

PLANET-C Venus Exploration Mission: Probing Venus Atmosphere in 2-micron Near-Infrared Region.

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The near-infrared camera IR2, one of 5 cameras on board PLANET-C Venus Climate Orbiter, observes dynamics of Venusian middle-to-lower atmosphere through so-called “windows”. IR2 utilizes the windows at 1.74 and 2.26 microns, where CO₂ absorption is relatively weaker and thermal radiation from deeper level (high temperature) can be observed on the night (unilluminated) hemisphere. Spatial variation of the cloud opacity modulates the intensity of such infrared radiation and dynamics in middle-to-lower atmosphere can be studied by tracking motions of cloud features. Adjacent to 2.26 micron, IR2 also observes Venus at 2.32 micron, a CO absorption band. By differentiating 2.26 and 2.32 micron images, it is possible to map spatial variation of CO abundance and to monitor its temporal variability. CO is photochemically produced in the upper atmosphere and is thought to be transported to the lower atmosphere through unknown sink. Therefore, CO can be a good tracer to understand the meridional circulation of Venusian atmosphere.

IR2 also has a filter (2.02 micron) to observe the day-side disk. This wavelength is within a strong CO₂ absorption band. The incident sunlight is absorbed by CO₂ with strength proportional to its path length between the top of atmosphere and the reflective cloud. The intensity variation in this wavelength, therefore, reflects variation of cloud-top altitude. Another camera on board PLANET-C, LIR, detects variation of cloud-top altitude as variation of temperature and is complementary with IR2. LIR works on Venus disk regardless it is night or day with moderate spatial resolution, while IR2 (2.02 micron) with high spatial variation works only on the day-side disk.

Another important science objective of IR2 is the zodiacal light. For this observation, IR2 is equipped with an astronomical H-band (1.65 micron) broad-band filter and will observe how dust is distributed in the inner part of the solar system.

The main manufacturer of IR2 is Sumitomo Heavy Industries, Co. Ltd. with the optical elements made by Nikon, the PtSi detector (1040 x 1040 pixels) by Mitsubishi Electronic, Co., and the hood by Magoshi. The flight model has already been made and adjustments and acquisition of calibration data are being done, being prepared to participate the final integration test that will begin in June 2009. Some details of development and test as well as expected scientific outcome will be presented.