AKBP 11: PWA / TNSA III

Zeit: Mittwoch 16:45–18:00 Raum: F.10.01 (HS 4)

AKBP 11.1 Mi 16:45 F.10.01 (HS 4)

Adiabatic Matching at the External Injection Experiment at REGAE — •Irene Dornmair[1,2], Klaus Floettmann[3], Florian Grüner[1,2], Andreas R. Maier[1,2], and Benno Zeitler[1,2] — [1]Universität Hamburg, Institut für Experimentalphysik, 22761 Hamburg — [2]CFEL, Center for Free-Electron Laser Science, 22607 Hamburg — [3]DESY, 22607 Hamburg

Laser Plasma Accelerators provide very high accelerating gradients, but also strong focusing fields. Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together to combine university research in the field of laser-plasma acceleration with the expertise of a large and well-established accelerator facility.

Externally injecting an electron bunch from a conventional gun into a laser driven plasma wakefield is a promising path towards increased control over the injected electron phase space. To prevent emittance growth, the beam size needs to be matched to the focusing forces present in the wakefield. This matched beam size is very small, which requires very strong focusing optics, both for injection and for beam capturing after the plasma. We show how the requirements on the beam optics can be relaxed by introducing tapered matching sections in the plasma target where the focusing is slowly, thus adiabatically, changed.

AKBP 11.2 Mi 17:00 F.10.01 (HS 4)

Laser-Plasma Acceleration in Hamburg — •Andreas R. Maier[1,2], Niels Delbos[1,2], Irene Dornmair[1,2], Klaus Flöttmann[3], Vaclav Hanus[1,2,4], Spencer Jolly[1,2,4], Byunghoon Kim[1,2,4], Manuel Kirchen[1,2], Vincent Leroux[1,2,4], Philipp Messner[1,2], Nils Plambeck[1,2], Matthias Schnepp[1,2], Dominik Trosien[1,2], Paul Andreas Walker[1,2], Christian Werle[1,2], Paul Winkler[1,2], Benno Zeitler[1,2], and Florian Grüner[1,2] — [1]CFEL, Center for Free-Electron Laser Science, 22607 Hamburg — [2]University of Hamburg, Institute of Experimental Physics, 22761 Hamburg — [3]DESY, 22607 Hamburg — [4]ELI Beamlines, 18221 Praha 8, Czech Republic

The stability and reproducibility of todays laser-plasma generated electron beams is not comparable to the performance of conventional machines. Within the LAOLA Collaboration, the University of Hamburg and DESY work closely together to combine university research with the expertise of a large and well-established accelerator facility. On behalf of the LAOLA collaboration, we will discuss the experimental programm driven by the recently commissioned 200 TW laser ANGUS. It drives two beamlines, REGAE and LUX, to study external injection of electrons from a conventional gun into a plasma stage, as well as plasma-driven undulator radiation. We provide an overview on the commissioning of the facility and its experiments. As an outlook, we will discuss the experimental strategies in Hamburg towards a first proof-of-principle FEL experiment using plasma-driven electron beams available today.

AKBP 11.3 Mi 17:15 F.10.01 (HS 4)

GPGPU Powered 3D Simulations of Micro Droplets in Laser-Ion Acceleration — •Axel Huebl[1,2], Thomas Kluge[1], Peter Hilz[3], and Michael Bussmann[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]Technische Universität Dresden — [3]Ludwigs-Maximilians-Universität München

We present current large scale, full 3D particle-in-cell simulations and studies of laser-ion acceleration utilizing highly over-dense, mass and volume limited micro targets with PIConGPU. Powered by thousands of GPGPUs on Oak Ridge's supercomputer Titan, we show early results such as the influence of the target to laser spot size and the arising acceleration regimes thereof.

The simulations show the capability of PIConGPU, a highly scalable particle-in-cell code for many-core compute architectures that allows for in-situ, real time visualization and ultra-fast computation of large systems.

AKBP 11.4 Mi 17:30 F.10.01 (HS 4)

Radiation as synthetic spectral diagnostics in the particle-in-cell code PIConGPU — •Richard Pausch[1,2], Alexander Debus[1], Axel Huebl[1,2], Klaus Steiniger[1,2], René Widera[1], Michael Bussmann[1], and Ulrich Schramm[1,2] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]Technische Universität Dresden

We present in-situ computation of relativistic radiation in the particle-in-cell code PIConGPU that can give both qualitative and quantitative agreement with analytical models and thus has predictive capabilities. This new kind of synthetic spectral diagnostics can be used to infer plasma dynamics with high spatial and temporal resolution.

Our method is based on the far field approximation of Liénard-Wiechert potential. Its direct integration with the highly-scalable GPU framework of PIConGPU allows computing the spectrally and angularly resolved radiation for thousands of frequencies, ranging from infrared to x-rays, hundreds of detector positions and billions of particles efficiently. Recent updates allow studying polarization and improve time resolution thus extending the range of applications.

These capabilities are demonstrated using recent simulations of laser wakefield acceleration (LWFA), high harmonics generation during target normal sheath acceleration (TNSA) and the Kelvin-Helmholtz instability (KHI).

AKBP 11.5 Mi 17:45 F.10.01 (HS 4)

Bright Subcycle Extreme Ultraviolet Bursts from a Single Dense Relativistic Electron Sheet — •wenjun ma[1], jianhui bin[1,2], hongyong wang[2,3], mark yeung[4,5], christian kreuzer[1], peta foster[4,6], brendan dromey[4], xueqing yan[3], juergen meyer-ter-Vehn[2], matthew zepf[4,5], and joerg schreiber[1,2] — [1]Fakultät für Physik, Ludwig-Maximilians-University, Garching, Germany — [2]Max-Planck-Institute of Quantum Optics, Garching, Germany — [3]State Key Laboratory of Nuclear Physics and Technology & Center of Applied Physics and Technology, Peking University, Beijing, China — [4]Department of Physics and Astronomy, Queen's University Belfast, Belfast, United Kingdom — [5]Helmholtz Institute Jena, Jena, Germany — [6]Central Laser Facility, STFC Rutherford Appleton Laboratory, Chilton, United Kingdom

Relativistic electrons are prodigious sources of photons. Beyond classical accelerators, ultra-intense laser interactions are of particular interest as they allow the coherent motion of relativistic electrons to be controlled and exploited as sources of radiation. Here we report that bright extreme ultraviolet (XUV) radiation was observed when double foil targets separated by a low density plasma were irradiated by a PW-class laser. Simulations show that a dense sheet of relativistic electrons is formed during the interaction of the laser with the tenuous plasma between the two foils. The coherent motion of the electron sheet as it transits the second foil results in a subcycle XUV pulse, consistent with our experimental observations.