ISS-IMAP mission: airglow observation with a wide FOV imaging spectrograph VISI

Takeshi Sakanoi[1]; Yuichi Otsuka[2]; Takuji Nakamura[3]; Makoto Taguchi[4]; Shoichi Okano[5]; Atsushi Yamazaki[6]; Akinori Saito[7]; Saito Akinori IMAP satellite working group[8]

[1] PPARC, Grad. School of Sci., Tohoku Univ.; [2] STELAB, Nagoya Univ.; [3] RISH, Kyoto Univ.; [4] NIPR; [5] PPARC, Tohoku Univ.; [6] ISAS/JAXA; [7] Dept. of Geophysics, Kyoto Univ.; [8] -

http://pparc.geophys.tohoku.ac.jp/~tsakanoi/

ISS-IMAP (Ionosphere, Mesosphere, upper Atmosphere, and Plasmasphere mapping) mission is a part of ISS-JEM 2nd stage plan, and the purpose is to clarify the energy and physical transfer processes in the boundary region between earth's atmosphere and space at an altitude of ~80 km. The visible imaging spectrometer instrument (VISI) on board ISS-IMAP will perform imaging spectroscopic observations of airglow distributions for understanding the generation, growth, and decay processes of the small and medium-scale atmospheric and ionospheric variations in the mesopause and lower thermosphere.

The principle of VISI optical system consists of grism and CCD detector, and the wavelength range and resolution are 630 - 762 nm, and 1 nm, respectively. The targets of airglow emission are OI (630 nm, altitude 250 km), OH Meinel band (650 nm, altitude 87km), O2 (0-0) atmospheric band (762 nm, altitude 95 km). The unique point of VISI optical design is that two line slits are located in the forward and backward end of the field-of-view (FOV) at a 1st focal plane. The two slits correspond to 42 deg forward and 42 deg backward directions. This two slit optical system enable us to obtain the imaging spectrogram in the forward and backward directions simultaneously by using one camera system. Each slit has the rectangle-shape FOV of 85 (perp. to orbital plane) x 1 (orbital plane) deg, which corresponds to ~550 km x 6 km mapping to an altitude of 100 km.

In this observation with VISI, the region covered by the forward FOV will be observed again by the backward FOV after 90 sec. The aim of two slit system is as follows. 1) To extract background emissions, such as ground scatter and cloud albedo. Continuous emission component can be extracted using the airglow spectrum data, and the albedo of airglow emission is extracted by using the correlation between forward and backward FOV data. Since the altitude of airglow is much higher than clouds and ground structures, we can distinguish the airglow and clouds/ground by the correlation analysis. 2) To estimate the phase velocity of airglow wave structures. From the difference between forward and backward FOV data, we expect to estimate the parameters of airglow wave structure.

We adopt a 1024 x 1024 pixel electrical-cooled CCD as a sensor. The exposure time will be in the range from 1 - several sec depending on the airglow intensity. Spatial resolution is determined by the convolution among the orbital motion of ISS (~8km/s), exposure time and the slit width (~6km). In this presentation, the current status of observation plan, instrumental design, size, weigh, power and data rate will be reported.