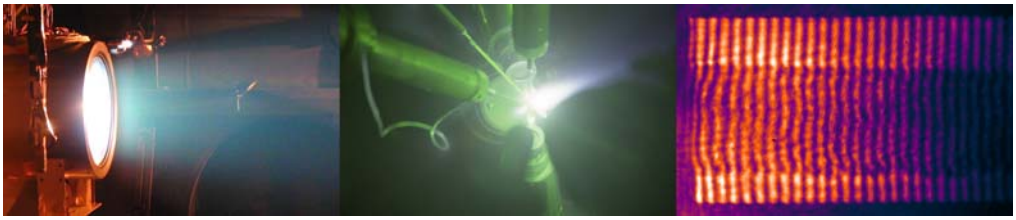

Michigan Institute for Plasma Science and Engineering Seminar

Universal Scaling of the Electron Distribution Function in Relativistic Laser-Plasma Interactions

Dr. Mark Sherlock, Imperial College London

Insights into Long and Short-Pulse Laser-Plasma Experiments from Vlasov-Fokker-Planck Simulations

Dr. Chris Ridgers, Imperial College London

Friday, 18 Sept. 2009 – 12 noon, Room 1114 EERB-1.

(***Joint Seminar with the Center for Ultrafast Optical Science)***

Abstracts

Dr. Sherlock - We provide a formula for the distribution function of energetic electrons which stream in the forward direction when a relativistic ally-intense laser pulse irradiates a short-scale-length dense plasma at normal incidence. If the energy absorption fraction is known, the entire function can be characterized in terms of the laser intensity. A number of important characteristics can then be obtained, including the fast electron energy, current density and angle of ejection. We suggest an objective means for calculating the fast-electron energy which is approximately given by ~0.6 of the vacuum oscillatory energy. This reduction in energy is shown to be consistent with the energy required to draw a return current.

*Dr. Ridge*rs - Vlasov-Fokker-Planck (VFP) simulations provide a novel tool for investigating laser-plasma interactions with long and short laser-pulse durations. When applied to long-pulse interactions they can correctly describe non-local transport and B-field dynamics; both important in hohlraums. In short-pulse solid-density simulations VFP codes describe the high degree of anisotropy of the distribution function while accurately modelling collisions. We used IMPACTA to model ns interactions for plasmas in large (12T) externally generated B-fields. Results demonstrated the suppression of non-locality by B-fields and their rapid advection caused by the Nernst effect (seldom considered in simulations). We will also discuss VFP modelling of short-pulse interactions using FIDO. The generation of large B-fields at the target rear-surface confines fast electrons, likely modifying rear-surface probe measurements.

About the Speakers:

Dr. Mark Sherlock is a theoretical plasma physicist from Imperial College London (ICL) where he received his PhD (supervised by Prof. M. Haines) and was a post-doctoral researcher. He joined the Central Laser Facility at Rutherford Appleton Laboratory in 2005 and returned to ICL in 2009. His research interests include fast electron transport, fast ignition, beam fusion and Z-pinches. Dr. Chris Ridgers is a theoretical plasma physicist from ICL and post-doctoral researcher on the HiPER project. His 2008 PhD thesis (supervised by Dr. R. Kingham) addressed hydrodynamic modeling of implicit VFP plasma transport.