

## Three-dimensional full-particle simulations of beam instability

# Taketoshi Miyake[1]; Takamichi Ishikawa[1]; Masaki Okada[2]; Hideyuki Usui[3]; Takeshi Murata[4]; Yoshiharu Omura[3]; Hiroko, O Ueda[5]

[1] Toyama Pref. Univ.; [2] NIPR; [3] RISH, Kyoto Univ.; [4] CITE, Ehime University; [5] JAXA

In efficient exploration and utilization of the geospace environment, it is very important to understand interactions between spacecrafts and electromagnetic environment around themselves. Recently, influences of spacecrafts on space electromagnetic environment are gradually increasing due to new space technologies such as ion engine which is used in HAYABUSA satellite. When the ion engine emit a large quantity of accelerated heavy ions to the space, these heavy ion beams interact with space plasmas around the spacecraft, which can excite some kind of beam instabilities and plasma waves. This kind of beam instabilities and plasma waves become serious noises in observing electromagnetic environment in space by satellites.

We investigate about time evolutions of ion beam instabilities excited by ion beams emitted from ion engine, as a case study of the influences on space environment by spacecraft. We perform three-dimensional computer experiments of ion beam instabilities, and demonstrate nonlinear evolutions of ion beam instabilities, in time as well as in space. Simulation study of beam instabilities are difficult because these instabilities are very sensitive to numerical thermal noises in full-particle simulations. We developed, therefore, three-dimensional particle simulation code which is specialized to parallel computing on large scale super computers, such as Earth Simulator. In the present study, we perform three-dimensional particle simulations of most fundamental beam instabilities excited by a uniform beam at first, and investigate on the interaction between ion beam and space electromagnetic environment.