Spectacle of a lifetime for astronomers – Venus between Earth and the Sun

04 June 2012

On 6 June 2012, it is now or never. On this day, between 04:40 and 06:55 CET, those living in Germany, Austria and Switzerland will have the last opportunity in their lifetime to see Venus pass directly between the Sun and Earth – a small circular spot crossing the solar disc. The next time that this event will occur is in December 2117, 105 years from now. "Viewers will only just be able to see Venus in front of the Sun's disc with the naked eye, but they must always use special solar viewing glasses to protect their eyes," says astronomer Manfred Gaida, who is a researcher at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR).

Transits of Venus have always caused a great deal of excitement among astronomers worldwide, even back in the 18th century. David Rittenhouse, clockmaker, astronomer and founder of the first US observatory, was so excited as he expected this astronomical event that he fainted as it began, missing Venus' first 'contact' with the solar disc. In 1761, Nevil Maskelyne, the fifth Astronomer Royal, had bad luck; he travelled to Saint Helena by boat to observe the transit, but the weather did not allow observations and so the trip was fruitless. Even though the ‘morning star’ crossed the solar disc in 1631 and 1639, there are not many records of its observation. But this changed in 1761, when, apart from Rittenhouse and Maskelyne, 120 viewers at 62 stations worldwide observed this astronomical event. For this, expeditions were made to Sumatra, Saint Helena, Newfoundland, Siberia, Vienna, Rodrigues and Mauritius.

From the southern Pacific to Egypt

"They wanted to observe the transit of Venus from various locations in order to measure the distance from Earth to the Sun as accurately as possible," explains Gaida. "Calculating the exact distance, known as an Astronomical Unit (AU), was needed for precise longitude determination as well." Once the exact value of the AU was known, scientists were able to calculate the size of the Solar System and the precise orbit of the Moon; moreover, navigation became more accurate. "Observation of the transit of Venus was not only of scientific interest back then; it also had political implications." But in 1761, researchers were disappointed by the observations of the transit; all of the observers, regardless of location, noted a black drop that seemed to follow Venus, which compromised recording of the exact time of entry and exit from the solar disc. "Back then, telescopes were smaller and diffraction was not as well controlled as it is today," adds Gaida. While metre-size telescopes are used for observing the transit nowadays, at that time the diameter of the instruments was about 20–30 centimetres.

Astronomers' enthusiasm continues to this day. In 1769, 80 expeditions to observe the transit were made from Europe alone. James Cook embarked on one of them on his voyage to Tahiti. In his notes, he wrote: "We very distinctly saw an atmosphere or dusky shade round the body of the planet, which very much disturbed the times of the contacts particularly the two internal ones." In the nineteenth century, scientists travelled to China, Auckland Island and Punta Arenas in Chile and looked at the sky, or set up their telescopes in Egypt, Persia and South Carolina. The estimated distance between the Sun and Earth was not exact: "but only differed from today's value by two percent," comments DLR planetary researcher Pascal Hedelt. At that time, astronomers also noted that Venus has no moons.

The search for a second Earth

Transit phenomena are also used to search for extrasolar planets – the quest to discover other Earth-like worlds. "We are able to detect exoplanets, planets outside our Solar System, when they transit their stars. As the planet passes in front of its star, the amount of light we observe is diminished." The European space telescope CoRoT (Convection, Rotation and Planetary Transits), with involvement by DLR, has so far discovered more than 25 exoplanets, from gas giants to super Earths. By observing the transit of Venus, which takes place a lot closer to Earth, scientists can learn a great deal: "These observations can help us, for example, to distinguish planetary transits from normal star spots," says Hedelt. These spots diminish a star's light in the same way as a planetary transit.

Viewing Venus

"The transit of Venus on 5–6 June can best be viewed from eastern Australia, New Zealand, Asia, Hawaii and Alaska, as well as in any position above the Arctic Circle, where the Sun does not set at this time of year," comments Manfred Gaida. For those who miss the Venus transit on 6 June 2012, they would be able to see it on 21 December 2012, if they lived on Saturn. The US Cassini spacecraft, which has been orbiting Saturn since 2004, will be the only one to see this transit, as it will be aligned with the 'evening star'. DLR performs part of the data processing and mapping of Saturn's icy moons in the mission. Among other instruments, on board Cassini are the Visual and Infrared Mapping Spectrometer and the Imaging Science Subsystem camera.

Venus is observed continuously; the German Venus Monitoring Camera on board Venus Express is studying the planet's hot surface. But, despite the short distance from Venus' surface, there is constant 'bad weather', as the dense clouds tend to get in the way.

Watch the Venus transit live on NASA TV.

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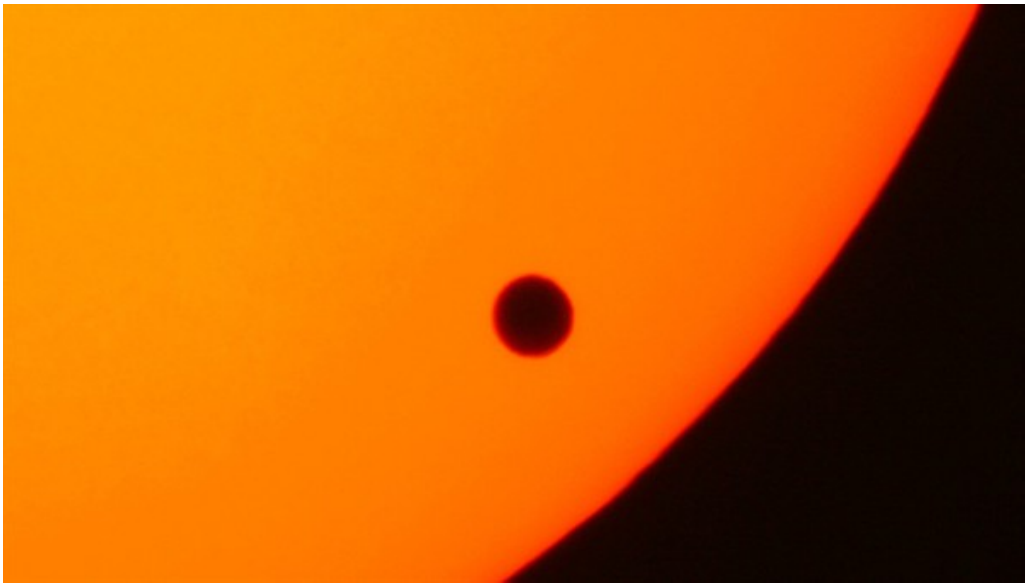
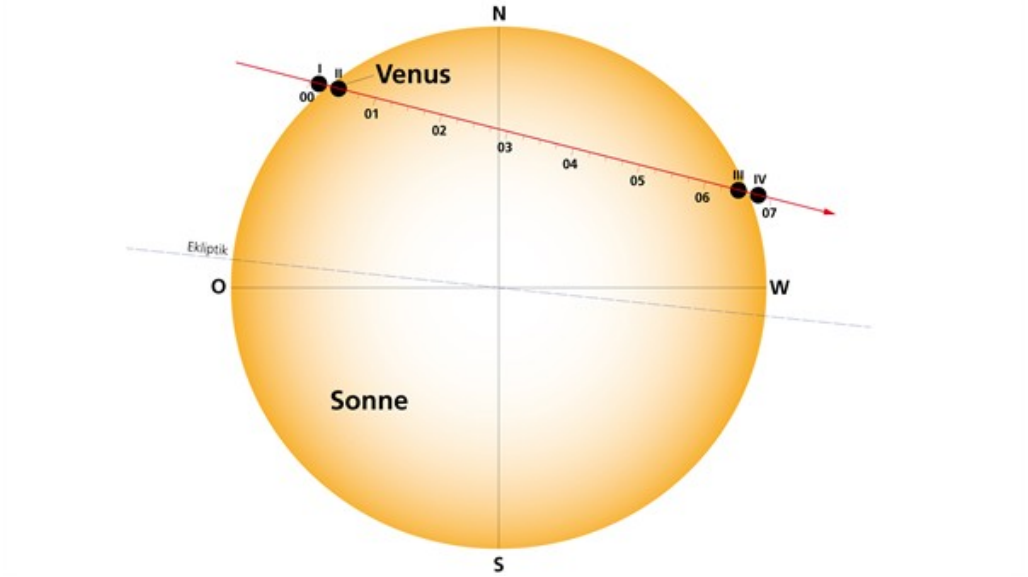
Transit of Venus in 2004



On 6 June 2012, Venus will pass between Earth and the Sun. This telescope image shows the 'black Venus' near the Eastern edge of the Sun during its transit on 8 June 2004.

Credit: Jan Herold.

The transit of Venus on 6 June 2012



Between 5 and 6 June 2012, and in less than seven hours, Venus will cross the northern hemisphere of the solar disc. The 'first contact' (I) and 'second contact' (II) will not be visible from Central Europe. If the weather is favourable, from Germany and Central Europe we can expect to see the last two hours of this event, including ‘third contact’ (III) and ‘fourth contact’ (IV).

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