O 63: Plasmonics and nanooptics: Applications and other aspects I

Time: Wednesday 12:00–13:00 Location: MA 041

O 63.1 Wed 12:00 MA 041

Heat transfer along a chain of nanoparticles — •Christoph Kathmann[1], Philippe Ben-Abdallah[2], and Svend-Age Biehs[1] — [1]Institut für Physik, Oldenburg University, Germany — [2]CNRS, Laboratoire Charles Fabry, Palaiseau, France

In the near field, the radiative heat flux transferred between two bodies can overcome the predictions made by Planck's law by several orders of magnitude due to the contribution of evanescent modes. We consider a chain of SiC nanoparticles with the distance between the particles being small enough to allow the coupled surface phonon polaritons to propagate along the chain. The resulting heat transfer is calculated numerically exact using fluctuating electrodynamics and compared to results from a ballistic and a diffusive approach based on Landauer and Boltzmann equation.

O 63.2 Wed 12:15 MA 041

Ultrafast point-projection electron microscopy with a time-of-flight delay-line detector — •Germann Hergert[1], Andreas Wöste[1], Jan Vogelsang[1], Dong Wang[2], Petra Gross[1], and Christoph Lienau[1] — [1]Institut für Physik, Carl von Ossietzky Universität, 26129 Oldenburg, Germany — [2]Institut für Werkstofftechnik, TU Ilmenau, 98693 Ilmenau, Germany

Observing electrons move on their natural few-fs-time and nm-spatial regime requires ultrahigh resolution. In laser-triggered ultrafast electron microscopes the temporal resolution typically is limited to around 100fs by the mesoscopic propagation distance of the probing electron pulse to the sample, which leads to pulse broadening due to dispersion.

One way to overcome this broadening is to reduce the distance between emitter and sample. An already known solution to this is adiabatic nanofocusing of surface plasmon polaritons along the shaft of a sharp metallic taper. This prevents direct illumination of a sample and allows minimal distances to the emitter. Implementing this method into an ultrafast point-projection electron microscope (UPEM) allows imaging with unprecedented spatio-temporal resolution. We equip the system with a time-of-flight delay-line detector to gain additional information about the electron energies for studying the interaction between electrons and localized electric fields, e.g. around nanostructures.

Here, we present such an UPEM setup with high spatio-temporal resolution. We show first results, where we photoemit electrons from nanometer-sized plasmonic antennas with femtosecond laser pulses and observe their motion with 20-nm spatial and 25-fs temporal resolution.

O 63.3 Wed 12:30 MA 041

Directional emission from dielectric antennas: A parameter study — •Till Leuteritz and Stefan Linden — Physikalisches Institut, Universität Bonn, D-53115

Metal nanostructures can be used as optical antennas to shape the far field emission pattern of quantum dots to achieve directional emission with large front-to-back ratios. In order to get a broadband emission and to have low losses, dielectric materials are a great candidate for these structures. Following this approach, M. Peter et al demonstrated recently a dielectric leaky-wave antenna made from Hafniumdioxide (HfO2) with a front-to-back ratio of around 12.5 dB [1].

In this presentation, we report on a systematic study of the dependence of the emission properties of dielectric leaky wave antenna on the geometrical parameters. The antennas consist of only two simple dielectric building blocks, a director and a reflector, whose length, height and width is parametrically changed. Quantum dots placed in between reflector and director serve as internal light source.

We find that by varying the width, the director changes from a leaky waveguide to a transversal single mode guided waveguide to a transversal multimode guided waveguide. Moreover, we observe that short leaky waveguides exhibit a bright emission peak at small angles that shifts to larger angles with increasing length. A similar behavior is also found for the transversal single mode guided waveguides.

[1] Directional Emission from Dielectric Leaky-Wave Nanoantennas; Manuel Peter et al.; Nano Letters 2017 17 (7), 4178-4183; DOI: 10.1021/acs.nanolett.7b00966

O 63.4 Wed 12:45 MA 041

Robustness of a nontrivial edge mode against periodic perturbations of a topological defect in a plasmonic waveguide array. — •Zlata Cherpakova and Stefan Linden — Physikalisches Institut, Universität Bonn, Nussallee 12, 53115 Bonn, Germany

The Su-Schrieffer-Heeger (SSH) model describing a chain of identical lattice sites with alternating strong and weak bonds exhibits nontrivial edge states which are known to be robust against static deformations. Of special interest is to probe the robustness of these states against temporal perturbations. Here, we investigated the influence of periodic fluctuations on the topological edge mode in the plasmonic analogue of the SSH model. The plasmonic structures were fabricated by making use of negative-tone gray-scale electron beam lithography. Based on the quantum-optical analogy, the SSH chain was realized in an array of identical plasmonic waveguides with alternating long and short center-to-center distances. The temporal perturbations of the topological defect were implemented by periodically bending the central waveguide at the interface between two SSH domains. Surface plasmon polaritons were excited by shining a highly focused laser beam on the grating, deposited on top of the central waveguide. The spatial evolution of the SPP field intensity was monitored by real- and Fourier space leakage radiation microscopy. In our experiments as well as in numerical calculations we observe that if the frequency of these periodic perturbations was in the range which allows to overcome the bandgap, the edge mode couples to the bulk modes and becomes delocalized.