Venus caught transiting the Sun

October 22 2012

The very rare astronomical event of Venus, the nearest planet to Earth, passing in front of the solar disk on June 5th and 6th, 2012, was captured by an international team headed by Jay Pasachoff (Williams College and Caltech) and Glenn Schneider (University of Arizona) in the US, and Thomas Widemann (Paris Observatory in Meudon) and Paolo Tanga (Observatoire de la Côte d'Azur in Nice) in France.

A major observing site—from which Pasachoff, Schneider, and their team observed the June 5th event with a variety of instruments—was the 10,000-foot-high volcano Haleakala on Maui, Hawaii. (Some locations saw the transit on June 6th in their local time zones.) No transit of Venus across the face of the Sun will be visible from Earth until the year 2117, 105 years in the future, so the Pasachoff/Schneider team felt an obligation to amass the fullest possible set of data not only to study in 2012 but also for the background of the astronomers of the 22nd century. The first major goal was to study the atmosphere of Venus as it bent sunlight toward Earth. A second major goal was to provide an analog in our own solar system to the now-observed transits of thousands of exoplanet candidates discovered in recent years by the Kepler spacecraft and other telescopes on the ground and in space, presumably as exoplanets passed in front of their host stars. (Some 80 or 90 percent of those exoplanet candidates are real exoplanets; our detailed observations of a transiting planet in our own solar system, with our sunspotted Sun seen in two dimensions, may help scientists determine methods to tell which faraway events are real exoplanet transits.)

At Haleakala, Pasachoff and Schneider had one of nine coronagraphs,

specialized telescopes to block out bright objects to reveal faint ones beside them (a type of telescope originally designed for viewing the solar corona without an eclipse). These coronagraphs were designed by Tanga and Widemann; the other eight coronagraphs were spread out at sites around the world. The coronagraph at Haleakala was operated by Bryce Babcock of Williams College and Williams College undergraduate Muzhou Lu, using a blue filter. Tanga was at Flagstaff, Arizona, with a coronagraph using a yellow (visual) filter, while Widemann was at Svalbard in the Arctic with a coronagraph using an infrared filter. This Venus Twilight Experiment was readied to study Venus's atmosphere as sunlight passed through the region of twilight there, and was bent by the atmosphere toward Earth. The observations will be interpreted together with simultaneous observations made with the European Space Agency's Venus Express spacecraft, which is in orbit around that planet.

Other observations made by the Williams College Expedition on Haleakala were made with a series of advanced electronic cameras operated through telescopes by Ronald Dantowitz of the Clay Center Observatory, Dexter-Southfield Schools, Brookline, Massachusetts. Assisting on site were Robert Lucas of the University of Sydney and videographer Aram Friedman, Ansible Technologies.

Coordinated observations were made from the Sacramento Peak Observatory in Sunspot, New Mexico, by Williams College alumnus Kevin Reardon of the National Solar Observatory staff. He used the giant Dunn Solar Tower, which provided large-scale images of the Sun and is equivalent to a 55 thousand millimeter telephoto lens, giving a magnification about a thousand times greater than a "normal" camera lens.

Additional coordinated observations were made from the Big Bear Solar Observatory in California by Vasyl Yurchyshyn and by a bevy of NASA telescopes in space, including the Solar Dynamics Observatory's

Atmospheric Imaging Assembly and Helioseismic Magnetic Imager; the Solar Optical Telescope and X-ray Telescope aboard the Japanese Hinode spacecraft; and two telescopes that continually monitor the total amount of light coming from the Sun: ACRIMsat operated by Richard Willson and SORCE/TIM operated by Greg Kopp.

Though it has been widely and correctly quoted that the 2004 and 2012 transits of Venus are the last such to be seen from Earth until 2117, the Pasachoff/Schneider group didn't give up their planet-transit quest in June. They teamed up with French scientists David Ehrenreich of the Observatoire de Genève, Switzerland, and Alfred Vidal-Madjar of l'Institut d'Astrophysique in Paris to use the Hubble Space Telescope to try to detect the transit of Venus that was visible from Jupiter on September 20. They did so by using 14 orbits of Hubble to stare at Jupiter, taking 124 images total divided between an ultraviolet filter and a near-infrared filter. For 10 hours in the midst of the observations, the sunlight reaching Jupiter and reflecting off Jupiter's clouds dimmed by a hundredth of a percent since Venus obscured that tiny fraction of the solar disk, and Venus's atmosphere made an even slighter differential effect. It will take many months of data analysis before the scientists know if the effect can be detected. The same scientists will join with Cornell University astronomer Philip Nicholson on December 21 to use the Cassini spacecraft in orbit around Saturn to look directly at the Sun and to try to detect the transit of Venus that will be visible from there. These observations from Jupiter and Saturn are particularly appropriate analogs to the exoplanet transits that are now the center of so much astronomical attention.

More information: Pasachoff, Jay M., Glenn Schneider, Bryce A. Babcock, Muzhou Lu, Kevin P. Reardon, Thomas Widemann, Paolo Tanga, Ronald Dantowitz, Richard Willson, Greg Kopp, Vasyl Yurchyshyn, Alphonse Sterling, Philip Scherrer, Jesper Schou, Leon Golub, and Kathy Reeves, 2012, "The 2012 Transit of Venus for

Cytherean Atmospheric Studies and as an Exoplanet Analogue," DPS, Reno, 508.06.

Provided by Williams College