Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Electron Weibel Instability Mediated Laser Driven Electromagnetic Collisionless Shock QING JIA, Department of Astrophysical Sciences, Princeton University, KUNIOKI MIMA, Institute of Laser Engineering, Osaka University, HONG-BO CAI, Institute of Applied Physics and Computational Mathematics, Beijing, TOSHIHIRO TAGUCHI, Department of Electric and Electronic Engineering, Setsunan University, HIDEO NAGATOMO, Institute of Laser Engineering, Osaka University, X.T. HE, Institute of Applied Physics and Computational Mathematics, Beijing — As a fundamental nonlinear structure, collisionless shock is widely studied in astrophysics. Recently, the rapidly-developing laser technology provides a good test-bed to study such shock physics in laboratory. In addition, the laser driven shock ion acceleration is also interested due to its potential applications. We explore the effect of external parallel magnetic field on the collisionless shock formation and resultant particle acceleration by using the 2D3V PIC simulations. We show that unlike the electrostatic shock generated in the unmagnetized plasma, the shock generated in the weakly-magnetized laser-driven plasma is mostly electromagnetic (EM)-like with higher Mach number. The generation mechanism is due to the stronger transverse magnetic field self-generated at the nonlinear stage of the electron Weibel instability which drastically scatters particles and leads to higher energy dissipation. Simulation results also suggest more ions are reflected by this EM shock and results in larger energy transfer rate from the laser to ions, which is of advantage for applications such as neutron production and ion fast ignition.

Qing Jia
Department of Astrophysical Sciences, Princeton University

Date submitted: 24 Jul 2015 Electronic form version 1.4