Geophysical Research Abstracts,
Vol. 11, EGU2009-9482, 2009
EGU General Assembly 2009

”Thick” equilibrium current sheets in the Earth’s magnetotail: influence of guiding field. Comparison with experimental data.

L. Zelenyi (1), H. Malova (1,2), V. Popov (3), A. Artemiev (1), A. Petrukovich (1), and D. Delcourt (4)

(1) Space Research Institute of Russian Academy of Sciences, Moscow, Russia, (2) Scobeltsyn Institute of Nuclear Physics of Moscow State University, Moscow, Russia (hmalova@yandex.ru), (3) Physics Department of Moscow State University, Moscow, Russia , (4) Centre d’Etude Terrestre et Planetaires, Paris, France

The self-consistent theory of “thick” current sheets in collisionless plasma with double-temperature distribution or high-temperature tail is developed taking into account the interaction of several plasma components: electrons, cold and hot ions. The quasi-adiabatic approximation is used to describe the motion of ions, whereas the fluid approximation is taken as a more appropriate one for electrons. Grad-Shafranov equations are solved to obtain the equilibrium structure of current sheet. It is shown that self-consistent equilibrium solutions might exist in a wide range of parameters of the system. The corresponding profiles of current densities and magnetic fields depend on the relative plasma density of colder and warmer ion populations and their temperatures. These solutions might describe single as well as several-peaked current sheets. The thicknesses of the obtained current equilibria are several times larger than the characteristic Larmor radius (as in the models with a single plasma component). Therefore theory provides possible explanation of the appearance of a really thick ($\geq$ Larmor radii) current sheets often observed in space experiments. We also studied the influence of a guiding magnetic field on such equilibrium. It is found that the presence of guiding field might substantially change properties of charged particle trajectories, which significantly modify the current sheet structure. This work demonstrates that characteristic profiles of current sheet parameters provided by our model are in good agreement with the ones observed experimentally.

This work was supported by RFBR grants 08-02-00407, 06-02-72561 and Russian Ministry of Science program (НШ-472.2008.2)