

## Computer Simulations on Rocket-Plasma Interactions

- Research Background

Near-Earth space is filled with a plasma, consisting of a huge number of free moving electrons and ions. The plasma interacts with spacecraft and rockets in space and sometimes causes anomalies on their systems. The interaction of spacecraft or rocket with the plasma environment is a very crucial issue for future space development. The computer simulation based on the Particle-In-Cell method is a very powerful tool to solve the problem.

- Project

The project focuses on a sounding rocket which is launched to investigate the Earth's ionospheric region. As a result of interactions of the rocket with the ionospheric plasma, a number of interesting phenomena will take place around the rocket such as rocket charging, plasma sheath/wake formation, and non-uniform potential structures. You may use/improve a pre-existing plasma particle simulator called EMSES to simulate these phenomena. After determining physical and numerical parameters for the EMSES simulations, you will run the program on the FX10 supercomputer owned by Kobe University. Post-processing is also an important aspect of this project; the output data should be processed and visualized with ParaView and a virtual reality system for better understanding of physical phenomena reproduced by the simulations.

- Programming and Computational Skills:

Basic knowledge about Fortran90, parallelization with Message Passing Interface (MPI), and visualization with ParaView will be helpful, but the project is open also for those who are not familiar with the subjects. Some materials and short courses will be given before/during the school.

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