

O4.209 Advanced multi-dimensional simulations on parametric instabilities in in-homogeneous plasmas relevant to inertial confinement fusion

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See the full abstract here <http://ocs.ciemat.es/EPS2019ABS/pdf/O4.209.pdf>

Parametric instabilities in two- and three-dimensional configurations in inhomogeneous plasmas have been studied on a wide range of parameter space ranging from direct-drive scheme to shock ignition. These include the nonlinear evolutions of stimulated Raman scattering (SRS), stimulated Brillouin scattering (SBS), and two-plasmon decay (TPD), and interactions among them. In 2D particle-in-cell (PIC) simulations [1], we have demonstrated a clear transition from TPD dominant regime to SRS dominant regime near the quarter-critical density as the laser intensity increases from direct-drive regime to shock ignition. Instability nature changes from absolute TPD/SRS to convective SRS. The relevant hot-electron generation is discussed based on a simple particle acceleration model [2]. Hot electron fraction is shown to have a peak near the convective SRS threshold. And the effective hot electron temperature is about 90keV when TPD is dominant, and is shown to have a bi-Maxwellian distribution with $Th1=90\text{keV}$ (dominated by TPD) and $Th2=54\text{keV}$ (dominated by SRS) when in shock ignition regime. The behaviour of SRS and TPD were recently observed by experiments [3]. Next, we have performed more realistic 3D PIC simulations to study interactions among SRS, TPD, and SBS [4]. Especially, we observed when the laser power is high enough (above some certain threshold), stimulated Raman sidescattering (SRSS) occurs ubiquitously in a wide range of density regions, and finally scattered out of plasma with a large exit angle. The situation may be found in a single laser speckle. Thus, we simulated this effect on 3D configuration. SRSS grows to an intensity comparable with the laser beam when excited. It has a weak competition with Raman backward scattering, while both of them can suppress TPD. It is also observed that SRSS has few influences on SBS occurred at low density regions. Also, differences of parametric instabilities in 2D and 3D PIC simulations are discussed.

References

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