Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Collisionless shock formation and electron acceleration in conditions relevant for NIF experiments ANNA GRASSI, SLAC National Accelerator Laboratory, DREW P. HIGGINSON, LLNL, HANS RINDERKNECHT, University of Rochester, LLE, GEORGE SWADLING, DMITRI RYUTOV, LLNL, ANATOLY SPITKOVSKY, Princeton University, HYE-SOOK PARK, LLNL, FREDERICO FIUZA, SLAC National Accelerator Laboratory — Collisionless shocks are ubiquitous in astrophysics and are known to be important in magnetic field amplification and acceleration of high-energy radiating electrons and cosmic rays. While diffusive shock acceleration (DSA) is well established, the details of how particle injection into the DSA phase depends on the shock structure are not yet fully clear. Recently laser-driven high-energy-density (HED) experiments at the National Ignition Facility (NIF) have observed for the first time the formation of collisionless shocks mediated by electromagnetic instabilities and nonthermal electron acceleration, opening a path for the detailed study of the shock acceleration physics in the laboratory. We will present particle-in-cell (PIC) simulations of counterstreaming inhomogeneous plasmas for the conditions of NIF experiments and discuss the associated shock formation and electron acceleration physics. We show that the inhomogeneous plasma profiles lead to efficient formation of a turbulent shock mediated by the Weibel instability and that electrons can be injected/accelerated to nonthermal energies via a Fermi-like mechanism occurring within the finite, turbulent shock transition. Our results suggest that high Mach number astrophysical shocks can be efficient electron accelerators.

Anna Grassi
SLAC National Accelerator Laboratory

Date submitted: 28 Jun 2019 Electronic form version 1.4