# AKBP 6: New Accelerator Concepts

Time: Tuesday 9:30–11:00 Location: HSZ 301

AKBP 6.1 Tue 9:30 HSZ 301

**Photonic particle acceleration: from advanced electron phase space control to attosecond electron pulse train generation** — •Alexander Tafel[1], Norbert Schönenberger[1], Johannes Illmer[1], Anna Mittelbach[1], Ang Li[1], Roy Shiloh[1], Yuya Morimoto[1], Peyman Yousefi[1], Stefanie Kraus[1], Leon Brückner[1], Uwe Niedermayer[2], Peter Hommelhoff[1], and ACHIP Collaboration[3] — [1]Department Physik, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), 91058 Erlangen — [2]Technische Universität Darmstadt, 64289 Darmstadt — [3]achip.fau.de, achip.stanford.edu

The combination of high damage threshold dielectrics, high repetition rate femtosecond lasers and the nanofabrication capabilities of today enable the realization of an all-optical miniaturized particle accelerator on a chip. While the miniaturization is one of the biggest benefits, it is also one of the key challenges, which comes along with the micrometer wavelength of the driving laser pulses: we need to control the 6D electron phase space on the nanometer, milliradian and attosecond level. Here we report on how we use optical near-fields of tailored photonic nanostructures to manipulate both the transverse and the longitudinal phase space of the electron beam, which has recently enabled us to generate attosecond bunch trains and to confine the electron beam over long distances by virtue of alternating phase focusing. All of this brings us close to building the accelerator on a photonic chip. We will give an overview over the current state of the art and the upcoming challenges.

AKBP 6.2 Tue 10:00 HSZ 301

**Online Diagnostics and Stabilization of the ANGUS 200 TW Laser** — •Cora Braun[1], Timo Eichner[1], Thomas Hülsenbusch[1,2], Matthias Schnepp[1], and Andreas R. Maier[1] — [1]Center for Free-Electron Laser Science, Hamburg, Germany — [2]DESY, Hamburg, Germany

Laser-Plasma-Accelerators are prominent candidates to drive a next generation of high-brightness x-ray sources. The LUX laser-plasma-accelerator, driven by the ANGUS 200 TW laser, has recently demonstrated the generation of few-nm-plasma-driven undulator radiation. Long-term operation of the plasma accelerator with reproducible and stable electron beams requires a highly stable drive laser. To reach this goal, we have integrated the ANGUS laser in an accelerator-grade control system. Enabled by the analysis tools at every stage of the laser system, we observe that changes in the front-end of the amplifier chain have a direct impact on both, laser parameters in all amplification stages and the properties of the accelerated electrons. We will report on the long-term-drifts we have observed during laser operation and their effects on the laser system, and present recent upgrades to the laser system to stabilize against these drifts.

AKBP 6.3 Tue 10:15 HSZ 301

**Influence of flat-top lasers in Particle-In-Cell simulations of plasma accelerators** — •Laurids Jeppe, Sören Jalas, Manuel Kirchen, and Andreas R. Maier — Center for Free-Electron Laser Science and Department of Physics, Universität Hamburg

In a laser-plasma accelerator, electron beams are accelerated in strong plasma wakefields excited by a high-power laser pulse. A common simplification when modelling these experiments is the use of simple Gaussian profiles for the transversal laser envelope. However, to increase the energy density, modern laser systems typically feature flat-top transverse intensity profiles out of focus. We use the spectral, quasi-cylindrical Particle-in-Cell code FBPIC to model such a laser profile and discuss its effects on the laser-plasma interaction.

AKBP 6.4 Tue 10:30 HSZ 301

**External injection plasma wakefield acceleration at FLASHForward** — •Sarah Schröder[1,2] and on behalf of FLASHForward[1] — [1]Deutsches Elektronen-Synchrotron (DESY), Notkestrasse 85, 22607 Hamburg — [2]Universität Hamburg, Mittelweg 177, 20148 Hamburg

Owing to high-gradient accelerating fields (>GV/m), plasma wakefield accelerators (PWFA) have the potential of significantly reducing size and costs of future high-average power accelerator facilities. Acceleration stability and beam quality are largely dependent on the interplay between the parameters of the injected bunch and the structure of the plasma wakefield. Precise control of the bunch profile is essential for maximising the energy transfer efficiency and preserving the energy spread. At FLASHForward, driver/witness bunch pairs of adjustable bunch length and separation are generated by collimators in a dispersive section. Here we present the capabilities of precision measurements at FLASHForward and the latest experimental results.

AKBP 6.5 Tue 10:45 HSZ 301

**FLASHForward X-1: High brightness beams from a plasma cathode** — •Bridget Sheeran[1,2], A. Aschikhin[1,2], S. Bohlen[1,2], G. Boyle[1], L. Boulton[1,4], R. D'Arcy[1], M. Dinter[1], T. Bruemmer[1], J. Chappel[3], S. Diederichs[1,2], B. Foster[1,2], M.J Garland[1], L. Goldberg[1,2], P. Gonzalez[1,2], S. Karstensen[1], A. Knetsch[1], O. Kononenko[1,2], A. Kontogoula[1,2], P. Kuang[1], V. Libov[1,2], C.A Lindstroem[1], K. Ludwig[1], A. Martinez de la Ossa[1], F. Marutzky[1], M. Meisel[1,2], T. Mehrling[1,2], P. Niknejadi[1], K. Poeder[1], P. Pourmoussavi[1], A. Rahali[1], J-H. Roeckemann[1,2], L Schaper[1], A. Schleiermacher[1], B. Schmidt[1], S Schroeder[1,2], J-P. Schwinkendorf[1,2], T. Staufer[1,2], G. Tauscher[1,2], S. Thiele[1], S. Wesch[1], P. Winkler[1,2], J.C Wood[1], M. Zeng[1], and J. Osterhoff[1] — [1]DESY — [2]University of Hamburg — [3]University College London — [4]University of Strathclyde

The FLASHForward facility at DESY provides a unique opportunity for the study of Plasma Wakefield Acceleration (PWFA). At FLASHForward, a several kA electron beam with energies up to 1.25 GeV interacts with a plasma in a dedicated windowless, differentially pumped beamline. The FLASHForward X-1 experiment focuses on the development and study of internal injection techniques to produce ultra-high quality, fs-length electron bunches. Pulses from a 25~TW, fs-class, synchronised laser system allow for selective dual-arm pre-formation of density down-ramp. In this work we present the first demonstration of highly stable internal injection at FLASHForward on density-downramps.