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Studying astrophysical particle acceleration mechanisms with colliding magnetized laser-produced plasmas W. FOX, W. DENG, A. BHATTACHARJEE, Princeton Plasma Physics Laboratory, G. FIKSEL, P. NILSON, D. HABERBERGER, P.-Y. CHANG, D. BARNAK, Laboratory for Laser Energetics
— Significant particle energization is observed to occur in many astrophysical environments, and in the standard models this acceleration occurs as a part of the energy conversion processes associated with collisionless shocks or magnetic reconnection. A recent generation of laboratory experiments conducted using magnetized laser-produced plasmas has opened opportunities to study these particle acceleration processes in the laboratory. Ablated plasma plumes are externally magnetized using an externally-applied magnetic field in combination with a low-density background plasma. Colliding unmagnetized plasmas demonstrated ion-driven Weibel instability [1] while colliding magnetized plasmas drive magnetic reconnection [2]. Both magnetized and unmagnetized colliding plasma are modeled with electromagnetic particle-in-cell simulations which provide an end-to-end model of the experiments. Using particle-in-cell simulations, we provide predictions of particle acceleration driven by reconnection, resulting from both direct x-line acceleration and Fermi-like acceleration at contracting magnetic fields lines near magnetic islands.

[1] W. Fox, G. Fiksel, A. Bhattacharjee, et al, PRL 111, 225002 (2013).
[2] G. Fiksel, W. Fox, A. Bhattacharjee, et al, PRL 113, 105003 (2014).

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