Development of 1 - 5 micron infrared camera for planetary atmospheric observations: electronics

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Recent progresses of infrared imaging technique bring us a breakthrough in measurements of Jovian auroras at wavelengths of 3.4 and 3.9 microns, and Venusian middle and lower atmospheres revealing the cloud pattern at 2.3 microns. It is essential to make continuous measurements for understanding the Jovian ionosphere-magnetosphere coupling processes and their relationship to solar wind, and Venusian atmospheric phenomena such as super rotation and meridional circulation. However, such continuous measurements are prevented due to limited machine time on large telescopes.

We have been developing an infrared camera for planetary atmospheric observations. This camera has a 256x256-pixel InSb focal plane array with a sensitive wavelength of 1 - 5 microns. The camera will be installed at the Cassegrainian focus of the Iitate Telescope (F12, D=525 mm) of Tohoku University, and the spatial resolution of 0.43 arcsec/pixel. Double filter turrets are located in the collimator section, and each turret has eight filter positions. Three filters with center wavelengths of 2.294, 2.329 (for Venusian clouds), and 3.414 microns (for Jovian aurora) are already mounted on the turret. The vacuum level of outer chamber is 3.5 x 10ˆ-6 torr, while the inner radiation shield and the sensor are cooled to 92 K and 30K, respectively, using a helium refrigerator for shielding the radiation from the outer chamber. The total camera weight is totally 67 kg, and the camera and electronics could be mounted on the Iitate Telescope using additional balance weight.

In this presentation, the development of electronics for the InSb sensor on board the camera will be given. We have developed the digital electronics using the one-board computer SUZAKU-V which consists of FPGA, CPU (with Linux OS), memories and I/F ports, and succeeded to produce the clock patterns and coded the devise driver for driving the sensor and controlling the exposure time. In addition, we also manufactured the analog electronics which consists of power, bias, clock driver, pre-amplifier, A/D converter, PIO and isolator boards. We confirmed that the six bias voltages are produced correctly, and the pre-amplifier and the A/D converter work satisfactorily.

The observation plans of Jovian aurora and Venusian atmosphere will also be discussed.