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Laser channeling in mm-scale underdense plasmas of fast ignition[1]

C. REN, G. LI, R. YAN, University of Rochester, T.L. WANG, J. TONGE, W.B. MORI, UCLA — Two dimensional particle-in-cell simulations show that laser channeling in mm-scale underdense plasmas is a highly nonlinear and dynamic process involving laser self-focusing and filamentation, channel expansion through ponderomotive blowout and high mach number shock waves, plasma density snowplowing, laser hosing, and channel bifurcation and merging. The channeling speed is much less than the laser linear group velocity. The simulations find that the channeling time T_c and the total required energy E_c to reach the critical surface scale with the laser intensity I as $T_c \sim I^{-0.64}$ and $E_c \sim I^{0.36}$. The scaling shows that low-intensity channeling pulses are preferred to minimize the required pulse energy but with an estimated lower bound on the intensity of $I \approx 4 \times 10^{18}$W/cm^2 if the channel is to be established within 100ps. These results will also be compared with those from smaller scale 3D simulations.

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