# A 24: Poster II - Interaction with VUV and X-ray light

Zeit: Donnerstag 16:30–18:30 Raum: Poster B

A 24.1 Do 16:30 Poster B

**Direct interaction of light with quantum systems governed by the strong force** — •Andreas Ipp[1], Adriana Pálffy[1], Thomas J. Bürvenich[2], Jörg Evers[1], and Christoph H. Keitel[1] — [1]Max Planck Institute for Nuclear Physics, Heidelberg — [2]Frankfurt Institute for Advanced Studies

The direct interaction of atoms and laser fields allows in many cases for a controlled preparation, manipulation, and measurement of the internal and external degrees of freedom of the atoms, giving rise to a multitude of applications [1]. A key ingredient to many of these schemes is the coherence of the light field, and therefore, it is not surprising that present and upcoming light sources aim at extending the availability of coherent light both towards higher frequencies and intensities. Thus the question arises whether light-matter interaction, reminiscent of quantum optics, is also possible in quantum systems characterized by much higher energy scales. For example, recently it was shown that super-intense laser fields make the direct interaction of laser and nuclei feasible [2]. Here, we discuss prospects of controlled matter-light interaction in quantum systems governed by the strong interaction. Our model systems include quark-gluon plasmas and highly excited nuclei.

[1] M. O. Scully and M. S. Zubairy, Quantum optics (Cambridge, 1997).

[2] T. J. Bürvenich, J. Evers, and C. H. Keitel, Phys. Rev. Lett. 96, 142501 (2006).

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**Quantum dynamics in atomic and molecular fragmentation by strong FLASH pulses** — •Y. H. Jiang[1], R. Moshammer[1], L. Foucar[2], A. Rudenko[1], Th. Ergler[1], C.D. Schröter[1], S. Lüdemann[1], K. Zrost[1], D. Fischer[3], J. Tietze[2], T. Jahnke[2], M. Schöffler[2], T. Weber[2,4], R. Dörner[2], T. Zouros[5], A. Dorn[1], T. Ferger[1], K.U. Kühnel[1], J. Ullrich[1], R. Treusch[4], P. Radcliff[4], and E. Plönjes[4] — [1]Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg — [2]Institut für Kernphysik, Universität Frankfurt, D 60486 Frankfurt — [3]Stockholm University, Stockholm — [4]DESY, Notkestrasse 85, 22607 Hamburg — [5]University of Crete, Greece

Few-photon multiple ionization of Ne and Ar atoms as well as $D_2$ molecule by strong VUV laser pulses from the Free electron LASer at Hamburg (FLASH) was investigated differentially with the reaction microscope. The light of wavelengths 44 nm and 32 nm, a pulse duration of ≈50 fs, at pulse energies ≈3-10 $\mu$J, allows to observe few-photon multiple ionization of atoms and molecules The light intensity dependence of ion production yields reveals the dominance of non-sequential multi-photon ionization mechanisms at relative low intensities. Recoil ion momentum spectroscopy of $Ne^{2+}$ shows for the first time that two electrons absorbing "instantaneously"two photons are ejected mostlikely into opposite hemispheres with very similar energies, a situation that is strongly different in single photon double ionization or even forbidden for equal energies in strictly opposite direction.

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**The Variable Polarization XUV Beamline at PETRA III** — •Jens Viefhaus and Frank Scholz — DESY, Hamburg, Garmany

The storage ring PETRA III (DESY, Hamburg) with its very low emittance of 1 nm rad makes it an excellent facility to host a Variable Polarization XUV Beamline. User operation of the beamline will start in 2009 right after the startup phase of PETRA III.

The high brilliance and flux of the beamline provided in a broad photon energy range (200 eV to 3000 eV) will open up new scientific opportunities in fields like high resolution PES, spectroscopy of dilute targets, emvironmental chemistry and many more.

Key absorption edges of practically all important elements lie in the range of photon energies provided by the beamline which creates the possibility to uniquely determine the element-specific local electronic structures. Of equal importance will be polarization-dependent studies using the 5 m APPLE-II-type undulator (65.6 mm period) which allows full polarization control by the user and operates over the whole photon energy range in the first harmonic providing both high flux and complete polarization. Using state-of-the-art technology it is possible to achieve a spectral resolving power of more than 10000 with an extremely high flux ($\geq 10^{12}$ photons/sec) inside a focal spot of the order of 10 $\mu$m. Together with the main source parameters a detailed layout of the beamline will be presented.

A 24.4 Do 16:30 Poster B

**Hochauflösende Röntgenabsorptions- und Röntgenemissionsmessungen an Titanverbindungen** — •Falk Reinhardt[1,2], Burkhard Beckhoff[1], Birgit Kanngiesser[2], Matthias Müller[1], Beatrix Pollakowski[1] und Gerhard Ulm[1] — [1]Physikalisch-Technische Bundesanstalt, Abbestr. 2-12, 10587 Berlin — [2]Technische Universität Berlin, Hardenbergstr. 36, 10623 Berlin

Der Vergleich zwischen hochauflösender Röntgenemissionsspektroskopie und NEXAFS (Near-Edge X-ray Absorption Fine Structure) Spektroskopie mit durchstimmbarer Synchrotronstrahlung an den L(ii,iii)-Kanten von Titan wird gezeigt. Beide Methoden ermöglichen die zerstörungsfreie chemische Speziation von Elementen in ihren Verbindungen. Dazu wird die Struktur und Lage der Absorptionskanten untersucht und mit den sich ändernden Lagen und Übergangswahrscheinlichkeiten der Emissionslinien in Beziehung gesetzt. Die Messungen fanden am Plangittermonochromator - Strahlrohr der PTB für Undulatorstrahlung bei BESSY II statt. Die Röntgenemission wurde mit einem wellenlängendispersiven Spektrometer basierend auf einem sphärischen Gitter und einer CCD untersucht. Für die Absorption wurde die Fluoreszenzstrahlung mit einem Si(Li)-Detektor gemessen.

A 24.5 Do 16:30 Poster B

**Electron dynamics in clusters excited by strong short-wavelength laser fields** — •Ionuţ Georgescu, Ulf Saalmann, and Jan-Michael Rost — Max-Planck-Institut für Physik komplexer Systeme, Nöthnitzerstr. 38, 01187 Dresden, Germany

Shining a strong short-wavelength laser pulse on rare gas clusters results into dense, warm plasmas which absorb energy very effectively by means of inverse bremsstrahlung. Due to the small quiver energy (in contrast to IR pulses) and to the small kinetic energy of the photoelectrons (in contrast to X-Ray pulses), these systems show unique features such as inner-ionization, charge localization and shift of the atomic levels due to screening.

We discuss the theoretical description of these processes, which turn out to depend critically on the treatment of the inner ionization process as well as on the electron-ion interaction potential.

Furthermore, we present our results which are in very good agreement with the initial experiments at 98nm and the most recent ones at 32nm wavelength, both performed at the free electron laser facility at DESY, Hamburg. Finally, we propose a pump-probe scheme with atto-second XUV pulses to gain further, time resolved insight into the energy absorption process.