PAUL SCHERRER INSTITUT

PSI

GFA & SwissFEL Accelerator Seminar

Laser plasma accelerator R&D at Berkeley Lab's BELLA Center

Wednesday, 27 April 2016, 16.00 h, WBGB/019

Wim Leemans, LBNL

Electron acceleration of electrons using intense laser pulses that excite tens of gigavolt per meter fields in plasmas will be discussed and the path forward to practical machines. The potential impact of compact laser plasma accelerators (LPA) ranges from providing the capability of producing high energy, ultra-short electron bunches and associated radiation pulses for forefront science in a small laboratory setting, to medical and homeland security applications, to the development of high energy particle colliders for fundamental science into the origin of matter and energy.

About a decade ago, laser plasma accelerators were demonstrated that could produce high quality beams (Nature 2004), followed by generation of GeV beams (Nature Physics 2006). We will discuss experiments at Lawrence Berkeley National Laboratory that address key challenges for the development of laser plasma accelerators. This includes the recent demonstration of multistage coupling of independent laser plasma accelerators (S. Steinke et al., Nature 2016) and the achievement of 4.3 GeV electron beams from a 9 cm long accelerator powered by the BELLA laser (W.P. Leemans, PRL 2014). Two new initiatives on LPA powered free electron laser and a compact gamma ray source will be presented, as well as a novel medical application that relies on an arthroscopic implementation of LPA technology. Plans for future upgrades of our laser facilities will be shown that aim at producing multi-kW average power ultra-fast laser beams and at reaching laser intensities in excess of 10^{21} W/cm^2 for relativistic plasma science experiments including ion acceleration.

Contact: Andreas Adelmann