Imaging Spectroscopy of Venus with the Anglo-Australian Telescope

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The Anglo-Austrlian 3.9m Telescope and its IRIS2 instrument has been used to obtain imaging spectroscopy observations of Venus over the last four observing seasons (July 2004, December 2005, June/July 2007, July 2009). The observations provide spectroscopy over the nightside of Venus at a spectral resolving power of R ~ 2400 at wavelength from 1.1 to 2.4 μm split into three bands. Full two dimensional coverage is obtained by scanning the spectrogrph slit across the disk of Venus.

The observations have been used for a number of studies. The strong O_2 airglow emission at 1.27 μm has been used to determine the temperature in the mesosphere (~95 km altitudes) by fitting models to the rotational line structure in the band. Temperaturre maps in this region (Bailey et al., 2008a) show temperatures around 15-30K higher than those in the standard VIRA atmospheric profile. Maps of the CO distribution in the lower atmosphere (~35km altitudes) have been obtained using the absorption feature at 2.3 μm. The observations show increased CO mixing ratios at high latitudes, and are the first to map the distribution in two dimensions over both hemispheres (Cotton & Bailey, 2009). The results provide constraints on the lower atmosphere circulation and chemistry.

Observations in the 1.18 μm window are being used to investigate the water vapour abundance near the surface. We have investigated the available H_2O spectral line lists and found that previous studies have used lists that are inaccurate or incomplete, particularly for the 1.18 μm region (Bailey, 2009). We are now using the new BT2 line list in conjunction with our IRIS2 spectra to determine the water vapour abundance. We have also demonstrated that our observations can be used to detect the surface of Venus (Bailey et al., 2008a) and are able to detect a number of new features of the Venus spectrum that have been discovered by VIRTIS, including the new thermal window at 1.51 μm and the O_2 (0-1) airglow feature at 1.58 μm.

References

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