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Macro and micro physics of magnetic reconnection in a multi-hierarchy open system RITOKU HORIUCHI, National Institute for Fusion Science, MITSUE DEN, TAKASHI TANAKA, National Institute of Information and Communications Technology, HIROAKI OHTANI, SHUNSUKE USAMI, National Institute for Fusion Science — Based on particle-in-cell (PIC) simulation results of collisionless driven reconnection in a steady state [1], an effective resistivity model is developed for a global magnetohydrodynamic (MHD) simulation in order to bridge over huge gap between macro and micro physics of magnetic reconnection. A reconnection system evolves into a quasi-steady state after an initial transient phase of about one ion-gyration period if the driving flow satisfies some condition [1]. In the steady state, reconnection electric field controlled by microscopic physics balances flux inflow rate which is determined by global dynamics in a macroscopic system. Thus, this effective resistivity model does not include any adjustable parameters relating to kinetic dissipation processes. This resistivity model is applied to global MHD phenomena controlled by magnetic reconnection in the earth magnetosphere. It is found that some global phenomena such as onset of magnetic substorm, dipolarization, and propagation of flux rope, detailed processes of which are longstanding questions, are well reproduced in a global MHD simulation and consistent with the observations.

[1
W. Pei, R. Horiuchi, and T. Sato, Physics of Plasmas, Vol. **8**(2001), pp. 3251-3257.

Ritoku Horiuchi
National Institute for Fusion Science

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