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History

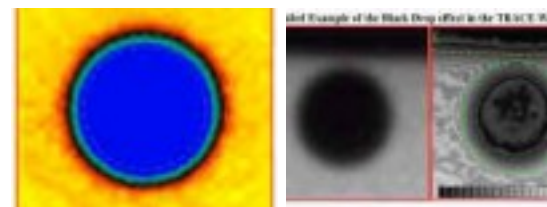
History section recalls the experiences of previous observers as they try to witness the elusive Transit of Venus from around the world. Here are *all* articles found within the History sub-menus.

Links: Black Drop Effect

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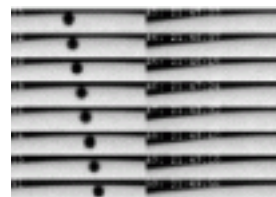
http://www.phys.uu.nl/~vgent/venus/venus_text2.htm#black%20drop
Bibliography: *The Black Drop and Related Phenomena*, from R.H. van Gent

<http://www.transitofvenus.org/faq/298-what-causes-the-black-drop-effect>
FAQ: *What causes the Black Drop Effect?* A simplified explanation of limb darkening and point-spread function, courtesy of Jay Pasachoff.



<http://nicmosis.as.arizona.edu:8000/POSTERS/TOM1999.jpg>

Poster on the 1999 transit of Mercury "definitively solves the problem of the black-drop effect that plagued past transits of Venus;" by Jay Pasachoff, Glenn Schneider and Leon Golub; from the American Astronomical Society's Division of Planetary Science meeting in 2001.



<http://arxiv.org/pdf/astro-ph/0310379>

Report by Schneider, Pasachoff, and Golub (see poster above) "separates the primary contributors to [the "Black Drop" Effect], solar limb darkening and broadening due to the instrumental point spread function...for the 1999 transit of Mercury, seen in high spatial resolution optical imaging with NASA's TRACE spacecraft."

<http://www.aas.org/publications/baas/v32n4/aas197/785.htm>
Abstract describes physical cause of "black drop" effect; B. E. Schaefer (Univ. Texas Austin) at 2001 AAS meeting.



From footnote 28 of **Chapter 7** of *Sky and Ocean Joined: U.S. Naval Observatory, 1830-2000*, by Steven J. Dick, (Cambridge University Press, 2003):

“The physical cause of the black drop phenomenon has been the subject of considerable controversy. Bradley Schaefer reviews the controversy in “The Transit of Venus and the Notorious Black Drop,” *BAAS*, 32 (2000), 1383-1384. He concludes that the phenomenon is not caused by diffraction, illusion or atmospheric refraction, but by terrestrial atmospheric smearing that blurs the image.”

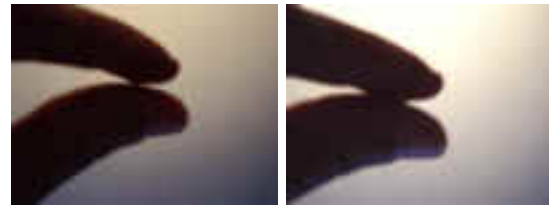
<http://www.bo.astro.it/~biblio/Horn/Blackdrop.htm>

Origin and Phases of the "Black Drop" Phenomenon, a paper on the understanding of the black drop effect as of 1922. Also available in Italian; from Guido Horn D'Arturo of Università di Bologna, Dipartimento di Astronomia, 1922.



http://skyandtelescope.com/news/article_1277_1.asp

Sky & Telescope magazine asks, "Where Was the Black Drop?" after the 2004 transit of Venus.



To simulate the appearance of the "black drop" effect, almost pinch your thumb and forefinger together against a bright background. Near contact the ligament between them appears.

http://vestige.lmsal.com/TRACE/transits/venus_2004/

Images and movies from the TRACE spacecraft are among many new perspectives of the 2004 transit of Venus.

At the critical moment when observers try to time when Venus touches the inside edge of the sun, strange phenomena such as the **black drop effect** suddenly emerge. This site guides observers in discerning at what instant internal contact occurs; from Steven van Roode.

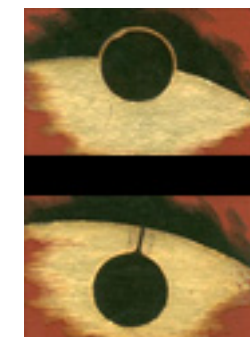


<http://star.arm.ac.uk/history/transit.html>

Drawings of the Transit of Venus by Captain James Cook and Charles Green; from the Armagh Observatory.

<http://www.metaresearch.org/home/Viewpoint/blackdrop.asp>

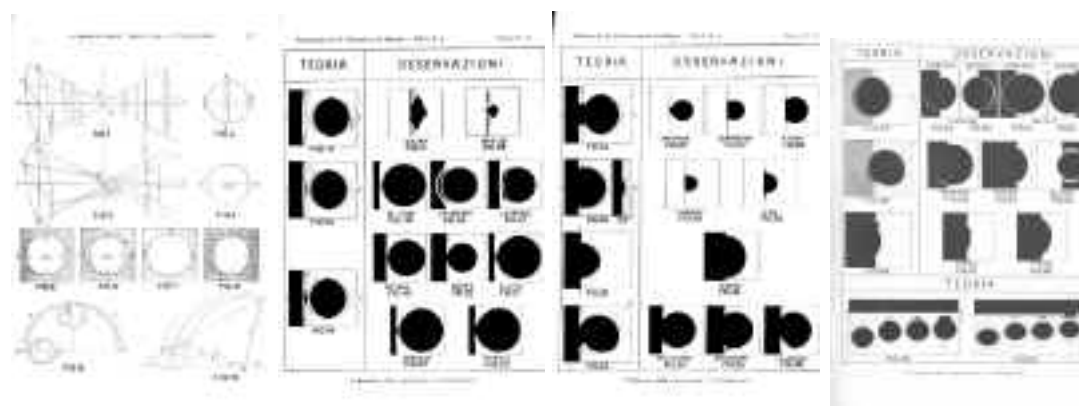
In noting "an irradiation effect – the apparent spreading of light from bright areas onto any adjacent dark areas," author Tom Van Flandern asserts that the well-understood black drop effect "provides a timing advantage rather than a disadvantage."



http://www.bo.astro.it/~biblio/sma/page/venere_05_06_1761.html

Bibliographical and archival records from the Department of Astronomy of the University of Bologna (Italy), featuring manuscripts of observations made in Bologna by Eustachio Zanotti; includes images and resources from transits in addition to the 1761 records. (Italian; a link with some English translation is at

<http://www.bo.astro.it/~biblio/Archives/copertina.html>.)



<http://www.bo.astro.it/~biblio/Horn/Blackdrop.htm>

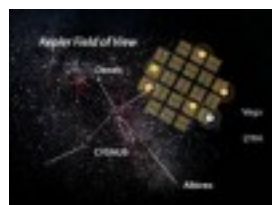
A detailed 1922 assessment of the black drop effect suggests "instrumental astigmatism should be considered the cause of some aspects of the *photographed* GUIDO HORN D'ARTURO The "black drop" phenomenon and astigmatism. Università di Bologna, Dipartimento di Astronomia, (Pubblicazioni dell'Osservatorio astronomico della R. Università di Bologna, vol. I, n.3, 1922). ligaments."

[Read more: Links: Black Drop Effect](#)

[Links: Exoplanet Transits](#)

[Paine's Footnote on the Transit of Venus](#)

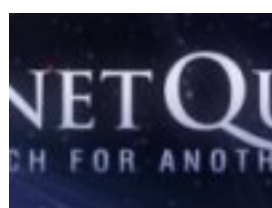




<http://kepler.nasa.gov>

"NASA Kepler Mission is searching the skies for planets that are the same size as Earth--worlds that could possibly be similar to our own." The spacecraft identifies transiting planets as it scans more than 100,000 stars near the constellation Cygnus, looking for recurring dips in the light curve. Excellent website with many resources, including:

- [Classroom Activities](#)
- [Formal Education, Informal Education, and Public Outreach](#)
- [Models and Simulations](#)
- and much more.



<http://planetquest.jpl.nasa.gov/>

PlanetQuest Exoplanet Exploration is an engaging site for news and multimedia about NASA's search for new worlds. Keep pace with current tally of new and candidate planets; get your questions answered by Astronomer Steve; create your planet with Extreme Makeover; check out the great videos from multiple NASA missions, and always see the latest exoplanet news at the forefront of science.

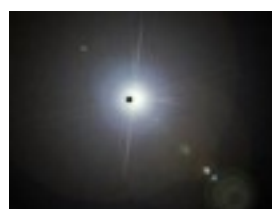
<http://kepler.nasa.gov/files/mws/TransitTracks-7-2010.pdf>

Transit Tracks is an investigation in which students describe a transit and the conditions when a transit may be seen; describe how a planet's size and distance from its star affects the behavior of transits; and interpret graphs of brightness vs time to deduce information about planet-star systems.



<http://oklo.org/>

The Systemic Weblog, written by [Greg Laughlin](#), reports recent developments in the field of extrasolar planets, with a particular focus on observational and theoretical astronomical research work. Tutorials show how to use the [Systemic Console](#), a program that "uses an intuitive graphical interface to analyze data in order to detect and characterize planets."



<http://www.transitsearch.org/>

An observing program whose purpose is "to coordinate and direct a cooperative observational effort which will allow experienced amateur astronomers and small college observatories to discover transiting extrasolar planets." To observe transiting planets around distant stars, you need a telescope with an accurate clock drive, a CCD camera, and appropriate computer software. Observers who obtain photometry of known transiting planets can submit their light curves. The transitsearch.org site currently functions primarily as an ephemeris information service.



Thomas Paine (1737 -1809) was an English-born American political figure, philosopher, and author of Footnote on the Transit of Venus. The works of Thomas Paine are said to have influenced many of the founders of the United States. Paine's [The Age of Reason: Being an Investigation of True and Fabulous Theology](#), 1794-96, was the result of Paine's years of study and reflection on the place of religion in society. It was very popular and controversial in its time. It also touches on Paine's interest in science and astronomy. The work is still in print.

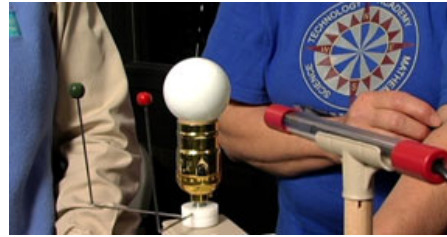
The excerpt below is part of Paine's introduction to his theories on the plurality of worlds. In it he describes the planetary system, as known at the time, in terms of Kepler's Laws. He then uses the observation of the Transit of Venus as a practical application of the laws. [Paine's footnote #11](#) is presented below in **BOLD** for emphasis.

[Read more: Paine's Footnote on the Transit of Venus](#)



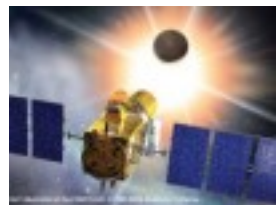
<http://www.planethunters.org/>

Actually find new planets orbiting distant stars using the data from the Kepler mission. Participants steer astronomers to candidate stars by judging the existence of patterns in a light curve. From Planet Hunters.



<http://www.wnit.org/outdoorelements/1000/1003/1003.html>

Planetarium director Ruth Craft uses a photometer and orrery to simulate the Kepler spacecraft monitoring a star with transiting planets. In the demonstration, computer software generates a light curve that is projected on the domed ceiling, where visitors can discern the presence and characteristics of companion planets. See *How the Kepler Telescope Works* (Segment #3 of Episode #1003); from WNIT Outdoor Elements.



<http://smc.cnes.fr/COROT/>

COROT (COncvection, ROTation and planetary Transits) space telescope is international venture launched in December, 2006; it uses stellar seismology to examine the inner structure of stars and a CCD camera to detect the transits of extrasolar planets. See sidebar in [March 2009 Planetarian](#), page 10.

<http://www.mykepler.com/>

MyKepler is an educational program with a vision to involve 3,000 schools (1,000 in the USA) in the tracking and exploration of the Kepler telescope data to discover earth-like planets in the close Milky Way proximity.

http://www.planetary.org/explore/topics/extrasolar_planets/extrasolar/transit_photometry.html

Extrasolar Planets: Transit Photometry Method for Finding Earths; from Planetary Society.

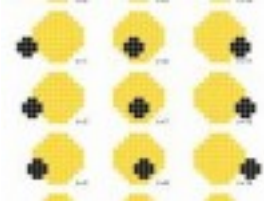
http://www.ati.ulg.ac.be/TRAPPIST/Trappist_main/Home.html

TRAPPIST: TRAnsiting Planets and Planetesimals
Small Telescope



http://sunearthday.nasa.gov/2012/articles/ttt_75.php

Mathematical Problems Featuring Transit Applications, by Dr. Sten Odenwald. Transit Math book from NASA opens with dozens of math problems and answers related to eclipses, transits, and occultations, with an emphasis on transits of Venus through the centuries. Problems align with AAAS Project: 2061 Benchmarks as detailed in a Mathematics Topic Matrix. The PDF document includes summaries of the historic aspects of the transit and a diverse collection of modern images and historic images alike. Stated emphasis for Transit Introduction is on grades 3-8, while Transit Math challenges grades 5-12. "The problems were created to be authentic glimpses of modern science and engineering issues, often involving actual research data...The problems were designed to be 'one-pagers' with a detailed Answer Key as a second page."

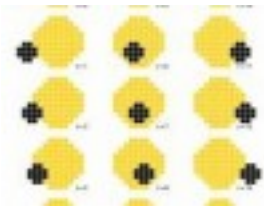


<http://transitofvenus.nl/wp/2011/11/08/classroom-activities/>

Free workbook

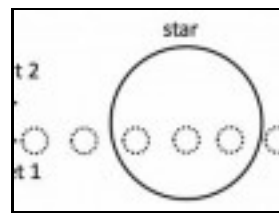
(<http://www.transitofvenus.nl/files/TransitOfVenus.pdf>)

from Steven van Roode addresses the frequency of the transit of Venus, angular measurements, parallax measurements to establish distances, and finding the physical properties of exoplanets from light curves. Also available as hard copy.



[education/science-math/316-activity-pixel-count](http://www.ck12.org/education/science-math/316-activity-pixel-count)

Pixel Count Activity has student plot the decrease in light received from a star that has a planet transiting it; single activity is adapted from Steven van Roode workbook.



http://universe.utoronto.ca/wp-content/uploads/2012/02/12feb17_tdsb_eureka_transit_worksheet_v1.pdf

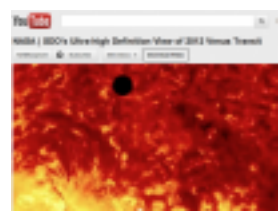
Using Transits to Find Exoplanets, from University of Toronto, gives diagrams and examples from which students derive answers and plot graphs about exoplanets.

2012

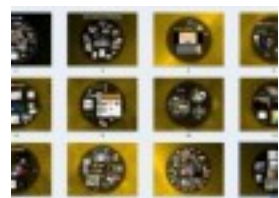
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2012 Transit of Venus

With the 2012 transit of Venus over, a vast collection of images are available on the internet. This page offers a representative sampling of images, videos, observer reports, science findings, new papers, and other odds and ends, several of which are my own. It is admittedly incomplete as I wind down my transit of Venus outreach and website maintenance. Thanks for having followed. - Chuck B.



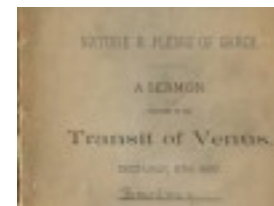
<http://youtu.be/4Z9rM8ChTjY>
NASA I SDO's Ultra-high Definition View of 2012 Venus Transit; stunning video from Solar Dynamics Observatory on YouTube.



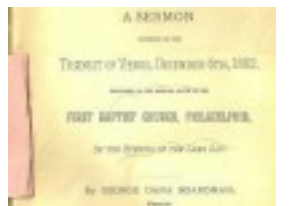
[history/2004/365-a-community-celebrates](http://www.history.com/history/2004/365-a-community-celebrates)

Paper: A Community Celebrates the Transit of Venus; summary of extensive transit of Venus outreach by Michiana educators, businesses, volunteers, and amateur astronomers. Text outlines prez images at

Sermon Suggested by the Transit of Venus



On the evening of December 6, 1882, after the transit of Venus had occurred earlier that day,



Pastor George Dana Boardman delivered an eloquent [sermon](#) "to unfold and apply a great moral lesson which the transit of Venus suggests and confirms." On the title page is written:

Nature a Pledge of Grace.
A SERMON
SUGGESTED BY THE
TRANSIT OF VENUS, DECEMBER 6th, 1882
DELIVERED IN THE MEETING HOUSE OF THE
FIRST BAPTIST CHURCH, PHILADELPHIA,
ON THE EVENING OF THE SAME DAY.

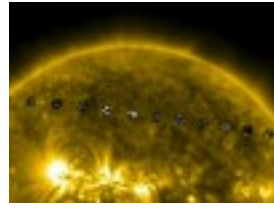
By GEORGE DANA BOARDMAN
PASTOR

PUBLISHED BY REQUEST

Boardman writes that God expresses His commitment to man and His promise through the immutable expressions of nature. The predictable movements of planets "testify to the unchangeableness of nature's laws, that is to say, to the veracity of God's covenant of nature." That man can study those laws of nature and eke out predictions like the transit of Venus confirms the certainty of nature, itself a covenant from God. We cannot break these laws, though they can break us.

[Read more: Sermon Suggested by the Transit of Venus](#)

<http://prezi.com/3tgyibho9g-w/transit-of-venus-across-the-sun/>, and was presented at 2012 GLPA Annual Conference in Pittsburgh, PA. An audio file of the talk summarizing the highlights is at www.transitofvenus.org/docs/2012GLPA-Pittsburgh2.mp3.



<http://prezi.com/3tgyibho9g-w/transit-of-venus-across-the-sun/>

Prezi: Transit of Venus Across the Sun. An image-intensive prezi captures the multiple events that occurred before and during the 2012 transit of Venus in northern Indiana and southwestern Michigan, also known as Michiana. Among the diverse components were a planetarium program, a treasure hunt, a lecture series, a symphony performance, a newsletter, a motor coach tour, original videos, art exhibits, historical displays, public outreach events, Sun Funnel workshops, social media initiatives, related products by small businesses, multiple observing opportunities, and a time capsule.



[history/2004/366-poster-transit-of-venus-time-keg](http://history.2004/366-poster-transit-of-venus-time-keg)

Poster: Transit of Venus Time Keg; shown at 2012 GLPA Annual Conference in Pittsburgh, PA.

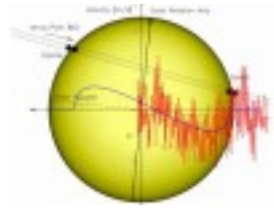


[history/2004/361-viewing-great-timing-difficult](http://history.2004/361-viewing-great-timing-difficult)

Blog: Viewing Great, Timing Difficult; summary of events from the big day, June 5, 2012. Clear skies allowed viewing, but timing the moment of internal contact was difficult to do.

misc/363-vision-for-future

After the transit of Venus, political candidates from the 2012 election year were invited to share their visions of the future--not of four years, but 104 years, when the next transit of Venus will occur. What is the role of observational science such as the transit of Venus in our country's well-being?



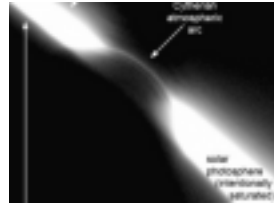
<http://mnras.oxfordjournals.org/content/early/2012/12/10/mnrasl.sls027.full.pdf?keytype=ref&ijkey=0VPPUJI6ZcCKg5G>

Italian astronomers measured the Rossiter-McLaughlin effect during the 2012 transit of Venus, when the sun's spectral lines are distorted slightly. The experiment is a precursor to having a 40 meter scope with spectrograph studying the orbital properties of Earth-like exoplanets; *Monthly Notices of the Royal Astronomical Society*, December 11, 2012. Courtesy of Paolo Molaro.

<http://arxiv.org/abs/1210.8451>

Venus transit, aureole and solar diameter, by Wenbin Xie, Costantino Sigismondi, Xiaofan Wang, and Paolo Tanga. "To measure the solar diameter using the transits...compare the ephemerides of the internal contact timings with the observed timings. The transits of Venus of 2004 and 2012 gave the possibility to apply this method, involving a planet with atmosphere, with

the refraction of solar light through it creating a luminous arc all around the disk of the planet. The observations of the 2012 transit made to measure the solar diameter participate to the project Venus Twilight Experiment to study the aureole appearing around it near the ingress/egress phases."



<http://sites.williams.edu/transitofvenus2012/glenn-schneiders-images/>

Venus Twilight Experiment coronagraph on Haleakala

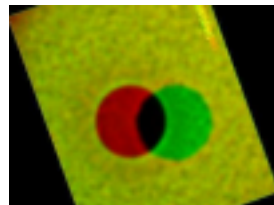
<http://www.aeonmagazine.com/nature-and-cosmos/dava-sobel-transit-of-venus/>

Venus Still Beguiles, by Dava Sobel. Writing of her 2012 experience, "Once seen as the Holy Grail of the heroic age of astronomy, this year's transit of Venus was the most democratic ever." From Aeon Magazine.



[images/stories/nasa-largest-event.jpg](http://www.nasa.gov/images/stories/nasa-largest-event.jpg)

A slide from the Sun-Earth Day team at NASA Goddard Research Center suggests the 2012 transit of Venus was the "Largest NASA Event Ever...All NASA Internet Stats--Broken."



<http://www.astrode.de/nordkap/venustr2012.htm>

Venustransit 2012, Parallaxenmessung mit Hilfe der Sonnengranulation; Measuring the astronomical unit by combining images of the 2012 transit of Venus from Norway and Australia.

<http://munin.uit.no/bitstream/handle/10037/4178/thesis.pdf?sequence=2>

Maximilianus Hell (1720-1792) and the Eighteenth-Century Transits of Venus. A Study of Jesuit Science in Nordic and Central European Contexts, Per Pippin Aspaas University of Tromsø, 2012. New thesis about Father Hell and transits of Venus.

http://sites.williams.edu/transitofvenus2012/files/2012/07/2012JAHH__15__3P.pdf

Lomonosov, the Discovery of Venus's Atmosphere, and Eighteenth Century Transits of Venus, by Jay M. Pasachoff and William Sheehan; Paper suggests Lomonosov, to whom the discovery of Venus' atmosphere has been historically attributed, had a "preconceived bias for believing that the other planets must have atmospheres." Therefore, several other observers "should receive credit for first detecting the aureole due to refraction of sunlight by the atmosphere of Venus during a transit." From *Journal of Astronomical History and Heritage*, 15(1), 3-14 (2012).

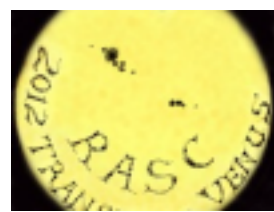
<http://arxiv.org/abs/1210.0873>

The Hetu'u Global Network: Measuring the Distance to the Sun Using the June 5th/6th Transit of Venus, by Jacqueline K. Faherty, David R. Rodriguez, Scott T. Miller. Rodriguez writes, "Team Hetu'u presents the result of our outreach collaboration to bring together students from across the world, watch the transit of Venus, and measure the distance to the Sun. Our best estimate of the distance: 152+/-30 million km; not very precise, but the goal was the outreach."

<http://www.newscientist.com/article/dn22276-sizing-up-a-new-measuring-ruler-for-the-solar->

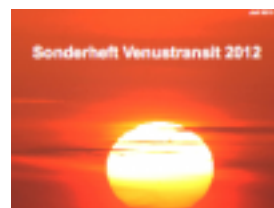
[system.html](#)

At its 2012 meeting in Beijing, the IAU redefined the Astronomical Unit to 149,597,870,700 metres. The previous definition accounted for solar mass, but that's always changing, so new value locks in distance.



<http://rasc.ca/transit-2012-results>

Results from the Royal Astronomical Society of Canada, which notes, "Maritime Canada was plagued by clouds and a number of our Maritime members travelled west to observe the transit."



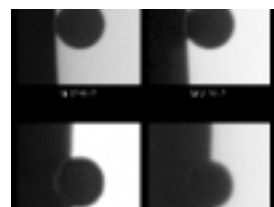
<http://www.gva->

[hamburg.de/Sternkieker_Sonderheft_Venustransit.pdf](http://www.gva-hamburg.de/Sternkieker_Sonderheft_Venustransit.pdf)

Sternkieker magazine special edition offers 46 pages of images from 2012 transit of Venus.

<http://youtu.be/IHz6OCj0DtK>

A documentary by Nebeto, dedicated to the Transit of Venus 2012; clouds challenge observers.



<http://www.sussenbach.eu/Venus%20Transit%20Expedition5.pdf>

Observer John Sussenbach reports on his personal expedition to Turkey.

<http://www.facebook.com/groups/108400462513165/>

Members of the Transit of Venus Group on Facebook share images and stories.

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More Articles...

[Church Celebrates Transit of Venus](#)

[Links: 1761-1769](#)

[US Naval Observatory Expeditions](#)

[Hubble Space Telescope to Target 2012 Transit of Venus](#)

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