Solar Dynamics Observatory to observe Venus transit

June 1 2012

Venus appears as a black dot on the lower left edge of the sun in this image from NASA's Transition Region and Coronal Explorer (TRACE), captured during the 2004 transit. Credit: NASA/TRACE/LMSAL

On June 5, 2012 at 6:03 PM EDT, the planet Venus will do something it has done only seven times since the invention of the telescope: cross in front of the sun. This transit is among the rarest of planetary alignments and it has an odd cycle. Two such Venus transits always occur within eight years of each other and then there is a break of either 105 or 121 years before it happens again.

The moments when Venus first appears to cross the limb of the sun and the moments it leaves, known as ingress and egress respectively, are historically the most scientifically important aspects of the transit since comparison of Venus's journey viewed from different points on Earth provided one of the earliest ways to determine the distance between Earth and the sun. The transit is also helpful to scientists today: NASA's Solar Dynamics Observatory (SDO) will be watching the June 2012 transit to help calibrate its instruments as well as to learn more about Venus's atmosphere.

Since the points at which Venus will first touch and later leave the sun is known down to minute detail, SDO can use this information to make sure its images are oriented to true solar North. Orienting instruments is a constant adjustment game for telescopes in space, since their original position can be shifted during launch. Various calibrations throughout the two years SDO has been in space have left the scientists confident that the instruments are highly accurate, but making sure that Venus appears in the SDO images exactly where scientists know it should be will help make sure SDO's orientation is accurate to within a tenth of a pixel.

Second, the SDO team can use the lightless center of Venus to help calibrate what is called the point spread function of the telescope. This function describes how much light leaks from one pixel into others around it. Since there is no light emitted from the very center of Venus as it crosses the sun, it serves as a perfect test case for an area of the image where the pixels should remain black. By measuring how much light bleeds into those pixels from the rest of the sun, the SDO team will have a better sense of how to correct for that. These measurements also help us to understand the black drop effect – in which a tiny black spot appears to connect Venus to the limb of the sun -- that bedeviled scientists' attempts to measure the exact position of Venus during transits in the 18th and 19th centuries.

And last, the SDO team hopes to learn more about Venus's atmosphere as it is partially transparent to the extreme ultraviolet light observed by the telescopes on SDO. Venus will appear to be a little bigger in longer wavelengths (such as 304) as compared to shorter wavelengths (such as 171). This difference tells us how much oxygen is in Venus's atmosphere.

Provided by NASA's Goddard Space Flight Center

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