Rare transit of Mercury

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Scientists from Williams College and the University of Arizona observed Mercury in front of Venus from vantage points on earthbound mountains and with orbiting spacecraft on Wednesday.

Jay Pasachoff of Williams College (Williamstown, Massachusetts) and Glenn Schneider of the Steward Observatory of the University of Arizona (Tucson, Arizona) were perched at the University of Hawaii's solar observatory, at the rim of the giant Haleakala crater at an altitude of 10,000 feet on the island of Maui. (The crater is wider than Manhattan island and deeper than Manhattan's tall skyscrapers.) Separately, Williams College's Bryce Babcock and solar astronomer Kevin Reardon from the Arcetri Observatory in Florence, Italy, observed the transit from the Sacramento Peak Observatory in Sunspot, New Mexico.

Among planets, only Mercury and Venus can go in transit across the face of the Sun, as seen from the Earth, since they are the only planets whose orbits are inside that of Earth's. Pasachoff and Schneider have already used the 1999 transit of Mercury to unravel a centuries-old mystery known as the black-drop effect. (Their analysis was published in the journal Icarus and in the proceedings of an International Astronomical Union symposium on the transit of Venus.) This blurring of the distinction between a planet's silhouette and the edge of the Sun prevented accurate knowledge of the size of the solar system for hundreds of years.

It had been seen at the very rare transits of Venus, which occur in pairs

separated by over a century, and often falsely attributed to Venus's atmosphere. Pasachoff and Schneider, on the other hand, by observing and explaining a black-drop effect at a transit of Mercury observed from NASA's TRACE spacecraft, showed that no atmosphere was necessary, since Mercury's atmosphere is negligible and the spacecraft was outside Earth's atmosphere.

Transits of Mercury occur a dozen times a century, most recently in 2003. The next won't occur until 2016. Pasachoff and Schneider, in Hawaii are working with University of Hawaii scientists Jeff Kuhn, Don Mickey, and Garry Nitta to observe Mercury's stately progress silhouetted against the Sun for approximately five hours, from 9 a.m. to just after 2 p.m. local time (2 p.m. to sunset Eastern Standard Time).

Pasachoff and Schneider and their University of Hawaii Institute for Astronomy colleagues used the Imaging Vector Magnetograph instrument on the telescope in the Mees Solar Observatory in a spectral-scanning mode to measure the sodium component of Mercury's extremely tenuous "atmosphere," measure its height, and determine how it varies from Mercury's pole to its equator. They also used the polarimetry capability of the instrument to try to detect the weak Mercurian magnetic field against that of the Sun.

Pasachoff and Schneider extended their interest in transits to the 2004 transit of Venus, the first to be visible from Earth since 1882. They teamed up with Richard Willson of Columbia University, whose NASA satellite ACRIMSAT is able to measure the total amount of energy from the Sun that reaches Earth. They were able to measure a decrease of a tenth of one percent in the radiation from the Sun because of Venus's blocking the Sun's disk. (They reported their results in the April 10, 2006, issue of the Astrophysical Journal.) The event provides a close analogy in our solar system for transits increasingly found for planets around other stars. NASA's Kepler spacecraft, to be launched in 2008,

should discover hundreds of planets around other stars with this transit technique.

Williams College scientist Bryce Babcock worked with Kevin Reardon of Italy's Arcetri Observatory (Reardon is a Williams College alumnus) at the Sacramento Peak Observatory in Sunspot, New Mexico, part of the U.S. National Solar Observatory. From their 9200-foot altitude, they observed at the Dunn Solar Telescope there to measure the true sizes of the smallest features visible in the solar atmosphere. They used camera systems obtained with a grant from NASA for Pasachoff and Babcock's studies of Pluto and other solar-system objects.

Reardon and Babcock used a special instrument known as IBIS, constructed at the Institute in Florence and installed at the Dunn Solar Telescope, to construct a detailed map of the sodium atmosphere of Mercury. This experiment is led by Andrew Potter, currently a visitor at the National Optical Astronomy Observatories. The team in New Mexico, as well as Pasachoff and Schneider's team and Kuhn's team in Hawaii, will try to detect the spectrum of sodium in Mercury's atmosphere as it passes in front of the Sun.

Pasachoff Website on transits of Venus and Mercury:
www.transitofvenus.info

NASA site from Fred Espenak with a visibility map and table:
sunearth.gsfc.nasa.gov/eclipse/OH/transit06.html

See also a Website from Chuck Bueter at
www.transitofvenus.org/mercury.htm

Source: Williams College