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Measuring Magnetic Fields Using Protons for Characterizing Laser-Driven Collisionless Shocks* N.L. KUGLAND, H.-S. PARK, Lawrence Livermore National Laboratory, L. GARGATE, Princeton University, C. PLECHATY, Lawrence Livermore National Laboratory, R. PRESURA, Univ. of Nevada Reno, J.S. ROSS, D.D. RYUTOV, Lawrence Livermore National Laboratory, A. SPITKOVSKY, Princeton University, B.A. REMINGTON, Lawrence Livermore National Laboratory — We present progress in the use of proton deflectometry and radiography to study collisionless shocks in experiments at the OMEGA & OMEGA EP laser facilities. Collisionless shocks are important for astrophysical phenomena such as supernova remnants and ultra high-energy cosmic ray acceleration. The shocks will be created by two laser-ablated counter-streaming supersonic CH_2 plasmas with v = 1000 km/s and $n_i = 10^{17} - 10^{18}$ cm^{-3}, sufficient that the ion-ion collisional mean free path is larger than the mm-scale system. Hydrodynamic simulations predict possible regular grad(n) x grad(T) magnetic fields; particle-in-cell simulations predict filaments and turbulent magnetic fields B_t that change direction with a correlation length L. Turbulent fields blur the proton beam; for example, 5 MeV protons blur $\approx$ 2 mrad for B_t = 20 kG and L = 100 μm. The particle-in-cell code LSP has been used to generate synthetic proton images and explore the sensitivity of proton diagnostics to the signatures of collisionless shock development.
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