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Plasma Heating by Intense Electron Beams in Fast Ignition NATHAN SIRCOMBE, AWE plc, MARK SHERLOCK, ROBERT BINGHAM, PETER NORREYS, CLF, Rutherford Appleton Laboratory — Collisionless electron beam-plasma instabilities are expected to play an important role in fast ignition. Such beams are produced by the short high power ignition laser interacting with long scale length plasmas. Here we present results from a one dimensional Vlasov-Poisson code used to investigate different electron beam temperatures and background plasma conditions. The simulations demonstrate that the beam-plasma instabilities drive large amplitude electrostatic waves that undergo the parametric decay instability driving backwards propagating electrostatic waves and much lower frequency ion acoustic waves. Saturation of the beam-plasma instability creates a plateau in the electron distribution function consistent with quasi-linear theory. We observe the creation of high energy tails in the electron and ion distribution functions, formed by the trapping of particles in the waves formed during the collapse of the beam. At the highest electron-beam temperatures we observe the formation of coherent phase-space structures - a direct consequence of the cascade nature of the parametric instability. These simulations are clearly beyond a simple quasi-linear treatment and demonstrate the transfer of energy from an incident beam to the ion population via collisionless effects. Implications of these mechanisms to the fast ignition scheme will be discussed.

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