Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

The generation of tens kT magnetic fields by transport instability of laser generated electrons in a near critical preformed plasma

TOMA TONCIAN, BJORN MANUEL HEGELICH, University of Texas at Austin, OSWALD WILLI, GOETZ LEHMANN, Heinrich Heine University Duesseldorf —

First direct measurements of the electron transport along extended wire targets by Quinn et al [PRL **102** (2009)] revealed a charging current and associated magnetic field moving close to the speed of light away from focal volume of the employed heating laser. The motion of the electrons is bound electrostatic to the proximity of the solid. A return current compensating the escaping charge is formed at the surface of the solid, the overall current loop sustaining kT magnetic fields, with traversal decay lengths of μm. In our study we show by means of numerical 2 dimensional particle in cell simulations that the motion of the hot electrons and dynamic of the charge compensating return current can be dramatically affected by a preformed μm scale length plasma gradient on the solid surface. In particularly the two velocities distribution and two antiparallel currents developing in the near critical plasma are unstable in respect of two stream and Kevin Helmholtz instability. The particle motion becomes locally magnetized resulting in current eddies trapping particles and localized magnetic and electric fields with values of tens of kT and TV/m sustained on μm scales and with characteristic decay times of ps.

Toma Toncian
University of Texas at Austin

Date submitted: 10 Jul 2014 Electronic form version 1.4