background information and tutorials; insights into historical endeavors and the adventures of explorers; the role of spacecraft and the search for extra-solar planets; and miscellaneous items--some bizarre--relating to the transit of Venus."

As with anything posted on the Internet, not all sites (including here) are guaranteed to have accurate information, as our caveat suggests. We do ask that you please respect the copyrighted ownership of material where it applies. If you find any resources or websites to which we should link, please forward the address to us at transitofvenus.org. We thank you in advance.

Three noteworthy books in print as of 2004 are *The Transit of Venus & the Quest for the Solar Parallax* by

David Sellers;
The Transits of Venus by William Sheehan and John Edward Westfall, and *June 8, 2004--Venus in Transit*, by Eli Maor.

Your local planetarium is often a great source for current astronomy information.

What have others said through the ages?

A collection of quotes hint at the rewards of witnessing a transit of Venus, as these samples suggest:

"Willingly would I burn to death like Phaeton, were this the price for reaching the Sun and learning its shape, its size, and its distance."
-Eudoxus

"Thy return Posterity shall witness. Years must roll away, but then at length the splendid sight again shall greet our distant children's eyes."
Jeremiah Horrocks

"This sight...is by far the noblest astronomy affords..."
Edmond Halley

"That is the fate which often attends astronomers...exiling myself from my motherland, only to be the spectator of a fatal cloud, which arrived in front of the Sun at the precise moment of my observation, snatching from me the fruit of my efforts and exertions."
Guillaume Joseph Hyacinthe Jean Baptiste Le Gentil

"Still, to have seen even a part of a transit of Venus is an event to remember for a lifetime, and we felt more delight than can easily be expressed at even this slight gleam of success."
Robert Ball

"No reader of this [*Sky & Telescope*] magazine will purposely miss such a rare event--a chance to stand beside Edmond Halley and James Cook and take a dip into the magic waters of astronomical history."
David Levy

In his exhortation to future explorers/scientists, Halley wrote:

> "There remains therefore Venus's transit over the sun's disk, whose parallax, being almost 4 times greater than that of the sun, will cause very sensible differences between the times in which Venus shall seem to pass over the sun's disk in different parts of our earth. From these differences, duly observed, the sun's parallax may be determined, even to a small part of a second of time; and that without any other instruments than telescopes and good common clocks, and without any other qualifications in the observer than fidelity and diligence, with a little skill in astronomy. For we need not be scrupulous in finding the latitude of the place, or in accurately determining the hours with respect to the meridian; it is sufficient, if the times be reckoned by clocks, truly corrected according to the revolutions of the heavens, from the total ingress of Venus on the sun's disk, to the beginning of her egress from it, when her opaque globe begins to touch the bright limb of the sun; which times, as I found by experience, may be observed even to a single second of time."