3D hybrid simulation of interaction between the solar wind and a mini-magnetosphere of magnetized objects

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Interaction between the solar wind and a mini-magnetosphere of magnetized objects is investigated by three-dimensional electromagnetic hybrid simulation (kinetic ion, fluid electron). The study is important for not only understanding of the physical interaction processes for magnetized asteroids but also evaluation of the magnetic sail propulsion that uses a static artificial dipole magnetic field to deflect the solar wind. A physical parameter characterizing the magnetosphere of the magnetized objects is a distance, in units of the ion inertial length, ahead of the object where the dipole magnetic field pressure balances the solar wind ram pressure. If the distance is much smaller than unit, the interaction is very weak and changes in the solar wind velocity and density is negligible. If the distance becomes much larger, it will approach an earth-like magnetosphere. When the distance is the order of the ion inertial length, the ion kinetic effects become much important for the formation and structure of the mini-magnetosphere. A plasma wake is also enhanced in the shadow of the mini-magnetosphere. We develop a three-dimensional hybrid code and investigate the formation and structure of the mini-magnetosphere in the solar wind.