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B 会場 ：11/4　PM1 （13:45-15:30）
14:00〜14:15

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Variation of ion current in the current – voltage characteristics obtained by Langmuir Probe onboard “SS-520-3” sounding rocket

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Ion outflow along the geomagnetic lines of force from the polar ionosphere have been reported since 1970's based on the sounding rocket and satellite observations. The ionospheric cusp is known as a particular region where the largest flux of the ionospheric ion is observed. In November, 2021, in Svalbard, Norway, JAXA and the related organizations conducted a sounding rocket "SS-520-3" campaign whose purpose is to elucidate the plasma acceleration/heating mechanism responsible for the ion outflow/upflow in the ionospheric cusp region. A combination of the high time resolution in-situ rocket measurements and the ground-based optical and radar observations makes it possible to approach such an important science topic. In comparison with other experiments, the feature of this campaign is to try to make an in-situ measurement of wave-particle interaction which is believed to play a primary role in the ion energization. Sounding rocket "SS-520-3" was launched at 11:09:25 CET from the SvalRak facility at Ny-Alesund in Svalbard, Norway, after confirming that the rocket would traverse a region of the ion upflow. A total of 9 science instruments were installed on the rocket. Observations of thermal plasmas by FLP (Fast Langmuir Probe) instrument onboard the rocket will be discussed in this presentation.

A cylindrical probe with a length of 200 mm and a diameter of 3 mm was adopted to the FLP. The probe is directly biased by a triangular voltage with an amplitude of 4 V with respect to the rocket potential and a period of 100 msec so as to provide the current-voltage relationship. A current incident to the probe was sampled with a rate of 6400 Hz and amplified by two different gains (low and high) so that it can measure in a wide range of the plasma density. In order to measure the ion current as well as the electron current, the amplifier has an offset voltage of +0.5 V. The electron temperature and number density can be derived from a relationship between the incident current versus voltage applied to the probe.

The obtained FLP data were good enough in quality to estimate electron temperature and density. In our study, ion current in addition to electron current is subject to be analyzed since the main objective of this rocket campaign is to investigate the thermal ion upflow in the cusp region. Results obtained so far from our analysis are summarized as follows:

1) The FLP successfully made its measurement during both upleg and downleg of the rocket flight, which means that the local electron temperature and density can be estimated.

2) The observed electron density is larger than the predicted value, which suggests a possible traverse of the rocket through a region of the electron precipitation.

3) The ion current exhibits unusual behavior in the current – voltage characteristics. The cause of such a particular component is now investigated.

4) A ratio of electron to ion random currents significantly changed during the flight, which may be caused by a change in a ratio of electron to ion temperature. However, the ratio may be related to an existence of the ion upflow somewhere along the rocket trajectory.

In this presentation, we will focus on a spatial/temporal variation of ion current in the current - voltage characteristics. A latest result from our analysis of FLP data will be presented in more detail.