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Characterization of >100 T magnetic fields associated with relativistic Weibel instability in laser-produced plasmas.[1] ROHINI MISHRA, CHARLES RUYER, SLAC National Accelerator Laboratory, SEBASTIAN GOEDE, Helmholtz-Zentrum Dresden-Rossendorf and TU Dresden, Dresden, Germany, CHRISTIAN ROEDEL, MAXENCE GAUTHIER, SLAC National Accelerator Laboratory, KARL ZEIL, ULRICH SCHRAMM, Helmholtz-Zentrum Dresden-Rossendorf and TU Dresden, Dresden, Germany, SIEGFRIED GLENZER, FREDERICO FIUZA, SLAC National Accelerator Laboratory — Weibel-type instabilities can occur in weakly magnetized and anisotropic plasmas of relevance to a wide range of astrophysical and laboratory scenarios. It leads to the conversion of a significant fraction of the kinetic energy of the plasma into magnetic energy. We will present a detailed numerical study, using 2D and 3D PIC simulations of the Weibel instability in relativistic laser-solid interactions. In this case, the instability develops due to the counter-streaming of laser-heated electrons and the background return current. We show that the growth rate of the instability is maximized near the critical density region on the rear side of the expanded plasma, producing up to 400 MG magnetic fields for Hydrogen plasmas. We have found that this strong field can be directly probed by energetic protons accelerated in rear side of the plasma by Target Normal Sheath Acceleration (TNSA). This allows the experimental characterization of the instability from the analysis of the spatial modulation of the detected protons. Our numerical results are compared with recent laser experiments with Hydrogen jets and show good agreement with the proton modulations observed experimentally.

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