Counting down to the Transit of Venus - our nearest exoplanet test-lab

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Image showing refracted sunlight observed during the 2004 egress with the DOT telescope in La Palma. Note the changes in brightness and latitude extension of the aureole. Credit: Tanga et al. 2012)

(PhysOrg.com) -- Three months before the last transit of Venus this century, scientists are gathering at the Observatoire de Paris to finalise their observation plans in a workshop supported by the Europlanet Research Infrastructure and the EGIDE/PHC Sakura Program.

The transit of Venus on 5-6 June 2012 will give scientists two important opportunities for science: firstly, to use Venus as an example of a transiting exoplanet. Astronomers will use the transit to test the techniques they have developed to analyse the composition, structure and dynamics of exoplanetary atmospheres. Secondly, they will be able to make simultaneous Earth- and space-based observations of Venus's atmosphere. These joint observations will give new insights into the complex middle layer of Venus's atmosphere, a key to understanding the climatology of our sister planet.

'This transit of Venus will be the last of our lifetime and will give a unique opportunity to closely observe an Earth-like planet passing in front of a Sun-like star,' said Dr Thomas Widemann of the Observatoire de Paris, who is co-organiser of the workshop.

'Corot, Kepler have confronted us with the discoveries of more and more super-earth sized planets. Venus and Earth are sister planets, yet Venus evolved in a dramatic, different way. If Venus were an extrasolar transiting planet, what would we learn about its physical characteristics? What would we miss or misinterpret? We will use Venus transit observations to characterize the spectral signature of Venus, and test the detection limits of gases in the atmosphere,' said Widemann.

The transit also gives a rare opportunity to study the atmosphere of Venus from Earth. As Venus appears to make contact with the edge of the Sun's disk, it becomes outlined by a thin arc of light, called the aureole. This aureole is caused by light refracted through Venus's atmosphere and is 10-100 times fainter than the visible surface of the Sun. The brightness and thickness of the aureole depends on the density and temperature of the atmosphere and the altitude of the atmospheric layers above Venus's cloud tops.

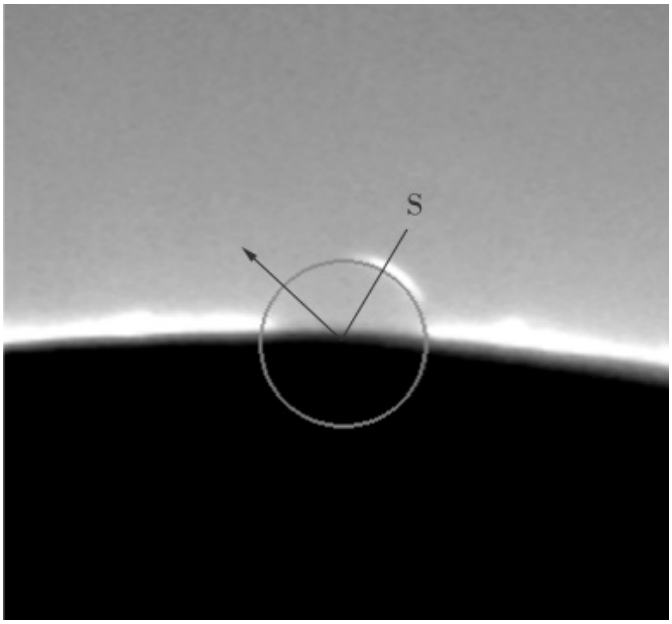

Image showing refracted sunlight observed during the 2004 egress with a ground-based coronograph using a

9-cm refractor. Credit: Tanga et al., 2012.

Although the aureole was first reported by observers in 1761, the transit in 2004 was the first time it could be photographed. The results of these observations are published the March issue of the journal Icarus.

'We didn't know until 2004 that the aureole could be easily observed and had science value.' said Dr Paolo Tanga of Laboratoire Lagrange, Observatoire de la Côte d'Azur, who led the study. 'From three sets of observations in 2004 we have been able to build up a model of the aureole for the first time.'

Spatially resolved observations along the curve of the aureole will allow the scientists to work out whether atmospheric phenomena observed by Venus Express, which has been orbiting Venus since 2006, are associated with variations in time or are dependent on latitude.

Widemann explained, 'We need ground-based observations to understand the rapid variations we see in Venus Express data. At the time of the transit, we can simultaneously measure the temperature structure at all latitudes from pole to pole, along the terminator, and allow a detailed comparison with Venus Express measurements.'

Tanga, Widemann and colleagues are building a set of eight coronographs, each working in a different wavelength, to monitor the aureole during the June transit. The coronographs, assembled in OCA, will be used in locations around the world where the transit will be most observable (Svalbard in Europe, The Far East, the US West Coast and Australia). The observations will be compared with data from other ground-based observatories, as well as Venus Express and the Hubble Space Telescope.

'The transits are an interesting marker of mankind's technological advances,' said Widemann. 'In the eighteenth century, pendulum clock allowed accurate timings during a Venus transit - to measure the Astronomical Unit. In the 19th century, we had a new tool in photography. In the 21st century, we are able to observe the phenomenon from space and from Earth at the same time. It would be interesting to know what tools will be available in the 22nd century!'

Provided by Europlanet