Investigation of Laser Pulse Propagation in Plasma using the PIC Simulation Method

A. H. Esmailian Araqi, H. Hosseinkhani, J. Yazdanpanah, A. Kouhi

Department of Inertial Confinement, Plasma Physics & Nuclear Fusion Research School, Nuclear Science & Technology Research Institute, AEOI.
P.O. 14395-836 , Tehran ,Iran.

hhosseinkhani@aeoi.org.ir
hassanhk@gmail.com

In this paper, the propagation of high power and short laser pulse in plasma medium is investigated. To do this aim, the particle model of plasma and particle-in-cell (PIC) computational method is used. The Maxwell equations are solved on a lattice and the relativistic Lorentz equation, by interpolation of the electromagnetic fields on the particles, leads to the temporal evolution of the phase space of the particles. The sources (ρ and J) are interpolated self-consistently. The equations are discretized with finite difference method and the Leapfrog differencing method is used to perform the computations for fields.

The results are in a very good consistency with the current theories of the wave propagation in plasmas. The energy loss, dispersion and the change in the shape of the pulse due to the interaction with the electrons are shown and discussed. The obtained results can be used in the study of laser-plasma interactions specially in fast ignition approach to laser fusion process.