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The PFS Experiment on board the VEX Mission

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The Planetary Fourier Spectrometer (PFS) for the Venus Express mission is an infrared spectrometer optimised for atmospheric studies. This instrument has a short wave (SW) channel that covers the spectral range from 1700 to 11400 cm^{-1} (0.9 to 5.5 µm) and a long-wave (LW) channel that covers 250 to 1700 cm^{-1} (5.5 to 45 µm). Both channels have a uniform spectral resolution of 1.3 cm-1. The instrument field of view FOV is about 1.6 degrees (FWHM) for the Short Wavelength channel (SW) and 2.8 degrees (FWHM) for the Long Wavelength channel (LW) which corresponds to a spatial resolution of 7 and 12 km when Venus is observed from an height of 250 km. The SW channel uses a PbSe detector cooled to 200-220 K while the LW channel is based on a pyroelectric ($L_i T_a O_3$) detector working at room temperature. The intensity of the interferogram is measured every 112 nm of physical mirrors displacement, corresponding to 450 nm optical path difference, by using a laser diode monochromatic light interferogram (a sine wave), whose zero crossings control the double pendulum motion. By working roughly 1.5 hour around pericentre, a total of 460 measurements per orbit will be acquired plus 60 for calibrations. PFS is able to take measurements at all local times, facilitating the retrieval of surface temperatures and atmospheric vertical temperature profiles on both the day and the night side.

The Planetary Fourier Spectrometer measures the (1) thermal surface flux at several wavelengths near 1 micron, with concurrent constraints on surface temperature and emissivity (indicative of composition), (2) the abundances of several highly-diagnostic trace molecular species, (3) atmospheric temperatures from 65 to 90 km altitude, (4) cloud opacities and cloud-tracked winds in the lower-level cloud layers near 50-km altitudes, (5) cloud top pressures of the uppermost haze/cloud region near 70-80 km altitude, and (6) oxygen airglow near the 100 km level. All of these will be observed repeatedly during the 500-day nominal mission of Venus Express to yield an increased understanding of meteorological, dynamical, photochemical, and thermo-chemical processes in the Venus atmosphere. Additionally, PFS will search for and characterize current volcanic activity.

Measurement of the 15 micron CO_2 band gives, by means of a complex temperature profile retrieval technique, the vertical pressure- temperature relation, basis of the global atmospheric study. Essential for this study is the possibility to measure not only Venusian radiation, but also space (3 K black body) and a calibration B.B., measurements allowed by the presence of a pointing device with one rotation axis.