

## 電離圏イオン組成観測のための広帯域インピーダンスプローブの開発

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## Development of wideband impedance probe system for observation of the ionospheric ion composition

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The performance of new wideband impedance probe system for observation of the ionospheric ion composition have been evaluated in the plasma chamber. Measurement system of Number density of Electron with Impedance probe (NEI) were developed by Oya [1966], and successfully utilized for numerous sounding rockets and spacecraft such as Denpa, Taiyo, Jikiken, Hinotori, Ohzora, and Akebono [e.g. Wakabayashi et al., 2013]. NEI measures the equivalent capacitance of the probe immersed in the magnetized plasma. By applying RF signal to the probe, we can identify the minimum of equivalent capacitance due to upper hybrid resonance (UHR). The frequency of RF signal is swept from 100 kHz to 25 MHz, in order to cover the UHR frequency range in the Earth's ionosphere. We can obtain accurate electron number density from the measured UHR frequency.

The equivalent capacitance of the probe in the magnetized plasma shows minimum not only at UHR frequency but also at another resonance frequency: Lower hybrid resonance (LHR). If we can measure LHR frequency with UHR frequency and electron cyclotron frequency, we can derive effective mass of ionospheric plasma and determine the ionospheric ion compositions. Because LHR frequency is about several kHz in the ionosphere, we have to extend the lower limit frequency of the current impedance probe system to 100 Hz.

Through the plasma chamber experiment in 2014 with bread-board model (BBM) of the new impedance probe system, we confirmed that it could measure (1) UHR in high frequency range as well as the current NEI could, and (2) equivalent capacitance profile from 100 Hz to 100 kHz, which indicates sheath capacitance of 120 pF and sheath resistance of 30 kohm. But it could not detect LHR as predicted due to high electron collision frequency in the chamber using backscatter-type plasma source. We are planning to perform another chamber test in 2015. In this test, we are going to try (a) large UV light source as plasma source in order to reduce electron collision frequency. In addition, in order to enable both of UHR measurement at high time resolution and LHR measurement at low time resolution with single probe, we are going to try (b) operation with applying dual-frequency RF signal to the probe.