

SYPS 2 Symposium: Plasmas in unusual situations, Part II: Laser generated plasmas

Zeit: Montag 14:00–16:00

Raum: HU Audimax

Hauptvortrag

SYPS 2.1 Mo 14:00 HU Audimax

Creation of cluster plasmas at short wavelengths: Results and perspectives — ●HUBERTUS WABNITZ¹, A. RUBENS B. DE CASTRO², PETER GUERTLER², TIM LAARMANN³, WIEBKE LAASCH², PATRICK MONTCHICOURT¹, JOACHIM SCHULZ⁴, CHRISTOPH BOSTEDT⁵, and THOMAS MOELLER⁵ — ¹CEA, DRECAM/SPAM, France — ²HASYLAB/DESY, Hamburg — ³Max-Born Institut, Berlin — ⁴MAX-Lab, Sweden — ⁵TU Berlin

Until recently the investigation of the interaction of strong light fields with matter at short wavelengths beyond the ultraviolet spectral range was hindered by the lack of sufficiently intense light sources. The production of gigawatt radiation in the vacuum ultraviolet range with intensities up to 10^{13} W/cm² at the DESY free-electron laser opened the door to such studies. First experiments with clusters have shown that in principle a highly ionised medium is formed, which absorbs unexpectedly strong and finally disintegrates by Coulomb explosion. This contribution will first review the results from the FEL experiment and then turn towards forthcoming experiments. Besides future work at the VUV-FEL, complementary time resolved cluster studies using high harmonic generation (HHG) as intense VUV light source will be presented.

Hauptvortrag

SYPS 2.2 Mo 14:30 HU Audimax

Hot nanoplasmas: clusters in intense fields — ●CHRISTIAN SIEDSCHLAG — AMOLF, Kruislaan 407, 1098SJ Amsterdam

Rare gas clusters respond extremely sensitive to irradiation with intense fields. Due to an absorption that can reach up to 100 %, hot, expanding nanoplasmas with 8 or more electrons per ion can be formed. We investigate the behavior of these hot clusters under a wide range of conditions, from single femtosecond IR pulses over FEL pulses in the VUV domain to various pump-probe schemes which turn out to be useful for the detailed understanding of the expansion process. The influence of different cluster sizes is investigated as well, and the evolution from molecular to plasma behavior is elucidated using an optimal control scheme.

Hauptvortrag

SYPS 2.3 Mo 15:00 HU Audimax

Metal clusters under short and intense laser pulses — ●K.H. MEIWES-BROER, T. DÖPPNER, TH. FENNEL, P. RADCLIFFE, A. PRZYSTAWIK, and J. TIGGESBÄUMKER — Fachbereich Physik, Universität Rostock, Universitätsplatz 3, 18051 Rostock

The interaction of metal clusters with intense laser light fields leads to a giant up-charging and subsequent Coulomb explosion. Most interestingly, it has been shown that for free metal clusters the highest charge states of the ionic fragments are not produced with the shortest laser pulses (and hence the highest intensity of 1.5×10^{16} W/cm²) but with stretched pulses having a width of 600 fs to 1000 fs [1]. This phenomenon we currently attribute to plasmon enhanced ionization. Studying the charging dynamics using the femtosecond dual-pulse technique gives a much higher time resolution and simplifies the interpretation of the experimental findings. Applying this method to free clusters and those which are embedded in helium droplets, reveals a significant influence of charge transfer processes [2]. The experimental results will be discussed in view of Vlasov simulations [3].

[1] L. Köller, M. Schumacher, J. Köhn, S. Teuber, J. Tiggesbäumker, and K.H. Meiwes-Broer, Phys. Rev. Lett. **82**, 3783 (1999).

[2] T. Döppner, S. Teuber, Th. Diederich, Th. Fennel, P. Radcliffe, J. Tiggesbäumker, and K.H. Meiwes-Broer, Eur. Phys. J. D **24**, 157 (2003).

[3] Th. Fennel, G. Bertsch, and K.H. Meiwes-Broer, Eur. Phys. J. D **29**, 367 (2004).

Hauptvortrag

SYPS 2.4 Mo 15:30 HU Audimax

High-Density Plasmas Generated by DESY FEL-Beams — ●JÜRGEN MEYER-TER-VEHN — Max-Planck-Institute for Quantum Optics, Hans-Kopfermann-Str. 1, 85748 Garching

New options to study hot dense matter physics and plasma soft X-ray lasers with very intense XFEL beams at DESY in Hamburg will be discussed. Already the 100 fs XUV pulses, becoming available with photon energies of 20 - 200 eV in 2005, may reach intensities up to 10^{18} W/cm² when focussed to spots of 1 mm diameter. They will generate thin layers of uniform solid-density plasma with temperatures up to 1 keV and

Gbar pressures and allow to investigate the phase diagram of hot dense matter in a wide density and temperature range, not accessible so far for high-precision measurements. In addition to target heating, scattered photons will provide detailed information on the structure of the generated plasma. During the 100 fs interaction time, the target material will be in an extreme state of non-equilibrium. Here we present theoretical investigations showing that the XUV pulses can be used as pumps to demonstrate He-a laser schemes for the first time.