O 26: Plasmonics and nanooptics: Fabrication, characterization and applications – Poster

Time: Monday 18:00–20:00 Location: P2

O 26.1 Mon 18:00 P2

Extending multiphysics crystallization models for phase-change materials with parameters derived from machine learning — •Luis Schüler[1,2], José Moreira[2], Andrei Lupuleasa[2], Wenjing Lei[2], Keerthika Kalavalapudi[2], Matthias Wuttig[2], Thomas Taubner[2], and Dmitry Chigrin[1,2] — [1]AMO GmbH, Aachen — [2]I. Institute of Physics (IA), RWTH Aachen

Optical metasurfaces based on dielectric or metallic scatterers such as nanoantennas provide advanced control over light-matter interactions. Dynamic tuning can be realized with phase-change materials (PCMs), which can be reversibly switched between amorphous and crystalline states with a strong difference in refractive index. Especially metallic nanostructures can significantly influence the crystallization dynamics of PCMs, resulting in deviations from the expected spectral behavior of the metasurface. Therefore, Multiphysics simulations that couple electrodynamics, heat transport, and crystallization kinetics are essential for understanding these effects and optimizing device geometry. However, it is experimentally challenging to obtain key crystallization parameters, such as viscosity or free energy density, over the relevant temperature range. Here, we use machine-learned interatomic potentials trained molecular dynamics data to compute the required material parameters. Furthermore, we use machine learning to predict the viscosity of chalcogenide-based PCMs using data from related glasses. This approach broadens the range of phase-change materials that can be reliably simulated and provides a pathway toward the systematic design of dynamically tunable metasurfaces.

O 26.2 Mon 18:00 P2

Toward Plasmonic Pump-Probe Spectroscopy of a Hot-Electron-Driven Reduction Reaction — •Marcel Schalling, Lukas Schmidt, Ferdinand Bauer, Thorsten Schumacher, and Markus Lippitz — University of Bayreuth

Plasmon-induced hot electrons offer a promising way to drive surface-catalytic chemical reactions with enhanced efficiency and selectivity. We want to follow the dynamics of the hot carriers by pump-probe spectroscopy.

In our approach, an initial laser pulse excites surface plasmons in the gold taper, generating hot electrons. These subsequently reduce adsorbed metal complexes on the taper's surface. This reduction is expected to locally modify the refractive index, which we probe by a second laser pulse. We show our first steps towards this goal. We start from the opto-electrochemical model system of methylene blue, and gradually add plasmonics and hot-electron generation towards the full implementation of the plasmonic pump-probe concept.

O 26.3 Mon 18:00 P2

Dissipation engineered plasmonic ratchet — •Anna Sidorenko[1], Jan Mathis Giesen[2], Sebastian Eggert[2], and Stefan Linden[1] — [1]Physikalisches Institut, Rheinische Friedrich-Wilhelms-Universität Bonn, 53115 Bonn, Germany — [2]Physics Department and Research Center OPTIMAS, RPTU University Kaiserslautern-Landau, D-67663 Kaiserslautern, Germany

This joint theoretical and experimental study presents a new design of a plasmonic ratchet, where directional transport is implemented purely by dissipation. Using Floquet theory, we identify resonant driving regimes depending on driving frequency and dissipation rates. An experimental observation of the ratchet effect in arrays of evanescently coupled plasmonic waveguides is provided by utilizing leakage radiation microscopy. Remarkably, we find that on resonance the transmitted signal shows lower losses for stronger local dissipation.

O 26.4 Mon 18:00 P2

Is the linkng number a topological invariant? — •Maja Manten[1], Alexander Neuhaus[1], Pascal Dreher[1], Phillip Gessler[1], Bettina Frank[2], Tim Davis[1,2,3], Harald Giessen[2], Michael Horn-von Hoegen[1], Karin Everschor-Sitte[1], and Frank Meyer zu Heringdorf[1] — [1]Faculty of Physics and Center for Nanointegration, Duisburg-Essen (CENIDE), University of Duisburg-Essen, 47048 Duisburg, Germany. — [2]4th Physics Institute, Research Center SCoPE, and Integrated Quantum Science and Technology Center, University of Stuttgart, Germany. — [3]School of Physics, University of Melbourne, Parkville, Victoria 3010 Australia

Optical near fields, like they occur in surface plasmon polaritons, exhibit a wide range of topological textures, including skyrmions, merons, and optical vortices carrying orbital angular momentum. Near fields that carry a fractional orbital angular momentum rather than integer orbital angular momentum, however, pose a challenge: they form a complex phase-vortex landscape and break the simple picture of a single vortex carrying the topological charge. When the fields become distorted, the situation becomes more complicated as more and more vortices appear. The sequence of vortices and antivortices can extend to infinity and evade global topological classification in real space. Here we show that a global topological invariant, the linking number, can be found in Fourier space. We show how the linking number of a plasmonic field can be determined from a time resolved polarimetric photoemission microscopy experiment and demonstrate the robustness of the linking number against deformation of the excitation structure.

O 26.5 Mon 18:00 P2

Reconfiguring resonator shapes optically to tailor the resonator modes of phonon polaritons in hBN using In_3SbTe_2 — •Arvid Schick, Lina Jäckering, Lukas Conrads, Matthias Wuttig, and Thomas Taubner — I. Institute of Physics (IA), RWTH Aachen University

The van der Waals material hexagonal boron nitride (hBN) hosts hyperbolic Phonon Polaritons (HPPs) with high volume confinement and low losses, suitable for nanophotonic devices [1]. Restricting the HPPs to resonators enables ultra-confined resonances [2]. Conventionally, resonator fabrication requires cumbersome lithography processes. Instead, resonators can be fabricated via optical programming of the phase-change material In_3SbTe_2 (IST), as IST can reversibly be switched between a metallic and a dielectric phase in the infrared [3]. Optical programming of reconfigurable, circular resonators for HPPs in hBN has been demonstrated and allowed for tailoring the field confinement [4]. We investigate square, rectangular and triangular resonators. We reconfigure resonator shape and aspect ratio to tailor the resonator modes that we investigate with scattering-type scanning near-field optical microscopy (s-SNOM). By decreasing the resonator size, we find confinement of up to $\lambda/69$ and a Q-factor of 49. Our results pave the way for rapid and reconfigurable prototyping of confined polariton resonators of arbitrary shape for various 2D materials. [1] Dai et al. *Science* **343**, 1125-1129 (2014); [2] Sheinfux et al. *Nat. Mat.* **23**, 499-505 (2024); [3] Conrads et al. *Opt. Mater. Express* **15**, 2664-2687 (2025); [4] Jaeckering et al. *Nano Lett.* **25**, 15809, (2025)