

Energy balance characteristics across the magnetospheric boundary: Validity of MHD description

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We have investigated characteristics of the energy flux flowing perpendicularly into and away from the dayside magnetopause by using the GEOTAIL plasma and magnetic field experiments. The boundary normal direction and the motion of the boundary are inferred, respectively, by using a minimum variance method to the magnetic field components and a momentum balance. For a case study, we have determined (1) All the energy flux show surplus of energy flux input from the magnetosheath to the magnetopause over energy outflow from the magnetopause to the magnetosphere, (2) A net energy flux that remains in the magnetopause amounts to the total of 96 ($\mu\text{W}/\text{m}^2$). We will address the implication and cause of this energy guide in the magnetopause by calling for the physics beyond the MHD limit.

We have investigated characteristics of the energy flux flowing perpendicularly into and away from the dayside magnetopause (bounded on the outer part by the magnetosheath and on the inner part by the magnetosphere), by virtue of the GEOTAIL plasma and magnetic field experiments. The energy flux comprises the kinetic energy flux, the enthalpy flux and the Poynting flux. The boundary normal direction and the motion of the boundary are inferred, respectively, by using a minimum variance method to the magnetic field components and a momentum balance relation with a moving reference frame. For a case study of a substorm event, we have determined the following: (1) All the three kinds of the energy flux show surplus of energy flux input from the magnetosheath to the magnetopause over energy outflow from the magnetopause to the magnetosphere, (2) A net energy flux that consequently remains in the magnetopause amounts to 67.8 by the Poynting flux, 16.5 by the kinetic energy flux, 11.7 by the enthalpy flux and a total of 96 (units are $\mu\text{W}/\text{m}^2$). We will address the implication and cause of this energy guide in the magnetopause by calling for the physics beyond the MHD limit.