Overview of electron number density and plasma wave observations by SS-520-3 NEI/PWM

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Preparations and preparative studies for electron number density and plasma wave observations in the earth' cusp region by impedance probe and plasma wave monitor (NEI/PWM) onboard the SS-520-3 sounding rocket are overviewed. The main objective of SS-520-3 is to observe acceleration processes of escaping ions from ionosphere in the cusp region. It was originally scheduled to launch from Svalbard in 2017. However, due to failure of the rocket avionics found in the integration test in Japan, the launch was postponed. The development and unit test of SS-520-3 NEI/PWM were already finished before the integration test in 2017. So, we were performing some preparative studies.

The observations of accurate electron number density in a range from 10^3 to 5 x 10^6 /cc and plasma wave spectrum in a wide frequency range from 300 Hz to 20 MHz will be performed by SS-520-3 NEI/PWM. The electron number density is determined from measured capacitance of impedance probe (NEI-S) extended into the ionospheric plasma. Plasma waves are detected by antenna and preamplifier of Low Frequency Analyzer System (LFAS). NEI/PWM obtains plasma wave spectrum from the signal from LFAS. Electron number density is an essential parameter to discuss resonance conditions between plasma waves and particles in their interactions. SS-520-3 NEI/PWM is designed to perform monopole measurements of plasma waves in order to clarify the distribution of the wake-induced plasma waves around the rocket [Endo et al., 2015]. Detection of lower hybrid resonance (LHR) by wideband impedance probe operated in a frequency range from 1 to 10 kHz will be tried first in the ionosphere by SS-520-3 NEI/PWM. It provides information of ion density including cold components and ion composition. The wideband impedance probe is planned to be used also in S-520 sounding rocket experiment in 2022.

We performed preparative analyses on relations between broadband extremely low frequency waves (BBELF) and ion heating by using Akebono data. The results suggest that not only the Alfvenic component of plasma waves around O+ cyclotron frequency but also electrostatic component around lower hybrid resonance (LHR) frequency contribute to the ion heating [Ishigaya, 2019].

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