

# P4: A POTENTIAL CONTROL OF MICRO-SATELLITE USING AN ELECTRON GUN

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## 1. Introduction

A micro-satellite is useful to experiment of the ionosphere plasma measurement. The Langmuir probe is popular technique to measure plasma.

However, using the Langmuir probes for ionosphere measurement has big problem in micro-satellites. This problem is that the satellite potential changes easily when a sweeping voltage is applied to a probe.

The objective of this research is to control the micro satellite potential. We use the thermionic emission from an electron gun to keep a constant potential.

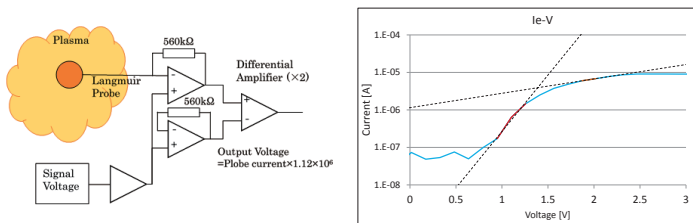
## 2. Langmuir Probe

The Langmuir probe measure an electron temperature and an electron density of plasma.

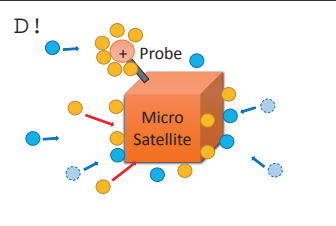
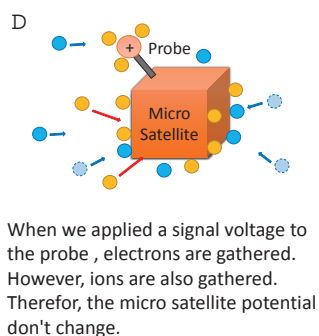
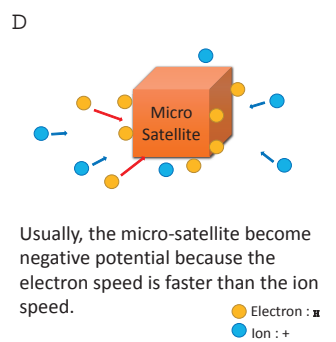
When a voltage is applied to a probe which is immersed in plasma, charged particles with energy larger than the potential difference between the probe potential and the plasma potential will flow into the probe and generate the probe current.

If we apply a sweeping voltage to the probe, electrons with different energy will be attracted by the various probe potential and generate various probe current.

We can get the I-V characteristics by plotting probe current versus probe potential. The electron density and temperature of the plasma parameter is calculated by the I-V characteristics.



## 3. Micro-satellite Potential in Space Plasma



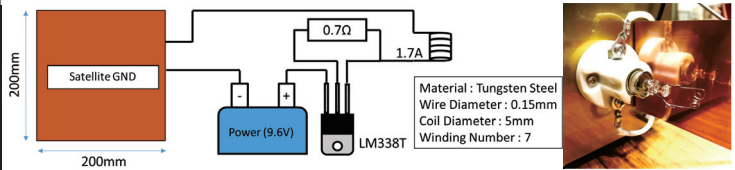
If applied voltage increase, the satellite collects a larger number of electrons. As a result, the micro-satellite potential become a lower value.

## 4. Electron Gun

This electron gun is very simple, looks like a filament of a bulb.

The electron gun filament is made by tungsten steel wire.

When the metal is heated until it is emitted light, thermal electrons are emitted from the metal. The electron gun emits thermal electrons that cancels incoming electrons by the probe current. Therefore, the satellite potential is kept at constant value.

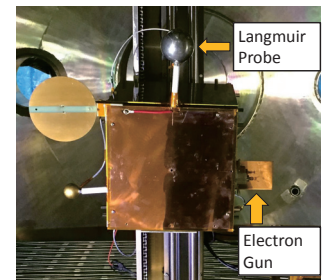


## 5. Experiment and Result

We test the way that use the electron gun to keep the satellite potential.

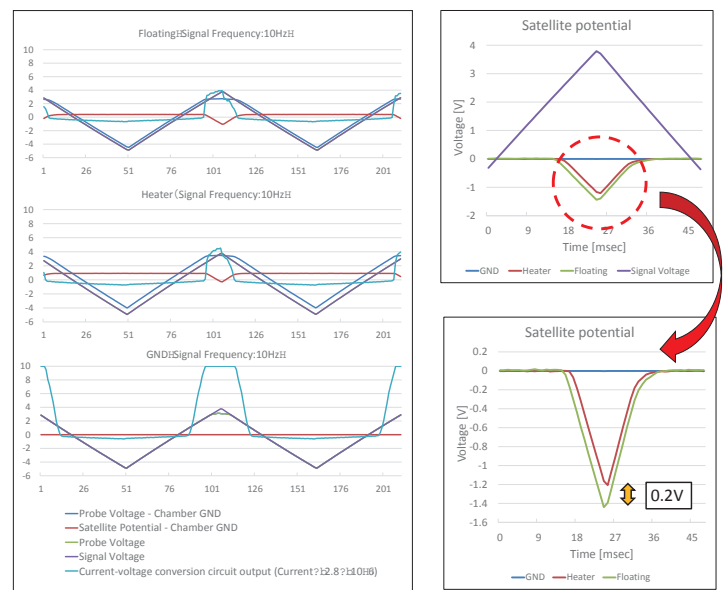
The measurement conditions are as follows :

- Disconnect the system from the earth GND (Floating)
- Use the electron gun (Heater)
- Connect the system to the earth GND (GND)



Next graph is the result of the experiment in the laboratory space plasma chamber. When we use the electron gun, the satellite potential is higher than the floating case (about 0.2V).

However, we couldn't keep the satellite potential value at constant.



## Acknowledgments

The experiments were carried out in the Large Space Plasma Simulation Chamber at the Institute of Space and Astronautical Science (ISAS). This work was carried out by the joint research program of Center for Environmental Remote Sensing (CERES), Chiba University (2015).