Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Trapping of Low Energy Electrons in Direct Laser Acceleration[1]

SUNG JUN YOON, JOHN PALASTRO, University of Maryland, College Park, DANIEL GORDON, Plasma Physcs Division, Naval Research Laboratory, Washington DC, HOWARD MILCHBERG, University of Maryland, College Park — Copropagation of a laser pulse and a relativistic electron beam in a corrugated plasma channel has been proposed for the direct laser acceleration. A laser pulse in a corrugated plasma channel consists of spatial harmonics whose phase velocities can be subluminal. The subluminal spatial harmonics can be phase matched to relativistic electrons resulting in linear energy gain over the interaction length. Scaling laws, supported by simulation, predict linear accelerating gradients of ∼100 MeV/cm for ∼2 TW of laser power and ∼0.6J of laser energy. However phase matching over extended lengths requires large initial electron energies. Here we examine ramped density profiles, tapered channel radii, and tapered modulation periods to lower the initial electron energy requirement for trapping. Each modification will be examined using the 2D cylindrical PIC simulation TurboWAVE, which at the same time will provide the first fully self-consistent PIC simulations of direct acceleration. Essential experimental components, a simple radial polarization converter and a ring grating to embed density modulation in a plasma channel, will be also discussed.

[1]This work is supported by DTRA, DOE, NSF

Sung Jun Yoon
University of Maryland, College Park

Date submitted: 15 Jul 2011 Electronic form version 1.4