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Magnetic field generation and evolution in high-energy-density plasmas C. MOISSARD, École Normale Supérieure de Cachan, Princeton Plasma Physics Laboratory, W. DENG, Princeton University, Princeton Plasma Physics Laboratory, W. FOX, Princeton Plasma Physics Laboratory, A. BHATTACHARJEE, Princeton University, Princeton Plasma Physics Laboratory — Magnetic reconnection has been proposed to account for many astrophysical phenomena and is inferred to play an important role in fusion. Recent experiments have studied magnetic reconnection in high-energy-density (HED) plasmas at the Vulcan, Omega and Shenguang laser facilities. Plasma bubbles are created by laser irradiation of solid targets. These bubbles self-generate MG-scale magnetic fields, and the collision of pairs of bubbles drives reconnection of this magnetic field. 2D first principles particle-in-cell (PIC) simulations with a collision operator have been used to study the evolution of the magnetic field in these experiments. The ablation of the target is modeled by a Gaussian heating function acting on an initially cold, high density plasma. It is shown that the Biermann battery effect ($\nabla T \times \nabla n$ in generalized Ohm's law) can account quantitatively for the magnetic field produced. However, special attention must be given to the temperature, which can no longer be considered as a scalar in the regime of the experiments. In simulations with a collision operator, the evolution of the magnetic field is compared to Braginskii's transport theory. Results of 3D simulations of magnetic reconnection with the self-consistent Biermann effect will be reported.

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