# K 7: Poster

Time: Wednesday 16:30–18:30 Location: SPA Foyer

K 7.1 Wed 16:30 SPA Foyer

**High energy laser sources for space debris detection** — •Daniel Kolbe, Daniel Sauder, and Jochen Speiser — Deutsches Zentrum für Luft- und Raumfahrt e.V., Stuttgart

The large and rising number of space debris particles in low earth orbit (LEO) is posing an increasing danger to LEO satellites and the ISS. For example, even sub-centimeter particles can cause significant damage to solar panels; cm-class objects can destroy satellites. In the medium term, this threat can limit the use of popular orbits that have a high density of space debris. A first step in dealing with space debris entails locating and tracking even small debris objects with high precision to calculate orbital data and evaluate the threat they pose to satellites. After an initial passive optical detection of particles, a ground-based, high energy laser is required to obtain precise distance information through time-of-flight measurements. For this purpose, a 1 J, 1 kHz laser system with good beam quality based on thin-disk laser amplifiers is under development. Here we present the current status of the experiment and give an overview of the planned laser setup.

K 7.2 Wed 16:30 SPA Foyer

**Molecular Dynamics Simulations of Laser Ablation in Covalent Materials** — •Alexander Kiselev, Johannes Roth, and Hans-Rainer Trebin — Institut für Theoretische und Angewandte Physik, Universität Stuttgart, Germany

Non-equilibrium phenomena in highly excited covalent systems induced by strong laser radiation fields have received much attention in recent years. Despite of many theoretical and computational investigations these ultrafast processes are still not well understood. Here we use multi-million particle molecular dynamics simulations to study the laser ablation in covalently bonded materials. A combined self-consistent continuum-atomistic model [1] was applied for carrier-lattice interaction and electron-hole recombination processes. In addition, the temporal and spatial dependence of the exited carrier density was taken into account by fitting the interatomic forces to finite-temperature density functional theory calculations.

Both, spatially homogeneous and Gaussian distributed laser power densities have been carried out. In the first case the heat conduction in the system can be treated as one-dimensional. Furthermore, by using single- and double-pulse femtosecond laser irradiations the influence of the pulse shape on the ablation threshold has been investigated for a wide range of laser fluences.

[1] J.K. Chen, D.Y. Tzou, J.E. Beraun, Int. J. Heat Mass Transfer. **48**, 501-509 (2005)

K 7.3 Wed 16:30 SPA Foyer

**Broadband XUV-Polarimetry of High Harmonics from Plasma Surfaces by multiple Fresnel Reflections** — •Thomas Hahn[1], Jana Bierbach[2,3], Christian Rödel[2,3], Dirk Hemmers[1], Mark Yeung[3,4], Brendan Dromey[4], Silvio Fuchs[2,3], Arpa Galestian Pour[2], Stephan Kuschel[2,3], Matt Zepf[3,4], Gerhard Paulus[2,3], and Georg Pretzler[1] — [1]Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf — [2]Institut für Optik und Quantenelektronik, Friedrich-Schiller-Universität Jena — [3]Helmholtz-Institut Jena — [4]Centre for Plasma Physics, School of Mathmatics and Physics, Queen's University Belfast, United Kingdom

High harmonic generation (HHG) from the nonlinear interaction of intense laser pulses with gases or plasma surfaces is the most prominent way of creating coherent extreme ultraviolet (EUV/XUV) pulses. The measurement and control of the polarization may become important in future applications. We present an broadband XUV polarimeter based on multiple Fresnel reflections providing an extinction rate of 5 to 25 for 17-45 nm that has been tested at a gas harmonic source. In a further experiment using HHG from plasma surfaces the XUV polarimeter allowed a polarization measurement of high harmonic radiation from plasma surfaces for the first time which reveals a linear polarization state as predicted for our generation parameters. The generation and control of intense polarized XUV pulses - together with the availability of broadband polarizers in the XUV - open the way for a series of new experiments.

K 7.4 Wed 16:30 SPA Foyer

**Characterization of the complex refractive index of metals by high harmonic XUV radiation** — •Christian Halter, Dirk Hemmers, and Georg Pretzler — Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf

Two methods to characterize the complex refractive index of thin metal foils are presented. The first method is based on the comparison of the intensities of two high harmonic XUV spectra. The XUV beam passes a gold grating and one of the two first orders is transmitted through a metal foil and thus harmonics are attenuated depending on their wavelength. The comparison to the second first order spectrum allows the calculation of the real part of the complex refractive index.

The second method uses a double pinhole setup. The interference pattern is changed by the introduction of an optical path difference via inserting a metal foil in one of the two optical paths which interfere. This reveals the imaginary part of the complex refractive index.

K 7.5 Wed 16:30 SPA Foyer

**Polarization Dependence of Laser Dressed States in Helium** — •Johan Hummert[1], Maurizio Reduzzi[1], Fabio Frasetto[2], Antoine Dubrouil[1], Chengyong Feng[1], Francesca Calegari[1], Mauro Nisoli[1], Luca Poletto[2], Kenneth Schafer[3], Mette Gaarde[3], and Giuseppe Sansone[1] — [1]Politecnico di Milano, Italy — [2]Universita degli Studi di Padova, Italy — [3]Louisiana State University, USA

Measuring the spectrally resolved absorption of atoms grants direct insight into their electronic structure. Paired with the high time resolution obtained with attosecond pulses this allows us to investigate the dynamics of bound electrons in a strong laser field.

Here we present transient absorption measurements in helium with attosecond time resolution. The experimental setup uses a few cycle near infrared pulse with variable polarization as a pump and an attosecond extreme ultraviolet pulse as a probe. The attosecond pulses are generated by few cycle IR pulses using high harmonic generation in combination with the polarization gating technique.

Apart from other strong-field effects light-induced features corresponding to so-called laser dressed states are observed. It is found that the absorption cross section of these laser dressed states depends strongly on the relative polarization of the pulses. We show that Floquet theory can be used to understand this behaviour. A simple analytic approach to the time-independent Floquet Hamiltonian method proves sufficient to reproduce the observed polarization dependence of dressed state absorption completely.