

Initial analysis of electron number density and plasma wave spectra measured in the cusp region by SS-520-3 NEI/PWM

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For investigation of the ion acceleration and heating processes in the cusp region, SS-520-3 sounding rocket was successfully launched on Nov. 4, 2021 from Svalbard. NEI/PWM (Number density of Electron measurement by Impedance probe/Plasma Wave Monitor) was installed on SS-520-3 for measurements of (a) background electron number density, and (b) plasma waves in wide frequency range. The background electron number density is one of the fundamental parameters for discussions on wave particle interactions associated with ion acceleration and heating. Frequency of the plasma waves depend on the energy range of the ions and electrons in the interactions with the plasma waves.

In the flight of SS-520-3, NEI/PWM successfully operated in altitude range from 154 to 742 km along the rocket trajectory. Vertical distribution of the electron number density in the topside and bottomside ionosphere with some irregular structures could be measured by NEI. In this experiment, we designed NEI not only for measurement of electron number density by detection of upper hybrid resonance (UHR) in high frequency range (0.1 - 20 MHz), which was performed in the previous sounding rocket experiments, but also for a new measurement of ion composition by detection of lower hybrid resonance (LHR) in low frequency range (1 - 11 kHz). The new dataset is now under analysis. The plasma waves in a frequency range from 0.3 kHz to 22 MHz were measured by PWM. Radio and plasma waves such as broadband extremely low frequency (BBELF), whistler-mode hiss, auroral kilometric radiation (AKR), UHR waves, and broadcast radio waves were found in the spectrogram. We are going to compare them with other datasets from other instruments onboard SS-520-3 and ground-based observations such as EISCAT Svalbard radar.

Keywords: Ion outflow, SS-520-3 sounding rocket, Electron number density, Radio and plasma waves, Impedance probe, Cusp region