WED1o: Opening remarks and plenary talk 1

Chair: Nikolay Zheludev, University of Southampton, UK & NTU, Singapore and Harald Giessen, University of Stuttgart, Germany

Time: Wednesday, 8:45–10:00 Location: Olympia

Opening Remarks

Plenary WED1o.1 Wednesday, 9:00 Olympia

Extreme Control Over Light and Sound with Metasurfaces — •Andrea Alu — City University of New York, New York, USA

In this talk, I overview our recent research activity in photonics, acoustics and polaritonics, showing how suitably structured surfaces have been opening exciting avenues to enable extreme wave phenomena for light and sound manipulation at the nanoscale.

10:00–10:15: Coffee break

WED2o: Nanophotonic energy solutions for the climate crisis

Chair: Rachel Won, Nature Photonics at Nature Publishing Group, London, United Kingdom

Time: Wednesday, 10:15–12:15 Location: Olympia

Keynote WED2o.1 Wednesday, 10:15 Olympia

A Nanophotonics Guide to Global Radiative Energy Balance and Design of Scalable Radiative Cooling Solutions — •Harry Atwater — California Institute of Technology, Pasadena, USA

In this presentation, I will discuss two themes: 1) how the global radiative flux balance in the land, sea and atmospheric environments influences and dictates global temperatures and 2) what concepts and motifs from nanophotonics could lead to scalable approaches to radiative cooling.

Keynote WED2o.2 Wednesday, 10:45 Olympia

Enhancing sustainability through nanophotonic innovations — •Emiliano Cortes — Nanoinstitute Munich, Faculty of Physics, University of Munich (LMU), Munich, Germany

The chemical industry, a major energy consumer, emitted 925 megatonnes of carbon dioxide in 2021. To combat this, it aims to transition to sustainable alternatives, developing catalysts powered by sunlight. Plasmonic-based photocatalysts show promise, outperforming traditional catalysts. Metasurfaces enhance further the light-matter interaction in our nanophotonics journey towards green energy.

Keynote WED2o.3 Wednesday, 11:15 Olympia

Nanoscale light and carrier management for improved photovoltaics — •Albert Polman — Center for Nanophotonics, Amsterdam, Netherlands

We present light and carrier management strategies for photovoltaic energy conversion and demonstrate the world record efficiency for Si-based multi-junction solar cells (36.1%).

Keynote WED2o.4 Wednesday, 11:45 Olympia

Unraveling photoluminescence and hot carrier processes with monocrystalline gold — •Giulia Tagliabue — EPFL, Lausanne, Switzerland

Using ultra-thin monocrystalline flakes, we present combined experimental and theoretical results that unravel the origin of luminescence in gold and clarify hot hole injection in plasmonic catalysis.

WED2s: Nanophotonics I

Chair: Ido Kaminer, Technion, Israel Institute of Technology, Haifa, Israel

Time: Wednesday, 10:15–12:15 Location: Tirol

Invited WED2s.1 Wednesday, 10:15 Tirol

Real time nanoscopy – from imaging dynamic near-fields to visualizing the light inside photonic integrated circuits — •Guy Bartal — Technion, Israel Institute of Technology, Israel, Israel

I will present our recent achievements relying on new capabilities. Those include active control over plasmonic near-field patterns such as directing plasmonic focal spot over several microns with 30nm control precision, toggling among multiple values of angular momentum of near-field modes and the visualization of light inside silicon photonic devices.

Oral WED2s.2 Wednesday, 10:45 Tirol

Imaging of quasi-bound-state-in-the-continuum properties of dielectric metasurfaces by near-field microscopy — Thorsten Gölz[1], Andreas Aigner[1], •Enrico Baù[1], Martin Barkey[1], Andrea Mancini[1,2], Fritz Keilmann[1], Stefan A. Maier[1,3,4], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Nano-Institute Munich, Ludwig-Maximillians University, Munich, Germany — [2]Center for Nano Science and Technology, Fondazione Istituto Italiano di Tecnologia, Milan, Italy — [3]School of Physics and Astronomy, Monash University, Clayton, Australia — [4]Department of Physics, Imperial College London, London, United Kingdom

Using transmission mode scattering scanning near-field optical microscopy, we study the near-field of quasi-bound-states-in-the-continuum (BIC) array metasurfaces and analyze how the collective mode of the resonator arrays depends on the array size, direction and asymmetry of its elements.

Oral WED2s.3 Wednesday, 11:00 Tirol

Metasurface-on-fiber platform for generating arbitrarily structured light — •Chenhao Li[1], Leonardo de S. Menezes[1,2], Stefan A. Maier[3,4,1], Markus A. Schmidt[5,6,7], and Haoran Ren[3] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig Maximilian University of Munich, Munich, Germany — [2]Departamento de Física, Universidade Federal de Pernambuco, Recife-PE, Brazil — [3]School of Physics and Astronomy, Faculty of Science, Monash University, Melbourne, Australia — [4]Department of Physics, Imperial College London, London, United Kingdom — [5]Leibniz Institute of Photonic Technology, Jena, Germany — [6]Abbe Center of Photonics and Faculty of Physics, Jena, Germany — [7]Otto Schott Institute of Material Research, Jena, Germany

Structured light has proven useful for numerous photonic applications. However, its current use in optical fiber-based systems is severely limited. We demonstrate a 3D direct laser-written metafiber platform that generates arbitrary structured light directly from an optical fiber output, providing a new approach for light shaping in integrated optical systems.

Oral WED2s.4 Wednesday, 11:15 Tirol

High-Q wavefront shaping with higher-order Mie-resonant metasurfaces — •Claudio U. Hail, Morgan Foley, Ruzan Sokhoyan, Lior Michaeli, and Harry A. Atwater — California Institute of Technology, Pasadena, USA

We report on a higher-order Mie-resonant optical metasurface for manipulating light in two dimensions with high quality factor as exemplified by beam deflection and radial lensing with up to Q = 1458.

Oral WED2s.5 Wednesday, 11:30 Tirol

Optically addressable spin defects coupled to bound states in the continuum metasurfaces — Luca Sortino[1], Angus Gale[2], Lucca Kühner[1], Chi Li[3], •Jonas Biechteler[1], Fedja J. Wendisch[1], Mehran Kianinia[2], Haoran Ren[3], Milos Toth[2,4], Stefan A. Maier[3,5], Igor Aharonovich[2,4], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, 80539 Munich, Germany — [2]School of Mathematical and Physical Sciences, University of Technology Sydney, , Ultimo, New South Wales 2007, Australia — [3]School of Physics and Astronomy, Monash University, Wellington Rd, Clayton VIC 3800, Australia — [4]ARC Centre of Excellence for Transformative Meta-Optical Systems, University of Technology Sydney, , Ultimo, New South Wales 2007, Australia — [5]The Blackett Laboratory, Department of Physics, Imperial College London, , London, SW7 2AZ, United Kingdom

We demonstrate the scalable integration of hexagonal boron nitride spin defects coupled within monolithic quasi-bound states in the continuum metasurfaces, achieving a 25-fold increase of the spin defects photoluminescence intensity and spectral narrowing below 4 nm linewidth.

Invited WED2s.6 Wednesday, 11:45 Tirol

Mie voids for sensing, nanoscale detection, and metasurfaces — •Mario Hentschel[1], Serkan Arslan[1], Micha Kappel[1], Michelle Pfahl[1], Kirill Koshelev[2], Julian Karst[1], Thomas Weiss[3], Yuri Kivshar[3], and Harald Giessen[1] — [1]4th Physics Institute and Research Center SCoPE, University of Stuttgart, Stutgart, Germany — [2]Nonlinear Physics Centre, Research School of Physics, Australian National University, Canberra , Australia — [3]Institute of Physics, University of Graz, and NAWI Graz, Graz, Austria

Single Mie voids are used to resolve refractive index changes in the 10-4 range in sub femtoliter volumes as well as for all-optical sizing and counting of microplastic. Moreover, the potential of these resonances for Mie void-based reflective metasurfaces is demonstrated.

12:15–16:00: Lunch break

WED3o: Industry talk 1

Time: Wednesday, 16:00–17:00 Location: Olympia

Technology WED3o.1 Wednesday, 16:00 Olympia

Expanding the lithography toolbox — •Vasileios Theofylaktopoulos — Heidelberg Instruments Nano, Zurich, Switzerland

This talk will introduce thermal scanning probe lithography (tSPL) and two photon polymerization (TPP) and their application in photonics, metamaterials and devices based on nanopatterning.

WED4o: Energy symposium / Topological photonics I

Chair: Giulia Tagliabue, EPFL - École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Time: Wednesday, 17:00–18:30 Location: Olympia

Keynote WED4o.1 Wednesday, 17:00 Olympia

Harnessing nonequilibrium excitations in quantum materials for energy conversion — •Prineha Narang — UCLA, Los Angeles, USA

I will present an introduction to theoretical and computational approaches to describe nonequilibrium dynamics in quantum matter, and predicting emergent states created by external drives.

Invited WED4o.2 Wednesday, 17:30 Olympia

4D conserved topological charge vectors in plasmonic quasicrystals — •Shai Tsesses[1,7,8], Pascal Dreher[2], David Janoschka[2], Kobi Cohen[1], Tim C. Meiler[3,4], Tomer Bucher[1], Shay Sapir[5], Bettina Frank[3], Timothy J. Davis[2,3,6], Frank Meyer zu Heringdorf[2], Harald Giessen[3], and Guy Bartal[1] — [1]Andrew & Erna Viterbi Department of Electrical and Computer Engineering, Technion – Israel Institute of Technology, Haifa, Israel — [2]Faculty of Physics and Center for Nanointegration, Duisburg-Essen (CENIDE), University of Duisburg-Essen, Duisburg, Germany — [3]4th Physics Institute, Research Center SCoPE, and Integrated Quantum Science and Technology Center, University of Stuttgart, Stuttgart, Germany — [4]Centre for Disruptive Photonic Technologies and School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, Singapore — [5]Faculty of Mathematics and Computer Science, Weitzmann Institute of Science, Rehovot, Israel — [6]School of Physics, University of Melbourne, Parkville, Australia — [7]The Russell Berrie Nanotechnology Institute, Technion – Israel Institute of Technology, Haifa, Israel — [8]Department of Physics, MIT-Harvard Center for Ultracold Atoms and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, USA

We discover topological charge vectors in 4D, which govern the real-space topology of 2D quasicrystals, and reveal their inherent conservation laws. We demonstrate control over the topology in pentagonal plasmonic quasi-lattices, mapped by both phase-resolved and time-domain near-field microscopy, opening a path to explore higher-dimensional topological physics and quasicrystal thermodynamics.

Oral WED4o.3 Wednesday, 18:00 Olympia

Observation of a dissipation induced topological edge state — Helene Wetter[1], Michael Fleischhauer[2], Julian Schmitt[3], and •Stefan Linden[1] — [1]Physikalisches Institut, Universität Bonn, Bonn, Germany — [2]Department of Physics and Research Center OPTIMAS, RPTU Kaiserslautern-Landau, Kaiserslautern, Germany — [3]Institut für Angewandte Physik, Universität Bonn, Bonn, Germany

We report on the observation of a topologically protected edge state soley induced by dissipation. For this purpose, we fabricate arrays of plasmonic waveguides with tailored absorption profiles. Using leakage radiation microscopy, we identify a zero-energy mode localized at the edge of the dissipative topological lattice.

Oral WED4o.4 Wednesday, 18:15 Olympia

Chiral topological light for detection of robust enantiosensitive observables — •Nicola Mayer[1], David Ayuso[1,2], Piero Decleva[3], Margarita Khokhlova[1,5], Emilio Pisanty[5], Misha Ivanov[1,2,4,7], and Olga Smirnova[1,6,7] — [1]Max-Born-Institut, Berlin, Germany — [2]Imperial College London, London, United Kingdom — [3]Università degli studi di Trieste, Trieste, Italy — [4]Humboldt Universitat, Berlin, Germany — [5]King's College London, London, United Kingdom — [6]Technische Universitat, Berlin, Germany — [7]Technion - Israel Institute of Technology, Haifa, Israel

We achieve the embedding of topological properties into enantiosensitive optical responses of chiral molecules, allowing for large enhancements of the efficiency and robustness of chiral optical discrimination, by introducing chiral topological light, a light beam which displays chirality locally, with an azimuthal distribution of handedness described by a topological charge.

WED4s: Photon - Electron interaction I

Chair: Guy Bartal, Technion, Israel Institute of Technology, Haifa, Israel

Time: Wednesday, 17:00–18:30 Location: Tirol

Invited WED4s.1 Wednesday, 17:00 Tirol

Attosecond Quantum Optics — Alexey Gorlach[1], Matan Even Tzur[2], Michael Birk[1,2], Andrea Pizzi[3], Nicholas Rivera[3], Michael Krüger[2], Oren Cohen[2], and •Ido Kaminer[1] — [1]Technion, Department of Electrical Engineering, Haifa, Israel — [2]Technion, Department of Physics, Haifa, Israel — [3]Harvard University, Department of Physics, Cambridge, USA

Our work predicts how quantum features of light affect such highly nonlinear attosecond processes as high harmonic generation. Our findings are a part of an

emerging field combining attosecond science and quantum optics, showing new applications of quantum information science in strong field physics.

Invited WED4s.2 Wednesday, 17:30 Tirol
Mapping Decoherence Dynamics with Electron Microscopes — •Nahid Talebi — Institute of Experimental and Applied Physics, Kiel University, Kiel, Germany
Exploring the ultrafast dephasing dynamics of solid-state excitations are perquisite for the realization of efficient nanophotonic systems. Here, we explore the dynamics of exciton polaritons and phonon-mediated transitions in atomic defect centres with electron beams, with 5 fs temporal resolution and 10 nm spatial resolution.

Oral WED4s.3 Wednesday, 18:00 Tirol
X-Ray-Driven Photon Bunching — •Shaul Katznelson[1], Offek Tziperman[1], Noam Kasten[1], Avner Shultzman[1], Tomer Bucher[1], Tom Lenkiewicz-Abudi[1], Roman Schuetz[1], Orr Be'er[2], Shai Levy[2], Rotem Strassberg[2], Georgy Dosovitsky[2], Yehonadav Bekenstein[2], Charles Roques-Carmes[3], and Ido Kaminer[1] — [1]Solid State Institute, Technion, Haifa, Israel — [2]Faculty of Materials Science and Engineering, Technion, Haifa, Israel — [3]E. L. Ginzton Laboratory, Stanford University, Stanford, USA
We measure the second-order coherence function $g^{(2)}(\tau)$ for X-ray-driven light emission (scintillation), observing extreme bunching values ($g^{(2)}(0)$ 97 ± 10) in perovskite nano-crystals. The $g^{(2)}(\tau)$ measurement provides a new method to extract the scintillation lifetime and yield.

Oral WED4s.4 Wednesday, 18:15 Tirol
Few-electron correlations and number statistics of free electron pulses in ultrafast photoemission from metal needle tips — •Jonas Heimerl[1], Stefan Meier[1], Alexander Mikhaylov[2], Maria Chekhova[1,2], and Peter Homelhoff[1,2] — [1]Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany — [2]Max Planck Institute for the Science of Light, Erlangen, Germany
We investigate Coulomb correlations of photo-emitted electrons from metal needle tips by ultrashort laser pulses. We observe a strong energy anti-correlation. Furthermore, we demonstrate that the electron number statistics inherits the statistics of the driving light, both for classical laser light and bright squeezed vacuum.

18:30–18:45: Coffee break

WED5o: Energy symposium / Topological photonics II

Chair: Olga Smirnova, Max Born Institute, Berlin, Germany

Time: Wednesday, 18:45–19:45 Location: Olympia

Invited WED5o.1 Wednesday, 18:45 Olympia
Nanolasers: Dynamics and Phase Locking — •Yeshaiahu (Shaya) Fainman, Sizhu Jiang, Suruj Deka, and Athena Pan — Department of Electrical and Compouter Engineering, University of California San Diego, La Jolla, USA
We discuss nanoscale metal-dielectric-semiconductor resonant gain geometries to create a new type of light emitters focusing on three key aspects: design and fabrication, second order intensity correlation characterizations, and coupled nanolasers dynamics.

Breakthrough WED5o.2 Wednesday, 19:15 Olympia
Optical pumping of electronic quantum Hall states with vortex light — •Deric Session[1], Mahmoud Jalali Mehrabad[1], Nikil Paithankar[2], Tobias Grass[3,4], Christian Eckhardt[5,6], Bin Cao[1], Daniel Suarez Forero[1], Kevin Li[1], Mohammad S. Alam[1], Kenji Watanabe[7], Takashi Taniguchi[7], Glenn S. Solomon[8], Nathan Schine[1], Jay Sau[1,9], Roman Sordan[2], and Mohammad Hafezi[1] — [1]Joint Quantum Institute (JQI), University of Maryland, College Park, USA — [2]L-NESS, Department of Physics, Politecnico di Milano, Como, Italy — [3]DIPC - Donostia International Physics Center, San Sebastian, Spain — [4]Ikerbasque - Basque Foundation for Science, Bilbao, Spain — [5]Institut fuer Theorie der Statistischen Physik, RWTH Aachen University and JARA-Fundamentals of Future Information Technology, Aachen, Germany — [6]Max Planck Institute for the Structure and Dynamics of Matter, Center for Free-Electron Laser Science (CFEL), Hamburg, Germany — [7]National Institute for Materials Science, Tsukuba, Japan — [8]Department of Physics University of Adelaide, Adelaide, Australia — [9]Condensed Matter Theory Center, University of Maryland, College Park, USA
We present a novel mechanism for the transfer of orbital angular momentum from optical vortex beams to electronic quantum Hall states. Specifically, we identify a robust contribution to the radial photocurrent in an annular graphene sample within the quantum Hall regime that depends on the vorticity of light.

WED5s: Photon - Electron interaction II

Chair: Uriel Levy, Hebrew University of Jerusalem, Israel

Time: Wednesday, 18:45–19:45 Location: Tirol

Invited WED5s.1 Wednesday, 18:45 Tirol
Quantum photonics with free electrons: Challenges and opportunities — •Javier García de Abajo — ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain
Electron beams play a pivotal role as the means to uncover fundamental phenomena and manipulate nanoscale quantum optical excitations. We will overview recent advances in this emerging field, including manipulation of the electron density matrix, optically driven generation of subnanometer/subfemtosecond electron pulses, and quantum sensing of distant objects.

Breakthrough WED5s.2 Wednesday, 19:15 Tirol
Chiral Optical Nano-Cavity with Atomically Thin Mirrors — Daniel G. Suarez- Forero[1], Ruihao Ni[2], •Supratik Sarkar[1], Mahmoud Jalali Mehrabad[1], Erik Mechtel[1], Valery Simonyan[1], Andrey Grankin[1], Kenji Watanabe[3], Takashi Taniguchi[3], Suji Park[4], Houk Jang[4], Mohammad Hafezi[1], and You Zhou[2] — [1]Joint Quantum Institute, University of Maryland, College Park, USA — [2]Department of Materials Science and Engineering, University of Maryland, College Park, USA — [3]National Institute for Materials Science, Tsukuba, Japan — [4]Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, USA
We propose and experimentally demonstrate a sub-wavelength 2D planar nanocavity using two atomically thin TMD mirrors. Remarkably, we show how the excitonic nature of the mirrors enables the formation of chiral and tunable

cavity modes upon the application of an external magnetic field and is robust up to ≈100K.

THU1o: Plenary talk 2

Chair: Mikhail Ivanov, Max-Born-Institute (MBI), Berlin, Germany

Time: Thursday, 9:00–10:00 Location: Olympia

Plenary THU1o.1 Thursday, 9:00 Olympia
Time crystals — •Krzysztof Sacha — Jagiellonian University, Krakow, Poland
Periodically driven systems can reveal time crystalline structures that exhibit various condensed matter properties. Time crystals can also spontaneously form in interacting systems. During the lecture, both of these methods of creating time crystals will be discussed, and the path to time-tronics, which involves building useful systems, will be outlined.

10:00–10:15: Coffee break

THU2o: Metasurfaces I

Chair: Nader Engheta, University of Pennsylvania, Philadelphia, USA

Time: Thursday, 10:15–12:15 Location: Olympia

Invited THU2o.1 Thursday, 10:15 Olympia
THz nanoscopy of ultraconfined in-plane anisotropic plasmon polaritons — •Rainer Hillenbrand — CIC nanoGUNE BRTA, San Sebastian, Spain — IKERBASQUE, Basque Foundation for Science, Bilbao, Spain
s-SNOM yields images of ultraconfined in-plane anisotropic THz plasmon polaritons in monoclinic silver telluride platelets. Placing the platelets above a metal, acoustic plasmon polaritons emerge. They increase the polaritons' direction-dependent relative propagation length and confinement, revealing an elliptical isofrequency contour in momentum space and the in-plane anisotropic effective electron masses.

Oral THU2o.2 Thursday, 10:45 Olympia
Reconfigurable emissivity shaping metasurface based on the plasmonic phase-change material In_3SbTe_2 — •Lukas Conrads[1], Natalie Honné[1], Andreas Ulm[2], Andreas Hessler[1], Matthias Wuttig[1], Robert Schmitt[2], and Thomas Taubner[2] — [1]I. Institute of Physics (IA) RWTH Aachen University, Aachen, Germany — [2]Fraunhofer Institute of Production Technology, Aachen, Germany
The plasmonic phase-change material In_3SbTe_2 can be reversibly switched from an amorphous dielectric to a crystalline metallic state. Infrared emissivity-control by patterning an absorber metasurface is demonstrated for different polarizations only visible at large wavelengths. Additionally, we fabricate a 1x1 cm^2 metasurface with enhanced emissivity displaying an apparent temperature pattern.

Oral THU2o.3 Thursday, 11:00 Olympia
Molecular J-aggregates Coupled to Dielectric Metasurfaces — Marco Marangi[1,2], Yutao Wang[1,2], Mengfei Wu[3], Febiana Tjiptoharsono[3], Arseniy Kuznetsov[3], •Giorgio Adamo[1,2], and Cesare Soci[1,2] — [1]Centre for Disruptive Photonic Technologies, TPI, Nanyang Technological University, Singapore, Singapore — [2]Division of Physics and Applied Physics, SPMS, Nanyang Technological University, Singapore, Singapore — [3]IMRE, Agency for Science Technology and Research (A*STAR), Singapore, Singapore
Highly ordered molecular J-aggregates have been widely studied for their superradiant behavior. Here we demonstrate transition from weak to strong coupling of J-aggregates to resonant dielectric metasurfaces, evidenced by Purcell enhancement of fluorescence and formation of polaritonic states, which may be used to control superradiance.

Invited THU2o.4 Thursday, 11:15 Olympia
Spectrally selective metasurfaces for maximally chiral light-matter interactions — •Andreas Tittl — Chair in Hybrid Nanosystems, Nano-Institute Munich, Ludwig-Maximilians-Universität München, München, Germany
New concepts for obtaining additional nanophotonic functionalities in BIC-based systems are presented, with a focus on metasurfaces with true chirality. A multi-step nanofabrication approach is introduced to control the height of individual resonators within all-dielectric metasurfaces, enabling maximally chiral quasi-BIC metasurfaces that selectively couple to specific circular polarizations of light.

Invited THU2o.5 Thursday, 11:45 Olympia
Revealing Local Optical Properties in Deep-Subwavelength Ultra-High Index Topological Insulators Bi2Se3 and Bi2Te3 — •Sukanta Nandi[1,2], Shany Z. Cohen[1,2], Danveer Singh[1,2], Michal Poplinger[1,2], Pilkhaz Nanikashvili[1,2], Doron Naveh[1,2], and Tomer Lewi[1,2] — [1]Faculty of Engineering, Bar-Ilan University, Ramat Gan 5290002, Israel — [2]Institute of Nanotechnology and Advanced Materials, Bar-Ilan University, Ramat Gan 5290002, Israel
We extract the optical constants of Bi2Se3 and Bi2Te3 across the 2-16um range, and utilize the material ultra-high index to fabricate deep-subwavelength nanostructures. Nanoimaging phase-mapping revealed local optical heterogeneity with varying imaginary part of the index. We measure up to 2π phase-shift across the resonance, in excellent agreement with simulations.

THU2s: Tailoring matter I

Chair: Yeshaiahu Fainman, University of California San Diego, La Jolla, USA

Time: Thursday, 10:15–12:15 Location: Tirol

Invited THU2s.1 Thursday, 10:15 Tirol
Nanotransfer printing for extreme plasmonic devices — •Farnaz Niroui — Massachusetts Institute of Technology , Cambridge , USA
We report a nanotransfer printing technique in which nanoscale engineering of forces allow bottom-up deterministic and high-yield fabrication of extreme plasmonic devices from nanoparticle building blocks. With this platform, we demonstrate examples of passive plasmonic devices and introduce a mechanism towards dynamically tunable designs leveraging mechanical reconfiguration.

Invited THU2s.2 Thursday, 10:45 Tirol
Multi-frequency approach towards virtual gain for compensation of optical loss of polaritons — •Shuang Zhang — New Cornerstone Science Foundation, Department of Physics, University of Hong Kong, Hong Kong, China
We present a multi-frequency approach towards virtual gain for compensation of plasmonic loss. Our approach has been successfully applied for improving the resolution of superimaging, molecular sensing and propagation of polaritons.

Oral THU2s.3 Thursday, 11:15 Tirol
Silicon rich Nitride Dielectric Metasurface for Augmented Reality Display — •Oren Goldberg, Noa Mazurski, and Uriel Levy — Institute of Applied Physics, The Faculty of Science, The Center for Nanoscience and Nanotechnology, The Hebrew University of Jerusalem, Jerusalem, Israel
We theoretically and experimentally demonstrate structural colors based on Silicon rich Nitride (SRN) metasurface for covering the sRGB chromaticity map.

Oral THU2s.4 Thursday, 11:30 Tirol

Engineering Temperature Invariant Metaphotonics — •Shany Z. Cohen, Sukanta Nandi, Danveer Singh, and Tomer Lewi — Bar Ilan University, Ramat Gan, Israel

We use hybrid meta-atoms composed from two materials with positive and negative thermo-optic (TO) coefficients, to engineer nanophotonic components with zero effective TO effect (dneff/dT≈0). We demonstrate temperature invariant resonant frequency, amplitude, and phase response in meta-atoms and metasurfaces, operating across a broad temperature range (ΔT=500K).

Invited THU2s.5 Thursday, 11:45 Tirol

Discovery of scale-invariant lasers — •Boubacar Kante — University of California, Berkeley, USA — Lawrence Berleley National Laboratory, Berkeley, USA

Lasers play a fundamental role in science and technology from quantum computing, to communications, manufacturing, defense, sensing, medicine, or imaging.

12:15–16:00: Lunch break

THU3o: Industry talk 2

Time: Thursday, 16:00–17:00 Location: Olympia

Technology THU3o.1 Thursday, 16:00 Olympia

Supercontinuum White Light Lasers - a Powerful Tool for Nano-Photonics Research and Materials Science — •Nicolai Granzow — NKT Photonics A/S, Birkeroed, Denmark

Supercontinuum "White Light Lasers" have become a well-established turn-key fiber-laser technology addressing a wide range of applications within Nano-Photonics research. In my presentation I will introduce what supercontinuum lasers are, how white laser light is generated, and show a range of scientific applications related to nano-photonics and optical metrology.

THU4f: Poster session

Time: Thursday, 17:00–18:30 Location: Foyer

THU4f.1 Thursday, 17:00 Foyer

A high-frequency solution for the diffraction of plane waves by truncated chiral metamaterial sheets — •Giovanni Riccio[1], Gianluca Gennarelli[2], Flaminio Ferrara[3], Rocco Guerriero[3], and Francesco Chiadini[3] — [1]D.I.E.M. - University of Salerno, Fisciano, Italy — [2]I.R.E.A. - C.N.R., Naples, Italy — [3]D.I.In. - University of Salerno, Fisciano, Italy

The diffraction problem involving a truncated chiral metamaterial sheet is solved by means of the Uniform Asymptotic Physical Optics approach. The provided solution is given in closed form and is easy to apply, and permits to compensate the discontinuities of the Geometrical Optics field at the shadow boundaries.

THU4f.2 Thursday, 17:00 Foyer

Gallium phosphide 2D optomechanical crystals for deterministic quantum memories — •Sho Tamaki[1,2], Théo Martel[3], Rémy Braive[3,4,5], and Albert Schliesser[1,2] — [1]Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark — [2]Center for Hybrid Quantum Networks, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark — [3]Centre de Nanosciences et de Nanotechnologies, Palaiseau, France — [4]Université Paris Cité, Paris, France — [5]Institut Universitaire de France, Paris, France

We have proposed, implemented, and characterized a 2D optomechanical crystal device made of gallium phosphide aiming for deterministic quantum memories. The device is in the resolved-sideband regime and has vacuum optomechanical coupling strength $g_0/2\pi$ = 748 kHz.

THU4f.3 Thursday, 17:00 Foyer

Inducing valley polarization in WSe_2 and $MoSe_2$ monolayers at room temperature — •Sergii Morozov [1], Torgom Yezekyan [2], Christian Wolff [1], Sergey I. Bozhevolnyi [2,3], and N. Asger Mortensen [1,3] — [1]POLIMA - Center for Polariton-driven Light-Matter Interactions, University of Southern Denmark, Odense, Denmark — [2]Center for Nano Optics, University of Southern Denmark, Odense, Denmark — [3]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark

We investigate the control of valley polarization in WSe_2 and $MoSe_2$ monolayers via strong electron doping at room temperature. Achieving 61% and 37% valley contrasts respectively, our work reveals the potential of such doped systems for practical valleytronic applications at ambient conditions, providing significant insights for quantum information technologies.

THU4f.4 Thursday, 17:00 Foyer

Dynamic beam switching device up to 26° using micrometer-sized switchable plasmonic metallic polymers — •Jonas Herbig, Monika Ubl, Dominik Ludescher, Mario Hentschel, and Harald Giessen — 4th Physics Institute and Research Center SCoPE, Universität Stuttgart, Stuttgart, Germany

We introduce a dynamic beam switching device made from metallic polymer consisting of individually addressable nanowires in planar geometry that allow various diffraction angles. The used metal-to-insulator transition is driven by CMOS-compatible voltages with a switching frequency of up to 30 Hz.

THU4f.5 Thursday, 17:00 Foyer

sub-femtoliter refractive index sensing using single mie voids — •serkan arslan — 4. physics institut, university of stuttgart, stuttgart, Germany

Pharmaceutical applications and analytical chemistry require measurements of liquid properties for even the tiniest quantities. Until now, refractive index measurements of liquids using, e.g., microinterferometry detectors in glass capillaries, require amounts in the hundreds of picoliter range. We push these limits towards smallest volumes by utilizing individual Mie voids.

THU4f.6 Thursday, 17:00 Foyer

Semiconductor Metasurfaces for Surface-enhanced Raman Scattering — •Haiyang Hu[1], Anil K. Pal[1], Alexander Berestennikov[1], Thomas Weber[1], Andrei Stefancu[1], Emiliano Cortés[1], Stefan A. Maier[1,2,3], and Andreas Tittl[1] — [1]Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, München, Germany — [2]School of Physics and Astronomy, Monash University Clayton Campus, Melbourne, Australia — [3]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom

We develop an improved SERS metasurface platform that leverages the combination of titanium oxide (TiO2) and the emerging physical concept of optical bound states in the continuum (BICs) to boost the Raman emission.

THU4f.7 Thursday, 17:00 Foyer

Shaping free electron wavepackets with structured light — •Sven Ebel[1] and Nahid Talebi[2] — [1]POLIMA - Center for Polariton-driven Light-Matter Interaction, University of Southern Denmark, Odense, Denmark — [2]Institute of Experimental and Applied Physics, Kiel University, Kiel, Germany

We demonstrate the transversal and longitudinal shaping of slow electron wavepackets in free space using the Kapitza-Dirac effect with structured light. Our numerical calculations reveal that the resulting electron energy and momentum modulation can be controlled by varying the spatial and temporal structure of the applied light beams.

THU4f.8 Thursday, 17:00 Foyer

Strain engineering valley polarization in monolayer transition metal dichalcogenides — •Yonas Lebsir[1], Sven Ebel[1], Sergii Morozov[1], Torgom Yezekyan[2], Sergey I. Bozhevolnyi[2], and N. Asger Mortensen[1,3] — [1]POLIMA–Center for Polariton-Driven Light–Matter Interactions, University of Southern Denmark, Odense, Denmark — [2]Center for Nano Optics, University of Southern Denmark, Odense, Denmark — [3]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark

This study investigates the application of non-uniform strain via precisely tailored nanostructures to enhance trion emission and induce electron funneling in monolayer transition metal dichalcogenides (ML TMDs). Trions in ML TMDs show heightened valley polarization over neutral excitons, making strain a valuable tool for quantum applications. Room temperature measurements provide practical insights.

THU4f.9 Thursday, 17:00 Foyer

Broadband resonances of percolated thin plasmonic films coupled to lithography-free photonic cavities — •Manuel Goncalves — Ulm University - Inst. Experimental Physics, Ulm, Germany

Broadband resonances in the vis-NIR are obtained by the interaction of light scattered by percolated thin films with lithography-free photonic resonator. The reflectance of the resulting colored surface varies from full reflection to full absorption. The Drude-Lorentz model used for noble metal films cannot describe the optical behavior observed.

THU4f.10 Thursday, 17:00 Foyer

Infrared near-field nanoscopy of reversibly photoswitchable lipid vesicles in an aqueous environment — •Thorsten Gölz [1], Enrico Bau[1], Jinhua Zhang[2], Korbinian Kaltenecker[1,3], Stefan A. Maier[1,4,5], Fritz Keilmann[1], Theobald Lohmüller[2], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Nano-Institute , Munich, Germany — [2]Chair for Photonics and Optoelectronics, Nano-Institute Munich, Munich, Germany — [3]Attocube Systems AG, Haar, Germany — [4]School of Physics and Astronomy, Clayton, Australia — [5]Department of Physics, London, United Kingdom

We present a s-SNOM study of photoswitchable lipid vesicles in water. We demonstrate the imaging of the photoswitching of single vesicles and the spectroscopical discrimination of the two photoisomers. Furthermore, we track the switching with subsecond resolution by monitoring the near field of an infrared wavelength sensitive to the switching process.

THU4f.11 Thursday, 17:00 Foyer

Coulomb-correlated few-electron states generated by nanotip photoemission — •Armin Feist[1,2], Rudolf Haindl[1,2], Till Domröse[1,2], Marcel Möller[1,2], John H. Gaida[1,2], Sergey V. Yalunin[1,2], and Claus Ropers[1,2] — [1]Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany — [2]4th Physical Institute - Solids and Nanostructures, University of Göttingen, Göttingen, Germany

We observe strong few-electron Coulomb correlations in femtosecond pulsed photoemission from a field emitter. Sorting into specific electron number classes reveals about 2 eV energy separations and discrete changes in the beam caustics for N=2,3,4. Electron number-filtered pulsed beams facilitate non-Poissonian statistics and single-electron heralding, promising applications in free-electron quantum optics.

THU4f.12 Thursday, 17:00 Foyer

Polarization invariant ultra-wide spectral metasurface absorber — Ruben Amedalor[1], •Liana Burns[3], Benjamin Asamoah[1], and Ibrahim Issah[2] — [1]University of Eastern Finland, Joensuu, Finland — [2]Tampere University , Tampere, Finland — [3]St. Patricks nursing and midwifery college, Kumasi, Ghana

We demonstrate the absorbance spectral contrast of a metasurface absorber based on Metal-Insulator-Metal (MIM) and Metal-Insulator-Metal-Insulator-Metal (MIMIM) nanodisk configurations. We identified a significant increase in absorbance over a long spectral range with over 90% average by updating the structure from a conventional MIM to MIMIM configuration.

THU4f.13 Thursday, 17:00 Foyer

Waveguide-Driven Plasmonic Nanoparticle-on-a-Mirror Cavity for Raman Detection of 5-Amino-2-Mercaptobenzimidazole Self-Assembled Monolayers — •Javier Redolat[1], María Camarena-Pérez[1], Amadeu Griol[1], Miguel Sinusia-Lozano[1], Jeremy J. Baumberg[2], Alejandro Martínez[1], and Elena Pinilla-Cienfuegos[1] — [1]Nanophotonics Technology Center, Valencia, Spain — [2]NanoPhotonicsCentre,CavendishLaboratory, Cambridge, United Kingdom

In this work gold surfaces are functionalized with 5-amino-2-mercaptobenzimidazole (5-A-2MBI) molecules, allowing the assembly of gold nanoparticles in nanoparticle-on-a-mirror (NPoM) cavities. These surfaces and NPoM cavities are characterized using various techniques and integrated with silicon-based photonic chips, enabling on-chip Raman spectroscopy and potential infrared and THz radiation detection.

THU4f.14 Thursday, 17:00 Foyer

Ultrafast Low-jitter Photodetection in High-Temperature Superconducting Nanowires — •Ankit Kumar[1], Dmitry Panna[1], Shlomi Bouscher[1], Avi Koriat[1], Yuval Nitzav[2], Ronen Jacovi[1], Amit Kanigel[2], and Alex Hayat[1] — [1]Department of Electrical Engineering, Technion Israel Institute of Technology, Haifa, Israel — [2]Department of Physics, Technion Israel Institute of Technology, Haifa, Israel

We demonstrate ultrafast optical response in high-Tc YBCO-based nanowires, crucial for single-photon sensitivity. Our research demonstrates ~100 ps jitter, with rise and fall times of ~850 and ~1250 ps. These nanowires respond across a wide wavelength range from visible to infrared, emphasizing their potential for practical quantum optics.

THU4f.15 Thursday, 17:00 Foyer

Fluorescence-detected two-dimensional electronic spectroscopy (F-2DES) of single molecules — •Sanchayeeta Jana, Simon Durst, and Markus Lippitz — Chair for Experimental Physics III, Universität Bayreuth, Bayreuth, Germany

Fluorescence-detected two-dimensional electronic spectroscopy (F-2DES) is a powerful ultrafast technique for studying the coupling between different states in a system. Single-molecule fluorescence spectroscopy can resolve the inhomogeneity of an ensemble. We combine these two techniques and measure 2D spectra of single molecules.

THU4f.16 Thursday, 17:00 Foyer

Experimental demonstration of optical cloaking of a silver nanowire — Shinich Ikari, Mana Toma, and •Kotaro Kajikawa — Tokyo Institute of Technology, Yokohama, Japan

Abstract: Experimental demonstration of the plasmonic cloaking is reported for an object of a silver nanowire 0.11 μm diameter, immobilized at the tip of an STM probe. The scattering was strongly suppressed, and the nanowire became invisible when covered with a cloaking medium (MoO_3 film) with an appropriate thickness (0.045 μm).

THU4f.17 Thursday, 17:00 Foyer

Topological protection of transport in fast Thouless pumps in the presence of static disorder — •Anna Sidorenko and Stefan Linden — Physikalisches Institut, Bonn, Germany

We probe the effect of static disorder potentials on the transport properties of fast Thouless pumps with non-Hermitian topology and Hamiltonian ratchets, both implemented by plasmonic waveguide arrays. For Thouless pumps, directional transport is observed even for large disorder strength, while directional transport is inhibited for ratchets in this case.

THU4f.18 Thursday, 17:00 Foyer

Large-area, two-dimensional single-crystal gold for low-loss nanoplasmonics — •Chenxinyu Pan[1], Yuanbiao Tong[1], Anatoly V. Zayats[2], Limin Tong[1], and Pan Wang[1] — [1]State Key Laboratory of Extreme Photonics and Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China — [2]Department of Physics and London Centre for Nanotechnology, King's College London, London, United Kingdom

Two-dimensional gold with a single-crystal structure is highly desired for upcoming technologies. In this work, we demonstrate the fabrication of large-area (>10^4 μm^2), two-dimensional single-crystal gold using a chemical etching approach with an atomic-level precision, and its use for the realization of ultrathin plasmonic structures with low loss.

THU4f.19 Thursday, 17:00 Foyer

Active Metasurfaces for Full Color Switching based on Inorganic Electrochromism — •Yohan Lee, Serkan Arslan, Monika Ubl, Mario Hentschel, and Harald Giessen — 4th Physics Institute and Research Center SCoPE, University of Stuttgart, Stuttgart, Germany

We introduce metasurfaces using tungsten trioxide (WO3) which is well-known for its electrochromic property. The proposed nanophotonic devices can not only express a wide color gamut space by tailoring the geometry of the nanoscatterers, but also be switched on and off depending on the applied voltages.

THU4f.20 Thursday, 17:00 Foyer

Phonon polaritons in van der Waals polar heterostructures for broadband strong light– matter interactions — •Tianwei Qin[1], Weiliang Ma[1], Tao Wang[2], and Peining Li[1] — [1]Huazhong University of Science and Technology, Wuhan, China — [2]Soochow University, Suzhou, China

We propose and experimentally demonstrate the polar van der Waals heterostructures which enable broadband phonon polariton responses. The heterostructure break the phonon polariton limitation of narrow spectral responses in practical application, and have the potential to achieve vibrational strong coupling for a few molecule monolayers with multiple molecular absorption modes.

THU4f.21 Thursday, 17:00 Foyer

Heralded single-photon source by Cooper-pair-based two-photon emission — •Sima Buchbinder, Shlomi Bouscher, Avi Koriat, Ankit Kumar, and Alex Hayat — The Andrew and Erna Viterbi Faculty of Electrical and Computer Engineering, Technion - Israel Institute of Technology, Haifa, Israel

We propose a new concept for an electrically-driven, integrated semiconductor-superconductor heralded single-photon source based on Cooper-pair two-photon emission. Such a source could serve as an invaluable part in photonic quantum computers, quantum information and quantum communications schemes.

THU4f.22 Thursday, 17:00 Foyer

withdrawn

THU4f.23 Thursday, 17:00 Foyer

Hyperlens enabled defect imaging in hexagonal Boron Nitride- covered Trilayer graphene — •Lina Jäckering, Konstantin G. Wirth, and Thomas Taubner — 1st Institute of Physics (IA), RWTH Aachen University, Aachen, Germany

Few layer graphene (FLG) is usually encapsulated in hexagonal boron nitride (hBN) because it strongly increases the FLGs carrier mobility. However, this aggravates the defect identification with optical tech-niques. With nano-imaging, we demonstrate that the subdiffractional focusing of hyperbolic phonon polaritons in hBN visualizes defects in FLG below the hBN.

THU4f.24 Thursday, 17:00 Foyer

Near-field investigation of the topologically protected edge state of the Su-Schrieffer-Heeger model — •Hans-Joachim Schill, Anna Sidorenko, and Stefan Linden — Physikalisches Institut, Bonn, Germany

We use phase-resolved scanning near-field optical microscopy in combination with leakage-radiation microscopy to study the edge mode of the Su-Schrieffer-Heeger model at the interface between two topologically distinct domains. As predicted by theory, the topologically protected edge mode features a characteristic oscillation between positive and negative electric field amplitudes.

THU4f.25 Thursday, 17:00 Foyer

Distributed Bragg Reflectors in Photonic Integrated Circuits for Quantum Applications — •James E. Blatcher, Martin J. Cryan, and Jon R. Pugh — University of Bristol, Bristol, United Kingdom

We report on the development of photonic integrated circuit based distributed Bragg reflector (DBR) filters and DBR resonant cavities in silicon-on-insulator and silicon nitride platforms. Devices are designed to comply with standard silicon photonics foundries' wafer scale fabrication, with a focus towards integration into larger PIC systems for quantum applications.

THU4f.26 Thursday, 17:00 Foyer

Direct programming of confined Surface Phonon Polariton Resonators using the plasmonic Phase-Change Material In3SbTe2 — Lukas Conrads, Luis Schüler, Konstantin G. Wirth, Matthias Wuttig, and •Thomas Taubner — Institute of Physics (IA), RWTH Aachen University, Aachen, Germany

Surface Phonon Polariton (SPhP) resonators with strongly confined fields inside the resonator facilitate low-loss nanophotonic devices. Here, we program SPhP resonators on SiC by patterning the plasmonic phase-change material In3SbTe2 and reconfigure their sizes. The flexibility of our concept is exploited by optically writing unconventional resonator shapes with complex field distributions.

THU4f.27 Thursday, 17:00 Foyer

The nonlinear electronic, thermal and optical response of transparent conducting oxides intense illumination — •Subhajit Sarkar[1], Ieng Wai Un[2], and Yonatan Sivan[3] — [1]Physics Department, Jagiellonian University, Krakow, Poland — [2]Physics Department, South China Normal University, Guangzhou, China — [3]School of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer-Sheva, Israel

We describe a Boltzmann-based model for the electron dynamics and thermal and optical properties of transparent conducting oxides, and show that it explains experimental findings with no need for any ad-hoc changes used so far.

THU4f.28 Thursday, 17:00 Foyer

Crossover from non-thermal to thermal photoluminescence from metals excited by ultrashort light pulses — •Yonatan Sivan[1], Imon Kalyan[1], Ieng-Wai Un[2], Kaiqiang Lin[3], John Lupton[3], and Sebastian Bange[3] — [1]Ben-Gurion University of the Negev, Be'er-Sheva, Israel — [2]South China Normal University, Guangzhou, China — [3]Institut für Experimentelle und Angewandte Physik, Universität Regensburg, Regensburg, Germany

We provide a quantitative theory for (nonlinear) photoluminescence from illuminated metal nanostructures under CW and pulsed illumination which reconciles decades-long arguments on seemingly contradicting experimental reports. We then describe a new set of measurements which provide detailed experimental evidence supporting our subtle novel predictions.

THU4f.29 Thursday, 17:00 Foyer

Single Au bipyramid and single quantum dot strong coupling at room temperature — •K. Mamaeva[1,3], C. Elliott[1,3], T. Faraone[2], C. Delaney[2], L. Florea[2], and A.L. Bradley[1,3] — [1]School of Physics, Trinity College Dublin, Dublin, Ireland — [2]School of Chemistry, Trinity College Dublin, Dublin, Ireland — [3]IPIC, Tyndall National Institute, Cork, Ireland

We demonstrate an experimental approach to obtain Rabi splitting for a strongly-coupled single Au bipyramid and a quantum dot using direct laser writing two-photon polymerization. This approach provides for localization of the quantum dot at the bipyramid's hotspot enabling successful demonstration of strong coupling.

THU4f.30 Thursday, 17:00 Foyer

One mode-model in nanostructures with inclined sidewalls applied to nano Fabry-Perot structures — •Jules Lackner[1,2], Baptiste Fix[1], Patrick Bouchon[1], and Alain Bosseboeuf[2] — [1]ONERA, Palaiseau, France — [2]C2N, Palaiseau, France

Metasurfaces allow incredible control over optical properties of surfaces. However, thin layers patterning techniques can lead to side-wall angles, thus modifying light propagation within the structure. Here, we introduce a one-mode model that fairly describes the propagation of light in structures with inclined sidewalls.

THU4f.31 Thursday, 17:00 Foyer

Manipulation of higher-order Poincaré sphere beams beyond the diffraction limit using single-layer metasurface — •Chuang Sun[1], Hailong Pi[1], Kian Shen Kiang[1], Jize Yan[1], and Jun-Yu Ou[2] — [1]School of Electronics and Computer Science, University of Southampton, Southampton, Southampton, United Kingdom — [2]School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom

Control and generation of arbitrary higher-order Poincaré sphere (HOPS) beams have attracted intensive interest because of the potential of extreme optical manipulation using HOPS beams. Here, we experimentally demonstrate the control of focused HOPS beams with multi-foci of 22% smaller than the diffraction limit via a single-layer metasurface.

THU4f.32 Thursday, 17:00 Foyer

Single cycle optical nonlinearity of transparent conducting oxides – are temporal photonic crystals feasible? — Ieng-Wai Un[1], Subhajit Sarkar[2], and •Yonatan Sivan[3] — [1]South China Normal University, Guangzhou, China — [2]Jagiellonian University, Krakow, Poland — [3]Ben-Gurion University, Be'er-Sheva, Israel

We model the full optical and electronic response of transparent conducting oxides to a single cycle intense pulse. Our model allows us to interpret recent experimental observation of the unexpected rapid relaxation of the optical response and to comment on the possibility of realizing temporal photonic crystals in such systems.

THU4f.33 Thursday, 17:00 Foyer

In situ Observation of Nanoparticle Photocharging: Gold Nanorods as Photochemical Capacitors — •Felix Stete[1], Wouter Koopman[1], and Matias Bargheer[1,2] — [1]Institut für Physik, Universität Potsdam , Potsdam, Germany — [2]Helmholtz-Zentrum Berlin , Berlin, Germany

The longitudinal plasmon resonance in gold nanorods is sensitive to the density of free charges. We utilize this effect to demonstrate that light can induce a charge on plasmonic nanoparticles. Describing the particles as nanocapacitors allows for a qualitative explanation of our results.

THU4f.34 Thursday, 17:00 Foyer

Continuous spectral and coupling encoding with dual-gradient metasurfaces — Andreas Aigner[1], •Thomas Weber[1], Alwin Wester[1], Stefan A. Maier[1,2,3], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Faculty of Physics, Ludwig-Maximilians-Universität München, München, Germany — [2]School of Physics and Astronomy, Monash University, Clayton, Australia — [3]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom

We introduce the concept of spectral and coupling gradient metasurfaces based on symmetry protected bound states in the continuum and their combination in form of a dual-gradient metasurfaces. Our new approach allows continuous spatial mapping of a material's spectral and coupling fingerprint which we exploit for molecular sensing in the infrared.

THU4f.35 Thursday, 17:00 Foyer

Reconfigurable Grating-Insulator-Grating (GIG) metamaterials for amplitude and phase control — •Abbas Sheikh Ansari, Ashwin K. Iyer, and Behrad Gholipour — University of Alberta, Edmonton, Canada

Metasurfaces possessing asymmetry along the direction of propagation of waves could provide asymmetric transmission (AT). We show a three-layer grating-insulator-grating (GIG) metamaterial stack enables broadband AT, which through integrating phase change materials into the GIG can be engineered to control both amplitude and phase of transmitted diffraction orders.

THU4f.36 Thursday, 17:00 Foyer

Second-harmonic generation in ultra-thin crystalline silver films — •Philipp K. Jenke[1,2], Saad Abdullad[3], Andrew P. Weber[3,4], Vahagn Mkhitaryan[3], J. Enrique Ortega[4,5,6], Philip Walther[1,7,8], F. Javier García de Abajo[3,9], and Lee A. Rozema[1] — [1]University of Vienna, Faculty of Physics, Vienna Center for Quantum Science and Technology (VCQ), Vienna, Austria — [2]University of Vienna, Vienna Doctoral School in Physics, Vienna, Austria — [3]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Barcelona), Spain — [4]Donostia International Physics Center, Donostia-San Sebastián, Spain — [5]Centro de Física de Materiales CSIC-UPV/EHU and Materials Physics Center, Donostia-San Sebastián, Spain — [6]Departamento de Física Aplicada I, Universidad del País Vasco, Donostia-San Sebastián, Spain — [7]University of Vienna, Research Platform for Testing the Quantum and Gravity Interface (TURIS), Vienna, Austria — [8]Christian Doppler Laboratory for Photonic Quantum Computer, Faculty of Physics, University of Vienna, Vienna, Austria — [9]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

Plasmonic excitations can enhance optical nonlinear processes. Here, we experimentally show that decreasing the thickness of a few-atom-thick crystalline silver films leads to overall stronger plasmon-enhanced second-harmonic generation. This highlights the role surface effects and band structure in such systems and contradicts the standard intuition of nonlinearities in bulk media.

THU4f.37 Thursday, 17:00 Foyer

Nanoparticle meta-grid for enhanced light extraction from light emitting devices — Debabrata Sikdar[1,2], Joshua Edel[1], John Pendry[1], and •Alexei Kornyshev[1] — [1]Imperial College London, White - Any other White background, United Kingdom — [2]Indian Institute of Technology, Guwahati, India

We present a theory and first experimental verification of a physical effect which shows that light extraction efficiency of the existing semiconductor light emitting devices (LEDs) can be increased up to 98% by introducing a meta-grid of plasmonic nanoparticles on top of the conventional LED chip within its encapsulating packaging.

THU4f.38 Thursday, 17:00 Foyer

Towards the realization of exceptional point physics in all-dielectric nanophotonics — •Adria Canos Valero[1], Vjaceslavs Bobrovs[2], Zoltan Sztranyovszky[3], Egor.A. Muljarov[4], Alexander S. Shalin[5], Andrey Bogdanov[6], Yuri Kivshar[7], and Thomas Weiss[1] — [1]Institute of Physics, University of Graz, and NAWI Graz, Graz, Austria — [2]Riga Technical University, Institute of Telecommunications, Riga, Latvia — [3]School of Chemical Engineering, University of Birmingham, Birmingham, United Kingdom — [4]School of Physics and Astronomy, Cardiff University, Cardiff, United Kingdom — [5]Center for Photonics and 2D Materials, Moscow Institute of Physics and Technology, Moscow, Russia — [6]Qingdao Innovation and Development Center of Harbin Engineering University, Qingdao, China — [7]Nonlinear Physics Centre, Department of Fundamental and Theoretical Physics, Australian National University, Canberra, Australia

We discuss exceptional points (EPs) in dielectric nanophotonics. We outline conditions for observing EPs in single dielectric nanoparticles and demonstrate the merging of multiple Bound States in the Continuum (BICs) into 'EP-BICs.' These novel singularities possess infinite radiative quality factors like BICs and high sensitivity to perturbations, like EPs.

THU4f.39 Thursday, 17:00 Foyer

Chalcogenide nano-optomechanical phase change metasurface — Abbas Sheikh Ansari[1], Ding Li[2], Avik Mandal[1], Kwanghyun Kim[1], Behrad Gholipour[1], and •Jun-Yu Ou[2] — [1]Nanoscale Optics Lab, Department of Electrical and Computer, University of Alberta, Southampton, United Kingdom — [2]School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom

Tuning any mechanical resonator like a guitar string requires continuous force and energy. Phase change chalcogenide semiconductors can provide non-volatile switching between phases. Here, we demonstrate a new class of reconfigurable nano-optomechanical metasurfaces with a non-volatile mechanical frequency shift of 22% and optical transmission change of 47% upon phase transition.

THU4f.40 Thursday, 17:00 Foyer

Chiral metasurface with simply rotated achiral meta-atoms — •Dmytro Gryb[1], Fedja J. Wendisch[1], Andreas Aigner[1], Thorsten Gölz[1], Andreas Tittl[1], Leonardo de S. Menezes[1,2], and Stefan A. Maier[3,4,1] — [1]Chair in Hybrid Nanosystems, Nano Institute Munich, Department of Physics, Ludwig-Maximilians-Universität München, Munich, Germany — [2]Departamento de Física, Universidade Federal de Pernambuco, Recife, Brazil — [3]School of Physics and Astronomy, Monash University, Clayton, Australia — [4]Department of Physics, Imperial College London, London, United Kingdom

Modern chiral metasurfaces usually use complex meta-atom shapes, which can complicate chiral response optimization and fabrication. We introduce a metasurface design based on the rotation of dielectric rectangles in a square lattice, that demonstrates a strong chiroptical response, and investigate the physical origins of the chiral response in this system.

THU4f.41 Thursday, 17:00 Foyer

Coupled Nano Fabry-Perot for enhanced photodetectors — •Benoît Pezeshgi[1,2], Baptiste fix[1], Julien Jaeck[1], Isabelle Sagnes[2], and Konstantinos Pantzas[2] — [1]ONERA, Palaiseau, France — [2]Centre de Nanosciences et de Nanotechnologies , Palaiseau, France

A common nanostructuration is the double metal patch resonator, which is often used with no reflection at resonance. However, it is possible to use two under coupled patch resonators to create a new resonator. We will present the key feature and advantages of this new type of nanoresonator.

THU4f.42 Thursday, 17:00 Foyer

Enantiosensitive exceptional points for control and discrimination of chiral media — •Nicola Mayer[1], Alexander Löhr[1], Nimrod Moiseyev[2], and Olga Smirnova[1,2,3] — [1]Max-Born-Institut, Berlin, Germany — [2]Technion - Israel Institute of Technology, Haifa, Israel — [3]Technische Universitat, Berlin, Germany

We exploit the remarkable properties of exceptional points for enantiosensitive control and discrimination of chiral molecules. We consider and investigate two possible configurations where we endow EPs with enantiosensitivity that we then exploit to manipulate enantiosensitively single chiral molecules or infer the enantiomeric excess of a mixture of molecular enantiomers.

THU4f.43 Thursday, 17:00 Foyer

Bound state in the continuum metasurfaces on suspended SiC membrane — •Lin Nan[1], Andrea Mancini[1], Thomas Weber[1], Andreas Tittl[1], Emiliano Cortes[1], and Stefan Maier[2,3] — [1]Ludwig-Maxilimians-Universität München, Munich, Germany — [2]Monash University, Clayton, Australia — [3]Imperial College London, London, United Kingdom

We successfully demonstrated SiC-based metasurfaces featuring bound states in the continuum (BIC) modes. These metasurfaces exhibited angle-independent performance and showed strong coupling with organic molecules. This discovery holds great potential for applications in sensing and quantum optics.

THU4f.44 Thursday, 17:00 Foyer

Nonlinear optical response in 2D materials: An overview from first-principles approach — •Fadil Iyikanat[1], Yadong Wang[3], Zhipei Sun[3,4], and F. Javier Garcia de Abajo[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain — [2]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain — [3]Department of Electronics and Nanoengineering, Aalto University, Espoo, Finland — [4]QTF Centre of Excellence, Department of Applied Physics, Aalto University, Espoo, Finland

In this study, we use ab initio calculations within the density functional theory framework to explore the exciton-induced nonlinear optical response of monolayer MoS2. By solving the equation of motion in the time domain, we demonstrate that the material's nonlinear optical response is dominated by strongly coupled excitons.

THU4f.45 Thursday, 17:00 Foyer

Subwavelength imaging with topological metamaterials — •Dongyang Wang[1] and C. T. Chan[2] — [1]University of Southampton, Southampton, United Kingdom — [2]Hong Kong University of Science and Technology, Hong Kong, China

Topological photonics has opened new windows for achieving electromagnetic wave control. Here we will report the results on subwavelength imaging with topological metamaterials. Through microwave characterization, the subwavelength features are maintained while the propagating of topological surface wave, which demonstrates the subwavelength imaging.

THU4f.46 Thursday, 17:00 Foyer

Electron–plasmon interactions and multi-plasmon effects in photoemission from nanostructures — •P. André D. Gonçalves[1] and F. Javier García de Abajo[1,2] — [1]ICFO - The Institute of Photonic Sciences, Castellfefels (Barcelona), Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avancats, Barcelona, Spain

We investigate multi-plasmon effects imprinted in the photoemission spectrum from metallic nanoparticles and nanographenes. Such effects lead to the emergence of sidebands in the photoelectron spectrum distanced from the core-level peak by quanta of the plasmon energy. Our works opens new directions for investigating ultrafast electron–plasmon interactions in nanophotonics.

THU4f.47 Thursday, 17:00 Foyer

Electrically-driven single-crystal plasmonic nanocavities — •Pan Wang — College of Optical Science and Engineering, Hangzhou, China

In this work, based on single-crystal nanocube-on-mirror plasmonic nanocavities with low loss, we demonstrate their electrical integration and the efficient excitation of plasmonic nanocavity modes via inelastically tunnelled electrons.

THU4f.48 Thursday, 17:00 Foyer

Enantioselective optical forces in active chiral nanoparticles — Rfaqat Ali[1], •Felipe A. Pinheiro[2], Rafael Dutra[3], Thiago Alegre[1], and Gustavo Wiederhecker[1] — [1]Applied Physics Department, Gleb Wataghin Physics Institute, University of Campinas, 13083-859, Campinas, Brazil — [2]Instituto de Física, Universidade Federal do Rio de Janeiro, Caixa Postal 68528, 21941-972, Rio de Janeiro, Brazil — [3] Instituto Federal de Educação, Ciência e Tecnologia, 26600-000, Rio de Janeiro, Brazil

We propose an enantioselective scheme in dye-doped chiral particles, demonstrating optical pulling and pushing forces that can be tuned using externally controllable parameters. By changing the dye concentration and pumping rate we achieve all-optical chiral resolution of racemic mixtures and enantioselection of small chiral particles.

THU4f.49 Thursday, 17:00 Foyer

Mid Infrared Mapping of Four and Five-Layer Graphene Polytypes using Near-Field Microscopy — •Daniel Beitner[1,2,3], Shaked Amitay[3], Simon Salleh Atri[3], Andrew McEllistrim[4,5], Tom Coen[3], Vladimir I Fal'ko[4,5], Shachar Richter[1,2], Moshe Ben Shalom[2,3], and Haim Suchowski[2,3] — [1]Department of Materials Science and Engineering Faculty of Engineering Tel Aviv University , Tel Aviv , Israel — [2]University Centre for Nanoscience and Nanotechnology Tel Aviv University, Tel Aviv , Israel — [3]School of Physics and Astronomy, Faculty of Exact Sciences, Tel Aviv University, Tel Aviv, Israel — [4]National Graphene Institute Booth Street East, Manchester, United Kingdom — [5]Department of Physics and Astronomy Oxford Road, Manchester, United Kingdom

Few-layer Graphene exhibits several polytypes that might be used for various applications due to their broad absorption and tunable properties. This study uses near-field microscopy to map the optical response of 4 and 5-layer Graphene polytypes in the 8.5-11.5 μm range, revealing their rich optical characteristics.

THU4f.50 Thursday, 17:00 Foyer

Objective free sensing of brain metastasis biomarkers at clinical limits using metamaterial antennas — •Serap Aksu — Koc University, Istanbul, Turkey

We demonstrate the clinical use of a large are metamaterial surfaces that are fabricated using low-cost Laser Interference Lithography. The signal reading can be achieved using an objective free reflection probe. The minimum detection level can go down to 1pg/ml for S100A9 and AXL, the major relevant brain metastasis biomarkers.

THU5o: Metasurfaces II

Time: Thursday, 18:30–19:30 Location: Olympia

Invited THU5o.1 Thursday, 18:30 Olympia

Non-reciprocal phase transitions — •Michel Fruchart — James Franck Institute and Department of Physics, University of Chicago, Chicago, USA — Gulliver, ESPCI Paris, Université PSL, CNRS, Paris, France

Out of equilibrium, a lack of reciprocity is the rule rather than the exception. I will discuss how it leads to time-dependent phases in which spontaneously broken continuous symmetries are dynamically restored and analyze the resulting non-reciprocal phase transitions using insights from bifurcation theory and non-Hermitian quantum mechanics.

Breakthrough THU5o.2 Thursday, 19:00 Olympia

Nonreciprocal phase transitions and time-space crystals — •Kevin MacDonald[1], Tongjun Liu[1], Venugopal Raskatla[1], Jinxiang Li[2], and Nikolay Zheludev[1,2] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

Using nano-opto-mechanical platform we demonstrate a new class of photonic materials in which illumination with light creates nonreciprocal interactions that spontaneously breaks continuous space and time translation symmetries into discrete translation symmetries.

THU5s: Tailoring matter II

Chair: Alex Hayat, Technion – Israel Institute of Technology, Haifa, Israel

Time: Thursday, 18:30–19:30 Location: Tirol

Oral THU5s.1 Thursday, 18:30 Tirol

Towards a compact Sr optical clock system with integrated metasurfaces — •Amit Agrawal[1], Wenqi Zhu[1], Andrew Ferdinand[2], Sindhu Jammi[2], Okan Koksal[1], Zi Wang[1], Junyeob Song[1], Will Lunden[3], Dan Sheredy[3], Parth Patel[3], Marty Boyd[3], and Scott Papp[2] — [1]National Institute of Standards and Technology, Gaithersburg, USA — [2]National Institute of Standards and Technology, Boulder, USA — [3]Vector Atomic Inc., Pleasanton, USA

We demonstrate a two-color, alignment-free 87Sr magneto optical trap with fully integrated multi-color metasurface photonics. We characterize the metasurface functionality, performance and facilitate laser cooling and trapping of strontium for realization of a compact optical lattice clock.

Oral THU5s.2 Thursday, 18:45 Tirol

Manipulation of an exciton-polariton condensate by the AC Stark effect — •Sarit Feldman[1], Dmitry Panna[1], Nadav Landau[1], Sebastian Brodbeck[2], Sebastian Klembt[2], Christian Schneider[2], Sven Höfling[2], and Alex Hayat[1] — [1]Technion – Israel Institute of Technology, Haifa, Israel — [2]Universität Würzburg, Würzburg, Germany

We report the first observation of the ac Stark effect in a condensate of exciton-polaritons by a novel approach based on coherent oscillations. The ultrafast, non-invasive ac Stark manipulation of the condensate paves the way for new quantum technologies and fundamental research in quantum optics and condensed matter.

Breakthrough THU5s.3 Thursday, 19:00 Tirol

Optomechanical meta-matter through temporal modulation — •Ewold Verhagen[1], Jesse Slim[1], Javier del Pino[1,2], Clara Wanjura[3], Matteo Brunelli[4], and Andreas Nunnenkamp[5] — [1]AMOLF, Amsterdam, Netherlands — [2]ETH Zürich, Zürich, Switzerland — [3]Max Planck Institute for the Science of Light, Erlangen, Germany — [4]University of Basel, Basel, Switzerland — [5]University of Vienna, Vienna, Austria

We create multi-mode nano-optomechanical networks in which the interactions between mechanical modes are induced and fully reconfigured through time-modulated radiation pressure forces. We study the nonreciprocal and topological states that emerge from controlled breaking of time-reversal symmetry and Hermiticity in such optomechanical metamaterials.

THU6o: Plenary talk 3

Time: Thursday, 19:30–20:30 Location: Olympia

Plenary THU6o.1 Thursday, 19:30 Olympia
Optical thermodynamics of highly multimode nonlinear photonic systems — •Demetrios Christodoulides — University of Southern California, Los Angeles, USA
We provide an overview of recent developments in the field of optical thermodynamics. This theoretical framework can be used to predict and understand the utterly complex processes currently observed in nonlinear multimode optical arrangements. The possibility for deploying these methodologies for applications will be discussed.

FRI1o: Plenary talk 4

Chair: Javier Garcia de Abajo,ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain

Time: Friday, 9:00–10:00 Location: Olympia

Plenary FRI1o.1 Friday, 9:00 Olympia
Light-matter interactions in photonic time-crystals — •Mordechai (Moti) Segev — TECHNION - Israel Institute of Technology, Haifa, Israel
The fundamentals of Photonic Time-Crystals (PTCs) will be introduced, along with classical and quantum features of light emission in PTCs from free electrons, classical dipoles, quantum fluctuations, and atoms. Recent experiments in realizing time-reflections at optical frequencies will be presented

10:00–10:15: Coffee break

FRI2o: NANO-opto-mechanics

Chair: Farnaz Niroui, MIT, Massachuetts Institute of Technology, USA

Time: Friday, 10:15–12:30 Location: Olympia

Invited FRI2o.1 Friday, 10:15 Olympia
Levitated optomechanics meets nanophotonics — •Romain Quidant — ETH Zürich, Zürich, Switzerland
In this presentation we discuss our most recent advances in the development of integrated hybrid levitation platforms combining planar electrodes with integrated photonics and metaoptics.

Invited FRI2o.2 Friday, 10:45 Olympia
How Thin Film Photonics Unlocks the Power of Fano Resonance and Extreme Optomechanics — •GIUSEPPE STRANGI — CASE WESTERN RESERVE UNIVERSITY, CLEVELAND, USA
In recent years, significant interest has emerged in the inverse design of artificial layered heterostructures for photonic applications. In this presentation, I will delve into how thin film photonics harnesses the potential of Fano resonances and extreme optomechanics.

Invited FRI2o.3 Friday, 11:15 Olympia
Direct Measurement of Radiation Pressure Forces on Membrane Lightsails — Lior Michaeli[1], •Ramon Gao[1], Michael D. Kelzenberg[1], Claudio U. Hail[1], John E. Sader[2], and Harry A. Atwater[1] — [1]Department of Applied Physics and Materials Science, California Institute of Technology, Pasadena, USA — [2]Graduate Aerospace Laboratories, California Institute of Technology, Pasadena, CA 91125 USA, Pasadena, USA
We report direct measurement of radiation pressure forces exerted on a 100-nm-thick silicon nitride lightsail membrane using noise-robust common-path interferometry.

Invited FRI2o.4 Friday, 11:45 Olympia
Quantum Control of Phononic Resonators: from Milli-Kelvin to Room Temperature — •Albert Schliesser — Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark — Center for Hybrid Quantum Networks, University of Copenhagen, Copenhagen, Denmark
We discuss two different approaches to control the motion of mechanical resonators at the quantum level: (i) measurement-based and (ii) coherent control. We demonstrate the performance of these methods from milli-Kelvin to room temperatures, on a phononic resonator monitored by (i) optical interferometry, and (ii) coupled to a superconducting resonance circuit.

Oral FRI2o.5 Friday, 12:15 Olympia
Toward solid-state based quantum metasurfaces — •Rivka Bekenstein — Racah Institute, Hebrew University, Jerusalem, Israel
We develop methods for quantum control over light with atomic-like arrays, including direction, spatial and polarization states. Our methods allow for atom-atom, atom-photon and photon-photon entanglement generation and are aimed for implementation in solid-based quantum metasurfaces.

FRI2s: Ultrafast plasmonics

Chair: Jacob B. Khurgin, Johns Hopkins University, Baltimore, USA

Time: Friday, 10:15–12:15 Location: Tirol

Invited FRI2s.1 Friday, 10:15 Tirol
Attosecond Electron Microscopy — •Peter Baum — Universität Konstanz, Konstanz, Germany
We report the advance of transmission electron microscopy to attosecond time resolution for resolving optical waves in space and time, and show selected experimental results.

Invited FRI2s.2 Friday, 10:45 Tirol
Far-field petahertz sampling of plasmonic fields — •Kai-Fu Wong[1,2], Weiwei Li[3,4], Zilong Wang[3,4], Vincent Wanie[2], Erik Månsson[2], Dominik Höing[1,5], Johannes Blöchl[3,4], Thomas Nubbemeyer[3,4], Andrea Trabattoni[2,6], Holger Lange[1,5], Francesca Calegari[1,2], and Matthias F. Kling[3,4,7] — [1]The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Hamburg, Germany — [2]Center for Free-Electron Laser Science, DESY, Hamburg, Germany — [3]Max Planck Institute of Quantum Optics, MPQ, Garching, Germany — [4]Ludwig-Maximilians-Universität München, LMU, München, Germany — [5]Institute of Physical Chemistry, Universität Hamburg, Hamburg, Germany — [6]Institute of Quantum Optics, Leibniz Universität Hannover, Hannover, Germany — [7]SLAC National Accelerator Laboratory, Stanford University, Menlo Park, USA
We demonstrate the realtime observation of linear plasmonic fields by optical field sampling. Our findings also demonstrate the ability to ma- nipulate the

spectral properties of ultrashort laser pulses by plasmonic samples.

Oral FRI2s.3 Friday, 11:15 Tirol

Intracavity spatiotemporal metasurfaces — •Wenhe Jia[1], Chenxin Gao[1], Yongmin Zhao[2], Liu Li[1], Shun Wen[1], Shuai Wang[1], Chengying Bao[1], Chunping Jiang[2], Changxi Yang[1], and Yuanmu Yang[1] — [1]State Key Laboratory of Precision Measurement Technology and Instruments, Department of Precision Instrument, Tsinghua University, Beijing, China — [2]Key Laboratory of Nanodevices and Applications, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, Suzhou, China

We experimentally demonstrate the simultaneous spatiotemporal laser mode control within a fiber laser cavity using the single-layer plasmonic metasurfaces strongly coupled to an epsilon-near-zero material.

Oral FRI2s.4 Friday, 11:30 Tirol

Controlling the resonant dynamics in condensed matter systems by tailored ultrafast pulses — •Omri Meron[1], Snir Nehemya[2], Uri Arieli[2], Eyal Bahar[2], Moshe Ben-Shalom[2], and Haim Suchowski[2] — [1]Condensed Matter Physics Department, School of Physics and Astronomy, Faculty of Exact Sciences, Tel Aviv University, Tel Aviv, Israel — [2]Center for Light–Matter Interaction, Tel–Aviv University, Tel Aviv, Israel

We experimentally demonstrate a novel control method for ultrafast coherent quasiparticle dynamics in 2D semiconductors and plasmonic nanoparticles. We selectively steer resonant nonlinear generation, rearranging the interfering quantum pathways from destructive to constructive interferences.

Invited FRI2s.5 Friday, 11:45 Tirol

Spontaneous symmetry breaking in plasmon lattice lasers — •Nelson de Gaay Fortman[1,3], Radoslaw Kolkowski[2], Debapriya Pal[3], Said Rodriguez[3], Peter Schall[1], and Femius Koenderink[1,3] — [1]Institute of Physics, University of Amsterdam, Amsterdam, Netherlands — [2]Department of Applied Physics, Aalto University, Aalto, Finland — [3]Department of Physics of Information in Matter and Center for Nanophotonics, AMOLF, Amsterdam, Netherlands

We show spontaneous symmetry breaking (SSB) in a nonlocal plasmonic metasurface laser. By simultaneous real-space and Fourier-space measurements, we map the relative amplitude (parity symmetry) and phase (rotational symmetry) of the two symmetry-broken modes. our results open new perspectives on studying SSB and emergence of spatial coherence in photonic systems.

12:15–16:00: Lunch break

FRI3o: Industry talk 3

Time: Friday, 16:00–17:00 Location: Olympia

Technology FRI3o.1 Friday, 16:00 Olympia

Infrared correlation nanoscopy for organic and inorganic material analysis at the nanoscale — •Andreas Huber, Bogdan Sava, Claas Reckmeier, and Alexander Govyadinov — attocube systems AG, Haar, Germany

Nanoscale resolved imaging and spectroscopy using tip-enhanced microscopy enables bypassing the diffraction limit of light in the visible, infrared and terahertz frequency range enabling enabling comprehensive characterization of functional nanostructures or fundamental properties of materials.

FRI4o: Time crystals

Chair: Andreas Tittl, Ludwig-Maximilians-Universität München, Munich, Germany

Time: Friday, 17:00–18:15 Location: Olympia

Oral FRI4o.1 Friday, 17:00 Olympia

Synthetic lattice lasing by means of fast-gain — •Alexander Dikopoltsev, Ina Heckelmann, Mathieu Bertrand, Giacomo Scalari, Mattias Beck, and Jérôme Faist — ETH Zurich, Zurich, Switzerland

Synthetic lattices surpass physical space phenomena and their utilization could improve laser systems. Typical lasers struggle to support those lattices due to predominant dissipation. We propose the fast-gain mechanism to uncover the full potential of the synthetic frequency space, and demonstrate this using modulated fast-gain semiconductor ring lasers.

Oral FRI4o.2 Friday, 17:15 Olympia

Quantum simulation with Floquet-engineered Rydberg atom arrays — Naveen Nishad[1], Anna Keselman[1], Thierry Lahaye[2], Antoine Browaeys[2], and •Shai Tsesses[3,4] — [1]Department of Physics, Technion - Israel institute of Technology, Haifa, Israel — [2]Université Paris-Saclay, Institut d'Optique Graduate School, CNRS, Laboratoire Charles Fabry, , Palaiseau, France — [3]Andrew and Erna Viterbi Department of Electrical & Computer Engineering, Technion - Israel Institute of Technology, Haifa, Israel — [4]Department of Physics, MIT-Harvard Center for Ultracold Atoms and Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, USA

Although quantum simulators give access to intractable physical phenomena, they are unavoidably limited in the material models they exhibit. We propose a new route for simulating otherwise unattainable quantum materials with Rydberg atom arrays via Floquet engineering with global and local control, requiring only available (and reasonable) experimental capabilities.

Oral FRI4o.3 Friday, 17:30 Olympia

Continuous Space-Time Crystal State Driven by Nonreciprocal Optical Forces — •Venugopal Raskatla[1], Tongjun Liu[1], Kevin MacDonald[1], and Nikolay Zheludev[1,2] — [1]Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, SPMS, TPI, Nanyang Technological University, Singapore , Singapore

An ensemble of thermally driven oscillators that are nonreciprocally coupled and inhomogeneously broadened exhibits a spontaneous transition to the continuous space-time crystal state.

Invited FRI4o.4 Friday, 17:45 Olympia

Engineering light scattering through temporal structure — •Emanuele Galiffi[1], Gengyu Xu[1], Shixiong Yin[1], Romain Tirole[1], Stefano Vezzoli[2], Riccardo Sapienza[2], and Andrea Alu[1,3] — [1]Advanced Science Research Center, City University of New York, New York, USA — [2]Blackett Laboratory, Imperial College London, London, United Kingdom — [3]Physics Program, Graduate Center, City University of New York, New York, USA

We report on recent theoretical developments and experiments on photonic time-reflection in a microwave metamaterial and optical time-diffraction in a 40-nm indium tin oxide film. We then demonstrate theoretically and experimentally the new opportunities opened by temporal wave control for the harnessing of dynamical gain, loss, and pulse shaping.

FRI4s: Nonlinear metamaterials

Chair: Kevin MacDonald, University of Southampton, United Kingdom

Time: Friday, 17:00–18:15 Location: Tirol

Oral FRI4s.1 Friday, 17:00 Tirol

Electrical tuning of four-wave mixing in nonlinear metasurfaces — •Euclides Almeida[1,2], Matthew D. Feinstein[1,2], and Alexander Andronikides[1] — [1]Queens College, City University of New York, Flushing, New York, USA — [2]The Graduate Center of the City University of New York, New York, New York, USA

We demonstrate a broadband, electrically tuneable nonlinear metasurface based

on hybrid gold-graphene plasmons. The gate-tuneable metasurface device converts mid-infrared radiation to visible light through four-wave mixing. The signal amplitude can be controlled through charge injection in graphene, and the amplitude modulation is enhanced compared to that of bare graphene.

Oral FRI4s.2 Friday, 17:15 Tirol
Enhancement and wavefront control of third harmonic generation with a local high-Q metasurface — •Claudio U. Hail, Lior Michaeli, and Harry A. Atwater — California Institute of Technology, Pasadena, USA
We report on simultaneous strong enhancement and local spatial control of the third harmonic generation process using high-Q metasurfaces relying on higher-order Mie-resonant modes.

Oral FRI4s.3 Friday, 17:30 Tirol
Imaging Propagating Phonon Polaritons in SiC Metasurfaces with Sum-Frequency Spectro-Microscopy — •Niclas S. Mueller[1], Richarda Niemann[1], Sören Wasserroth[1], Guanyu Lu[2], Martin Wolf[1], Joshua D. Caldwell[2], and Alexander Paarmann[1] — [1]Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin, Germany — [2]Vanderbilt University, Nashville, Tennessee, USA
We introduce sum-frequency spectro-microscopy as a tool to image phonon polaritons with combined sub-wavelength spatial resolution and full spectral resonance information. We employ this technique to image the hybridization of localized and propagating surface polaritons in millimeter-sized metasurfaces of SiC micropillars, demonstrating strong coupling and the formation of edge states.

Invited FRI4s.4 Friday, 17:45 Tirol
Attosecond electron microscopy by free-electron homodyne detection — •John H. Gaida[1,2], Hugo Lourenço-Martins[1,2], Murat Sivis[1,2], Thomas Rittmann[1,2], Armin Feist[1,2], Javier F. García de Abajo[3,4], and Claus Ropers[1,2] — [1]Department of Ultrafast Dynamics, Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany — [2]4th Physical Institute, University of Göttingen, Göttingen, Germany — [3]ICFO-Institut de Ciencies Fotoniques, Castelldefels (Barcelona), Spain — [4]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain
We implement attosecond electron microscopy in a transmission electron microscope to measure the optical near-field of a plasmonic nanoprism with 23 as (rms) temporal resolution and a few-nm spatial resolution. This demonstrates the concept of free-electron homodyne detection, where the quantum state of the electron wavefunction is reconstructed by a phase-controlled second interaction.

18:15–18:30: Coffee break

FRI5o: Time crystals / Plasmonic twistronics

Chair: Shai Tsesses, MIT, Massachuetts Institute of Technology, Cambridge, USA

Time: Friday, 18:30–19:30 Location: Olympia

Invited FRI5o.1 Friday, 18:30 Olympia
Photonic Time Crystals and Parametric Amplification: similarity and distinction — •Jacob Khurgin — Johns Hopkins University, Baltimore, USA
I investigate Photonic Time crystals (PTCs) and compare it with the second and third order parametric processes. The main difference is found in boundary conditions – otherwise the processes are quite similar.

Invited FRI5o.2 Friday, 19:00 Olympia
Plasmonic Twistronics: Discovery of Plasmonic Skyrmion Bags — •Julian Schwab[1], Alexander Neuhaus[2], Pascal Dreher[2], Shai Tsesses[3], Anant Mantha[1], Florian Mangold[1], Bettina Frank[1], Guy Bartal[3], Frank-J. Meyer zu Heringdorf[2], Timothy J. Davis[1,2,4], and Harald Giessen[1] — [1]4th Physics Institute, Research Center SCoPE, and Integrated Quantum Science and Technology Center, Stuttgart, Germany — [2]Faculty of Physics and Center for Nanointegration, Duisburg, Germany — [3]Andrew and Erna Viterbi Department of Electrical Engineering, Haifa, Israel — [4]School of Physics, Melbourne, Australia
Plasmonic skyrmion lattices are created by the interference of surface plasmon polariton waves. Superimposing two plasmonic skyrmion lattices with a relative twist creates a moiré skyrmion superlattice. Their vector fields are calculated numerically and measured using time-resolved PEEM vector microscopy, demonstrating that the topology contains skyrmion bags of controllable size for certain magic angles.

FRI5s: Metasurfaces II

Chair: Romain Quidant, ETH Zürich, Zürich, Switzerland

Time: Friday, 18:30–19:30 Location: Tirol

Invited FRI5s.1 Friday, 18:30 Tirol
Symmetry-controlled dielectric membrane metamaterials for circularly-polarized harmonic generation — Kuniaki Konishi[1] and •Makoto Kuwata-Gonokami[1,2] — [1]The University of Tokyo, Tokyo, Japan — [2]RIKEN, Saitama, Japan
The discrete rotational symmetry of the structure plays an important role in polarization selectivity in nonlinear optical processes. We applied this principle to dielectric metamaterials and demonstrated that photonic crystal nanomembranes with four-fold symmetry generate the circularly polarized third harmonic in the vacuum ultraviolet region.

Invited FRI5s.2 Friday, 19:00 Tirol
Nature-inspired, colorimetric metasurfaces for next-generation imaging of tissue microstructure — •Lisa Poulikakos — University of California, San Diego, La Jolla, USA
Iridescent structural color is abundant in nature, arising in butterfly wings or beetle shells. Here, we develop nature-inspired, colorimetric metasurfaces to selectively visualize disease-relevant fiber density and orientation in biological tissue. We then investigate versatile fiber-affecting diseases where metasurfaces hold great potential to achieve rapid, precise and low-cost tissue diagnostics.

SAT1o: Plenary talk 5

Chair: Lei Zhou, Fudan University, Shanghai, China

Time: Saturday, 9:00–10:00 Location: Olympia

Plenary SAT1o.1 Saturday, 9:00 Olympia
Sculpting light with metastructures — •Nader Engheta — University of Pennsylvania, Philadelphia, USA
I will present an overview of our ongoing work on structuring light with metastructures, with particular emphasis on wave-based analog computing and 4D optics. I will show how inverse-designed metasurfaces can be used as computing and processing machines, and how spatiotemporal variation of material parameters opens up new possibilities in light-matter interaction.

10:00–10:15: Coffee break

SAT2o: Nanophotonics II

Chair: Nahib Talebi Sarvari, Christian Albrechts University in Kiel, Germany

Time: Saturday, 10:15–12:15 Location: Olympia

Invited SAT2o.1 Saturday, 10:15 Olympia

Coupling single electrons and photons using high-Q photonics — •Armin Feist[1,2], Guanhao Huang[3,4], Germaine Arend[1,2], Yujia Yang[3,4], Jan-Wilke Henke[1,2], Arslan Sajid Raja[3,4], F. Jasmin Kappert[1,2], Rui Ning Wang[3,4], Hugo Lourenço-Martins[1,2], Zheru Qiu[3,4], Junqiu Liu[3,4], Ofer Kfir[1,2], Tobias J. Kippenberg[3,4], and Claus Ropers[1,2] — [1]Max Planck Institute of Multidisciplinary Sciences, Göttingen, Germany — [2]IV. Physical Institute, University of Göttingen, Göttingen, Germany — [3]Institute of Physics, EPFL, Lausanne, Switzerland — [4]Center for Quantum Science and Engineering, EPFL, Lausanne, Switzerland

We couple free electrons to optical cavity modes of a chip-based high-Q silicon nitride microresonator and observe single-particle correlations. Mode-specific cathodoluminescence is spatially mapped, and coincidence-gated electron imaging enables a two-orders of magnitude contrast enhancement. Event-based detection of electrons and their specific energy loss facilitates heralding multiphoton states.

Invited SAT2o.2 Saturday, 10:45 Olympia

Atomically-Engineered Optical Gain for Nanophotonics — Andreas Liapis, Peng Liu, and •Zhipei Sun — QTF Centre of Excellence, Department of Electronics and Nanoengineering, Aalto University, Espoo, Finland

Here, we demonstrate wafer-scale growth of highly-doped Er^{3+}:Al_2O_3 and Yb^{3+}:Al_2O_3 gain media by plasma-enhanced atomic layer deposition method. Such materials are key enabling building blocks for various nanophotonic applications (e.g., integrated lasers and amplifiers operating at telecom wavelengths).

Oral SAT2o.3 Saturday, 11:15 Olympia

Halting light dissipation by Zeno effect — •Anton N. Vetlugin[1], Ruixiang Guo[1], Cesare Soci[1], and Nikolay I. Zheludev[1,2] — [1]Nanyang Technological University, Singapore, Singapore — [2]University of Southampton, Southampton, United Kingdom

We experimentally demonstrate how to prevent a single photon from being dissipated in intricate optical networks containing multiple absorbers.

Oral SAT2o.4 Saturday, 11:30 Olympia

Active Tuning of Electroluminescence from Spin-Polarized Exciton Polaritons in Perovskite Metasurfaces — Yutao Wang[1,2,3], Giorgio Adamo[1,3], Ha Son Tung[4], Jingyi Tian[1,3], and •Cesare Soci[1,3] — [1]Centre for Disruptive Photonic Technologies, TPI, Nanyang Technological University, Singapore, Singapore — [2]Interdisciplinary Graduate School, Energy Research Institute @NTU (ERI@N), Singapore, Singapore — [3]Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, NTU,, Singapore, Singapore — [4]IMRE, Agency for Science Technology and Research (A*STAR), Singapore, Singapore

We report electroluminescence from spin-polarized exciton polaritons in halide perovskite light-emitting metatransistors with broken C2 symmetry. Electrical control of charge injection allows selective population of spin states and control of directionality and helicity of the circularly polarized light emission.

Invited SAT2o.5 Saturday, 11:45 Olympia

Meta-couplers for linking propagating waves and surface waves — •Lei Zhou — Physics Department, Fudan University , Shanghai, China

We describe our 10 years' journey to design and experimentally realize metasurface-based couplers that can efficiently convert propagating light to surface waves, and in turn, into on-chip photonic devices with subwavelength openings.

SAT2s: Metasurfaces III

Chair: Mario Hentschel, University of Stuttgart, Germany

Time: Saturday, 10:15–12:00 Location: Tirol

Invited SAT2s.1 Saturday, 10:15 Tirol

Imaging with meta lenses- capabilities and limitations — •Uriel Levy — Hebrew University of Jerusalem, Jerusalem, Israel

Metalenses are becoming a prime topic for research and are being implemented in variety of optical devices and systems. In this talk we discuss design rules, limitations, and approaches to circumvent these limitations

Oral SAT2s.2 Saturday, 10:45 Tirol

Spontaneous parametric downconversion in ultra-thin 3R-stacked transition-metal dichalcogenides — •Benjamin Braun[1], Josip Bajo[1,2], Chiara Trovatello[3,4], Philipp K. Jenke[1,2], Giulio Cerullo[4], P. James Schuck[3], Philip Walther[1,5,6], and Lee A. Rozema[1] — [1]Vienna Center for Quantum Science and Technology (VCQ), University of Vienna, Vienna, Austria — [2]Vienna Doctoral School in Physics, University of Vienna, Vienna, Austria — [3]Department of Mechanical Engineering, Columbia University, New York, USA — [4]Dipartimento di Fisica, Politecnico di Milano, Milan, Italy — [5]Research Platform for Testing the Quantum and Gravity Interface (TURIS), University of Vienna, Vienna, Austria — [6]Christian Doppler Laboratory for Photonic Quantum Computer, University of Vienna, Vienna, Austria

Nonlinear optics with ultra-thin media is a promising means to combine nonlinear optics with integrated photonics. However, using thin media limits the applicability to quantum processes, such as SPDC. We overcome this using the high second-order susceptibility of the transition metal dichalcogenides, presenting our characterization of non-phase matched SPDC.

Oral SAT2s.3 Saturday, 11:00 Tirol

Ultrafast nanoimaging of hyperbolic phonon polaritons in van der Waals crystals and conventional bulk crystals — •Peining Li — Huazhong University of Science and Technology, Wuhan, China

We use time-resolved s-SNOM to visualize in both time and space hyperbolic phonon polaritons n van der Waals crystals and anisotropic bulk crystals.

Oral SAT2s.4 Saturday, 11:15 Tirol

Direct electron beam patterning of electro-optically active PEDOT:PSS for active metasurfaces — •Dominik Ludescher[1], Siddharth Doshi[2,3], Julian Karst[1], Moritz Floess[1], Johan Carlström[3], Bohan Li[3], Nofar Mintz Hemed[2], Yi-Shiou Duh[3], Nicholas A. Melosh[2], Mario Hentschel[1], Mark Brongersma[3], and Harald Giessen[1] — [1]4th Physics Institute and Research Center SCoPE, Stuttgart, Germany — [2]Department of Materials Science and Engineering, Stanford, USA — [3]Geballe Laboratory for Advanced Materials, Stanford, USA

Integrating conducting polymers with nanophotonic methods presents promising developments for sophisticated optoelectronic devices. However, conventional fabrication techniques encounter significant limitations. This research introduces an alternative and novel fabrication process based on the direct patterning of PEDOT:PSS via electron beam lithography utilized for the generation of a dynamic optical metasurface.

Oral SAT2s.5 Saturday, 11:30 Tirol

Picometer topological optical metrology at a million measurements per second — •Cheng-Hung Chi[1], Thomas Grant[1], Eric Plum[1], Kevin MacDonald[1], and Nikolay Zheludev[1,2] — [1]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, Singapore , Singapore

Using a nanowire as example, we experimentally demonstrate all-optical metrology with resolution up to 80 pm and sampling rate up to 1M fps. Here, topologically structured light scattering is used to visualize nanoobject's trajectory with an algorithm discriminating instrumental instabilities and movements of the object relative to its immediate environment.

Oral SAT2s.6 Saturday, 11:45 Tirol

Observation of the orbit–orbit interaction of light in plasmonics — Raghvendra P. Chaudhary, Avraham Reiner, and •Nir Shitrit — School of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva 8410501, Israel

We report the orbit–orbit interaction of light in a plasmonic ellipse cavity, whose unique geometry facilitates vortex–trajectory interplay when a vortex is considered in one of the ellipse foci. This interaction, manifested by vortex-dependent shifts, opens a new paradigm for light manipulation by leveraging the manifold vortex states.

SAT3o: Prize ceremony and closing remarks by Nikolay Zheludev & Harald Giessen

Time: Saturday, 12:15–13:30 Location: Olympia

Prize ceremony

Closing Remarks

13:30–14:30: Beer reception