Vlasov equilibrium of a tangential layer: the principles

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The classical method for constructing a Vlasov equilibrium of a tangential layer consists in writing the distribution function as a function of the particle invariants. This has led up to now to a limited class of solutions, the most famous one being the "Harris sheet" [1]. In this particular solution, the current in the layer $j = q\, n^*(v_i - v_e)$ is localized due to the only density localization, the velocities being constant. This is why such a solution can only account for current layers that are surrounded by vacuum, which has few applications in space or in astrophysical plasmas. We will review the main attempts in the literature to go beyond this too simple solution and the limitations of these generalizations hitherto. We show the necessity of considering two-valued functions to reach a class of solutions sufficiently large to allow realistic modeling. A quasi-analytical model is shown [2], allowing to model asymmetric "magnetopause-like" layers, with a well controlled form of the magnetic field variation and fixed asymptotic values of the densities and temperatures on both sides. The numerical proof of this equilibrium [3] is presented in an associated talk.

References

[1] E. Harris, Il Nuovo Cimento (1955–1965) **23**, 115 (1962).
[2] G. Belmont, N. Aunai, and R. Smets , *Phys. Plasmas* **19**, 022108 (2012);
[3] N. Aunai, G. Belmont, and R. Smets , submitted to *Phys. Plasmas* (2013)