

A simulation study of the tail current sheet at the time of substorm onset

UCHINO, Hiroto^{1*}, MACHIDA, Shinobu¹

¹SPEL, Kyoto University

A substorm is known as a primarily process to release stored energy in the Earth's magnetotail, and the magnetic reconnection as well as the tearing instability are thought to be related to the substorm. Although a number of models for substorm onset have been suggested so far, no consensus is not obtained yet. Recently we proposed a new scheme of substorm onset called "Catapult Current Sheet Relaxation Model" to comprehensively explain our result of the analysis of Geotail data. However, details of the model still remain to be solved. Thus, we conduct a study on a stability of the current sheet with highly stretched dipole magnetic field in order to clarify the mechanism of substorm onset and further to contribute to the progress of the space weather research.

Initially, we give a solution which is modified from the Harris solution that is widely used in the simulation of the magnetic reconnection, to include the contribution of Earth's dipole magnetic field. Then, we run 2-1/2D full-particle PIC simulation code for the approximated Earth's magnetotail. In this simulation, initial locations of particles are determined with a quiet start method to suppress the numerical noise with limited number of particles. We then investigate the relation between the distribution of northward magnetic field originated from the Earth's dipole magnetic field and the location of the magnetic neutral line, as well as the development of the tearing instability and its relationship to the occurrence of the magnetic reconnection.

Keywords: Substorm, Magnetic reconnection, Tearing instability, PIC simulation