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Observation of astrophysical Weibel instability in counterstreaming laser-produced plasmas W. FOX, University of New Hampshire, G. FIKSEL, University of Rochester, Laboratory for Laser Energetics (LLE), A. BHATTACHARJEE, Princeton University and PPPL, K. GERMASCHEWSKI, UNH, P.-Y. CHANG, S.X. HU, P.M. NILSON, LLE — Astrophysical shocks are typically collisionless and require collective electromagnetic fields to couple the upstream and downstream plasmas. The Weibel instability has been proposed to be one of such collective mechanism. Here we present laboratory tests of this process through observations of the Weibel instability generated between two counterstreaming, supersonic plasma flows, generated on the OMEGA EP laser facility by irradiating of a pair of opposing parallel CH targets by UV laser pulses (0.351 μm, 1.8 kJ, 2 ns). The Weibel-generated electromagnetic fields were probed with an ultrafast proton beam, generated with a high-intensity laser pulse (1.053 μm, 800 J, 10 ps) focused to $> 10^{18}$ W/cm^2 onto a thin Cu disk. Growth of a striated, transverse instability is observed at the midplane as the two plasmas interpenetrate, which is identified as the Weibel instability through agreement with analytic theory and particle-in-cell simulations. These laboratory observations directly demonstrate the existence of this astrophysical process, and pave the way for further detailed laboratory study of this instability and its consequences for particle energization and shock formation.

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