Spectroscopic and imaging observations for short-wavelength infrared aurora and airglow at Longyearbyen (78.2˚N, 15.6˚E) coordinated with EISCAT Svalbard radar and VLF/LF radio wave receivers.

*Takanori Nishiyama[1,2], Masato Kagitani[3], Yasunobu Ogawa[1,2,4], Fuminori Tsuchiya[3], Keisuke Hosokawa[5], Takeshi Sakanoi[3]

1. National Institute of Polar Research, 2. Department of Polar Science, The Graduate University for Advanced Studies, SOKENDAI, 3. Planetary Plasma and Atmospheric Research Center, Tohoku University, 4. Joint Support-Center for Data Science Research, Research Organization of Information and Systems, 5. The University of Electro- Communications

We are currently developing and testing a 2-D imaging spectrograph to evaluate spatial and temporal characteristics of dayside aurora. It is designed for short-wavelength infrared (SWIR) wavelength ranging from 1.1 to 1.3 microns covering strong auroral emissions in N_2^+ Meinel band (0-0) and N_2 1st Positive bands (1-2 and 0-1) as well as airglow emissions in OH Meinel bands (5-2, 6-3, and 7-4) and O_2 IR band. Its field-of-view (FOV) and angular resolution are 55 degrees and 0.11 degrees per pixel, respectively. If a 30-microns slit is used, wavelength resolutions are 2230 and 5070, with two different gratings (950 lpmm and 1500 lpmm). A signal-to-noise ratio for 1 kR emissions is expected to be larger than 1.0 in a few seconds exposure time. Therefore, we can investigate temporal variability of dayside reconnection and pulsating auroras with sufficient sampling rates of a few seconds. In a test observation, we successfully measured airglow spectrum for OH (7-4) band and O_2 IR band in a twilight condition (solar zenith angle, SZA, is about 96˚).
The spectrograph will be installed at The Kjell Henriksen Observatory/The University Centre in Svalbard (KHO/UNIS), Longyearbyen (78.2˚N, 15.6˚E) by the end of 2021. Taking advantage of its location, 24-hours continuous observations can be expected (SZA larger than 96˚) near the winter solstice. Coordinated studies with active/passive radio remote sensing, such as EISCAT Svalbard radar and VLF/LF radio wave receivers, are planned. In addition, we start to consider a brand-new SWIR imager or echelle spectrograph that will be introduced at KHO/UNIS after 2022. A detailed specification of the instrument is presented as well.

Keywords: Aurora and airglow, Short-wavelength infrared, EISCAT Svalbard radar, VLF/LF radio wave receivers, M-I coupling, Mesosphere and Lower Thermosphere

