P 17: Laserplasmen und innovative Anwendungen

Time: Thursday 10:30–12:15 Location: V55.01

P 17.1 Thu 10:30 V55.01

Ultra-thin polymer foils feature mono energetic multi-ion acceleration — •Bastian Aurand[1,2,4,5], Jana Bierbach[1,3], Sven Herzer[1,3], Oliver Jäckel[1,3], Stephan Kuschel[1,3], Jens Polz[1,3], Christian Rödel[1,3], Huanyu Zhao[2,6], Paul Gibbon[5,7], Anupam Karmakar[5,7], Bentsian Elkin[8], Gerhard Paulus[1,3], Malte Kaluza[1,3], and Thomas Kühl[1,2,4,5] — [1]Helmholtz Institute Jena; 07743 Jena;Germany — [2]GSI Helmholtz Center; 64291 Darmstadt; Germany — [3]Institute for Optic and Quantum Electronics; Friedrich Schiller University; 07743 Jena; Germany — [4]Johannes Gutenberg University; 55122 Mainz; Germany — [5]EMMI Extreme Matter Institute; 64291 Darmstadt; Germany — [6]Institute of Modern Physics; 73000 Lanzou; China — [7]Research Center Jülich; 50428 Jülich; Germany — [8]Fraunhofer Institute for Interfacial Engineering and Biotechnology; 70569 Stuttgart; Germany

Recent experiments on laser-ion-acceleration out of ultra-thin plastic foils performed at the JETI laser system in Jena show intriguing new results on collective multi-ion acceleration. We observe a mixed acceleration regime partly based on radiation-pressure acceleration (RPA) and Coulomb-explosion (CE). A detailed 2D PIC simulation supports our observations. Scans on different parameters like ellipticity and intensity allow a detailed understanding of the observed effects. In addition we improve the well known target-normal-sheath acceleration (TNSA) in case of using fully circular polarized light.

P 17.2 Thu 10:45 V55.01

LIGHT: Towards a laser-based accelerator — •Simon Busold[1], Oliver Deppert[1], Christian Brabetz[3], Trevor Burris-Mog[4], Martin Joost[4], Abel Blazevic[2], Bernhard Zielbauer[2,5], Vincent Bagnoud[2], Oliver Kester[2,3], Tom Cowan[4], and Markus Roth[1] — [1]Technical University of Darmstadt, Institute for Nuclear Physics, Schlossgartenstraße 9, 64289 Darmstadt — [2]GSI Helmholtz Center for Heavy Ion Research, Planckstraße 1, 64291 Darmstadt — [3]Goethe University Frankfurt/Main, Institute for Applied Physics, Max von Laue Straße 1, 60438 Frankfurt — [4]Helmholtz Center Dresden-Rossendorf, Bautzner Landstraße 400, 01328 Dresden — [5]Helmholtz Institute Jena, Helmholtzweg 4, 07743 Jena

Proton acceleration by ultrashort, high intensity laser pulses has been a fast growing field of research during the last decade. The most intensely investigated accleration mechanism is the TNSA mechanism (Target Normal Sheath Acceleration), providing protons in the multi-MeV-range.

For many possible applications, however, the full energy spread and large beam divergence are major draw-backs. Therefore, a pulsed high-field solenoid was used for collimation and energy-selection and is now integrated in a full test stand for a laser-based accelerator at GSI Helmholtz Center, Darmstadt, namely the LIGHT project (Laser Ion Generation, Handling and Transport), which is a collaboration between TU Darmstadt, GSI, HZDR, JWGU Frankfurt and HI Jena.

An overview of the new infrastructure, the goals of the LIGHT project and first experimental results are presented.

P 17.3 Thu 11:00 V55.01

Einfluss des Gases bei der Elektronenbeschleunigung mittels Hochleistungslaser — •Alexander Sävert[1], Stuart P. D. Mangles[3], Michael Schnell[1], Maria Nicolai[1], Oliver Jäckel[1,2], Maria Reuter[1,2], Ajay K. Arunachalam[1,2] und Malte C. Kaluza[1,2] — [1]Institut für Optik und Quantenelektronik Friedrich-Schiller-Universität, Jena, Germany — [2]Helmholtz-Institut Jena, Friedrich-Schiller-Universität, Jena, Germany — [3]Department of Physics, Imperial College, London, United Kingdom

Bei der Wechselwirkung von hochintensiven Laserpulsen mit einem Plasma werden periodische Elektrondichteschwankungen erzeugt, mit deren Hilfe Elektronen auf relativistische Energien beschleunigt werden können. Dafür wurde der 30TW Laser am Institut für Optik und Quantenelektronik (Jena) in einen Überschallgasjet aus Helium fokussiert. Es konnten Elektronenpulse mit Energien von bis zu 200 MeV erzeugt werden. Durch Wechsel auf Wasserstoff wurde die Divergenz des Elektronenstrahls reduziert und die Ladung innerhalb des Elektronenpulses erhöht. Mit Hilfe numerischer Simulationen wurden die zu Grunde liegenden physikalische Ursachen indentifiziert. Dieses Verständnis ist wichtig um die Qualität der Elektronenpulse für zukünftige Anwendungen weiter zu verbessern.

P 17.4 Thu 11:15 V55.01

Diagnostik, Simulation und Visualisierung eines Mikrowellenplasmas — •Tim Brandt, Thomas Trottenberg und Holger Kersten — Institut für Experimentelle und Angewandte Physik, Christian-Albrechts-Universität zu Kiel, D-24098 Kiel

Breitstrahlionenquellen, die für die Plasmaerzeugung das Prinzip der Elektron-Zyklotron-Resonanz (ECR) nutzen, finden heutzutage viele Anwendungen in der Industrie. Zur Optimierung dieser Anwendungen und der Ionenquellen selbst ist ein genaues Verständnis des ECR-Prozesses erforderlich. Theoretische Beschreibung und Simulation von ECR-Plasmen sind sehr anspruchsvoll. Es werden Messdaten benötigt, um das Modell zu verifizieren und zu optimieren.

Die Diagnostik eines ECR-Plasmas stellt allerdings ebenfalls eine große Herausforderung dar. Mikrowellen und das starke statische Magnetfeld erfordern unkonventionelle diagnostische Methoden.

In diesem Beitrag werden sowohl Simulation als auch Diagnostik an einer industriellen ECR-Breitstrahlionenquelle vorgestellt. Es wird dabei deutlich, dass sowohl die theoretische als auch die experimentelle Untersuchung dieses Plasmatyps Stärken und Schwächen haben. Die beiden Zugänge können sich gegenseitig ergänzen und zu einem besseren Verständnis führen. Insbesondere wird der Frage nachgegangen, wie anhand der Messdaten zwischen ECR-Heizung und reiner Mikrowellenheizung unterschieden werden kann. Ergänzend werden Funktionsweise und Anwendungsmöglichkeiten von ECR-Ionenquellen mit animierten Computergraphiken dargestellt, die in Ausbildung und Öffentlichkeitsarbeit verwendet werden können.

P 17.5 Thu 11:30 V55.01

Venus magnetosphere studies under the aspect of modern information technologies in the field of plasma physics — •Florian Topf[1], Helmut O. Rucker[1], Christian Jacquey[2], Maxim Khodachenko[1], Vincent Génot[2], Tarek Al-Ubaidi[1], Nicolas André[2], Michel Gangloff[2], and Esa Kallio[3] — [1]IWF/OeAW, A-8042 Graz, Austria — [2]CNRS/IRAP, 31028 Toulouse, France — [3]FMI, FI-00101 Helsinki, Finland

In today's research environment, the use of advanced information technologies increasingly gains importance, since most of science work relies on different data sources and tools distributed over the Internet. So called "Virtual Observatories" are describing, organizing and interconnecting those resources in a standardized way. As a result, scientific work can be done in homogeneous web-based environments with the possibility to integrate tools and data sources from different scientific fields. This paper will point out two best practice examples coming from the planetary science community. The first solution, the Automated Multi Dataset Analysis (AMDA) was extended during the FP7 project EuroPlaNet with Venus Express data, which can be analyzed and manipulated in this tool. The second solution, the FP7 project Integrated Medium for Planetary Exploration (IMPEx) builds on top of AMDA and integrates modelling tools like the HYBRID code into a standardized environment in order to intercompare observational data with simulation data. Preliminary results and important design aspects of those tools will be presented and put in relation with their advantages and scientific potential in plasma physics.

P 17.6 Thu 11:45 V55.01

Pulsed Electric Fields in Food Processing: Equipment Design and Commercial Applications — •Stefan Töpfl — DIL e.V., Quakenbrück, Germany

Pulsed electric fields allow a short-time, low energy disintegration of plant and vegetable tissue as well as microbial inactivation in liquids. For plant and vegetable tissue an increase of juice or oil yield during pressing or extraction is observed. In addition, the techniques impact on textural properties allows a targeted modification of structural properties, e.g. to enhance cutting performance. Low energy and time requirements are major benefits in comparison to a mechanical grinding or a thermo-break application. To allow a preservation of heat sensitive liquids, the inactivation of target strains as well as naturally occurring microorganisms in orange juice, mango and melon puree as well as smoothies has been evaluated. An inactivation of 4 to 5 log cycles has been achieved, while maintaining the fresh-like product characteristics. An increase of shelf life from 7 to 21 days has been obtained. Since 2011 the technique is used in an industrial scale. Pulsed power systems for food treatment with an average power of up to 80 kW has been developed. At present a capacity of up to 50 t/h can be achieved. During the presentation application examples will be shown and the technical, commercial and legal framework discussed.

P 17.7 Thu 12:00 V55.01

Plasma sterilization of pharmaceutical products: from basics to production — •Benjamin Denis[1], Simon Steves[1], Egmont Semmler[1,2], Nikita Bibinov[1], Wenzel Novak[2], and Peter Awakowicz[1] — [1]Lehrstuhl fur Allgemeine Elektrotechnik und Plasmatechnik, Ruhr-Universitat Bochum, Deutschland — [2]groninger & co gmbh, Crailsheim, Deutschland

Sterilization is a crucial step in pharmaceutical packaging and filling. Conventional sterilization methods used in pharmaceutical industry e.g. highly toxic chemicals (e.g. ethylene oxide), autoclaves or gamma radiation are not suitable for all kinds of pharmaceutical products, due to material damaging.

The route from a laboratory plasma reactor to an industry scale plasma sterilization reactor is shown. Absolutely calibrated measurements yield to a knowledge transfer from an experimental set-up to a prototype and a industrial plasma reactor. It was shown that UV and VUV radiation is needed to kill (endo)spores. Langmuir probe measurements reveal that a discharge with a homogeneous distribution of the electron density around large objects is possible. Temperature measurements show that the gas temperature and therefore the energy impact on materials cannot be neglected. With both high power and lowering the duty-cycle it is possible to achieve relatively high UV/VUV dosages, but also keeping the thermal load low.

High sterilization efficiency of 4 log spore count reduction in 10 s of Geob. stearothermophilus and B. subtilis spores prove the applicability of an industrial grade plasma sterilization reactor.