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About the Theory of Equilibrium and Stability of Nonelectroneutral Current Sheaths in Space Plasma

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A new procedure of examination of the equilibrium and stability of current sheaths in space plasma taking into account the effect of polarization is offered. Novelty of the approach lies in the fact that stability of the current sheath is examined with solving the kinetic equation by angle integration (by contrast to the method of paths applied earlier). The advantages of the offered method is that it has allowed obtaining of the exact solution of the kinetic equation in contrast to the solution obtained by the method of paths where replacement of the real paths of particles with their approximate trajectories is required to realize the analytical solution.
The necessity of statement of Cauchy problem in the course of deriving the solution for an equilibrium (stationary) current sheath is justified. It appears that equilibrium current sheaths are thus structurally unstable. Solutions of current sheath type are realized only in some areas of 7-dimensional space of parameters. The phase volume of these areas is small in comparison with the whole phase volume of the interval on which these parameters are defined. Thus, the stationary current sheath is realized only in those areas of the outer space where medium parameters have well defined ("allowed") values.
The derived dispersion equation gives the chance to study not only a tearing instability, but also all the remaining natural eigenmodes of instability of the current sheath. The derived growth rate of tearing-instability is by an order of magnitude greater and more and thus exceeds the earlier obtained values.