Abstract

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Title: Localized heating of ions in magnetized plasma in a laser-plasma interaction

Short Abstract:

Laser plasma interaction studies have covered a large area of fundamental as well as applied interest. With the advent of high power, short pulse low frequency lasers (e.g. CO_2 laser) and magnetic fields of the order of Kilo Tesla in laboratory, a new regime of laser plasma interaction studies with magnetized electrons has been achieved. We focus on studying various aspects of this particular regime through PIC simulations using Osiris4.0. We demonstrate the absorption of laser energy directly into ion species with the application of external magnetic field to the system and choice of laser frequency lying below the lower hybrid resonance frequency [1,2,3]. We identify the presence of lower hybrid oscillations in plasma when the laser is incident on a sharp plasma density profile under the above-mentioned conditions. For inhomogeneous plasma density profile, on the other hand, we observe localized absorption of laser energy in plasma. We propose a mechanism to allow localized absorption of laser energy by choosing appropriate plasma density profile. The laser first excites electromagnetic perturbations in plasma. The density gradient has been chosen so as to allow the propagation of these perturbations in plasma. These perturbations propagate well until they encounter a resonance point where the conversion of energy takes place. The electromagnetic energy from laser first converts to electrostatic fluctuations and then finally into kinetic energy of ions. This conversion takes place where the incident laser frequency matches the lower hybrid resonance point in plasma. The absorption point can be tailored with incident laser frequency and/or plasma density profile. We propose to present a detailed parametric study and observations on this work.

References:

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