

Inflation process of a small-scale artificial magnetosphere by plasma injection from a spacecraft

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Magneto Plasma Sail (MPS) was proposed as one of the innovative interplanetary flight systems. The propulsion of MPS is obtained as a result of multi-scale kinetic interactions between the solar wind plasma and a small-scale artificial magnetosphere created around the spacecraft. In order to obtain the maximum thrust, we need to expand the small magnetosphere so that the solar wind can interact with the extended magnetosphere and transfer the momentum to MPS as much as possible. However, the inflation process in the plasma kinetic regime is not clearly known yet. In the current study, we examine the inflation process of a dipole magnetic field by plasma injection by performing three-dimensional particle simulations. We particularly focus on the expansion phase of the dipole fields and analyze the interaction between the plasma beam dynamics and the local magnetic fields. We also examine the relation between the current flow profile and the magnetic field structure.