

Particle-in-cell simulations of filamentation in laser wakefields

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The laser filamentation instability is observed in plasma wakefields with sub-critical densities, and in high density inertial fusion plasmas. This leads to non-uniform acceleration or compression respectively. Here, we present simulation results on laser filamentation in plasma wakefields. Two-dimensional simulations have been carried out using the particle-in-cell code Osiris. The filament intensity was found to increase exponentially before saturating. The maximum amplitude to which the highest intensity filament grew for a specific set of parameters was also recorded, and plotted against a corresponding parameter value. Clear, positively correlated linear trends were established between plasma density, transverse wavenumber k , laser pulse amplitude and maximum filament amplitude. Plasma density and maximum filament amplitude also showed a positive correlation, which saturated above a certain plasma density. Pulse duration and interaction length did not affect either filament intensity or transverse k -value in a predictable manner. There was no discernible trend between pulse amplitude and filament width.