

Abstract Submitted
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Kink deformation of Weibel-mediated current filaments and onset of shock formation¹ CHARLES RUYER, E. PAULO ALVES, FREDERICO FIUZA, SLAC National Accelerator Laboratory, Menlo Park, USA — The Weibel instability is believed to mediate the interaction of high Mach number collisionless shocks in weakly magnetized astrophysical environments. Although the generation of current filaments and strong magnetic fields by this instability has now been demonstrated experimentally, it is still not clear what is the long-term evolution of these filaments and how they lead to shock formation. We have studied the stability of Weibel-mediated current filaments using 2D/3D Particle-In-Cell simulations and analytical theory. We show that these are prone to kink-like instabilities that we characterize in both the linear and non-linear stage for a single filament, leading to an efficient ion slowing down and isotropization. We then demonstrate that our results are relevant to the self-consistent counter-streaming plasma interaction. Our 3D simulations show that the kink deformation dominates the late-stage of the interaction, when the current filaments break and most of the flow dissipation occurs, leading to the onset of magnetic turbulence and shock formation. We will discuss the important implications of these results for the shock structure and its ability to accelerate particles.

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