**Formation of Collisionless Shocks and Magnetic Reconnection by Laser-produced Plasma Ablation**

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**Abstract**

Collisionless shocks and magnetic reconnection play important roles in particle acceleration in space and astrophysical objects. The advent of high-intensity lasers allows the formation of collisionless shocks and magnetic reconnection in a laboratory. (1) We perform particle-in-cell simulations of electron-proton collisionless shocks generated by a plasma ablation expanding into a magnetized background plasma. The interaction between the ablated and background plasmas generates a magnetized collisionless shock. The Biermann battery and the Weibel instability-generated magnetic fields are observed in the ablation side. In 3D, the simulated proton radiography is compared with the experimental result to appear in the Omega/Omega-EP laser facility, LLE, as a part of the ACSEL collaboration. Secondly, (2) we perform particle-in-cell simulations of forced magnetic reconnection in collisionless and weakly collisional regimes generated by counter-streaming oppositely magnetized ablation plumes, following the experiments and model of Fiksel et al. PRL (2014). We explore conditions of shock formation by expanding plumes before magnetic reconnection operates, and study the interplay between collisionless shocks and magnetic reconnection, and their role in particle acceleration via Fermi acceleration and/or the X-point acceleration.