SYLP 2 Relativistische Laser-Plasma-Physik 2

Zeit: Samstag 14:00–17:00 Raum: HU Senatssaal

Hauptvortrag

SYLP 2.1 Sa 14:00 HU Senatssaal

Laser Acceleration of Protons — •Claes-Göran Wahlström[1], Filip Lindau[1], Olle Lundh[1], Anders Persson[1], and Paul McKenna[2] — [1]Department of Physics, Lund Institute of Technology, Lund, Sweden — [2]Department of Physics, University of Strathclyde, Glasgow, UK

Laser acceleration of ions during the interaction of intense femtosecond lasers with thin solid target foils will be discussed. In particular, a systematic experimental study of the spatial distribution of the proton beams as function various laser parameters will be described. In this study, which is performed with the target foil irradiated under oblique angle of incidence, it is found that under certain laser and target conditions, the proton beams are directed away from the target normal. This deviation is towards the laser forward direction, with an angle that depends on the level and duration of the ASE pedestal before the main laser pulse. In addition, for a given laser pulse, this beam deviation increases with proton energy.

SYLP 2.2 Sa 14:40 HU Senatssaal

Laser accelerated ions and electron transport in ultra-intense laser matter interaction — •Markus Roth[1], Erik Brambrink[1,2], Patrick Audebert[2], Abel Blazevic[1], Robert Clarke[3], Jim Cobble[4], Julien Fuchs[2], Matthias Geissel[5], Dieter Habs[6], Manuel Hegelich[4], Stefan Karsch[3], Kenneth Ledingham[7], David Neely[3], Jörg Schreiber[6], and Juan Fernandez[4] — [1]University of Technology Darmstadt, Germany — [2]Laboratoire pour l'Utilisation des Lasers Intense, France — [3]Rutherford Appleton Laboratory, Great Britain — [4]Los Alamos National Laboratory, USA — [5]Sandia National Laboratory, Albuquerque, USA — [6]Ludwigs Maximilian Universität, München, Germany — [7]University of Strathclyde, Glasgow, Great Britain

Laser accelerated ion beams have been the subject of great interest. The ion beam peak power and beam emittance has been found to be unmatched by any conventionally accelerated ion beam. Comparing ion acceleration experiments at laser systems with different beam parameters and using targets of varying thickness, material and temperature, insight on the underlying physics can be obtained. In the talk, we will present experimental results obtained at different laser systems, a first beam quality measurement on laser accelerated heavy ions and ion beam source size measurements at different laser parameters. We will compare information obtained from micro patterned ion beams about the accelerating electron sheath and the influence of magnetic fields on the electron transport inside conducting targets.

SYLP 2.3 Sa 15:00 HU Senatssaal

Sudden acceleration of ions with intense femtosecond laser-pulses — •Matthias Schnürer[1,2], Sargis Ter-Avetisyan[1,2], Stefan Busch[1,2], Peter Nickles[1,2], and Wolfgang Sandner[1,2] — [1]Max-Born-Institut, Max-Born-Str. 2a, 12489 Berlin — [2]Transregio TR18 collaboration

If intense femtosecond Ti:Sa-laser pulses (intensity $> 10^{18} W/cm^2$, pulse duration $< 50fs$) irradiate matter (thickness $\sim 10\mu m$) an energetic electron population is immediately created which builds up an acceleration field for ions. In succession ions are abruptly accelerated from the plasma-vacuum interface. As shorter the laser pulse as steeper the electron distribution is formed which results in specific start conditions for the ion burst. Detailed studies of ion spectra from isolated water troplet targets as well as from plane foil targets are introduced and the acceleration behaviour, leading to deep modulations in the ion energy spectra [1], is discussed in the frame of a multi-electron temperature plasma. A creation of narrow band (monoenergetic) ion/proton spectra seems to be possible, which could give new application options in the accelerator and proton imaging technology. [1] S. Ter-Avetisyan e.a. Phys.Rev.Let. 93, 155006 (2004)

SYLP 2.4 Sa 15:40 HU Senatssaal

Electric field measurements in dense plasmas using proton imaging — •Toma Toncian[1], P. Antici[2], P. Audebert[2], M. Borghesi [3], C. A. Cecchetti[3], J. Fuchs[2], G. Pretzler[1], L. Romagnani [3], and O. Willi[1] — [1]Heinrich-Heine-Universität Düsseldorf, Universitätsstr. 1 40225 Düsseldorf, Germany — [2]Laboratoire pour l'Utilisation des Lasers Intenses (LULI), Ecole Polytechnique, Palaiseau cedex , France — [3]Queens University, Belfast, United Kingdom

Proton imaging is a powerful technique to investigate electric fields in dense laser produced plasmas. During the interaction of a intense laser pulse 10^{19} W/cm^2 with thin metal foil targets a multi MeV proton beam is generated. This diagnostic has been applied to study the rear side proton acceleration process of laser irradiated targets. The experimental results have been compared to the theoretical model of plasma expansion in vacuum. Good agreement has been found.

SYLP 2.5 Sa 16:00 HU Senatssaal

Charge distributions of ions accelerated from thin foils irradiated by high-intensity laser pulses — •Jörg Schreiber[1,2], Florian Grüner[1], Ulrich Schramm[1], Michael Geissler[2], Manuel Hegelich[3], Jim Cobble[3], Erik Brambrink[4], Julien Fuchs[5,6], Patrick Audebert[5], Dieter Habs[1], and Klaus Witte[2] — [1]LMU München, Garching, Germany — [2]MPI für Quantenoptik, Garching, Germany — [3]Los Alamos Natl. Lab, Los Alamos, USA — [4]TU Darmstadt, Darmstadt, Germany — [5]LULI, CNRS-CEA-École Polytechnique-Univ. Paris VI, Palaiseau, France — [6]University of Nevada, Reno, USA

We report on measurements of spectra and charge state distributions of ions accelerated from thin foils irradiated by ultrashort (300fs) high-intensity (6×10^{19}W/cm^2) laser pulses. The foils were resistively heated to remove the light surface contaminants. Sandwich targets consisting of a 25-μm thick tungsten layer, a 2-nm thin beryllium layer, and again a tungsten layer whose thickness was varied were used. Among the spectra of beryllium ions, peaked energy spectra of oxygen and argon ions corresponding to the equilibrium distribution after propagation through matter were observed [1]. For the found agreement we suggest an explanation in terms of starting positions of the detected ions underneath the rear-surface. Among the sandwich target geometry, a variety of different target materials was investigated to crosscheck spectra and charge state distributions of different elements in terms of the proposed explanation. Partially funded by DFG TR18.

[1] J. Schreiber *et* al., Appl. Phys. B, (2004)

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SYLP 2.6 Sa 16:20 HU Senatssaal

Investigation of high-intensity laser interaction with gaseous targets and the consequent plasma evolution — •Ralph Jung[1], Jens Osterholz[1], Oswald Willi[1], Marco Borghesi[2], Satyabrata Kar[2], Lorenzo Romagnani[2], Marco Galimberti[3], Robert Heathcote[4], Carlo Alberto Cecchetti[2], and Julien Fuchs[5] — [1]Heinrich-Heine-Universität Düsseldorf — [2]Queens University Belfast — [3]IPCF, Consiglio Nazionale delle Ricerche, Pisa — [4]CLF, Rutherford Appleton Laboratory, UK — [5]École Polytechnique, France

In a recent 100 TW-experiment at the Rutherford Appleton Laboratory (UK) the laser interaction with gaseous targets has been investigated using the proton imaging technique and infrared emission observations. The experiment used the VULCAN pulse (700 fs, 1.05 μm) at focussed intensities of 2-3$\cdot 10^{19}$ W/cm^2. The proton images show evidence of channeled propagation and filamentation of the laser beam, revealed by the associated electric fields.

SYLP 2.7 Sa 16:40 HU Senatssaal

Plasma of extreme energy density by intense VUV-beams — •Annika Krenz and Jürgen Meyer-ter-Vehn — Max-Planck-Institut für Quantenoptik Hans-Kopfermann-Str.1, Garching

We report on new possibilities to generate solid-density plasma at extreme energy density by intense VUV-beams becoming available at DESY in 2005. The VUV-FEL TESLA Test Facility TTF2 will provide pulses of 10^{13} photons with 20-200eV photon energy and 100fs pulse duration reaching intensities up to $10^{17} W/cm^2$ by focussing up to $1\mu m^2$. Photons in this energy range show maximum absorption and energy deposition in solids and therefore producing uniform plasma layers at solid density with temperatures up to 500eV. In this context we discuss the absorption mechanism of VUV light in solid targets. In addition scattered photons will provide detailed information on the structure of the generated plasma. This offers new possibilities to study equations of state and opacities over a wide range of the phase diagram also in the regime relevant for Inertial Confinement Fusion. Besides, fundamental studies of the warm dense matter regime (0,1-10eV) are of particular interest in first experiments. Here the liquid-gas phase transitions are located and therefore the information about the critical points which are unknown for many materials.