

O 36: ELI-ALPS: A New European Light Source for Ultrafast Surface Science

Time: Tuesday 14:00–16:00

Location: TRE Phy

Invited Talk O 36.1 Tue 14:00 TRE Phy
Attosecond control of excited electrons and nuclei in gas- and condensed-phase systems — ●THOMAS PFEIFER — MPI für Kernphysik, Heidelberg

The physics of (visible) matter is mainly determined by electrons bound to nuclei. Electrons also represent the atomic glue to connect atoms in molecules and clusters and finally form nanoparticles and solids. Dynamics occurs when electrons are, sometimes only for very short times, elevated to excited states, in which they are particularly responsive to small changes in their environment that can influence the product of a chemical reactions or result in a particular phase transition.

Here, we discuss the effect of intense laser fields on the excited states of atoms, molecules, and condensed-phase systems. A universal change of the quantum-mechanical phase evolution (not to be confused with a phase transition) is observed and can be extracted from a broad coherent spectrum of a pulse with a lifetime much shorter than the (atto-, femto-, ..., nanosecond) lifetime of the excited state.

This phenomenon gives rise to a multitude of scientific opportunities, ranging from laser control of few- to many-electron systems, x-ray-frequency combs and (nuclear) precision spectroscopy to observing and understanding the emergence of fundamental quantum processes by time-resolving their spectrum, exemplarily shown here for the buildup of a Fano resonance.

Invited Talk O 36.2 Tue 14:30 TRE Phy
Probing ultrafast electron and spin dynamics in momentum, space, and time - chances and opportunities of a surface science end station at ELI-ALPS — ●STEFAN MATHIAS — I. Physikalisches Institut, Georg-August-Universität Göttingen, 37077 Göttingen

Recent progress in the development of coherent ultrashort laser-based light sources in the extreme ultraviolet regime has paved the way for

a completely new generation of real-time photoemission spectroscopy and microscopy techniques. Moreover, when these light sources are combined with novel spin detectors, "complete" photoemission experiments can be realized, with full access to the spin-resolved transient band-structure dynamics on the (sub-)femtosecond time scale. In my talk, I will discuss our latest experiments using such novel spin detectors in combination with extreme ultraviolet pulses from high-harmonic generation. From these experiments, it can be extrapolated what might be possible with a dedicated surface science end station at the novel ELI-ALPS facility in coming years.

References:

- T. Rohwer et al., Nature 471, 490-493 (2011)
- M. Plötzing et al., Rev. Sci. Instrum. 87, 043903 (2016)
- S. Mathias et al., Nature Comm. 7, 12902 (2016)

Invited Talk O 36.3 Tue 15:00 TRE Phy
Attosecond electron dynamics on surfaces and layered systems — ●REINHARD KIENBERGER — Fakultät für Physik, TU München, James Franck Straße, 85748 Garching

Attosecond streaking experiments have been used for a systematic investigation of electron emission times from solids at different excitation photon energies (90 * 145 eV). Different crystal orientations will be discussed. Also, results from time-resolved transport of different types of electrons through defined adlayers on a bulk material on the attosecond timescale will be shown.

Invited Talk O 36.4 Tue 15:30 TRE Phy
Coincidence ARPES on molecules — ●REINHARD DOERNER — University Frankfurt

We will show that measuring coincidences between several electrons and ions emitted by photoabsorption is a rich source of information on electron correlation and entanglement. The talk will present experiment on atoms and molecules in the gas phase.