AKBP 11: Synchrotron Radiation Sources, Hadron Accelerators and Colliders

Zeit: Donnerstag 16:30–18:15 Raum: NW-Bau - HS5

AKBP 11.1 Do 16:30 NW-Bau - HS5

Analytical Calculations for Thomson-Backscattering — •Paul Volz[1,2] and Atoosa Meseck[1] — [1]Helmholtz-Zentrum Berlin — [2]Humboldt-Universität zu Berlin

Scattering high intensity laser radiation on MeV electrons can yield high energy photons that would require GeV or even TeV electron beams using conventional undulators or dipoles. Thus, given the availability of a high brightness electron beam, X-ray and gamma ray sources based on Thomson and Compton backscattering seem very promising. However, the quality of the generated X-ray or gamma beams in terms of flux, bandwidth, and brilliance is often inferior to the radiation delivered by conventional sources. In order to study the merit of Thomson-backscattering-based light sources, we are developing an analytical code to simulate the characteristics of the Thomson scattered radiation. The goal is to incorporate the incident laser profile as well as the full 6D bunch profile, including microbunching. The status of the code and first results will be presented.

AKBP 11.2 Do 16:45 NW-Bau - HS5

Study of the laser-induced energy modulation amplitude at the short-pulse facility at DELTA — •Arne Meyer auf der Heide, Benedikt Büsing, Shaukat Khan, Nils Lockmann, Carsten Mai, Bernard Riemann, and Boris Sawadski — Center for Synchrotron Radiation, TU Dortmund University, Dortmund, Germany

At DELTA, a synchrotron light source operated by the TU Dortmund University, the short-pulse facility provides ultrashort pulses in the vacuum ultraviolet and terahertz regime based on the seeding scheme coherent harmonic generation (CHG). Here, a laser-electron interaction results in a modulation of the electron energy which is transformed into a density modulation by a magnetic chicane giving rise to coherent emission at harmonics of the laser wavelength.

The amplitude of the energy modulation is measured with different techniques. By introducing a second laser pulse and, thus, a second modulation, the amplitude measurements demonstrate that both laser pulses interact with the same electrons within a bunch. This is a crucial requirement for echo-enabled harmonic generation (EEHG) comprising a twofold energy modulation, which is the goal of a future upgrade of the short-pulse facility.

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AKBP 11.3 Do 17:00 NW-Bau - HS5

Studies and results for the EEHG upgrade of the DELTA short-pulse source — •Maximilian Schmutzler, Benedikt Büsing, Shaukat Khan, Daniel Krieg, Nils Lockmann, Carsten Mai, Arne Meyer auf der Heide, Bernard Riemann, Boris Sawadski, Frederik Teutenberg, and Peter Ungelenk — Center for Synchrotron Radiation (DELTA), TU Dortmund University, Dortmund, Germany

At DELTA, a 1.5-GeV synchrotron light source operated by the TU Dortmund University, a short-pulse source based on coherent harmonic generation (CHG) is used to generate sub-picosecond synchrotron radiation pulses in the VUV regime. An upgrade to echo-enabled harmonic generation (EEHG) will enable radiation at shorter wavelengths. The EEHG scheme uses a twofold energy modulation induced by laser-electron interaction and two chicanes to create micro-bunches at the center of an electron bunch. The current status including optics studies, chicane designs and measurements to verify a twofold energy modulation of the same electrons will be presented.

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AKBP 11.4 Do 17:15 NW-Bau - HS5

Recent laser cooling experiments at the ESR — •Sebastian Klammes[1,2], Danyal Winters[1], Thomas Walther[2], Daniel Kiefer[2], Lewin Eidam[2], Oliver Boine-Frankenheim[1,2], Axel Buss[3], Christian Egelkamp[3], Volker Hannen[3], Zhongkui Huang[4], Thomas Kühl[1,5], Markus Löser[6,7], Xinwen Ma[4], Fritz Nolden[1], Wilfried Nörtershäuser[2], Rodolfo Sanchez Alarcon[1], Ulrich Schramm[6,7], Mathias Siebold[6], Peter Spiller[1], Markus Steck[1], Thomas Stöhlker[1,5,8], Johannes Ullmann[2,8], Hanbing Wang[4], Weiqiang Wen[4], Christian Weinheimer[3], Daniel Winzen[3], and Michael Bussmann[6] — [1]GSI Darmstadt — [2]TU-Darmstadt — [3]Uni Münster — [4]IMP Lanzhou — [5]HI-Jena — [6]HZDR Dresden — [7]TU-Dresden — [8]Uni-Jena

In terms of observing relativistic effects and verifying the predictions of quantum electrodynamics, stored particles of high energy with a small momentum spread and small emittance are of great interest in current atomic physics and accelerator research. Due to its effectivity at high energies, laser cooling has proven to be a potentially powerful tool in recent years. Laser cooling is a longitudinal beam cooling method and is based on the resonant absorption and the subsequent spontaneous emission (fluorescence) of photons by ions [1]. We will show results of recent laser cooling experiments performed at the ESR at GSI Darmstadt, Germany [2]. [1] M. Bussmann, ICFA Beam Dyn. Newslett. **65** (2014). [2] D. Winters et al., Phys. Scr. **T166** 014048 (2015).

AKBP 11.5 Do 17:30 NW-Bau - HS5

Status of a Design Study for a Proton EDM Ring — •Martin Gaisser for the JEDI-Collaboration — III. Physikalisches Institut B, RWTH Aachen University

Electric Dipole Moments (EDMs) of charged particles are an important place to search for physics beyond the Standard Model. In order to measure EDMs directly, strong electric fields (in the particle's rest frame) are required. To capture charged particles, a storage ring is necessary. The observable of an EDM is a particular rotation of the spin due to the torque excerted by the electric field. Because the spin precession due to the EDM is expected to be many orders of magnitude smaller than that due to the magnetic dipole moment (MDM), false spin rotations due to the MDM that could create a fake EDM signal have to be suppressed or understood very accurately. Here we report about the current status and challenges of a design study for a dedicated, all-electric storage ring to measure the proton EDM. In such a ring, two counterrotating, longitudinally (spin-) polarized proton beams with kinetic energy of 232 MeV would be stored for about 1000 seconds. There are several challenges for the design of such a ring. First of all, there are many conflicting requirements and second, detailed spin dynamics calculations have to be incorporated into the de- sign process from the start. Furthermore, tight tolerances on field quality, element placement and magnetic shielding etc. exist.

AKBP 11.6 Do 17:45 NW-Bau - HS5

Moving Long-Range Beam-Beam Encounters in Heavy-Ion Colliders — •Marc Jebramcik[1,2] and John Jowett[1] — [1]CERN, Geneva, Switzerland — [2]Goethe University Frankfurt, Frankfurt, Germany

Heavy-ion colliders like the LHC or RHIC are occasionally operated with asymmetric beams, i.e., the two beams contain different ion species. The most prominent example for the LHC is the collision of fully stripped lead ions with protons (Pb-p). One way to accelerate the two beams simultaneously is ramping the energy with both beams having the same magnetic rigidity. This acceleration scheme, however, leads to slightly unequal revolution frequencies and therefore to moving long-range beam-beam encounters in the interaction regions of the collider. The resulting time-modulated momentum kicks might cause the excitation of overlap knock-out resonances, emittance blow-up and fast beam losses. A model to describe the observed phenomena has been developed and is applied to the LHC and RHIC.

AKBP 11.7 Do 18:00 NW-Bau - HS5

Laser cooling at the FAIR SIS100 — •Danyal Winters[1], Gerhard Birkl[2], Michael Bussmann[3], Volker Hannen[4], Daniel Kiefer[2], Sebastian Klammes[1,2], Thomas Kühl[1], Ulrich Schramm[3,5], Mathias Siebold[5], Thomas Stöhlker[1,6,7], Johannes Ullmann[1,4], Thomas Walther[2], Daniel Winzen[4], and Peter Spiller[1] — [1]GSI Darmstadt — [2]TU-Darmstadt — [3]HZDR Dresden — [4]Uni Münster — [5]TU-Dresden — [6]HI-Jena — [7]Uni-Jena

The heavy-ion synchrotron SIS100 is the core machine of the Facility for Antiproton and Ion Research - FAIR in Darmstadt, Germany. It is capable of accelerating a large range of ions, produced by the injector (GSI), up to highly relativistic velocities and extract them for unique experiments (*e.g.* APPA/SPARC). In order to cool such beams of heavy, highly charged ions, laser cooling was considered to be the best option. Therefore, plans to set up a laser cooling pilot facility at the SIS100, as the only in-ring experiment, are currently being executed. We will present this project and give an update of its current status. Finally, we will show which kinds of ions could be used for first experiments.