Laser Seminar / NCCR MUST Seminar
Wednesday, December 6, 2017

Time	16.45h
Location	ETH Zurich, Hönggerberg, HPF G6
Speaker	**Prof. Dr. Martin Aeschlimann**, Department of Physics, University of Kaiserlautern, Germany
Title	**Revealing the subfemtosecond dynamics of orbital angular momentum in nanoplasmonic vortices**

Abstract

Surface plasmon polaritons (SPPs) are coherent modes of collective electronic motion and electromagnetic fields. Nanooptical circuitry based on SPP has been suggested as a possible pathway to further miniaturize optical devices. Accordingly, the investigation of propagating SPP wave packets in space and time has received tremendous attention during the last decade. To circumvent the experimental limitation of optical diffraction we use a photoemission electron microscope (PEEM) that has been proved to be a versatile tool for the investigation of near field properties of nanostructures with nanometer spatial resolution and several attosecond time steps. The potential of this technique will be demonstrated on two recent experiments.

In a first work, long-range energy transfer mechanism between two coupled plasmonic whispering gallery nanoantennas in an elliptical cavity has been investigated. Only one gold antenna is excited selectively when the structure is illuminated under grazing incidence. We demonstrate periodic energy transfer back and forth over a distance of twice the excitation wavelength mediated by SPPs [1]. The experimentally observed ultrafast dynamics is in accordance with simulations as well as a coupled-oscillator model and suggests the feasibility of long-range coherent coupling of pairs of quantum emitters.

In a second work we experimentally reveal and measure the spatiotemporal dynamics of the formation of plasmonic vortices and their dressing by optical angular momentum. We have manipulated one of the basic properties of light by converting spin angular momentum into orbital angular momentum in plasmonic Archimedes spiral and image the evolution with subfemtosecond time steps. Our phase-resolved technique allows us to demonstrate three key stages in the vortex lifetime resulting from spin-orbit conversion. This study provides fundamental understanding of the orbital angular momentum property of light [2].

Reference:

[1] M. Aeschlimann *et al*, accepted for publication in *Light: Science & Applications*.

[2] G. Spektor *et al*, Science, **355**, 1187 (2017)

Host	Ursula Keller, Ultrafast Laser Physics, IQE
More Info	http://www.fastlab.ethz.ch/laser-seminar.html

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