Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Hybrid simulations of strong filamentation of relativistic electron beam propagating through collisionless plasma.[1] VLADIMIR KHUDIK, GENNADY SHVETS, Institute for Fusion Studies, The University of Texas at Austin, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory — Development of the Weibel instability during propagation of relativistic beam through ambient plasma leads to formation of low-current filaments, which continue to merge with each other and eventually form filaments with large currents. Analytical theory and computationally efficient simulations of this nonlinear stage of Weibel instability are presented. In our hybrid approach [1] beam electrons are modeled using numerical macroparticles while plasma electrons are modeled as a passive fluid responding to the beam evolution. But in contrast to [1], present analysis captures effects of violation of the charge quasi-neutrality near the boundaries of high-current filaments and reproduces in details the structure of the electron plasma-void regions. This approach is especially effective in the cases when beam electrons have a large relativistic factor. Results of hybrid simulations are compared with those obtained from direct fully electromagnetic PIC simulations and applicability limits of the developed model are established. [1] Oleg Polomarov et al., Phys. Plasmas 14,043103 (2007).

[1]Supported by the US DOE grant DE-FG02-05ER54840.

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Date submitted: 17 Jul 2009 Electronic form version 1.4