SYPA 2: Sympsium Plasma-based Particle Accelerators 2

Zeit: Mittwoch 16:30–18:30 Raum: Plenarsaal

Hauptvortrag SYPA 2.1 Mi 16:30 Plenarsaal

Plasma Wakefield Acceleration: Instabilities and Stabilization — •Alexander Pukhov — Heinrich-Heine-University of Dusseldorf

New acceleration technology is mandatory for the future of high energy particle acceleration. A feasible approach is to exploit the plasma wakefield acceleration, where the driver can be a high intensity laser pulse or a charged particle beam. Already a lot of progress has been achieved on this path both in theory and experiment and several most promising configurations have been identified. On the other hand, the plasma is known for its instabilities that can significantly affect both the driver and the witness bunch. In some cases, the driver instability in plasmas is highly welcome, like in the AWAKE project, where a long proton driver has to undercome a deep self-modulation in a plasma column to be able to excite a strong plasma wave. In many other configurations, like the hollow plasma channel or a bubble or blow-out regime, the instabilities must be mitigated.

Hauptvortrag SYPA 2.2 Mi 17:00 Plenarsaal

LUX - A Laser-Plasma Driven Undulator Beamline — •Andreas R. Maier — Center for Free-Electron Laser Science and Department of Physics, Universität Hamburg, Hamburg, Germany

LUX is a novel laser-plasma accelerator. Building on the joint expertise of the University of Hamburg and DESY the beamline was carefully designed to combine state-of-the-art expertise in laser-plasma acceleration with the latest advances in accelerator technology and beam diagnostics. LUX introduces a paradigm change moving from single-shot demonstration experiments towards available, stable and controllable accelerator operation. Here, we discuss the general design concepts of LUX and present first experimental results that have recently been achieved: This includes the 24h operation of the plasma accelerator with several 10.000 consecutive shots, and the generation of spontaneous undulator radiation at few-nm wavelength. Finally, we will discuss recent activities to upgrade the LUX beamline with a new undulator to demonstrate FEL gain following the decompression scheme.

Hauptvortrag SYPA 2.3 Mi 17:30 Plenarsaal

Magnetic reconnection as a particle accelerator — •Michael Hesse — Birkeland Centre for Space Science, University of Bergen, Bergen, Norway

Magnetic reconnection in plasmas is an efficient mechanism to convert stored magnetic energy to particle energy in an often-explosive fashion. Particle energization can be in form of increases of thermal energy, the kinetic energy inherent in bulk plasma motion, and in form of energetic tails of particle distribution functions. Acceleration can further occur by means of direct acceleration by the reconnection electric field or by Hall-type electric fields in the current layer, by the thermalization of particle beams, and by Fermi-type acceleration in the reconnection outflow region. Finally, there is excellent theoretical and observational evidence of the generation of high-energy tails not directly associated with the reconnection process, but rather as a result of magnetic reconfigurations downstream of the reconnection outflow. This talk will consist of an overview of the magnetic reconnection process, and of the various modes of particle acceleration associated with it. Theoretical predictions will be supported by observations, in particular from spacecraft operating in the near-Earth plasma environment.

Hauptvortrag SYPA 2.4 Mi 18:00 Plenarsaal

Experimental demonstration of proton bunch self-modulation and of electron acceleration in a 10m-long plasma — •Patric Muggli for the AWAKE-Collaboration — Max Planck Institute for Physics, Munich, Germany

Self-modulation of a long, relativistic particle bunch in a dense plasma is a proposed scheme to drive large amplitude wakefields over a long distance. Externally injected electrons can then gain large amounts of energy in a single plasma, thereby avoiding well-known staging issues. We will explain the principle of the AWAKE experiment that uses a 400GeV proton bunch to demonstrate this acceleration scheme. We will show detailed experimental results demonstrating the control of the self-modulation process through two seeding methods. We will also show that externally injected MeV electrons were accelerated to the GeV energy scale. Finally, we will briefly outline future experiments and possible applications of this acceleration scheme.