Geospace Environment Simulator Project

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In the space development and utilization, it is very important to understand the interactions between spacecraft/structures and space plasma environment as well as the natural phenomena occurring in space plasma. In order to evaluate the spacecraft-environment interactions quantitatively to contribute to the progress of space utilization and space technology, we aim to develop a proto model of 'Geospace environment simulator' by making the most use of the conventional full-particle, hybrid and MHD plasma simulations. The Geospace environment simulator can be regarded as a numerical chamber in which we can virtually perform space experiments and analyze the temporal and spatial evolution of spacecraft-environment interactions. The geospace environment simulator will be able to provide fundamental data regarding various engineering aspects such as the electrostatic charging and electromagnetic interference of spacecraft immersed in space plasma, which will be useful and important information in determining the design and the detailed specification of spacecraft and space system. In the presentation, we focus on the current status of large-scale computer experiments on heavy ion injection from ion propulsion engine and the influence on the space environment. We are particularly interested in the dynamics of the emitted ions as well as the electrons which are to neutralize the heave ions. The associated perturbation of fields by the ion beam is also of our interest. The electrostatic model of GES can provide the exact solution of the spatial distribution of surface potential of spacecraft including the transient plasma response of its vicinity. This solution can be used as a reference of the one obtained with MUSCAT which has been being developed by JAXA for the numerical evaluation tool for spacecraft potential. We will also mention the link of GES to MUSCAT in terms of solution of spacecraft potential.