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On the role of relativistic shocks in fast ignition FREDERICO FIUZA, RICARDO FONSECA, LUIS SILVA, GoLP/IPFN - Instituto Superior Tecnico, JOHN TONGE, JOSHUA MAY, Department of Physics & Astronomy, University of California, Los Angeles, WARREN MORI, Department of Electrical Engineering and Department of Physics & Astronomy, University of California, Los Angeles, CHUANG REN, University of Rochester — One of the critical issues for fast ignition of fusion targets is to understand/optimize the coupling of the ignition laser to the fast particles, and their transport in the mildly to high dense region of the target. We have performed a series of 2D PIC simulations in order to examine laser absorption and electron transport using ignition lasers with ultra-high intensities, up to $5\text{x}10^{21}\text{W/cm}^2$, and density gradients up to 1000 nc. Our results indicate that the dynamics of the Weibel/streaming instabilities leads to an isotropization of inward heat flux. This causes energy to be bottled up near the laser interaction point causing a shock to be launched. In uniform plasmas, this process and the emission of plasmons by the inward flowing electrons leads to a softening of the electron energy spectrum to the 1-3 MeV range for ultra-high laser intensities. In fast ignition (both channel and cone guided) this shock and the associated heat flux need to propagate up a density gradient to the core. The inclusion of the density gradient is observed to be crucial, leading to a stronger energy release by the shock structure and therefore to potentially higher efficiencies.

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