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An Empirical Model for the Interaction of Ultra-Intense Laser Pulses with Fully Ionized Plasmas Including Electrostatic Effects J.-H. YANG, R.S. CRAXTON, Laboratory for Laser Energetics, U. of Rochester — This work investigates the capability of ultrafast lasers with irradiance $I \geq 10^{18}$ W cm^{-2} to produce highly energetic electron beams in a Gaussian focus in a low-density plasma. A simple particle simulation code including a physical model of collective electrostatic effects in relativistic plasmas has been developed. Without electrostatic fields, free electrons escape from the Gaussian focal region of a 10-ps petawatt laser pulse very quickly, well before the laser field reaches its maximum amplitude. In this case very small net energy transfer occurs, indicating that free electrons cannot extract enough energy for ignition. However, it has been demonstrated that the electrostatic field generated by the electron flow is able to strongly modify the range and direction of the laser-generated MeV electrons by allowing trapped electrons to experience much higher laser-intensity peaks along their trajectories and, therefore, be accelerated to higher velocities, drifting along the laser direction. This modeling predicts some collimation, but not enough to meet the requirements of fast ignition.
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