P 9 Schwerionen- und lasererzeugte Plasmen 1

Zeit: Samstag 08:30–09:45 Raum: HU 3059

Fachvortrag P 9.1 Sa 08:30 HU 3059

Nichtlineare Resonanz - Grundlage der stoßfreien Absorption kurzer Laserpulse — •Peter Mulser — Theoretische Quantenelektronik (TQE), TU Darmstadt, Schlossgartenstr.7, D-64289 Darmstadt

Bei der Wechselwirkung intensiver ultrakurzer Laserpulse mit Festkörpern und Clustern wird ein heißes, relativistisches Plasma erzeugt, dessen Heizung nur zu Beginn auf Stoßabsorption beruht. Experimente und numerische Simulationen zeigen, dass die weitere Heizung und Erzeugung schneller Teilchenstrahlen im sogenannten stoßfreien Bereich erfolgt. Über den Heizmechanismus hierzu gibt es einige Modellvorstellungen, wegen deren Unzulänglichkeit muss dieser trotzdem bereits seit zwei Jahrzehnten als unverstanden angesehen werden. Im Vortrag wird das physikalische Prinzip der stoßfreien Absorption, d.h. die Absorption von Photonen durch „freie“ Elektronen, in Festkörpern und Clustern erläutert und durch Modellrechnungen erhärtet. Der Schlüssel zum Verständnis wird dabei eine charakteristische Eigenschaft nichtlinearer Oszillatoren sein. Aus dem neuen Modell können weitreichende Schlüsse gezogen werden

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Study of electron beam propagation in dense plasmas — •Ralph Jung[1], Jens Osterholz[1], Krischan Löwenbrück[1], Sergey Kiselev[1], Alexander Pukhov[1], Georg Pretzler[1], Oswald Willi[1], Satyabrata Kar[2], Marco Borghesi[2], Stefan Karsch[3], Robert Clarke[3], David Neely[3], and Wigen Nazarov[4] — [1]Heinrich-Heine-Universität Düsseldorf — [2]Queens University of Belfast — [3]Rutherford Appleton Laboratory, UK — [4]University of Dundee, UK

The generation and transport of relativistic electron beams is a field of topical interest, in particular for the fast ignitor scheme relevant for inertial confinement fusion. We have studied the propagation of laser accelerated electrons in dense plasmas. Aluminium- and foam targets with various thicknesses were irradiated with the Petawatt laser beam at the Rutherford Appleton Laboratory (UK). The electron beam is investigated by observing the coherent transition radiation (CTR) generated at the target rear side. A decrease of CTR intensity for the thicker targets is observed and explained by dephasing of the electron bunches as they propagate through the plasma. For the foam targets, a break-up of the electron beam into filamentary structures is evident, showing that the relativistic electron beam is sensitive to Weibel type instabilities due to counter propagating current of cold electrons. The experimental results are consistent with 3D PIC simulations.

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Isochoric heating of low Z solid targets with 10 fs laser pulses — •Jens Osterholz[1], Thomas Fischer[1], Felix Brandl[1], Mirela Cerchez[1], Ariane Pipahl[1], Georg Pretzler[1], Oswald Willi[1], and Steven Rose[2] — [1]Heinrich-Heine-Universitaet Düsseldorf — [2]University of Oxford

The investigation of high density plasmas plays an important role for astrophysics, inertial confinement fusion and x-ray lasers. Therefore the generation of dense plasmas with ultra-intense laser pulses is a field of enormous topical interest. An upper limit of the maximum plasma density that can be achieved with this method, however, occurs due to the formation of a preplasma and the expansion of the plasma during the interaction. Here we describe a novel approach that is based on a laser system that generates 10 fs pulses with a low prepulse energy. Isochoric heating is demonstrated with small Z solid targets. Time integrated XUV spectroscopy is used to investigate the emission from the plasma. The series limits observed in the spectra are explained by pressure ionisation. The XUV spectra were simulated by two different models. The first calculates the effect of pressure ionisation and the second calculates the line intensity ratios. Preliminary calculations suggest that the plasma density of the emitting region is close to solid density with an electron temperature of about 100eV.

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Hydrodynamical simulation of inhomogenous plasma — •Thomas Raitza, Heidi Reinholz, August Wierling, and Gerd Roepke — Universitaetsplatz 3; 18055 Rostock

Application of hydrodynamical simulations are considered, which aim at the description of the plasma formation and the investigation of its properties. We will show results, obtained by the MULTI CODE as described in [1]. We simulate the formation of density and temperature profiles in shock wave induced plasmas. Experimentally, an explosion driven impactor induces a shock wave, that propagates through a gas and ionizes it [2]. Previously used shock front profiles, which were fitted to reproduce experimental results [3], can now be taken from the preliminary consideration. Simulations will be presented with respect to laser induced highly excited clusters, which leads to density and temperature profiles during Coulomb expansion.

[1] K. Eidmann, J. Meyer-ter-Vehn, T. Schlegel, S. Hueller; Phys. Rev. E 62,1202; 2003 [2] V. B. Mintsev, Yu. Zaporogehts; Contrib. Plasma Phys.; 29, 493; 1989 [3] H. Reinholz, Yu. Zaporogehts, V. Mintsev, V. Fortov, I. Morozov; Phys. Rev. E 68, 036403; 2003