TU301

POSITRON BEAMS PROPAGATION IN PLASMA WAKEFIELD ACCELERATORS

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Abstract

Plasma-based accelerators are one of the emerging technologies that could revolutionize e-/e^+ colliders, significantly reducing their size and cost by operating at multi-GeV/m accelerating gradients. Proof-of-principle experiments at SLAC have demonstrated the energy doubling of 42 GeV incoming e^- in a plasma only ~85 cm-long,* corresponding to an unloaded gradient of ~50 GeV/m. Plasma wakes driven by e^+ bunches are different from those driven by e^- bunches. The acceleration of e^+ in plasmas has been demonstrate,** but the acceleration of high-quality e^+ beams is challenging. Measurements show that single e^+ bunches suffer halo formation and emittance growth when propagating through dense meter-scale, uniform plasmas.*** Advanced schemes, such as hollow plasma channels, or e^+ bunch acceleration on the wake driven by a e bunch, may have to be used in a future plasma-based linear collider. Experimental results obtained with e^+ beams in plasmas will be reviewed and compared to those obtained with e^- beams. Future experiments including a new scheme to produce a drive e bunch closely followed by a witness e^+ bunch appropriate for PWFA experiments will also be discussed.

* I. Blumenfeld *et al.*, Nature 445, 741-744 (15 February 2007).
** B.E. Blue *et al.*, Phys. Rev. Lett. 90, 214801 (2003).
*** P. Muggli *et al.*, accepted for publication in Phys. Rev. Lett. (2008).