IF/P-03 · Effects of Radiation Transport on Mass Ablation Rate and Conversion Efficiency in Numerical Simulations of Inertial Confinement Fusion.

N. K. Gupta, Bhabha Atomic Research Centre, High Pressure Physics Division, Mumbai, India
Contact: nkgupta@apsara.barc.ernet.in

Abstract: The effects of radiation transport on hydrodynamic parameters of laser produced plasmas are studied. LTE and non-LTE atomic models are used to calculate multi group opacities and emissivities. Screened hydrogenic atom model is used to calculate the energy levels. The population densities of neutral to fully ionized ions are obtained by solving the steady state rate equations. Radiation transport is treated in multi-group diffusion or Sn method. A comparison is made between 1 and 100 group radiation transport and LTE and non-LTE models. For aluminium, multi group radiation transport leads to much higher mass ablation as compared to the 1 group and no radiation transport cases. This in turn leads to higher ablation pressures. However, for gold gray approximation gives higher mass ablation as compared to multi group simulations. LTE conversion efficiency of laser light into x-rays is more than the non-LTE estimates. For LTE as well as non-LTE cases, the one group approximation over-predicts the conversion efficiency Multi group non-LTE simulations predict that the conversion efficiency increases with laser intensity up to a maximum and then it decreases.

IF/P-04 · Petawatt Laser System for the Fast Ignition Studies at ILE, Osaka University

Y. Izawa, Institute of Laser Engineering,Osaka University, Osaka, Japan
Contact: izawa@ile.osaka-u.ac.jp

Abstract: We have developed a PW Nd:glass laser system, which can deliver 1 PW output with 500 J in 0.5 ps, to study a fast ignitor concept in laser fusion. In the front end of this system, the optical parametric chirped-pulse amplifier (OPCPA) was introduced. The OPCPA solves several problems arising in an existing Ti:sapphire regenerative amplifier, such as low single-pass gain, high prepulse and output fluctuation. A booster amplifier is a Cassegrain-type three pass disk system having a 350 mm clear aperture, which generated 1.1 kJ output energy with the spectral width of 3.7 nm corresponding to 0.5 ps in Fourier transform limited pulse. The spatial phase aberration mainly caused in the booster amplifier is corrected using a deformable mirror. The laser pulse is compressed by a pair of 1-m diffraction gratings and focused by a parabolic mirror. The timing jitter between PW laser and GEKKO XII is less than 10 ps, which was attained by injecting a weak pulse splitted out from the front end into the preamplifier of GEKKO XII.

IF/P-05 · Electron and Photon Production from Relativistic Laser-Plasma Interactions

E. Lefebvre, CEA/DIF, Département de Physique Théorique et Appliquée, Bruyères-le-Châtel, France
Contact: erik.lefebvre@cea.fr

Abstract: The interaction of short and intense laser pulses with plasmas is a very efficient source of relativistic electrons with tunable properties. In low density plasmas, we observed bunches of electrons up to 200 MeV, accelerated in the wake field of the laser pulse. Less energetic electrons (tens of MeV) have been obtained, albeit with a higher efficiency, during the interaction with a solid target. When these relativistic electrons slow down in a thick tungsten target, they emit very energetic Bremsstrahlung photons which have been diagnosed directly with photoconductors, and indirectly through photonuclear activation measurements. With the first method, a maximum dose of 80 mR at 1 m in air was measured, along the laser axis. Regarding the photonuclear measurement, up to 3.4 million photofission events have been diagnosed in a 238-U sample placed at the back of the target. The results are in reasonable agreement, over three orders of magnitude, with a model built on laser-plasma interaction and electron transport numerical simulations. They provide valuable insight on the electron acceleration and transport needed for fast ignition.