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Collisionless shock waves mediated by Weibel Instability[1] NEDA NASERI, PANPAN RUAN, XI ZHANG, VLADIMIR KHUDIK, GENNADY SHVETS, Department of Physics and Institute for Fusion Studies, the University of Texas at Austin — Relativistic collisionless shocks are common events in astrophysical environments. They are thought to be responsible for generating ultra-high energy particles via the Fermi acceleration mechanism. It has been conjectured [1] that the formation of collisionless shocks is mediated by the Weibel instability that takes place when two initially cold, unmagnetized plasma shells counter-propagate into each other with relativistic drift velocities. Using a PIC code, VLPL [2], which is modified to suppress numerical Cherenkov instabilities, we study the shock formation and evolution for asymmetric colliding shells with different densities in their own proper reference frame. Plasma instabilities in the region between the shock and the precursor are also investigated using a moving-window simulation that advances the computational domain at the shock's speed. This method helps both to save computation time and avoid severe numerical Cherenkov instabilities, and it allows us to study the shock evolution in a longer time period. Project is supported by US DOE grants DE-FG02-04ER41321 and DE-FG02-07ER54945.

[1] M. V. Medvedev et al., ApJ 526, 697-706 (1999)
[2] A. Pukhov, J. Plasma Phys. 61, 425-433 (1999)

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