E139-P011 **Room: Poster Session Hall** **Time: May 16**

Development of mid-infrared high dispersion spectrograph (IRHS) and its application to atmospheric observation

Tomomichi Oka[1]; Hitoshi Tokoro[2]; Noriomi Akatsuka[1]; Yasuhiro Hirahara[3]

[1] Earth and Environmental Sci., Nagoya Univ.; [2] Earth and Environmental Sci., Nagoya Univ; [3] Earth and Planetary Sci., Nagoya Univ

High dispersion infrared observation is useful for the study of atmospheric molecules, especially for deriving the excitation temperature, spatial distribution, time variations, and vertical profile for each chemical species. For obtaining the vertical distribution profiles of atmospheric molecules with high accuracy, the resolving power lambda/delta-lambda of the spectrometer is required to be 10,000. Although most of the previous study used the Fourier transform infrared (FT-IR) spectrometer, the sensitivity of detection was inherently limited by the fluctuation of the instrumental thermal radiation, especially in the mid-infrared region. Therefore, only a few result of the thermal emission of atmospheric species in infrared region have been reported.

Recently, our group have developed the 'mid-infrared high dispersion spectrograph (IRHS)'. IRHS is a cryogenic echelle spectrometer, which operate at 7.5-13.5 micrometer in wavelength with the resolving power lambda/ delta-lambda of ~44,000 at 10micrometer. In order to achieve high dispersion, broad bandwidth and high sensitivity, two key devices are employed: a single crystal germanium immersion echelle grating (30*30*72mm) and a Si:As IBC (Impurity band conductor) array detector (412*512 pixels, unit pixel size 30 micrometer) operated at 5 K. The germanium immersion echelle grating for collimated beam size of diameter 28mm was fabricated by utilizing ultra precision micro-grinding method coupled with 'ELectrolytic In-process Dressing' (ELID) technique. To reduce thermal radiation of the instrument, all optics of IRHS is arranged on the cold optical base plate (~30K) of the cryostat with the diameter of 80cm.

By using the radiative transfer code 'SEASCRAPE PLUS', we estimated in detail the spectral intensities for the thermal emission of H2O, CO2, O3, CH4, N2O, and HNO3 in stratosphere and troposphere. As a result, the SEASCRAPE PLUS prediction showed that the atmospheric observation of IRHS could detect the weak emissions with integration time of a few seconds. This suggests that the IRHS is an unique and powerful equipment for the emission spectroscopy of the atmospheric species, which can detect the shorter temporal variation related with photochemical reactions compared with the previous method.