

APR08-2008-000244

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

High energy particle accelerators that can fit on a (large) tabletop by using lasers¹

WIM LEEMANS, Lawrence Berkeley National Laboratory

Accelerators are essential tools of discovery and have many practical uses. At the forefront of accelerator technology are the machines that deliver beams for particle physics, for synchrotron and free electron based radiation sources. The technology that drives these accelerators is extremely sophisticated but is limited by the maximum sustainable accelerating field. This impacts the size and cost of the device. More than two decades ago, lasers were proposed as power source for driving novel accelerators based on plasmas as the accelerating medium. An overview will be presented of what these devices can produce to date, including the 2004 demonstration of high quality electron beams [1] and the 2006 demonstration of GeV class beams from a 3 cm long accelerating structure [2]. We then discuss the key challenges for broad applicability of the technology and our goal of making a laser accelerator driven a VUV/soft x-ray free electron laser.

[1] C.G.R. Geddes et al., *Nature* **431**, 538-541 (2004); S.P.D. Mangles et al., *ibid* 535-538; J. Faure et al., *ibid.* 541-544.

[2] W.P. Leemans et al., *Nature Physics* **2**, 696-699 (2006).

¹Work supported by DOE, DARPA and NSF.