

The collisionless transient pinch

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The mechanism of the transient pinch at low densities, outlined in an early paper by Rosenbluth, has been studied in detail. The thickness of the surface current layer is found to be the electron inertial length (c/ω_{pe}). The electron and ion trajectories have been calculated, the latter being essentially due to the electrostatic field which transfers the $j \times B$ force from the electrons to the positive ions. The collapse velocity is comparable to the Alfvén velocity, but the theory of magnetohydrodynamics (MHD) is not applicable to collision-free plasmas.

References

- [1] M. Rosenbluth, Magnetohydrodynamics, ed.
R.K.M. Landshoff, (Stanford University Press,
1957) p.57.