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Stability of thin current sheets in the Earth's magnetotail

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Experimental findings of the last decade (Interball, Geotail, Cluster observation) shed a new light on the dynamics magnetotail plasma system and its role in plasma processes during substorm perturbations. The reconnection processes in thin current sheets (with the thicknesses about ion gyroradius) possibly play an important role in substorm magnetotail dynamics. To investigate the stability of a thin current sheets in magnetotail the analytical self-consistent model of anisotropic current sheet, where plasma consists of anisotropic protons and electrons, is developed. The influence of the electron population is taken into account assuming Boltzman-like quasi-equilibrium distribution in the ambipolar electrostatic field. It is shown that thin current sheets have larger free energy than Harris's ones, this gives the motivation for revisiting the classical problem of their stability. The linear tearing instability as the most natural mechanism for the spontaneous reconnection of magnetic field lines is investigated in the frame of anisotropic model. Contrary to previous investigations of Harris-like current sheets with $B_n \neq 0$, where current sheet were found to be stable due to electron compressibility effect, our investigations demonstrated the "gaps" in parameter space where the system could become unstable. It is shown that the main region of stability is concentrated near $B_n \sim 0.1$ and its width depends on the temperature ratio T_i/T_e, average pitch-angles of electrons and the anisotropy of ion source $\varepsilon = v_T/v_D$. This investigation of the magnetotail current sheets stability could be useful to reconsider the "old" problem of stability of current sheets with magnetized electrons.