Three-Dimensional MHD Simulation of Interaction between the Solar Wind and Magnetosphere of Hot-Jupiter

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In our solar system, structure and dynamics of planetary magnetospheres are affected by interaction with the solar wind with interplanetary magnetic field (IMF). Moreover, the individualities of planetary magnetospheres are determined by the mass, intrinsic magnetic field, co-rotation period, plasma sources and distance from the sun. Thus three fundamental important parameters for planetary magnetospheres can be presented as the magnetopause distance, Alfven radius, where rotational speed equals the Alfven speed, and distribution and species of plasma sources. Moreover, many characters of planets such as atmosphere and ionosphere are strongly affected by distance from the sun.

In recently, more than three hundreds of extra-solar giant planets have been discovered by observations and their characters are interested in space science. Many features on electromagnetic circumstances are of course not known for the extra-solar giant planets. One of outstanding features is the location of the giant planets and they are so close to the central star. Therefore we have studied interaction of the solar wind with an extra-solar giant planet by using the three-dimensional global MHD simulation when Jupiter is assumed to be located at a very closed distance of 10 solar radii from the sun. In such a situation, a magnetospheric configuration with Alfven wings is usually formed because the Alfven Much number is less than unity for normal conditions of the solar wind and IMF (Interplanetary Magnetic Field). We will present magnetospheric configuration and dynamics of hot-Jupiter when the IMF changes. Magnetic reconnection is also discussed depending on IMF orientation and reconnection rate and polar phenomena such as ionospheric convection and field-aligned currents are demonstrated in sub-Alfvenic condition.