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Zoom meeting B ：11/4 PM1 (13:45-15:30)
15:00〜15:15

Spectroscopic and imaging observations of SWIR aurora (1.1-1.3 microns) at Longyearbyen: Current status of the developments

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We are currently developing and testing a 2-D imaging spectrograph with a fast optical system and high spectral resolutions to challenge twilight/daytime aurora measurements from the ground. It is designed for short-wavelength infrared (SWIR) wavelength, in which sky background intensity is weaker than in visible, ranging from 1.1 to 1.3 microns and covering strong auroral emissions in N_2^+ Meinel band (0-0) and N_2 1st Positive bands (1-2, and 0-1). 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, spectral bandpass around 1.1 microns are 0.52 nm and 0.22 nm with two different gratings (950 lpmm and 1500 lpmm). A signal-to-noise ratio for 1 kR emissions is estimated to be larger than 1.0 in a few seconds exposure time. Therefore, we expect that temporal variability of particle precipitations such as those associated with dayside reconnection and pulsating auroras can be investigated with sufficient sampling rates of about 10-15 seconds. In a test observation, we successfully measured airglow emissions of OH (5-2), (6-3), and (7-4) bands in 1.07-1.23 microns (shown in an attached figure).

In addition to the spectrograph, we start to design and develop a brand-new SWIR imager focusing on aurora emissions in N_2^+ Meinel band (0-0). The imager consists of a few commercial SWIR lenses for security/defense purposes, plano-convex lenses, a custom optical filter and an InGaAs FPA (640 x 512 pixels). Total optical system is fast (F-number 1.4) and we examined that the point spread function is less than 5 pixels in full width at half maximum even near the end of the FPA. The FOV is 92 degrees and slightly wider than that of the spectrograph. The more detailed specification of the imager will be shown in this presentation.

The both instruments are going to be installed at The Kjell Henriksen Observatory/The University Centre in Svalbard (KHO/UNIS), Longyearbyen (78.2^{o}N, 15.6^{o}E) by the end of 2022. Taking geographical advantage of the observatory, 24-hours continuous observations can be expected near the winter solstice. Coordinated studies with active/passive radio remote sensing, such as EISCAT Svalbard radar and VLF/LF radio wave receivers, are also planned to estimate precisely energy flux of precipitating particles associated with aurora and sub-sequent changes in electron density and neutral/ion temperatures. Possible scientific targets are as follows: dayside reconnections and wave-particle interactions monitored by aurora emissions, ion upflow from resonant scattering of N_2^+ ions, and atmospheric waves seen as neutral temperature modulations. We will also discuss about the observational strategies and future collaborations.