Geophysical Research Abstracts, Vol. 7, 00101, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00101

Nonlinear particle dynamics in bifurcated current sheets

D. C. Delcourt (1), H. V. Malova (2,3) and L. M. Zelenyi (3)

(1) CETP-CNRS-IPSL, Saint-Maur des Fosses, France, (2) Skobeltsyn Institute of Nuclear Physics, MSU, Moscow, Russia, (3) Space Research Institute, RAS, Moscow, Russia (dominique.delcourt@cetp.ipsl.fr/33-1-48894433)

Recent in-situ measurements reveal that thin current sheets in the Earth's magnetotail often exhibit a double-humped structure with two current maxima on either side of the midplane, a situation which is at variance with the single-humped (Harris-like) structure that is commonly postulated. We review some features of the nonlinear dynamics of charged particles in such "bifurcated" current sheets. We show that the particle behavior may be ordered using an adiabaticity parameter Keff which is similar to the usual parameter K but evaluated away from the midplane. For weak field reversals (Keff $>$ 1), it is found that the magnetic moment scattering experienced by the particles may be described as the result of perturbation of their gyromotion by a centrifugal impulse as is the case in a simple parabolic field. However, the current sheet bifurcation here yields repeated impulses and specific magnetic moment variations with possible quasi-adiabatic behavior at Keff = 1. For sharp field reversals (Keff $<$ 1), comparison of Poincaré surfaces of section reveals that the phase space partition into trapped, stochastic, and transient domains persists in double-humped current sheets provided that these are nearly symmetrical with respect to the midplane. In contrast, an asymmetrical current distribution leads to significant alteration of the phase space structure with prominent expansion of the stochastic regime.