

Measurement of ionosphere by microsatellite "GAIA-I" and development of the electron density and temperature probe: EDTP

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Chiba University plans to hold orbital experiment by using a microsatellite named GAIA-I. The GAIA-I could investigate relationship between diastrophism and ionospheric phenomenon to seize precursors of earthquake. Many ground based observations show that ionosphere is modified before large earthquakes. The mechanism of the ionosphere modification is still not known. Recently, ionosphere observation by small and micro satellites has been proposed in order to study the mechanism of the ionosphere modification. However, conventional ionosphere measurement has some problems in small and micro satellites. In the case of Langmuir Probe, one problem is that satellite potential changes easily when sweeping voltage which is applied to probe and second problem is that the measurement is influence by the electrode contamination. We discuss here a new sensor to observe an electron density and temperature at the same time with one simple low cost, low power consumption and low data rate instrument. This sensor is called Electron Density and Temperature Probe (EDTP).

EDTP has a probe that is formed by two semicircular plate shapes. When a sinusoidal voltage whose frequency is lower than ion plasma frequency is applied to an electrode, the floating potential shifts to the negative potential. The electron temperature can be calculated from the ratio of the two floating potential shifts which are caused by applying two successive signal of amplitude a and $2a$. This principle to measure electron temperature is applied the instrument was developed in 1970, which is named Electron Temperature Probe (ETP).

In a high frequency region, plasma impedance is more dominant and the amplitude of sinusoidal signal which is applied between electrode and sheath edge is controlled by the combination of sheath impedance and plasma impedance. Based on this principle, we added one more function of ETP to measure electron density as well by replacing low frequency oscillator which was used for ETP to sweep frequency generator.

We tested EDTP experiment that compared EDTP with Langmuir Probe and Impedance Probe by using space chamber. Our experiment has revealed that EDTP is better than conventional ionosphere measurement.

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