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P4.2009 Interactions of crossing laser pulses in plasma with applications to auxiliary heating

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It has been suggested that crossing two electron beams within the fusion plasma may increase the energy transfer to the fuel, improving heating of the fuel and possibly pushing the hot-spot over threshold for ignition. The interaction and its dispersion relation were first derived in a theoretical study by Ratan et al. [1]. This interaction is collisionless and so is expected to perform better than collisional stopping for relativistic electron beams. For this reason it shows promise as an auxiliary heating process for conventional hotspot implosions, especially in variants which trade heating for improved implosion stability such as the wetted-foam implosions described by Olson et al. [2].
In this work I present a simulation study of effects observed at a Vulcan laser experiment in which crossing filaments of a channelling laser pulse produced turbulent magnetic field structures observed using proton radiography. This turbulence fits expectations of the cascade of energy from crossing electron beams through Langmuir waves into breaking ion-acoustic waves and the simulations provide insight into the mechanism by which this turbulence is formed.
References
1. Ratan, N. et al. Dense plasma heating by crossing relativistic electron beams. Phys. Rev. E 95, 013211 (1 Jan. 2017).
2. Olson, R. E. et al. First Liquid Layer Inertial Confinement Fusion Implosions at the National Ignition Facility. Phys. Rev. Lett. 117, 245001 (24 Dec. 2016).

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