

MIRROR AND WEIBEL INSTABILITIES: SIMILARITIES AND NONLINEAR DYNAMICS

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A commonality in nonlinear saturation mechanisms of Mirror and Weibel instabilities near threshold is demonstrated. In both cases the major contribution is provided by modification of the velocity distribution function in the vicinity of small parallel particle velocities (ions in Mirror case and electrons in Weibel). The final relaxation scenario is based on almost resonant particle interaction with Mirror/Weibel modes. This scenario differs from that in quasilinear plateau formation (or equivalent trapping effects). The analogy between nonlinear regimes of those instabilities developing far from thresholds becomes muted. The saturated plasma state can be considered as a magnetic counterpart to electrostatic BGK modes. Our analytical model is verified by relevant numerical simulations. Test particle and PIC simulations indeed show that it is a modification of distribution function at small parallel velocities that results in fading away of free energy driving Mirror/Weibel modes. The multipoint measurements in space plasma are used to validate a proposed scenario.