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Kinetic equilibrium as the initial condition for asymmetric reconnection in hybrid simulations

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Recently, a new theory, based on the physical concept of particle accessibility, has allowed constructing collisionless kinetic equilibria for general (asymmetric) current sheets. The present work makes a step further by confronting, for the first time, such kinetic equilibria theory to numerical simulations. Two dimensional hybrid simulations, initialized with this theoretical model, are shown to lead actually to a steady asymmetric current sheet. In contrast, a similar current sheet initialized with the same density, temperature and magnetic field profiles, but with local Maxwellian distributions, shows FLR effects, macroscopic reconfiguration and wave emission. We can so outline that the kinetic framework is mandatory for two issues: 1) it brings strong constraints on the possible macroscopic profiles in the current sheet and 2) it provides a true stationary equilibrium while the local Maxwellian initialization, even with the same macroscopic profiles, is not stationary.