

The transit of Venus

May 29 2012



The Transit of Venus in 2004. Credit: Charles Barclay

Many astronomers and members of the public in Britain will be getting up early on the morning of 6 June, so they can see the final Transit of Venus of the 21st century. The Transit, when Venus passes directly between the Earth and the Sun, was last seen in 2004 and will not happen again until the year 2117. To help the public view this rare phenomenon, the Royal Astronomical Society has created an online resource about the Transit, including a map of public events around the UK.

In astronomy, transits take place when a smaller body passes in front of a

larger one. Although the [Sun](#), [Venus](#) and Earth roughly line up every 584 days, the orbits of the Earth and Venus around the Sun are tilted with respect to one another. This means that Venus normally appears to pass above or below the Sun. A [transit](#) only takes place on the rare occasions when the three bodies are almost exactly in line.

On average, Transits of Venus happens only every 80 years or so. This average figure is however very misleading, because transits occur in a 'pair of pairs' pattern that repeats every 243 years. First, two transits take place in December (around Dec 8th), 8 years apart. There follows a wait of 121 years 6 months, after which two June transits occur (around June 7th), again 8 years apart. After 105 years 6 months, the pattern repeats.

Prior to the last transit on 8 June 2004, no living person had seen a Transit of Venus (the previous one was on 6 December 1882). The forthcoming Transit will take place on 5-6 June 2012, but only the final stages will be visible from the UK. The entire event will be seen from eastern Asia and Australasia, the Pacific Ocean and the north-western parts of North America. The next transit of Venus after that will not take place until 2117, so 2012 will be the last chance in most of our lifetimes to see this extraordinary celestial event.

Observing the transit

NEVER look directly at the Sun, with or without a telescope or pair of binoculars, without using a safe solar filter. To do is very dangerous and is likely to result in permanent blindness.

The 2012 Transit of Venus occurs on 5-6 June, with the whole event lasting slightly under seven hours. The transit starts at 23:04 British Summer Time (22:04 UTC) on 5 June, after the sun has set in the UK. It will take about 20 minutes from the point when Venus first encroaches onto the disk of the Sun ('first contact') until the planet is fully

silhouetted ('second contact'). The planet will then take a curved path across the northern part of the Sun. Mid-transit is at about 02:30 BST (01:30 UTC) on 6 June. Venus begins to leave the Sun ('third contact') at about 05:37 BST (04:37 UTC), and the transit will be over ('fourth contact') at 05:55 BST (04:55 UTC). Timings differ by a few seconds for different latitudes, but the transit will be visible from any place where the Sun is up (clouds permitting).



Young people watching the transit of Venus in 2004, using approved solar filters.
Credit: Charles Barclay

Unfortunately, this means that only the final stages of the transit will be visible from the UK. As a guide, on 6 June the Sun rises at 04:30 in Edinburgh, 04:46 in London, 04:51 in Belfast and 04:58 in Cardiff (all BST), so observers in the UK will be able to see the final hour or so of the event.

During the Transit, Venus will be visible in silhouette as a dark disc set against the bright solar surface or photosphere. The planet is about 1/32nd of the diameter of the Sun, so it will block about 0.1% of the Sun's light from reaching the Earth. Venus will be large enough to be

just visible to someone with normal eyesight, without the help of binoculars or a telescope (this should NOT be attempted without appropriate safe solar filters).

For safe viewing of the transit, the same rules apply as those for observing a partial or annular eclipse of the Sun. Eclipse viewing glasses can be used, as long as they are undamaged and observing is limited to a few minutes at a time. Note that they must NOT be used with binoculars or a telescope. For an enlarged view, an image of the Sun can be projected onto a screen by a small telescope. Pinhole projection, however, will not produce a sharp enough image to show Venus clearly.

Observers should only use eclipse glasses that are marked CE under the EU Directive on the safety of Personal Protective Equipment. These are certified to conform to an agreed and effective safety standard. Under that specification the glasses or their packaging must be marked with any applicable obsolescence deadline (colloquially, the 'best-before' date). The capacity of eclipse glasses to block harmful radiations from the sun reduces with time. For example, glasses bought for the total solar eclipse in Britain in 1999 are now nearly thirteen years old and should not be used. In any case observers should inspect pre-used glasses for damage (for example scratches, holes or a weakened mounting for the lenses) and consider replacing them if there is a risk that their effectiveness in protecting the eyes is reduced.

The best way to see the Transit in the UK is to join one of the 15 public observing events taking place around the country (see the [map](#) on the RAS Transit page). In many cases these are led by amateur astronomy groups who are well placed to offer access to equipment and to give advice on viewing the Transit safely.

The scientific significance of transits

In the 18th and 19th centuries, transits of Venus presented valuable opportunities to tackle a fundamental problem of the time – finding an accurate value for the distance between Earth and the Sun, called the 'Astronomical Unit' (AU). Modern determinations of the AU fix it at 149,597,870.691 km (and involve a complex technical definition, as the [Earth](#)–Sun distance varies slightly with time).

In the [21st century](#), much of the interest in the transit of Venus of 2012 is its rarity as an astronomical spectacle, the educational opportunities it presents, and the sense of a link with important events in scientific and world history.

[Astronomers](#) are now particularly interested in the general principle of planet transits as a way of hunting for and characterising the nature of planetary systems around other stars. When a planet crosses in front of its parent star, there is a minute dip in the star's apparent brightness. Identifying such dips is a useful method of finding planets orbiting other stars, and studying their properties. The 2012 transit will be observed by the Hinode solar observatory, the Hubble Space Telescope (that will look at the Moon during the Transit), the Venus Express mission currently in orbit around Venus and by a number of observatories on the ground.

More information: www.ras.org.uk/transit2012

Provided by Royal Astronomical Society

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