Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PCG040-07 Room: 301A Time: May 28 13:45-14:00

Investigations of Jovian thermospheric ion and neutral winds by using high-resolution near infrared spectrometer

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Jupiter is the largest planet in the solar system, and has a giant magnetosphere. Unlike Earth's magnetosphere that is driven by the solar wind energy, Jovian magnetosphere is driven by the rotational energy of the planet itself. In the Jovian magnetosphere-ionosphere-thermosphere coupling system, the distribution of neutral winds is important for the estimation of the momentum and energy transportation from the ionosphere to the magnetosphere, because the amount of Pedersen current depends on the relative ion velocity as seen from neutral atmosphere.But, longitudinal distribution and temporal variation of the dynamics of neutral atmosphere is less understood, because there is few observation of neutral winds.
In this study, we conducted high-resolution spectral observation of Jovian H_2aurora using an echelle spectrograph, CSHELL, of IRTF at Mauna Kea on the island of Hawaii. The Jovian thermospheric neutral winds will be examined by observing the Doppler shift of auroral H_2 emission line at 2.12 um.
Although temporal variations of Jovian ionospheric and neutral wind are suggested, continuous several weeks or several months observations is essentially difficult, because the observation by public observatories is limited by machine time.
For those targets, we are developing the infrared echelle spectrometer for the observation of Jovian ionospheric and neutral wind velocities that observed H_3^+ and H_2 emissions.
Our requirements are as follows: (a) H_3^+ (2.03 um) and H_2 (2.12 um) emissions with the luminosity of 0.5-1.0x10^{-6} W/m^2/str, (b) slit length of 50 arcsec, (c) spatial resolution of 1.0 arcsec, (d) temporal resolution of 30 minutes, and (e) 60 m/s of error in velocity of the neutral wind.
We decided slit width is 1.0 arcsec, plate scale is 0.5 arcsec/pixel, and spectral resolution is about 43,000. We use the 256x256 InSb array, and can take 2 orders at the same time. In the future, we use the 1024x1024 InSb array, and can take 8 orders.
It is optimized for observation of winds of planetary atmosphere in near infrared wavelength (1-4 microns). When the spectrometer will be completed, it can contribute to the investigation not only for Jupiter, but also Venus and Mars atmospheres.

Keywords: Infrared, spectrometer, Jupiter, planet, thermosphere, ionos