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The synthetic spectrum of Venus in the 7-micron region

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Trace sulfur and water compounds play a fundamental role in the chemistry of the upper atmosphere of Venus. Measuring their diurnal and latitudinal variations allows us to better understand the aeronomy of the planet, the coupling between photochemistry and dynamics, and clouds microphysics. The thermal emission in the 1220-1380 cm-1 range, observable from the ground, probes the upper atmosphere above the H2SO4 clouds. A calculation of the synthetic spectrum of Venus at high resolution (R > 50000) shows that transitions of CO2, HDO and SO2 are expected to be detectable. In particular, an HDO doublet, at 1350 cm-1, should provide a detectability limit of about 1 ppm (assuming the standard D/H value of Venus), and a combination of several SO2 transitions, between 1350 and 1375 cm-1, should lead to a limit of a few ppb. This limit should be sufficient for detecting and mapping SO2 if its abundance has not dropped since 2007 value. Mapping the disk of Venus from the ground in the 7-micron region at high spectral resolution, both on the night side and on the day side, at the time of quadrature, should give information upon the spatial variations of SO2 as a function of latitude and local time, as well as its temporal variability, which are presently a matter of debate. In addition, day-night variations of H2O could also be studied through the use of HDO transitions, and a global estimate of the D/H ratio above the clouds could be inferred using an independent measurement of H2O.
Such observations are planned in January 2011 using the EXES and/or TEXES high-resolution imaging spectrometers with the Infrared Telescope Facility at Mauna Kea Observatory. In this paper, a description of the synthetic spectrum of Venus will be given and a preliminary report on the observations will be presented.