太陽風と誘電物体との相互作用に関するブラソフシミュレーション

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Vlasov simulation on the interaction between solar wind and a dielectric body

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Recent advancement in Vlasov simulation techniques allows us to perform four- and five-dimensional phase-space Vlasov simulations. In the present study, the interaction between solar/stellar wind and a dielectric body is examined as an application of Vlasov code to a macro-scale process.

We assume a two-and-half-dimensional Cartesian system in which spatial grids are taken in the two-dimensional space (x, y) while velocity grids are taken in the three-dimensional space (v_x, v_y, v_z). There exists a spherical/cylindrical insulative body at the center of the simulation system, in which the charge accumulates. At the initial condition, there also exists a uniform plasma flow in the system except the body. The plasma flow is directed to the right (in the x direction) and has a uniform magnetic field which corresponds to the Interplanetary Magnetic Field (IMF). At the all edges and corners of the simulation box, absorbing boundary conditions are imposed while at the left boundary a plasma flow is continuously injected.

In the preset model, the solar-wind plasma accumulates to the surface at dayside of the body, while the plasma void is formed at nightside of the body. Strong electric fields are excited at the sides of the plasma void, which called “wake” fields. Structures of plasma void and wave fields depend on the magnitude and direction of the IMF.