ST 5: MAP: Laser-driven Particle acceleration

Chair: Dietrich Habs

Zeit: Mittwoch 9:00–10:00 Raum: A021

ST 5.1 Mi 9:00 A021

Laser-driven electron acceleration from ultra-thin DLC foils - towards an ultra-compact coherent X-ray source — •Daniel Kiefer[1,2], Andreas Henig[1,2], Daniel Jung[1,2], Kirk Flippo[3], Cord Gautier[3], Sandrine Gaillard[3], Randy Johnson[3], Tom Shimada[3], Rahul Shah[3], Juan Fernandez[3], Vitaly Liechtenstein[5], Jörg Schreiber[1,2,4], Manuel Hegelich[2,3], and Dietrich Habs[1,2] — [1]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Str. 1, D-85748 Garching — [2]Ludwig-Maximilians-Universität München, Am Coulombwall 1, D-85748 Garching — [3]Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA — [4]Plasma Physics Group, Blackett Laboratory, Imperial College London, SW7 2BZ, UK — [5]RRC Kurchatov Institute, 123182, Moscow, Russia

We report on the acceleration of electrons from ultra-thin diamond-like carbon (DLC) foils by an ultrahigh-intensity laser pulse. While thick targets show maxwellian shaped electron spectra, a distinct quasi-monoenergetic characteristic peaked at 31 MeV is observed at a target thickness as thin as 5nm. At the same time, a substantial drop in laser-accelerated ion energies is observed. The experimental findings give first indication that laser-driven relativistic electron mirrors can be generated from ultra-thin foils, which in future may be used to generate brilliant X-ray beams by the coherent reflection of a second laser.

ST 5.2 Mi 9:30 A021

Enhanced laser-driven ion acceleration in the relativistic transparency regime — •Andreas Henig[1,2], Daniel Kiefer[1,2], Daniel Jung[1,2], Kirk Flippo[3], Cort Gautier[3], Sam Letzring[3], Randy Johnson[3], Tom Shimada[3], Lin Yin[3], Brian Albright[3], Juan Fernández[3], Sergey Rykovanov[1,4], Hui-Chun Wu[1], Keith Markey[5], Matt Zepf[5], Vitaly Liechtenstein[2,6], Jörg Schreiber[1,2,7], Manuel Hegelich[2,3], and Dietrich Habs[1,2] — [1]Max-Planck Institut für Quantenoptik, Garching, Germany — [2]LMU München, Department für Physik, Garching, Germany — [3]Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA — [4]Moscow Physics Engineering Institute, Kashirskoe sh. 31, Moscow, Russia — [5]Department of Physics and Astronomy, Queen's University Belfast, BT7 1NN, UK — [6]RRC "Kurchatov Institute", 123182, Moscow, Russia — [7]Plasma Physics Group, Blackett Laboratory, Imperial College London, SW7 2BZ, UK

We report on the acceleration of ion beams from ultra-thin diamond-like carbon (DLC) foils of thickness 50, 30 and 10 nm irradiated by ultra-high contrast laser pulses at intensities of $\sim 7 \times 10^{19}$ W/cm^2. An unprecedented maximum energy of 185 MeV (> 15 MeV/u) for fully ionized carbon atoms is observed at the optimum thickness of 30 nm. The enhanced acceleration is attributed to self-induced transparency, leading to strong volumetric heating of the classically over-dense electron population in the bulk of the target. Our experimental results are supported by one- and two-dimensional particle-in-cell (PIC) simulations.