Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, October 24, 2006

(16:00 in Room 459/30b)

Structure Loaded Vacuum Laser–Driven Particle Acceleration Experiments at SLAC

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Abstract

The advent of relatively inexpensive and reliable ultra–short pulse tabletop lasers has become a motivation to explore structure loaded vacuum laser–driven particle acceleration as a potential low–emittance and high–gradient particle acceleration scheme. In a similar fashion to RF technology, this particle acceleration method relies on a longitudinal electric field for the particle acceleration process and employs a structure that controls the electromagnetic field along the electron beam trajectory. Compared to RF accelerators the wavelength of the accelerating field is reduced by almost 5 orders of magnitude to the visible or near infrared, which allows the use of dielectric materials instead of metal for the accelerator structure.

In this talk I will present the key concepts of the theory of laser–driven particle acceleration in vacuum and will describe our initial proof–of–principle experiment with corresponding observations for this acceleration mechanism. This will be followed by a description of our present research efforts towards developing an extended laser–driven particle accelerator. These efforts include our upcoming two–stage buncher–accelerator experiment, electron beam tests with hollow–core photonic bandgap fibers and other dielectric–based micro–devices, and finally, the development of a laser driven electron beam injector. I will conclude this talk with a brief analysis for the potential of these particle accelerators as sources for a compact free–electron based light device.

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