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Comparison of current sheets in solar wind and planetary magnetospheres

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Current sheets are structures that can be formed at the boundaries of different plasmas, magnetic fluxes and in areas with strong field gradients. When current sheets thicknesses become comparable with proton gyroradii they can play a key role of reservoirs of a free magnetic energy that can be released due to development of different current sheet instabilities. Such comparatively thin current sheets were relatively recently discovered by space missions in the magnetospheres of the Earth and planets, as well as in the solar wind. The development of a self-consistent current sheet theory in collisionless plasma has relatively long and dramatic history. The solution of the problem of thin current sheet structure and stability become possible in a frame of a kinetic quasi-adiabatic approach explaining multiscale embedded structure of thin current sheets and their metastability. We showed that the structure and stability of current structures are completely determined by the nonlinear dynamics of plasma particles within them. The similarity and difference of the current sheets in the solar wind and planetary magnetospheres are presented. Development of theoretical approaches to investigation of different current systems in space are discussed.