R006-11
A 会場 ：11/27　AM1 （9:00-10:15）
9:00〜9:15

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Multi-instrument observations of polar rain aurora

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Recently, we documented an extraordinarily large-scale aurora that encompassed the entire polar cap region during a period of nearly 28 hours when the solar wind almost completely vanished on December 25 – 26, 2022. By integrating data from ground-based and satellite observations, we demonstrated that this remarkable aurora was caused by the precipitation of field-aligned “strahl” electrons streaming directly from the Sun, a phenomenon known as “polar rain.” High-sensitivity ground-based imaging revealed complex spatial structures within the polar rain aurora, potentially reflecting the internal patterns of the solar wind or even the structure of the surface of the Sun.

Approximately a month later, on January 19 – 20, 2023, another case of polar rain aurora occurred in the northern hemisphere. This event lasted around five hours, shorter than the one observed in December 2022. However, during this interval, the EISCAT Svalbard Radar (ESR) in Longyearbyen, Norway, was operated as part of a special UK experiment. The radar detected intense ionization with a cut-off altitude as low as 90 km, suggesting that the electron precipitation was more energetic than typical polar rain events. Additionally, an all-sky airglow imager from OMTIs (Optical Mesosphere Thermosphere Imagers) in Eureka, Canada, captured corresponding diffuse greenish and reddish auroral signatures over the central polar cap, although the green line images were saturated most of the time, possibly due to the intense polar rain precipitation.

In this paper, we present a detailed analysis of these two polar rain aurora events, utilizing a comprehensive array of optical instruments in Svalbard and Eureka, along with ionospheric plasma parameters obtained from ESR. Specifically, we examine the mechanisms behind the unusually intense electron precipitations during the large-scale polar rain aurora and their connection to the origin of strahl electrons on the surface of the Sun.