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Direct observation of target material effects on high power laser-driven magnetic field generation[1] PAUL T. CAMPBELL, University of Michigan, CHRISTOPHER A. WALSH, JEREMY CHITTENDEN, Imperial College London, GENNADY FIKSEL, University of Michigan, PHILIP NILSON, University of Rochester, ALEXANDER G. R. THOMAS, KARL KRUSHELNICK, LOUISE WILLINGALE, University of Michigan — We report on experimental and computational observations of target material effects on magnetic field generation in high-power laser produced plasmas. Experiments performed with the OMEGA EP laser system compared nanosecond laser pulses focused to moderate intensity ($I_L = 2 \times 10^{14}\mathrm{Wcm}^{-2}$) with multi-picosecond pulses focused to high intensity ($I_L > 10^{19}\mathrm{Wcm}^{-2}$) interacting with foil targets. Proton radiography measured differences in the strength and spatial profile of self-generated magnetic fields as the target material was varied between plastic (CH), aluminum and copper. In the case of moderate intensity pulses, magneto-hydrodynamics (MHD) simulations including radiation transport reveal ionization dynamics in higher Z targets that initiate multiple regions of Biermann battery ($\nabla T_e \times \nabla n_e$) magnetic field generation. At high intensities, we observe enhanced filamentation in lower Z, insulator targets. These results should help inform magnetized high energy density (HED) and laboratory astrophysics experiments, such as laser-driven magnetic reconnection, where precise knowledge of the initial magnetic field topology is crucial.

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