

The Transits of Venus and Mercury



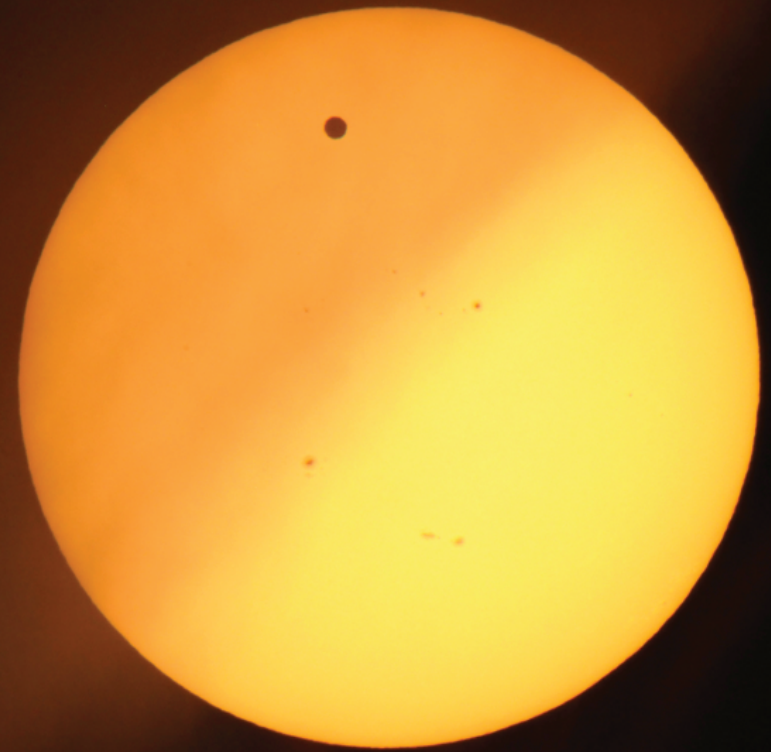
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The Transits of Venus and Mercury

There are only two planets that are closer to the Sun than Earth: Mercury and Venus. These are the planets that we can see in transit across the sun.

A transit occurs when a planet's orbit crosses between the earth and the sun. The planet blocks some of the light of the sun and its shadow can be seen passing across the sun from Earth.

Telescopic lenses and special filters are needed to allow us to see the planet safely. It is not safe to look directly at the sun. It will damage your eyes.



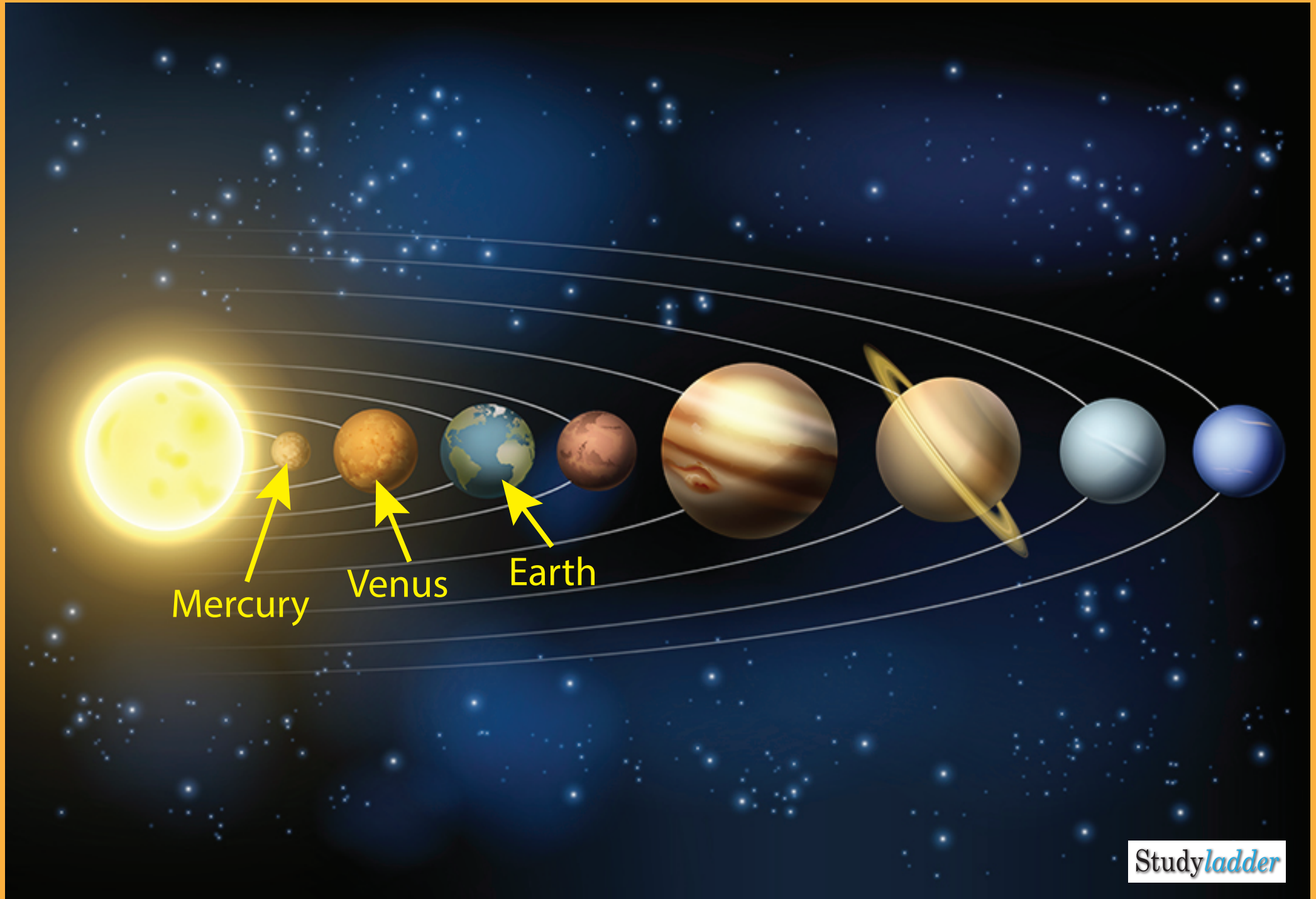
Above: This is a photograph of the last transit of Venus. It was visible on 5th/6th June 2012.

The last transits of Venus occurred in 2004 and 2012. The next will occur in 2117.

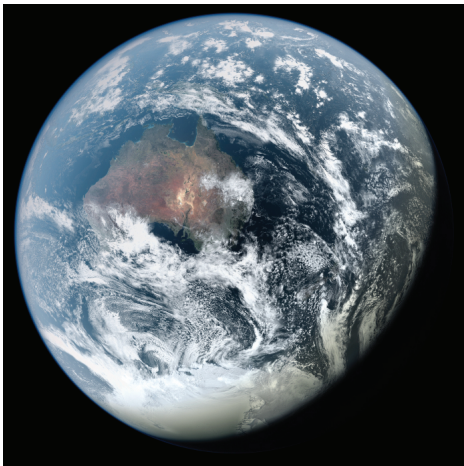
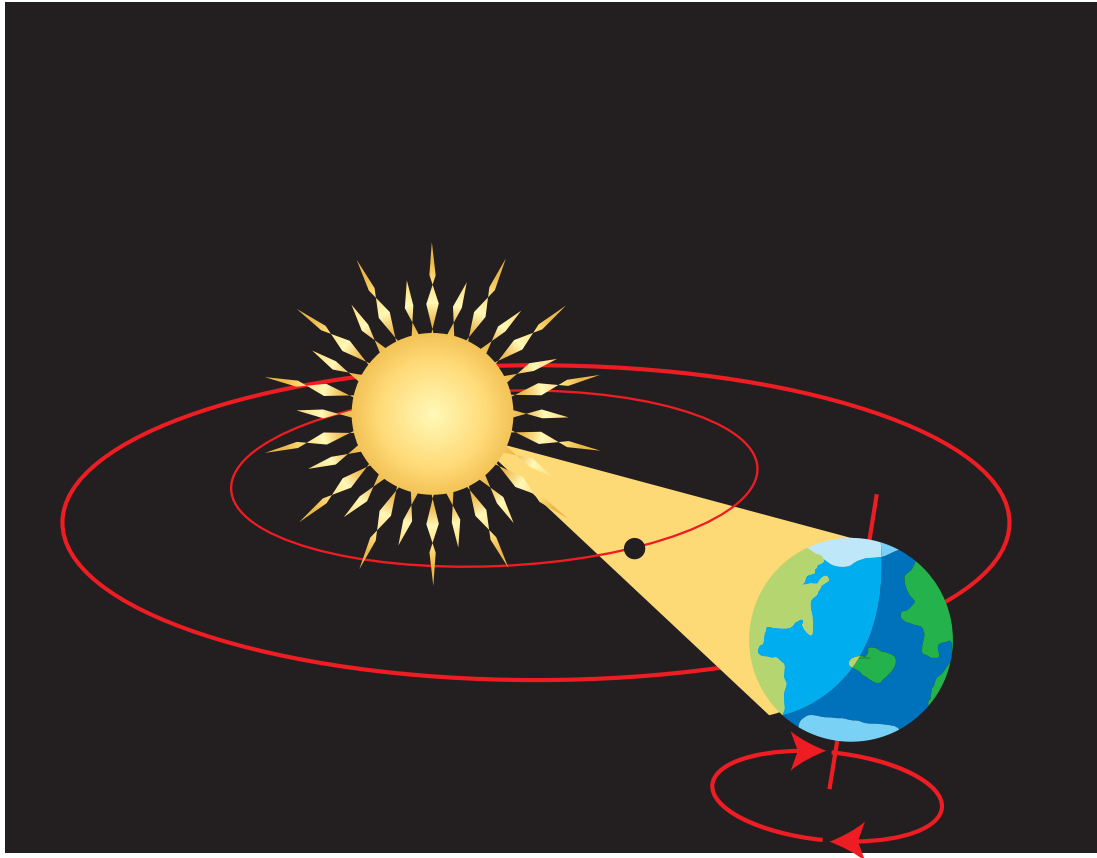
The last transits of Mercury occurred in 2003 and 2006 and in May 2016.

(A reminder: NEVER look directly at the sun as it can cause blindness.)

Why are Mercury and Venus the only planets that we see transit across the sun?



Where can a transit be viewed?



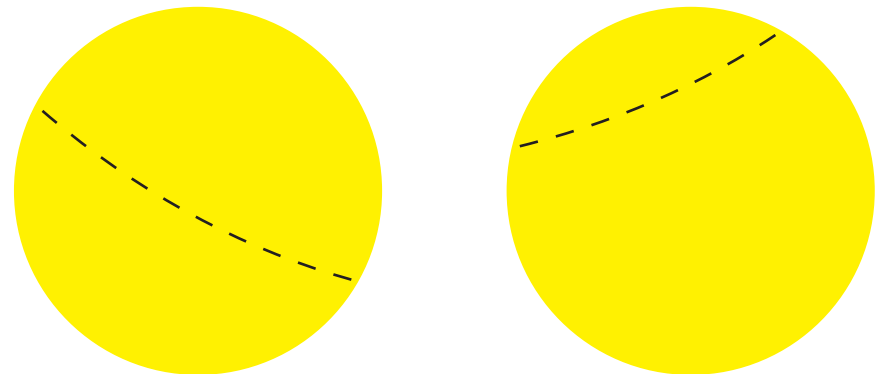
Of course, your view of a transit depends on the local weather conditions. Your view of the sun can be obstructed by cloud cover.

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Your side of the planet needs to be facing the sun for you to be able to see a transit. If your location is facing away from the sun it will be night time and you won't see a thing!

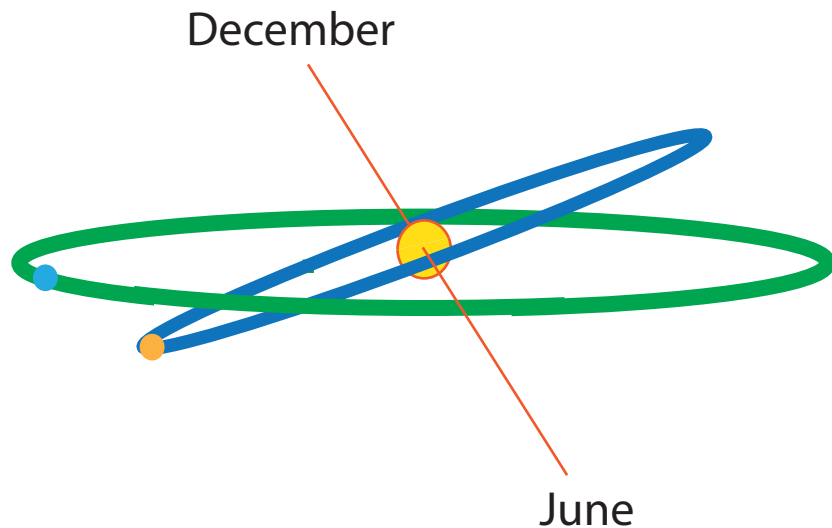
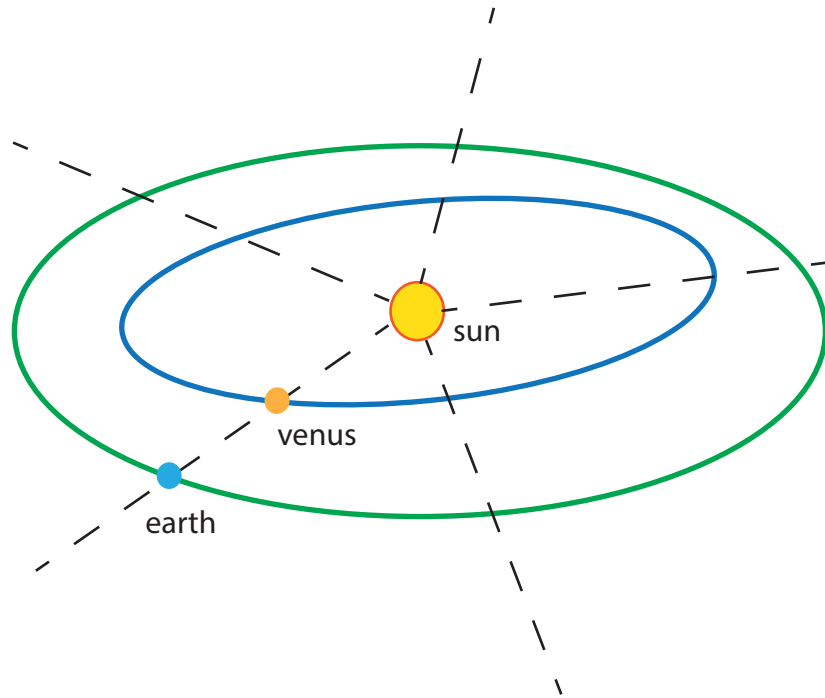
You might only be able to view some of the transit depending on the time of day. If the sun is low in the sky at sunrise or sunset you may only see part of a transit.

The length of time a transit takes depends on the path across the sun. For example, in the illustration below, the path on the left will take longer the path on the right.



Telescopes are necessary to see Mercury as it is so small. You should never look directly at the sun through a telescope- it can blind you. Special filters are needed to protect your eyes.

The Transit of Venus



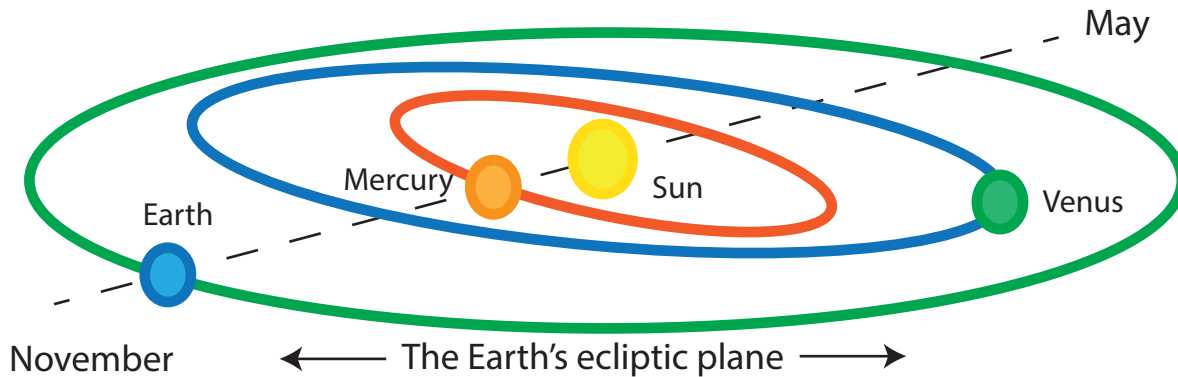
Transits of Venus occur in pairs with 8 years between them. The last pair of transits occurred in June in 2004 and 2012. The next pair of transits will happen in December in 2117 and 2125. So why is there such a long gap between pairs of transits?

The Earth and Venus orbit in elliptical paths around the Sun. The planets line up in a straight line with the Sun every 584 days. This means that there are five alignment points where a transit could occur. These alignment points are not always in the same spot as their location moves $2\frac{1}{2}$ degrees each time.

Even though the planets align with the sun in 5 locations we do not see a transit every time. The reason for this is because the orbit of Venus is tilted at 3.4 degrees. Most of the time Venus is either above or below the Earth's line of sight with the sun.

There is a narrow zone where the Sun, the Earth and Venus will line up with the Earth's plane and a transit can be observed. This transit will be followed by a second transit eight years later. Then the alignment points will not be in the zone where we can see them again for more than one hundred years.

The Transit of Mercury



A Transit of Mercury will occur when the planet passes between the Earth and the Sun and is within the ecliptic plane of the earth.

Mercury's orbit is tilted at 7 degrees so most of the time it passes above or below the Earth's plane. However, there are two times when a transit could occur. One in May and one in November. If the planet Mercury's orbit crosses the Earth's plane at these times then it could be observed as a tiny black dot passing in front of the sun.

Please note that it is dangerous to look at the sun- it can blind you. It is only safe to look at images of the sun that have been projected in a safe manner with special filters.

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Transits of Mercury occur about 13 times a century. Transits can happen in May and November but it is more common for us to see a transit in November.

The table below shows the predicted dates and times for Transits of Mercury for this century.

Year	Date	Start Time (Universal Time)	End Time (Universal Time)
2003	May 07	05:13	10:32
2006	Nov 08	19:12	00:10
2016	May 09	11:12	18:42
2019	Nov 11	12:35	18:04
2032	Nov 13	06:41	11:07
2039	Nov 07	07:17	10:15
2049	May 07	11:03	17:44
2052	Nov 09	23:53	05:06
2062	May 10	18:16	00:57
2065	Nov 11	17:24	22:48
2078	Nov 14	11:42	15:39
2085	Nov 07	11:42	15:26
2095	May 08	17:20	00:50
2098	Nov 10	04:35	09:57

Transit Predictions by Fred Espenak, NASA/GSFC