P 14: Miscellaneous

Time: Wednesday 16:30–18:15 Location: B 302

P 14.1 We 16:30 B 302

Energy loss of heavy ions in directly and indirectly laser-generated plasma — •Alexander Frank[1], Dennis Schumacher[1], Abel Blazevic[2], Thomas Hessling[2], Witold Cayzac[1], Gabriel Schaumann[1], Gregor Schiwietz[3], Pedro Luis Grande[4], Anna Tauschwitz[5], Mikhail Basko[6], Joachim Maruhn[5], and Markus Roth[1] — [1]TU Darmstadt — [2]Helmholtzzentrum für Schwerionenforschung — [3]Helmholtz-Zentrum Berlin für Materialien und Energie — [4]Universidade Federal do Rio Grande do Sul — [5]Universität Frankfurt — [6]ITEP, Moscow

At GSI there are two approaches for investigating the interaction of swift ions penetrating laser-generated plasma. One is to create the plasma by direct irradiation of a thin carbon foil. This scheme produces high plasma temperatures and hence high ionization degrees. The second approach uses a gold hohlraum as an x-ray converter target to achieve a volumetric heating of the target foil and hence a greater homogeneity of the plasma parameters. We present an overview on recent results and developments of beam plasma interaction studied with an Ca ion beam. A new spectrometer based on CVD diamond was developed for measuring the projectile charge states exiting the plasma target and energy loss. The results are compared with theoretical predictions based on modified charge transfer cross section calculation routines of ETACHA and a modified version of the CasP code. Furthermore time-resolved and time-integrated hohlraum spectra are presented in this talk and different target schemes for ion-plasma interaction experiments are presented.

P 14.2 We 16:45 B 302

Efficient ion acceleration in the laser transparency regime — •Sven Steinke[1], Andreas Henig[2], Matthias Schnürer[1], Thomas Sokollik[1], Rainer Hörlein[2], Daniel Kiefer[2], Xueqing Yan[2,3], Toshiki Tajima[2,4], Peter Nickles[1], Wolfgang Sandner[1], and Dietrich Habs[2] — [1]Max Born Institut, Max Born Str. 2a, D-12489 Berlin, Germany — [2]Max-Planck-Institut fuer Quantenoptik, D-85748 Garching, Germany — [3]State Key Lab of Nuclear Physics and Technology, Beijing University, 100871, Beijing, China — [4]Photomedical Research Center, JAEA. Kyoto, Japan

Experiments on ion acceleration from ultra-thin diamond-like carbon (DLC) foils with thicknesses below the skin depth (i.e. transparent), irradiated by ultra-high contrast laser pulses are presented. A maximum energy of $13 MeV$ for protons and $71 MeV$ for carbon ions is observed with an overall energy conversion efficiency Of $\sim 10\%$. The increase in ion energies can be attributed to a dominantly collective rather than thermal motion of the foil electrons leading to an observed reduction in electron heating and in case of circular polarization to a pronounced peak in the C^{6+} spectrum. Two-dimensional particle-in-cell (PIC) simulations reveal that those C^{6+} ions are for the first time dominantly accelerated by the laser radiation pressure.

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Divergence optimized targets for laser proton acceleration — •Oliver Deppert[1], Knut Harres[1], Frank Nürnberg[1], Gabriel Schaumann[1], Marius Schollmeier[2], and Markus Roth[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Sandia National Laboratories, Albuquerque, USA

The irradiation of thin metal foils by an ultra-intense, relativistic laser pulse leads to the generation of a highly laminar, high intense proton beam accelerated from the target rear side by the TNSA mechanism. This kind of acceleration mechanism strongly depends on the geometry of the target. The acceleration originates from the formation of a Gaussian-like electron sheath at the rear side of the target leading to an electric field in the order of TV/m. This sheath field-ionizes the target rear side instantaneously and therefore is able to accelerate predominantly protons from a hydrogen contamination layer. The sheath adds an energy dependent divergence to the local beam profile. For further applications it is essential to reduce the divergence already from the "source" of the acceleration process. Therefore numerical simulations where performed with the PIC-Code PSC in order to optimize the proton acceleration with respect to beam divergence. The results leads to the design of three different target geometries. The targets consist of a hemispherical, proton focusing part and a cone-like top part for collimation. Both, the results from the simulations and the technique of fabrication such sub-millimeter to μm targets will be presented. Finally, the results from the experimental campaign at the PHELIX laser system will be compared with the numerical calculations.

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Water micro droplets for generation of mono energetic — •Jens Polz[1,2], Sven Herzer[1,2], Wolfgang Ziegler[1,2], Oliver Jäckel[1,2], and Malte Kaluza[1,2] — [1]Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität, 07743 Jena, Germany — [2]Helmholtz Institut Jena, Friedrich-Schiller-Universität, 07743 Jena, Germany

Laser ion acceleration with Tera- and Petawatt class lasers has been studied for more than a decade. The dominant acceleration mechanism is target normal sheath acceleration. The maximum achievable ion energy is limited by the laser and the obtained energy spectra show a quasi-thermal distribution. It is highly desirable to increase the maximum ion energies and to be able to spectrally shape the energy distribution of the accelerated ions.

Using micro droplet targets provides us with the unique advantage of combining mass limitation corresponding to a field strength enhancement and spectral shaping making use of the confined TNSA process. Charge separation effects in the expanding ion beam containing at least two ion species enable the formation of non-thermal features in the spectrum.

The experiment presented here shows that water micro droplet targets can be used to generate spectrally modulated ion beams with increased maximum energy. In contrast to previous experiments, we were able to obtain non thermal energy spectra with a reliability increased to more than 50%.

P 14.5 We 17:30 B 302

X-Ray Thomson Scattering from warm dense carbon isochorically heated by laser-generated protons — •Alexander Pelka[1], Mark Günther[1], Knut Harres[1], Anke Otten[1], Markus Roth[1], Gabriel Schaumann[1], Anna Tauschwitz[2], Gianluca Gregori[3], Dirk Gericke[4], Siegfried Glenzer[5], Andrea Kritcher[5], and Marius Schollmeier[6] — [1]Technische Universität Darmstadt — [2]Gesellschaft für Schwerionenforschung, Darmstadt — [3]University of Oxford — [4]University of Warwick — [5]Lawrence Livermore National Laboratory, Livermore — [6]Sandia National Laboratory, Albuquerque

We demonstrate X-ray Thomson Scattering from warm, dense, volumetrically heated matter. An intense, ultrashort proton beam, generated by a high-intensity short-pulse laser via Target Normal Sheath Acceleration is used to heat a carbon sample to temperatures of a few thousand Kelvin. A second short pulse laser is then used to generate a short-lived (several 10 ps) bright source of 4.75 keV Ti He-alpha radiation for x-ray scattering. The scattered photons are detected with a spectrometer using a curved HOPG crystal in von Hamos geometry positioned at 90°. Due to the exponential energy distribution of the protons and the resulting depth dependency of the temperature a relatively wide range of temperatures up to 0.4 eV at constant densities could be accessed. Both the duration of heating and scattering are short compared to hydrodynamic processes in the target, allowing expansion to be neglected. The presented method allows the investigation of the EOS of isochorically heated carbon near its melting point.

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Catalytic Conversion of Biogas to Synthesis Gas in a Fluidised Bed Reactor Supported by a DBD — •Thorsten Kroker[1], Torsten Kolb[1], Andreas Schenk[1], Karl-Heinz Gericke[1], Michal Młotek[2], Krzysztof Krawczyk[2], and Krzystof Schmidt-Szałowski[2] — [1]Institute of Physical and Theoretical Chemistry Braunschweig, 38106, Germany — [2]Warsaw University of Technology, Faculty of Chemistry ul. Noakowskieo 3, 00-664 Warszawa

The catalytic conversion of the greenhouse gases methane and carbon dioxide was studied in a fluidized bed reactor supported by a RF driven dielectric barrier discharge. The discharge was realized in a coaxial DBD-reactor, driven by a 13.56 MHz power supply unit. Several catalysts powder Pd, Cu, Ag carried by Al2O3, were used supported by a heating system to control the temperature of the catalyst. The mixture of 60% methane and 40% carbon dioxide in Helium as carrier gas was investigated, because it is the average composition of the main components of biogas. The aim was to test whether the biogas composition could by used for the production of synthesis gas. The influence of power rates, catalysts and the temperature of the catalysts on the product yield were studied. The reaction was monitored online by quadrupole mass spectroscopy and infrared spectroscopy supported by a White-cell. The H2/CO ratio could be influenced by using a catalyst and was be found in a area from 1.6 without a catalyst and up to 2.0 by using a Palladium catalyst. The process is highly selective for the hydrogen production (up to 75%, by using the Palladium catalyst).

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Schaltlichtbögen - Vergleichbarkeit von Simulation und Experiment — •Sylvio Kosse und Andreas Hauser — Siemens AG, Corporate Technology, D-91058 Erlangen

In der Entwicklung und Konstruktion von Schaltgeräten aller Spannungsebenen gewinnt der Einsatz von Simulationen, insbesondere die Simulation von Schaltlichtbögen, mehr und mehr an Bedeutung. Durch die Verfügbarkeit nutzerfreund-licher kommerzieller Software-Pakete können die mathematischen Gleichungen, die der Lichtbogensimulation zu Grunde liegen, zeitabhängig und in 3D in angemessener Zeit gelöst werden. Verfügbare experimentelle Werte für die Größen Druck, Lichtbogenspannung und Lichtbogenstrom sind leicht mit den Simulationsergebnissen vergleichbar.

Für die Visualisierung des Lichtbogens bzw. des Lichtbogenlaufs vergleichen verschiedene Autoren Temperatur- oder Stromdichteverteilungen aus der Simulation mit Aufnahmen von Hochgeschwindigkeitskameras. Die Kameras detektieren jedoch weder Temperaturen direkt noch Stromdichten, sondern lediglich Strahlungsintensitäten in einem bestimmten kameraspezifischen Spektralbereich.

In diesem Beitrag werden verschiedene Methoden vorgestellt und diskutiert, wie Lichtbögen visualisiert werden können, um experimentelle Ergebnisse und Simulationen richtig vergleichen zu können.