NANOMETA 2022

8th International Topical Meeting on Nanophotonics and Metamaterials

www.nanometa.org

CONFERENCE DIGEST

Venue: Olympia Congress Centre,
Seefeld, Tirol, Austria

28 - 31 March 2022

Europhysics Conference Abstract Volume 45 A
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Digest and Copyright Information

The papers included in this digest comprise the short summaries of the 8th International Topical Meeting on Nanophotonics and Metamaterial Conference held in Seefeld in Tirol, Austria from 28 to 31 March 2022. The extended version of the papers (1-page summaries in pdf format) will be made available online during a time period of 2 months beginning from the conference. A link with login and password is provided on a separate sheet.

All web browsers (Firefox, Internet Explorer, Safari or similar) will allow you to download the digest.
A .pdf viewer (tested with Adobe Acrobat) will be necessary to view the papers. This software can be downloaded from http://www.adobe.com

The papers reflect the authors' opinion and are published as presented and without any change in the interest of timely dissemination. Their inclusion in these publications does not necessarily constitute endorsement by the editors, the European Physical Society.

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General Information

The 8th International Topical Meeting on Nanophotonics and Metamaterials
28 – 31 March 2022, Seefeld in Tirol, Austria

NANOMETA 2022 aims to bring together the international Nanotechnology, Photonics and Materials research communities where most recent and challenging results and plans are discussed in the informal setting on a glorious mountaineering resort. The technical programme includes invited and selected contributed papers in the areas of

- **Low dimensional photonic materials and phenomena**
- **Plasmonics and metamaterials, quantum nanophotonics**
- **Topological light and matter**
- **Artificial intelligence and nanophotonics**
- **Advanced nanophotonic applications.**

The conference will be organised in two oral parallel sessions (Nanophotonics and Metamaterials) and will feature joint plenary sessions. The conference timetable will be arranged in a way that permits mid-day breaks for recreational activities and informal contact between participants.

The programme will feature 133 presentations over 4 days including 5 plenary, 4 breakthrough, 18 invited, 59 oral presentations, 3 technology talks and 44 posters from 21 different countries.

Poster Session
Nanometa 2022 will present a total of 44 posters during a poster session to take place on Tuesday 29 March 2022 from 17:00 to 18:30. There will be no oral presentations during this time. Light snacks and soft drinks will be provided during the session.

Poster Prizes
A poster competition sponsored by Gruyter (https://www.degruyter.com/) will be organised to award the best posters presented by research students. The prizes will be awarded on the Closing Ceremony, which will take place on Thursday 31 March 2022, from 12:15 (Olympia room).

Instructions for Poster Presenters
Each author is provided with one bulletin board measuring 125 cm high and 120 cm wide on which to display a summary of the paper. Fixing material (tape) will be provided. The boards will be marked with the poster session code. Authors are requested to display their poster on their allocated board in the early afternoon of the day of presentation. In order to present their work and answer questions, authors are requested to be present in the vicinity of their poster on the day of their presentation during 17:00-18:30.

Speakers' Information
Speakers are asked to check-in with the session chair in the conference room ten minutes before the session begins. The conference rooms are equipped with microphone, beamer, and computer. Presenters may transfer their presentation files by USB memory stick. It will also be possible to give the presentations from own notebooks. A screen switch to connect several notebooks simultaneously to the data projector will be arranged. Individual notebooks will need to be connected to the box during the breaks.

Apart from a few exceptions, presentation times for oral presentations are as follows:
Plenary talks: 1-hour presentation including 10-15 minutes for discussion.
Breakthrough and Invited talks: 30 minutes presentation including 10 minutes for discussion.
Oral talks: 15 minutes presentation including 3 minutes for discussion.
Technology talks: 45 minutes presentation including 15 minutes for discussion.

Reception
A **beer reception** will be organised on Thursday 31 March 2022, 12:30 - 13:30.

Conference Language
The official language of the conference is English.

Conference Digest
The registration fee includes one printed programme and the one-page summaries available on-line.

On-site Facilities

Wireless high-speed Internet is available for both rooms (Olympia and Seefeld-Tirol) and the lounges.
The conference centre has an underground garage. Participants may benefit from a cost of 2.00 € for 6 hours. To validate this special fee, the parking must be directly paid at the swimming pool cash desk. Only here the special rate can be made.
The nearest bank machine is about 500 m away from the centre.

Registration Information

The registration fees for the meeting include admission to all technical sessions of the conference on "Nanophotonics and Metamaterials". It includes coffee breaks as mentioned on the programme. Lunches are not included.

Conference Help Desk - Opening Hours

Sunday 27 March 2022	17:00-18:00
Monday 28 March 2022	08:00-12:00 and 16:00-18:00
Tuesday 29 March 2022	08:30-11:30 and 16:00-18:00
Wednesday 30 March 2022	08:30-11:30 and 16:00-18:00
Thursday 31 March 2022	08:30-11:00

Conference Hours

Monday 28 March 2022	08:45-12:15 and 16:15-19:45
Tuesday 29 March 2022	09:00-12:15 and 16:15-19:30
Wednesday 30 March 2022	09:00-12:15 and 16:15-20:00
Thursday 31 March 2022	09:00-12:30

Photography

Attendance at, or participation in the workshop constitutes consent to the use and distribution by the European Physical Society of the attendees' image for informational, publicity, promotional and/or reporting purposes in print or electronic communications media.
Video recording by participants and other attendees during the conference is not allowed.
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Conference Management

The European Physical Society, 6 rue des Frères Lumière, 68200 Mulhouse, France, provides the conference management. This programme is edited by P. Helfenstein and A. Wobst.

Conference Location

NANOMETA 2022 will take place at the "Olympia" Congress Centre in the heart of Seefeld:
Olympia Sport and Kongresszentrum Seefeld – Tirol GmbH
Klosterstrasse 600
6100 Seefeld in Tirol
Austria
Phone: +43 (0) 5212 32 20
https://www.seefeld-sports.at/olympiabad-kongress/kongresszentrum-seefeld
https://www.seefeld-sports.at/

The Olympia room is on the first level and the Seefeld/Tirol room is on the basement level.
The registration area is on the same level as the Olympia room.

Austria

Austria is a central European predominately mountainous country. Eight other countries line the Austrian border: Italy, Switzerland, the Principality of Liechtenstein, Germany, the Czech Republic, Slovakia, Hungary, and Slovenia. Lying on the Danube River, the Austrian capital of Vienna is partly surrounded by the hills of the Vienna Woods.

Austria's population, which has just surpassed eight million, is 93% German speaking, and 20% of the global population resides in Vienna. Still, the country has a diverse ethnic mix that includes six officially recognised ethnic groups: Croats, Czechs, Hungarians, Roma/Sinti, Slovaks and Slovenes. While about 73% of the Austrian population is Roman Catholic, there are eleven other officially recognised religions.

Currency

Euro is the official currency in Austria.
Major credit cards (VISA, MasterCard/Euro card, American Express, Diners…) are generally accepted in airports, train stations, hotels, larger shop, etc.

Weather in Seefeld

Framed by the Mountain Range of the Karwendel National Park, Seefeld is situated on a sunny high-altitude plateau 1.200 m above sea level and is 150 km from Munich and Innsbruck is 21 km away. The average minimum temperature in Seefeld in March is 1.0°C. The average maximum daytime temperature lies around 11.8°C. As in the mountains the weather may rapidly vary. The Seefeld weather forecast can be viewed at http://www.seefeld.com/en

Seefeld

Seefeld with its around 3000 inhabitants is a major ski resort in the heart of the Tyrol Mountains, Austria, at the centre of untouched nature. It is a multi-faceted resort that is a magnet for guests from all over the world and combines nature, sport, wellness and a holiday atmosphere. The village is a true paradise for nature-lovers as well as alpine ski enthusiasts.

In Seefeld you can find excellent downhill and cross-country skiing, ice rink, indoor swimming pool, fantastic restaurants and a good choice of quality hotels. The magnificent mountain scenery of the Karwendel Alpine Park and the Wetterstein range surrounds all of Seefeld. There you will find a wide range of sports, relaxation and health facilities for everyone.

You can rent or buy your equipment! 25 uphill facilities between 1,200 m and 2,100 m and ski runs for all levels and ambitions are awaiting you. Besides Alpine skiing you should also try cross-country skiing on 283,5 km of well-groomed tracks, ideal for skaters and classic cross country skiing fans. Or choose from the wide range of winter hiking trails (approx. 80 km), Alpine curling (on more than 30 ice curling alleys) or a romantic ride in a horse-drawn sleigh across glittering winter landscapes. Seefeld holds numerous ski jumping hills, of which the biggest is Toni Seelos Olympiaschanze.

Here in the Olympia Region on the Seefeld plateau, walkers, mountaineers and climbers have their work cut out choosing their next adventure from the tightly woven network of 450 kilometres of hiking trails and mountain paths. Destinations in the region include the breath-taking countryside of the Wetterstein range and the Zugspitze, the Karwendel nature park with the well-known Ahornboden area, the Mieminger chain of peaks with the mighty Hohe Munde and the nature preserve of the Wildmoos. Around 143 kilometres of cleared and prepared winter walking trails are available in the region - a map with descriptions of all walks and cross-country trails is available in all information offices.

The Bergbahnen Rosshütte lifts will whisk you to over 2000 meters altitude in just a few minutes. In winter, enjoy 19 kilometres of beautifully prepared ski runs.

Indoor and outdoor pools, sauna, massage, tanning beds - all that and more is on offer at **Olympia Sport- and Kongresszentrum**. Nanometa participants will get a 10% discount from 28.03 to 31.03.22 on the 4-hour ticket for the leisure pool and sauna world upon showing their badges. The centre also includes a cinema and, in winter, an ice-skating rink. A few hotels offer free entrance passes to the indoor swimming pool.

Don't miss the highpoint of the Seefeld nightlife - the highest casino in Austria. The casino, at the start of the pedestrian area (open every day from 2:00 pm), is known as the most welcoming in the world, helped by its elegant atmosphere and the range of games of chance on offer.

Olympiaregion Seefeld guest card
Guests staying in the Olympiaregion Seefeld usually benefit from local advantages and price reductions. You will receive your Olympiaregion Seefeld guest card directly from your accommodation provider immediately upon your arrival. Upon presentation of your card and/or after having extras electronically added to your card, you can take advantage of a wide spectrum of discounts and special offers. The guest card is also valid as a bus ticket for the regional public transport during your stay. See https://www.seefeld.com/en/guestcard and https://www.seefeld.com/en/experience-shop#/experiences

Further tourist information may be obtained at the Information office:
Informationsbüro Seefeld, Bahnhofplatz 115, AT-6100 Seefeld
Phone: +43 50 880, email: info@seefeld.com, website: https://www.seefeld.com/en/

The office also offers a direct online search for accommodation.

Conference Committee:

Conference Chairs:

Nikolay Zheludev, *University of Southampton, Southampton, UK and NTU Singapore, Singapore*

Nikolay Zheludev, FRS is deputy director of the Optoelectronics Research Centre at Southampton and co-Director of the Photonics institute at NTU, Singapore. His research interests are in nanophotonics and metamaterials. His accolades include the Thomas Young Medal for “global leadership and pioneering, seminal work in optical metamaterials and nanophotonics”. He was awarded MSc, PhD and DSc from Moscow State University. Professor Zheludev is the Editor-in-Chief of the IOP "Journal of Optics".

Harald Giessen, *University of Stuttgart, Stuttgart, Germany*

Harald Giessen, graduated from Kaiserslautern University with a diploma in physics and obtained his M.S. and Ph.D. in optical sciences from the University of Arizona in 1995. After a postdoc at the Max-Planck-Institute for Solid State Research in Stuttgart he moved to Marburg as Assistant Professor. From 2001-2004, he was associate professor at the University of Bonn. Since 2005, he holds the Chair for Ultrafast Nano-Optics in the department of physics at the University of Stuttgart. He is a fellow of the Optical Society of America and received an ERC Advanced Grant in 2012 in the area of complex plasmonics. He was co-chair (2014) and chair (2016) of the Gordon Conference on Plasmonics and Nanophotonics. He is on the advisory board of the journals "Advanced Optical Materials", "Nanophotonics: The Journal", "ACS Photonics", "ACS Sensors" and "Advanced Photonics". He is a topical editor for ultrafast nanooptics, plasmonics, and ultrafast lasers and pulse generation of the journal "Light: Science & Applications" of Nature Publishing Group.

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Programme at a Glance

Monday 28 March 2022

	Olympia Room
08:45-10:00	Oral session MON1o **Opening Remarks and Plenary Talk 1**
10:00-10:15	Coffee Break (Olympia lobby)
10:15-12:15	Oral session MON2o **Active and Switchable Metamaterials**
12:15-16:15	Lunch Break
16:15-17:00	Oral session MON3o **Technology Talk 1 - Heidelberg Instruments Nano AG**
17:00-19:00	Oral session MON4o **Switchable and Dielectric Metamaterials**
19:00-19:15	Coffee Break (Olympia lobby)
19:15-19:45	Oral session MON5o: **Breakthrough Talk 1**

	Seefeld/Tirol Room
10:15-12:00	Oral session MON2s **Electron - Photon Interaction**
12:00-16:15	Lunch Break
17:00-19:00	Oral session MON4s **2D Matter**
19:00-19:15	Coffee Break (Olympia lobby)
19:15-19:45	Oral session MON5s: **Breakthrough Talk 2**

Tuesday 29 March 2022

	Olympia Room
09:00-10:00	Oral session TUEo1 **Plenary Talk 2**
10:00-10:15	Coffee Break (Olympia lobby)
10:15-12:15	Oral session TUE2o **Quantum Nanophotonics**
12:15-16:15	Lunch Break
16:15-17:00	Oral session TUE3o **Technology Talk 2 - Nanoscribe**

	FOYER Olympia
17:00-18:30	**Poster Session TUE4f** With snacks and drinks

	Olympia Room
18:30-19:30	Oral session TUE5o **Plenary Talk 3**

	Seefeld/Tirol Room
10:15-12:15	Oral session TUE2s **Applications**
12:15-16:15	Lunch Break

Wednesday 30 March 2022

	Olympia Room
09:00-10:00	Oral session WED1o **Plenary Talk 4**
10:00-10:15	Coffee Break (Olympia lobby)
10:15-12:15	Oral session WED2o **Nonlinear / Ultrafast Nanophotonics I**
12:15-16:15	Lunch Break
16:15-17:00	Oral session WED3o **Technology Talk 3 - Attocube (Neaspec)**
17:00-18:15	Oral session WED4o **Novel Topics I**
18:15-18:30	Coffee Break (Olympia lobby)
18:30-20:00	Oral session WED5o **Picophotonics**

	Seefeld/Tirol Room
10:15-12:15	Oral session WED2s **Topological Nanophotonics**
12:15-16:15	Lunch Break
17:00-18:15	Oral session WED4s **Nonlinear / Ultrafast Nanophotonics II**
18:15-18:30	Coffee Break (Olympia lobby)
18:30-19:30	Oral session WED5s **Electron – Photon Interaction II**
19:30-20:00	Oral session WED6s **Novel Topics II**

Thursday 31 March 2022

	Olympia Room
09:00-10:00	Oral session THU1o **Plenary Talk 5**
10:00-10:15	Coffee Break (Olympia lobby)
10:15-12:15	Oral session THU2o **Mixed Topics I**
12:15-12:30	**Closing Remarks by Nikolay Zheludev and Harald Giessen**
12:30-13:30	Beer reception (Olympia lobby)

	Seefeld/Tirol Room
10:15-12:15	Oral session THU2s **Mixed Topics II**

Plenary Talks at a Glance

Monday 28 March 2022

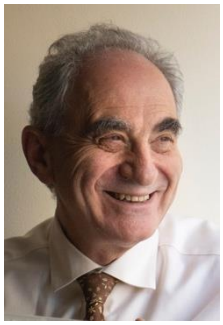
MON1o: Opening Remarks and Plenary Talk 1, 9:00 - 10:00, Olympia room

Markus Aspelmeyer, *University of Vienna, Austria*

Gravitational Quantum Physics, or: How to avoid the appearance of the classical world in gravity experiments?
No experiment today provides evidence that gravity requires a quantum description. The growing ability to achieve quantum optical control over massive solid-state objects may enable experiments that directly probe the phenomenology of quantum states of gravitational source masses. I will review the current status and challenges in the lab.

Tuesday 29 March 2022

TUEo1: Plenary Talk 2, 9:00 - 10:00, Olympia room



Eli Yablonovitch, *University of California, Berkeley, USA*

Onsager Computing– Optimization by the Principle of Minimum Heat Generation
Physics itself, performs optimizations in the normal course of dynamical evolution. Nature provides us with the Principle of Least Action, among many other optimization principles. Recently, there has been great success with Onsager Computing using the Principle of Minimum Entropy Generation.

TUE5o: Plenary Talk 3, 18:30 - 19:30, Olympia room

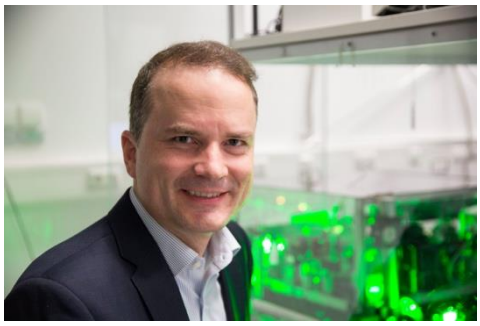
Marin Soljacic, *MIT, Cambridge, USA*

Nanophotonic tailoring of electron-light interactions

We present our recent work on understanding nano-scale phenomena in photonics. We also present our work on interaction on fast electrons with nano-structured materials to produce light. Finally, we discuss novel ways to tailor and enhance scintillation phenomena.

Wednesday 30 March 2022

WED1o: Plenary Talk 4, 9:00 - 10:00, Olympia room



Rupert Huber, *Department of Physics and Regensburg Center for Ultrafast Nanoscopy, University of Regensburg, Regensburg, Germany*

Quantum choreography with lightwaves
Intense infrared field transients can drive electrons in van der Waals materials along fascinating quantum trajectories, facilitating novel strong-field physics from optical band structure reconstruction to topological high harmonic generation. In a scanning-tunneling microscope, lightwaves enable ultrafast orbital videography and coherent control of a single-molecule switch by femtosecond atomic forces.

Thursday 31 March 2022

THU1o: Plenary Talk 5, 9:00- 10:00, Olympia room, Olympia room

Ido Kaminer, *Technion, Haifa, Israel*

Quantum Optics with Free Electrons
We study free-electron quantum optics at the nanoscale, observing the first coherent interaction of free electrons with photonic cavities and first interaction with the quantum statistics of photons. Looking forward, we envision using free electrons as carriers of quantum information and for measurement of quantum coherence of individual quantum systems

Breakthrough Talks at a Glance

Monday 28 March 2022

MON5o: Breakthrough Talk 1, 19:15 - 19:45, Olympia room
Photonic Time-Crystals
Mordechai (Moti) Segev, *Technion - Israel Institute of Technology, Haifa, Israel*

MON5s: Breakthrough Talk 2, 19:15 - 19:45, Seefeld/Tirol room
How light forms atomic-scale picocavities
Jeremy Baumberg[1], Qianqi Lin[1] 1, Shu Hu[1], Tamas Földes[2], Junyang Huang[1], Demelza Wright[1], Jack Griffiths[1], Bart de Nijs[1], Edina Rosta[2]; *[1]NanoPhotonics Centre, Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom; [2]Department of Physics and Astronomy, University College London, London, United Kingdom*

Thursday 31 March 2022

THU2o: Mixed Topics I, 11:45 - 12:15, Olympia room
Optical metrology with sub-atomic resolution
Kevin F. MacDonald[1], Tongjun Liu[1], Jun-Yu Ou[1], Nikolay I. Zheludev[1,2]; [1]*University of Southampton, United Kingdom,* [2]*Nanyang Technological University, Singapore, Singapore*

THU2s: Mixed Topics II, 11:45 - 12:15, Seefeld/Tirol room
Active van der Waals optical metasurfaces
Harry Atwater, *California Institute of Technology (Caltech), Pasadena, CA, USA*

Invited Talks at a Glance

Monday 28 March 2022

MON2o: Active and Switchable Metamaterials,10:15 -12:15, Olympia room

10:15 -10:45, MON2o.1
Flat Optics for Dynamic Wavefront Manipulation and Mixed Reality Eyewear
Mark Brongersma, *Stanford University, Stanford, USA*

MON2s: Electron - Photon Interaction, 10:15 -12:15, Seefeld/Tirol room

10:15 - 10:45, MON2s.1
Quantum and classical effects in the interaction of electron beams with optical excitations
F. Javier García de Abajo, *ICFO – Institut de Ciencies Fotoniques, Barcelona, Spain*

MON4o: Switchable and Dielectric Metamaterials, 17:00 – 19:00, Olympia room

17:00 - 17:30, MON4o.1
Electrically Switchable Metallic Polymer Nanoantennas and Metasurfaces
Julian Karst[1], Moritz Floess[1], Monika Ubl[1], Carsten Dingler[2], Claudia Malacrida[2], Tobias Steinle[1], Sabine Ludwigs[2], Mario Hentschel[1], Harald Giessen[1]; *[1]4th Physics Institute and Research Center SCoPE, University of Stuttgart, Germany*; *[2]IPOC-Functional Polymers, Institute of Polymer Chemistry and Center for Integrated Quantum Science and Technology (IQST), University of Stuttgart, Germany*

18:15 - 18:45, MON4o.5
(3+1)D printing for graded index photonic integration
Adria Grabulosa, Johnny Moughames, Xavier Porte, Muamer Kadic, **Daniel Brunner**, *Institut FEMTO-ST, Université Bourgogne Franche-Comté, CNRSUMR6174, Besançon, France*

MON4s: 2D Matter, 17:00 – 19:00

17:00 - 17:30, MON4s.1
Near-field Probing of Vibrational Strong Coupling
Rainer Hillenbrand, *CIC nanoGUNE BRTA, San Sebastian, Spain*

18:30 - 19:00, MON4s.6
Metasurfaces for energy conversion and holography
Stefan Maier, *LMU Munich, München, Germany*

Tuesday 29 March 2022

TUE2o: Quantum Nanophotonics, 10:15 - 12:15, Olympia room

10:15 - 10:45, TUE2o.1
Quantum optics in complex media
Inigo Liberal, *Public University of Navarre, Pamplona, Spain*

TUE2s: Applications, 10:15 - 12:15, Seefeld/Tirol room

10:15 - 10:45, TUE2s.1
MEMS-based optical metasurfaces for dynamic radiation control
Sergey Bozhevolnyi, *SDU Nano Optics, University of Southern Denmark, Odense M, Denmark*

Wednesday 30 March 2022

WED2o: Nonlinear / Ultrafast Nanophotonics I, 10:15 - 12:15, Olympia room

10:15 - 10:45, WED2o.1
Real-time imaging of surface waves with nonlinear near-field optical microscopy
Guy Bartal, *The Andrew and Erna Viterbi faculty of electrical and computer engineering, Technion, Haifa, Israel*

WED2s: Topological Nanophotonics, 10:15 – 12:15, Seefeld/Tirol room

10:15 - 10:45, WED2s.1
Skyrmionic Hopfions: particle-like topologies in light
Mark Dennis[1], Danica Sugic[1, 2], Ramon Droop[3], Eileen Otte[3], Daniel Ehrmanntraut[3], Franco Nori[2, 4], Janne Ruostekoski[5], Cornelia Denz[3]; [1]*School of Physics and Astronomy, University of Birmingham, United Kingdom,* [2]*Theoretical Quantum Physics Laboratory, RIKEN Cluster for Pioneering Research, Saitama, Japan;* [3]*Institute of Applied Physics and Center for Nonlinear Science (CeNoS), University of Muenster, Muenster, Germany;* [4]*Physics Department, University of Michigan, Ann Arbor, USA;* [5]*Physics Department, Lancaster University, Lancaster, United Kingdom*

11:30 - 12:00, WED2s.5
Topological insulator vertical-cavity laser array
Alex Dikopoltsev[1], Tristan H. Harder[2], Eran Lustig[1], Oleg A. Egorov[3], Johannes Beierlein[2], Adriana Wolf[2], Yaakov Lumer[1], Monika Emmerling[2], Christian Schneider[4], Sven Höfling[2], Moti Segev[1], **Sebastian Klembt**[2]; [1]*Physics Department, Technion, Haifa, Israel;* [2]*Chair for Applied Physics, Wilhelm-Conrad-Röntgen-Research Center for ComplexMaterial Systems, and Würzburg-Dresden Cluster of Excellence ct.qmat, Würzburg, Germany;* [3]*ITFO, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany;* [4]*Institute of Physics, University of Oldenburg, Oldenburg, Germany*

WED5o: Picophotonics, 18:30 - 19:00, Olympia room

18:30 - 19:00, WED5o.1
Light emission in extreme nanocavities: from intramolecular resolution to complex single photon emission
Javier Aizpurua, *Center for Materials Physics (CSIC-UPV/EHU), San Sebastian, Spain*

19:30 - 20:00, WED5o.4
Harnessing polaritons in extreme nanocavities
Sang-Hyun Oh, *University of Minnesota, Minneapolis, USA*

WED5s: Electron – Photon Interaction II, 18:30 - 19:30, Seefeld/Tirol room

18:30 - 19:00, WED5s.1
Holography, nanothermometry, and quantum correlations in extreme near fields probed with high-energy electrons
Albert Polman, *NWO-Institute AMOLF, Amsterdam, The Netherlands*

Thursday 31 March 2022

THU2o: Mixed Topics I, 10:15 - 12:15, Olympia room

10:15 - 10:45, THU2o.1
Nanophotonic chiral sensing: How does it actually work?
Steffen Both[1], Egor A. Muljarov[2], Harald Giessen[1], **Thomas Weiss**[1, 3]; [1]*4th Physics Institute, University of Stuttgart and Research Center SCoPE, Stuttgart, Germany;* [2]*Cardiff University, School of Physics and Astronomy, Cardiff, United Kingdom*; [3]*Institute of Physics, University of Graz, and NAWI Graz, Graz, Austria*

10:45 - 11:15, THU2o.2
Quantum Photonics Empowered by Plasmonics and Machine Learning
Alexandra Boltasseva, Vladimir Shalaev, *Purdue University, West Lafayette, USA*

THU2s: Mixed Topics II, 10:15 - 12:15, Seefeld/Tirol room

10:15 - 10:45, THU2s.1
Novel approaches for chip scale light vapor interactions
Roy Zektzer, Alex Naiman, Noa Mazurski, Eliran Talker, Liron Stern, **Uriel Levy**, *HUJI, Jerusalem, Israel*

11:15 - 11:45, THU2s.4
Simulating quantum nanophotonics on the IBM quantum computer
Anton N. Vetlugin[1], Cesare Soci[1], Nikolay I. Zheludev[1, 2]; [1]*Nanyang Technological University, Singapore, Singapore;* [2]*University of Southampton, Southampton, United Kingdom*

Technology Talks at a Glance

Monday 28 March 2022
16:15 - 17:00, MON3o.1, Technology Talk 1 - Heidelberg Instruments Nano AG, Olympia room

NanoFrazor – A versatile instrument for 2D & 3D nanofabrication
Nils Goedecke, Jana Chaaban, ZhengMin Wu, *Heidelberg Instruments Nano AG, Zürich, Switzerland*
NanoFrazor lithography systems exploit the possibilities of thermal scanning probe technology. Here a cantilever with a heated tip interacts with the substrates surface. Typically, one uses a thermal-responsive polymer to generate 2D or 3D nanopatterns. The presentation will illustrate the technology and an overview on the range of applications.

Tuesday 29 March 2022
16:15 - 17:00, TUE3o.1, Technology Talk 2 – Nanoscribe, Olympia room

3D Microprinting for optics and photonics: Two-Photon Grayscale Lithography and Aligned Two-Photon Lithography
Jochen Zimmer et al., *Nanoscribe GmbH & Co. KG, Eggenstein-Leopoldshafen, Germany*
Two-Photon Polymerization 2PP is one of the most versatile techniques to manufacture 3D metamaterials, waveguides, and microoptics. We have recently implemented significant advances of the 2PP technology, most notably Two-Photon Grayscale Lithography and Aligned Two-Photon Lithography. I will present these technologies, and the manufacturing systems in which they are implemented.

Wednesday 30 March 2022
16:15 - 17:00, WED3o.1, Technology Talk 3 - Attocube (Neaspec), Olympia room

Infrared correlation nanoscopy with unprecedented spectral coverage
Andreas Huber, Stefan Mastel, *Attocube systems AG, Haar, Germany*
We introduce a new tunable laser source optimized for IR nanoscopy applications which covers a spectral range of 2-18m. We demonstrate correlative scattering-type near-field s-SNOM and photothermal expansion based point spectroscopy and imaging for studying local chemical composition and the related phase separation in a thin film polymer blend sample.

MON1o: Opening Remarks and Plenary Talk 1

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

Opening Remarks by Nikolay Zheludev and Harald Giessen

Plenary MON1o.1 9:00

Gravitational Quantum Physics, or: How to avoid the appearance of the classical world in gravity experiments? — •Markus Aspelmeyer — University of Vienna, Vienna, Austria — Austrian Academy of Sciences, Vienna, Austria

No experiment today provides evidence that gravity requires a quantum description. The growing ability to achieve quantum optical control over massive solid-state objects may enable experiments that directly probe the phenomenology of quantum states of gravitational source masses. I will review the current status and challenges in the lab.

10:00–10:15: Coffee Break

MON2o: Active and Switchable Metamaterials

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

Invited MON2o.1 10:15

Flat Optics for Dynamic Wavefront Manipulation and Mixed Reality Eyewear — •Mark Brongersma — Stanford University, Stanford, USA

In this presentation I will discuss recent developments in the area of active and dynamic metasurfaces. I discuss the key physics/optics concepts underlying the operation of the metasurfaces and show their use in real-life applications.

Oral MON2o.2 10:45

MEMS Controlled Plasmonic Colors for Sustainable Optical Displays — •Zhengli Han, Christian Frydendahl, Noa Mazurski, and Uriel Levy — The Hebrew University of Jerusalem, Jerusalem, Israel

We show how it is possible to generate a cost-effective and CMOS (Complementary Metal–Oxide–Semiconductor) compatible, fast, and full range electrically controlled RGB color display by combining transmission based plasmonic metasurfaces with MEMS (Microelectromechanical systems) technology, using only two common materials: Aluminum and silicon oxide.

Oral MON2o.3 11:00

Dynamical Metamaterials — •Emanuele Galiffi[1,3], Paloma A. Huidobro[2], Shixiong Yin[1], Huanan Li[1], John B. Pendry[3], and Andrea Alu'[1] — [1]Photonics Initiative, Advanced Science Research Center, City University of New York, New York, USA — [2]Instituto de Telecomunicacoes, Instituto Superior Tecnico, University of Lisbon, Lisbon, Portugal — [3]Blackett Laboratory, Imperial College London, London, United Kingdom

Time has emerged as a new degree of freedom to engineer wave-matter interactions. We report of recent progress with temporal and spatiotemporal modulation of the electromagnetic parameters of a material, as realized in pump-probe setups, demonstrating their potential for linear and chiral wave amplification, localization, optical dragging, surface-wave excitation, and frequency conversion, among many other phenomena.

MON2s: Electron - Photon Interaction

Time: Monday, 10:15–12:00 Location: Seefeld/Tirol

Invited MON2s.1 10:15

Quantum and classical effects in the interaction of electron beams with optical excitations — •F. Javier García de Abajo — ICFO – Institut de Ciencies Fotoniques, Barcelona, Spain — ICREA- Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

Recent advances in the manipulation of free electron wave functions bring us closer to electron microscopy with sub-meV, sub-Ångstrom, and sub-fs spectral-spatial-temporal resolution. By leveraging intrinsic quantum effects in the interaction of free electron with photonic nanostructures, these advances grant us access the statistics, nonlinearity, and nonreciprocity of their optical excitations.

Oral MON2s.2 10:45

Observation of 2D Cherenkov Radiation and its Quantized Photonic Nature — •Yuval Adiv[1], Hao Hu[2], Shai Tsesses[1], Raphael Dahan[1], Kangpeng Wang[1], Yaniv Kurman[1], Alexey Gorlach[1], Hongsheng Chen[3], Xiao Lin[3], Guy Bartal[1], and Ido Kaminer[1] — [1]Technion-Israel Institute of Technology, Haifa, Israel — [2]Nanyang Technological University, Singapore, Singapore — [3]Zhejiang University, Hangzhou, China

We present the first observation of 2D Cherenkov radiation, wherein free electrons emit surface photonic quasiparticles into a dispersion-engineered structure. The reduced dimensionality enhances the electron-photon interaction, providing evidence for a recent paradigm shift in free-electron radiation: instead of emitting classical light, electrons become entangled with the photons they emit.

Oral MON2s.3 11:00

Generating entangled states in the interaction of shaped electron beams with optical excitations — •Andrea Konecna[1] and Javier Garcia de Abajo[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — [2]ICREA- Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We theoretically explore a novel platform for the generation of entangled states based on the inelastic interaction of fast electrons with optical excitations in a nanostructure. We demonstrate that letting a tailored electron wave function interact with samples featuring localized plasmonic or vibrational modes yields on-demand electron-sample entangled states.

Oral MON2o.4 11:15

Reconfiguring metamaterials with the pressure of light — Jinxiang Li[1], •Kevin F. MacDonald[1], and Nikolay I. Zheludev[1,2] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

The optical response of a nanowire metamaterial can be controlled by resonant ponderomotive non-thermal optical forces. The coupling of optical and mechanical resonances facilitates a strong optical nonlinearity enabling all-optical transmission modulation at microwatt power levels.

Oral MON2o.5 11:30

Reconfiguring magnetic resonances using the plasmonic phase-change material In3SbTe2 — Lukas Conrads, Andreas Hessler, Konstantin Wirth, Matthias Wuttig, and •Thomas Taubner — Institute of Physics(IA), RWTH Aachen University, Aachen, Germany

The "plasmonic" Phase-change material In3SbTe2 (IST) enables optically written metasurfaces by local switching between dielectric (amorphous) and metallic (crystalline) states. We now demonstrate even more complex resonance modes by tuning the magnetic dipole resonances of crystalline IST split-ring resonators (SRRs) and reconfiguring them to crescents and J-antennas.

Oral MON2o.6 11:45

Dielectric Mie Voids: Confining Light in Air — •Mario Hentschel[1], Kirill Koshelev[2,3], Florian Sterl[1], Steffen Both[1], Thomas Weiss[1,4], Yuri Kivshar[2], and Harald Giessen[1] — [1]4th Physics Institute and Research Center SCoPE, University of Stuttgart, Stuttgart, Germany — [2]Nonlinear Physics Centre, Research School of Physics, Australian National University, Canberra, Australia — [3]School of Physics and Engineering, ITMO University, St. Petersburg, Russia — [4]Institute of Physics, University of Graz, and NAWI Graz, Graz, Austria

We demonstrate that voids in high-index dielectrics support localized optical modes confined to the void and thus unaffected by the loss in the surrounding medium. We implement these dielectric Mie voids by focused ion beam milling into silicon and utilize the bright, intense, and naturalistic colours for nanoscale colour printing.

Oral MON2o.7 12:00

Radial bound states in the continuum for polarization-invariant nanophotonics — Lucca Kühner[1], Luca Sortino[1], Rodrigo Berté[1,5], Juan Wang[1], Haoran Ren[1,4], Stefan A. Maier[1,2], Yuri S. Kivshar[3], and •Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems and Center for NanoScience, Ludwig-Maximilians-Universität München, Munich, Germany — [2]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom — [3]Nonlinear Physics Centre, Australian National University, Canberra, Australia — [4]MQ Photonics Research Centre, Department of Physics and Astronomy, Macquarie University, Macquarie, Australia — [5]Instituto de Física, Universidade Federal de Goiás, Goiânia, Brazil

We demonstrate radial bound states in the continuum as a new concept for realizing resonances with high Q factors, strong near-field enhancements, and polarization invariance in a compact footprint, and utilize them for applications in biomolecular sensing and higher harmonic generation from 2D materials.

Oral MON2s.4 11:15

Tunable Photon-Induced Spatial Modulation of Free-Electron Wavefronts — •Shai Tsesses, Raphael Dahan, Kangpeng Wang, Ori Reinhardt, Guy Bartal, and Ido Kaminer — Technion - Israel Institute of Technology, Haifa, Israel

We present active spatial modulation of electron wavefronts by engineering their interaction with surface plasmon interference patterns. The patterns are imprinted on the electrons, in a manner resembling spatial light modulation. We further facilitate the nonlinear regime of electron–light interaction, wherein each electron undergoes 2D spatial Rabi oscillations.

Oral MON2s.5 11:30

Electron beam shaping and aberration correction using optical fields — •Andrea Konecna[1] and Javier Garcia de Abajo[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — [2]ICREA- Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We theoretically explore the interaction of fast electrons with tailored light and focus on the generation of on-demand electron beam amplitude and phase profiles. We suggest specific implementations of light-based elements in electron microscopes and discuss applications in rapid control over electron beam spot shapes and mitigation of aberration corrections.

Oral MON2s.6 11:45

Ultrafast Pump-Probe Spectral Interferometry without a Laser using Electron-Driven Photon Sources in an Electron Microscope — Masoud Taleb[1], Mario Hentschel[2], Harald Giessen[2], and •Nahid Talebi[1] — [1]Christian Albrechts Universty, Kiel, Germany — [2]Stuttgart University, Stuttgart, Germany

We provide the first results for correlative pump-probe electron-photon spectroscopy without a laser, by using coherent electron-driven photon sources. We apply the novel spectral interferometry scheme solely with an electron microscope for investigating spectral correlations in strongly-coupled systems. Our system is based on electrons hitting a plasmonic metasurface which then emits photons which interact with a second surface under investigation.

Monday

12:15–16:15: Lunch Break

MON3o: Technology Talk 1 - Heidelberg Instruments Nano AG

Time: Monday, 16:15–17:00 Location: Olympia

Technology MON3o.1 16:15

NanoFrazor – A versatile instrument for 2D & 3D nanofabrication — •Nils Goedecke, Jana Chaaban, and ZhengMin Wu — Heidelberg Instruments Nano AG, Bändliweg 30, CH-8048 Zürich, Switzerland

NanoFrazor lithography systems exploit the possibilities of thermal scanning probe technology. Here a cantilever with a heated tip interacts with the substrate's surface. Typically, one uses a thermal-responsive polymer to generate 2D or 3D nanopatterns. The presentation will illustrate the technology and an overview on the range of applications.

MON4o: Switchable and Dielectric Metamaterials

Time: Monday, 17:00–19:00 Location: Olympia

Invited MON4o.1 17:00

Electrically Switchable Metallic Polymer Nanoantennas and Metasurfaces — •Julian Karst[1], Moritz Floess[1], Monika Ubl[1], Carsten Dingler[2], Claudia Malacrida[2], Tobias Steinle[1], Sabine Ludwigs[2], Mario Hentschel[1], and Harald Giessen[1] — [1]4th Physics Institute and Research Center SCoPE, University of Stuttgart, Stuttgart, Germany — [2]IPOC-Functional Polymers, Institute of Polymer Chemistry and Center for Integrated Quantum Science and Technology (IQST), University of Stuttgart, Stuttgart, Germany

We realize nanoantennas from metallic polymers which show well-pronounced plasmonic resonances and can be electrically switched fully off and back on at video-rate frequencies of 30 Hz by applying voltages of only ±1 V. Utilizing this concept, electrically switchable beam steering metasurfaces with 100% contrast ratio in transmission are demonstrated.

Oral MON4o.2 17:30

Ultracompact LiDAR Platform using Electrically Switchable Metallic Polymer Nanogratings — •Yohan Lee, Julian Karst, Monika Ubl, Philipp Flad, Mario Hentschel, and Harald Giessen — 4th Physics Institute and Research Center SCoPE, University of Stuttgart, Stuttgart, Germany

We introduce nanogratings from metallic polymers which show an electrochemically-driven optical metal-to-insulator transition. A key feature of the design is separately addressable electrodes to vary the superlattice period of the grating via the applied voltages. Thus, the proposed ultracompact beam deflectors can generate various angles.

Oral MON4o.3 17:45

Radially polarized single photon source — •Danylo Komisar[1], Shailesh Kumar[1], Yinhui Kan[1,2], Cuo Wu[1,3], and Sergey I Bozhevolnyi[1,4] — [1]Center for Nano Optics, University of Southern Denmark, Odense, Denmark — [2]College of Astronautics, Nanjing University of Aeronautics and Astronautics, Nanjing, China — [3]Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Chengdu, China — [4]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark

We experimentally demonstrate radially polarized highly-directional single-photon beam generation. A 3-fold photon rate enhancement was reached by fabrication of plasmonic bullseye antenna around nitrogen-vacancy center in a nanodiamond.

MON4s: 2D Matter

Time: Monday, 17:00–19:00 Location: Seefeld/Tirol

Invited MON4s.1 17:00

Near-field Probing of Vibrational Strong Coupling — •Rainer Hillenbrand — CIC nanoGUNE BRTA, San Sebastian , Spain

Scattering-type scanning near-field optical microscopy (s-SNOM) and nano-FTIR spectroscopy are employed for studying the strong coupling between infrared molecular vibrations and phonon polaritons in h-BN layers and nanoresonators.

Oral MON4s.2 17:30

Giant enhancement of third-harmonic generation in graphene-metal heterostructures — P. K. Jenke[1], I. Alonso Calafell[1], L. A. Rozema[1], D. Alcaraz Iranzo[2], A. Trenti[1], J. D. Cox[3,4], A. Kumar[2], H. Bieliaiev[1], S. Nanot[2,5], C. Peng[6], D. K. Efetov[2], J.-Y. Hong[6], J. Kong[6], D. R. Englung[6], F. Javier Garcia de Abajo[2,7], F. H. L. Koppens[2,7], and •P. Walther[1] — [1]Vienna Center for Quantum Science and Technology (VCQ), University of Vienna, Vienna, Austria — [2]ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — [3]Center for Nano Optics, University of Southern Denmark, Odense, Denmark — [4]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark — [5]Laboratoire Charles Coulomb (L2C), Universit'e de Montpellier, CNRS, Montpellier, France — [6]Quantum Photonics Group, RLE, Massachusetts Institute of Technology, Cambridge, MA, USA — [7]ICREA-Institucio Catalana de Recerca i Estudis Avancats, Barcelona, Spain

Graphene is a promising candidate for nonlinear optoelectronics due to its strong and tunable nonlinearity, while simultaneously supporting plasmonic excitations. We use graphene–insulator–metal heterostructures to enhance third-harmonic generation in graphene by three orders of magnitude. Moreover, we find that graphene plasmons mediate the nonlinearity, modifying the third-harmonic signal.

Oral MON4s.3 17:45

withdrawn

Oral MON4o.4 18:00

High-index topological insulator meta-optics — Danveer Singh, Sukanta Nandi, Shany Cohen, Pilkhaz Nanikashvili, Doron Naveh, and •Tomer Lewi — Bar-Ilan University, Ramat-Gan, Israel

We study the optical properties of Bi2Te3 and Bi2Se3 topological insulators (TI) nanostructures of various morphologies and geometries. We find that both the bulk and surface states contribute to the extremely large optical constants of this family. We demonstrate deep subwavelength resonant structures for Bi2Se3 nanobeams and Bi2Te3 metasurfaces.

Invited MON4o.5 18:15

(3+1)D printing for graded index photonic integration — Adria Grabulosa, Johnny Moughames, Xavier Porte, Muamer Kadic, and •Daniel Brunner — Institut FEMTO-ST, Université Bourgogne Franche-Comté, CNRSUMR6174, Besançon, France

We demonstrate single-step 3D printing of graded-index optical elements by introducing light exposure as additional dimension to three-dimensional, hence (3+1)D laser writing. This highly flexible technique enables CMOS-compatible high-resolution additive fabrication of mm-scale 3D optical waveguides with low optical losses for photonic integration with complex waveguide topologies or GRIN profiles.

Oral MON4o.6 18:45

Non-radiative modes in finite arrays of Mie resonators — •Mihail Petrov[1], Danil Kornovan[1], Roman Savelev[1], and Yuri Kivshar[1,2] — [1]Department of Physics and Engineering, ITMO University, St.-Petersburg , Russia — [2]Nonlinear Physics Center, Australian National University, Canberra , Australia

We report on the formation of high-*Q* localized states in finite arrays of Mie resonators overcoming the previously predicted values by at least two orders of magnitude. The effect becomes possible due to the destructive interaction of two band-edge modes and the cancelation of their far-field radiation.

Oral MON4s.4 18:00

Complete coupling of light into 2D polaritons — •Eduardo J. C. Dias[1] and F. Javier García de Abajo[1,2] — [1]ICFO - The Institute of Photonic Sciences, Castelldefels, Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We show that a small scatterer placed at a suitable distance from a given surface can couple light completely into the surface modes supported by the surface, under illumination by an adequately modulated field.

Oral MON4s.5 18:15

Near-field nonlinear optics with graphene and atomic systems — •Joel Cox — University of Southern Denmark, Odense, Denmark

We explore schemes to achieve unconventional nonlinear light-matter interactions on the nanoscale, such as photon up-conversion, thermo-optical effects, and electrically-tunable optical bistability, that are enabled by interfacing graphene with atomic systems.

Invited MON4s.6 18:30

Metasurfaces for energy conversion and holography — •Stefan Maier — LMU Munich, Muenchen, Germany — Imperial College London, London, United Kingdom

We present two application areas of large-area dielectric metasurfaces. Firstly, metasurfaces based on 3D direct laser writing will be discussed that operate on the orbital angular momentum degree of freedom, with applications in video holography. Secondly, nanoimprinting of GaP nanostructures facilitates photocatalytically active metasurface electrodes for applications in water splitting.

19:00–19:15: Break

MON5o: Breakthrough Talk 1

Time: Monday, 19:15–19:45 Location: Olympia

Breakthrough MON5o.1 19:15

Photonic Time-Crystals — •Mordechai (Moti) Segev — Technion - Israel Institute of Technology, Haifa, Israel

Photonic Time-Crystals (PTCs) are materials in which the refractive index varies periodically and abruptly in time. They conserve momentum but not energy, and display momentum bands separated by gaps. I will present the fundamentals of PTCs with emphasis on light-matter interactions, ranging from emission by atoms and free electrons to new ideas and recent experiments.

MON5s: Breakthrough Talk 2

Time: Monday, 19:15–19:45 Location: Seefeld/Tirol

Breakthrough MON5s.1 19:15

How light forms atomic-scale picocavities — •Jeremy Baumberg[1], Qianqi Lin[1], Shu Hu[1], Tamas Földes[2], Junyang Huang[1], Demelza Wright[1], Jack Griffiths[1], Bart de Nijs[1], and Edina Rosta[2] — [1]NanoPhotonics Centre, Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — [2]Department of Physics and Astronomy, University College London, London, United Kingdom

We show how plasmonically-enhanced light-induced van-der-Waals forces pull single adatoms from metal facets, to create picocavities which confine light to volumes < 1nm^3. The thousandfold stronger optical forces depend on nearby molecules as well as temperature and local optical field, and offer a route to single molecule optical tweezers.

TUEo1: Plenary Talk 2

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

Plenary TUEo1.1 9:00

Onsager Computing– Optimization by the Principle of Minimum Heat Generation — •Eli Yablonovitch — University of California, Berkeley, Berkeley, USA

Physics itself, performs optimizations in the normal course of dynamical evolution. Nature provides us with the Principle of Least Action, among many other optimization principles. Recently, there has been great success with Onsager Computing using the Principle of Minimum Entropy Generation.

10:00–10:15: Coffee Break

TUE2o: Quantum Nanophotonics

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

Invited TUE2o.1 10:15

Quantum optics in complex media — •Inigo Liberal — Public University of Navarre, Pamplona, Spain

Complex media take full advantage of their multiple degrees of freedom (extreme material parameters, extreme geometry, bi-anisotropy and/or time-varying response) to enable advanced forms of light matter interactions). In our talk, we will provide several examples on how complexity translates into generalized optical quantum processes.

Oral TUE2o.2 10:45

Photon Pair Correlations in Semiconductor-Superconductor Light Sources — •Shlomi Bouscher[1], Dmitry Panna[1], Krishna Balasubramanian[1,2], Ronen Jacovi[1], Ankit Kumar[1], Christian Schneider[3], Sven Hoefling[3], and Alex Hayat[1] — [1]Department of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel — [2]Electrical Engineering Faculty, Indian institute of technology, Kanpur, India — [3]Technische Physik, Physikalisches Institut and Wilhelm Conrad Röntgen Research Center for Complex Material Systems, Universität Würzburg, Würzburg, Germany

We demonstrate evidence of photon pair correlations, resulting from injected Cooper-pairs in superconductor-semiconductor structures. Such structures can be utilized for multiple applications including enhanced two-photon gain, electrically-driven entangled-photon generation and Bell-state analyzers.

Oral TUE2o.3 11:00

Coupled molecular emitters in superstructures interact with plasmonic nanoparticles — •Daniel Beitner[1,2,3], Itai Carmeli[1,4], Zeev Zalevsky[4], Shachar Richter[1,2], and Haim Suchowski[2,3] — [1]Department of Materials Science and Engineering Faculty of Engineering Tel Aviv University , Tel Aviv, Israel — [2]University Center 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]Faculty of Engineering and Institute for Nanotechnology, Bar Ilan University, Ramat Gan, Israel

TPPS porphyrins rod-shaped J-aggregates on plasmonic Au nanoparticle arrays were studied using hyperspectral microscopy with K-means spectral sorting. Weak coupling behavior was observed for single J-aggregates, while Clusters of multiple J-aggregates caused a large redshift of the plasmonic peak. An analytical model was developed to validate the results.

TUE2s: Applications

Time: Tuesday, 10:15–12:15 Location: Seefeld/Tirol

Invited TUE2s.1 10:15

MEMS-based optical metasurfaces for dynamic radiation control — •Sergey Bozhevolnyi — SDU Nano Optics, University of Southern Denmark, Odense M, Denmark

Piezoelectric MEMS-based configurations, involving MEMS mirrors integrated with gap surface-plasmon based metasurfaces, for realizing electrically controlled optical metasurfaces operating in reflection are introduced. Experimental demonstrations of electrically controlled beam steering and focusing, along with dynamic wave plates, featuring high modulation efficiencies, broadband operation and fast responses are reported and discussed.

Oral TUE2s.2 10:45

Waveguide-coupled mid-IR photodetector based on interlayer excitons absorption in a WS2/HfS2 heterostructure — •Shahar Edelstein, S.R.K. Chaitanya Indukuri, Noa Mazurski, and Uriel Levy — Hebrew University, Jerusalem, Israel, Israel

We present a waveguide-coupled mid-IR photodetector based on interlayer excitons generated in a heterostructure made of a single layer of tungsten disulfide (WS2) and few layers of hafnium disulfide (HfS2). We measure broadband photodetection, with responsivity in the order of tens of μA/W with no significant effect on waveguide's transmission.

Oral TUE2s.3 11:00

Bistability of optical response of plasmonic nanowire device at microwatt power levels — Dimitrios Papas[1], Jun-Yu Ou[1], •Eric Plum[1], and Nikolay Zheludev[1,2] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

A profound optical bistability in light scattering is observed in a pair of oscillating nanowires decorated with plasmonic patterns. The response becomes bistable at only a few μW of incident optical power, which is facilitated by coupling between the plasmonic and the highly nonlinear mechanical subsystems of the nanostructure.

Oral TUE2o.4 11:15

Second harmonic enhancement from nonlinear plasmonic metasurface coupled to optical waveguide — •Tsafrir Abir[1,2], Mai Tal[1,2], and Tal Ellenbogen[2] — [1]Department of Condensed Matter Physics, School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel — [2]Department of Physical Electronics, School of Electrical Engineering, Tel-Aviv University, Tel Aviv, Israel

Collective resonances on nonlinear metasurfaces are known to significantly enhance second harmonic generation. We demonstrate experimentally and by simulations, that even larger enhancement can be achieved when the collective resonances originate from the coupling of the metasurface to guided modes.

Oral TUE2o.5 11:30

On-Chip Circularly Polarized Single-Photon Sources with Quantum Metasurfaces — •Fei Ding — University of Southern Denmark, Odense, Denmark

We have demonstrated a conceptually new approach of quantum metasurfaces to the room-temperature generation of circularly polarized single photons entailing quantum emitters nonradiative coupling to surface plasmons that are transformed, by interacting with an optical metasurface, into a collimated stream of single photons with the designed spin and orbital angular momentum.

Oral TUE2o.6 11:45

Probing quantum effects in nanoplasmonics with electron-beam spectroscopies — •P. André D. Gonçalves[1] and F. Javier García de Abajo[1,2] — [1]ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We present a concrete proposal for inferring the quantum nonlocal response of metals directly from measurements of electron energy-loss spectroscopy (EELS) and cathodoluminescence (CL) spectra. Our scheme exploits the unique ability of free-electron beams to produce deeply subwavelength near-fields and thus probe the optical response of metals at the nanoscale.

Oral TUE2o.7 12:00

Quantum-coherent light-electron interaction in an SEM — •Tomas Chlouba, Roy Shiloh, and Peter Hommelhoff — Friedrich-Alexander University, Erlangen, Germany

Quantum-coherent light-free electron interaction was shown more than a decade ago in a transmission electron microscope leading to a variety of scientific applications. We now show, for the first time, quantum-coherent interaction in a scanning electron microscope, which offers substantial advantages over TEMs in terms of chamber size, electron energy, and cost.

Oral TUE2s.4 11:15

High-throughput nanofabrication of highly efficient and functional metasurfaces for mid-infrared optics and biosensing — •Aleksandrs Leitis[1], Ming Lun Tseng[1], Aurelian John-Herpin[1], Yuri Kivshar[2], and Hatice Altug[1] — [1]EPFL, Lausanne, Switzerland — [2]Australian National University, Canberra, Australia

We demonstrate highly efficient mid-infrared meta-optical elements and metasurface-based optofluidic biosensors fabricated on ultra-thin metal-oxide membranes using industry-standard CMOS-compatible nanofabrication processes. The demonstrated nanofabrication method enables low-cost infrared optical components and disposable sensor chips for medical diagnostics and moves the mid-infrared metasurface technology markedly closer to real-world applications.

Oral TUE2s.5 11:30

dynamic terahertz emission in a coupled metal – epsilon near zero metasurface — •eviatar minerbi[1,2,3], symeon sideris[1,2], jacob khurgin[4], and tal ellenbogen[1,2] — [1]Department of Physical Electronics, School of Electrical Engineering, Tel-Aviv University, Tel Aviv, Israel — [2]Center for Light-Matter Interaction, Tel-Aviv University, Tel Aviv, Israel — [3]Raymond and Beverly Sackler Faculty of Exact Sciences, School of Physics & Astronomy, Tel-Aviv University, Tel Aviv, Israel — [4]Department of Electrical and Computer Engineering, Johns Hopkins University, Baltimore, USA

We show that a thin ITO film enhances the THz mission from plasmonic metasurfaces by two orders of magnitude. In addition, sub-picosecond hot-electron kinetics result in striking dynamic effects on the emitted THz field. Specifically, broadening of the generated signal and an abrupt flip of its phase are observed experimentally.

Oral TUE2s.6 11:45

AI-assisted FIB nanofabrication — Oleksandr Buchnev[1], James A. Grant-Jacob[1], Robert W. Eason[1], Nikolay I. Zheludev[1,2], Ben Mills[1], and •Kevin F. MacDonald[1] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

Deep learning can be used to predict the post-fabrication appearance of structures manufactured by focused ion beam (FIB) milling, accounting for variations in beam focusing/scanning parameters and target medium characteristics with nanoscale accuracy. With predictions generated in milliseconds, the approach can expedite process optimization and enhance precision/reproducibility in FIB nanofabrication.

Oral TUE2s.7 12:00

Electro-optical SRAM cavity device based on negative differential resistance — •Rivka Gherabli, Roy Zektzer, Meir Grajower, Joseph Shappir, and Uriel Levy — Hebrew University, jerusalem, Israel

We experimentally demonstrate a new electro-optic SRAM element based on the combination of a negative differential resistance described as two resistors in series but also as a unique PN junction embedded in a micro-ring resonator, remarkable for its simplicity and its complete CMOS compatibility with power consumption around the nanoWatt.

12:15–16:15: Lunch Break

TUE3o: Technology Talk 2 - Nanoscribe

Time: Tuesday, 16:15–17:00 Location: Olympia

Technology TUE3o.1 16:15

3D Microprinting for optics and photonics: Two-Photon Grayscale Lithography and Aligned Two-Photon Lithography — •Jochen Zimmer et al. — Nanoscribe GmbH & Co. KG, Eggenstein-Leopoldshafen, Germany

Two-Photon Polymerization (2PP) is one of the most versatile techniques to manufacture 3D metamaterials, waveguides, and microoptics. We have recently implemented significant advances of the 2PP technology, most notably Two-Photon Grayscale Lithography and Aligned Two-Photon Lithography. I will present these technologies, and the manufacturing systems in which they are implemented.

TUE4f: Poster Session (with snacks and drinks)

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

Poster TUE4f.1 17:00

withdrawn

Poster TUE4f.2 17:00

Bound States in the Continuum in Nano-Fin Metasurfaces — •Andreas Aigner[1], Haoran Ren[2], Andreas Tittl[1], and Stefan A. Maier[1,3] — [1]Chair in Hybrid Nanosystems, Faculty of Physics, Ludwig-Maximilians-Universität München, Munich, Germany — [2]MQ Photonics Research Centre, Department of Physics and Astronomy, Macquarie University, Macquarie Park, Australia — [3]Department of Physics, Imperial College London, London, United Kingdom

A new plasmonic Nano-Fin metasurface geometry allows out-of-plane symmetry breaking by tuning the triangle opening angle. Thus, high quality factor (Q-factor) symmetry-protected bound states in the continuum (BICs) can be excited. The plasmonic nature of these resonances enabling high field enhancement together with high Q-factors is utilized for pixelated surface-enhanced Mid-IR molecular sensing.

Poster TUE4f.3 17:00

Visible Wavelength Plasmonics in Zirconium Nitride for Surface-Enhanced Raman Spectroscopy — •Paul Butler[1], Ludwig Hüttenhofer[1], Fridrik Magnus[2], Emiliano Cortes[1], Helga Flosadóttir[3], and Stefan Maier[1] — [1]Nanoinstitut Ludwig-Maximilinas-Universität, München, Germany — [2]Grein Research, Reykjavik, Iceland — [3]Atmonia, Reykjavik, Iceland

By optical characterization of top-down fabricated ZrN nanoparticles, we design dimer antennas for visible-wavelength plasmonic excitations and demonstrate their applicability for SERS enhancement.

Poster TUE4f.4 17:00

Fiber Fabry-Perot cavity integrated mechanical resonators fabricated by direct laser writing — •Alexander Fassbender[1], Lukas Tenbrake[2], Sebastian Hofferberth[2], Stefan Linden[1], and Hannes Pfeifer[2] — [1]Physikalisches Institut, Bonn, Germany — [2]Institut für angewandte Physik, Bonn, Germany

We report on a mechanical membrane resonator integrated into a fiber Fabry-Perot cavity. The mechanical resonator consists of a thin polymer membrane supported by a frame and fabricated by DLW. The frequency noise spectrum shows a vacuum coupling strength of >10 kHz at a mechanical mode frequency of ~1 MHz.

Poster TUE4f.5 17:00

Strong exciton-plasmon coupling in a hybrid WS2-monolayer silver-nano-groove structure — •Yuhao Zhang, Hans-Joachim Schill, Paul Steinmann, and Stefan Linden — Physikalisches Institut, Bonn, Germany

In this work, we investigate the coupling between excitons in a WS2 monolayer and surface plasmon polaritons on a 1D silver nano-groove array. Our calculations predict a strong coupling regime with a Rabi splitting larger than 90 meV.

Poster TUE4f.6 17:00

Height-driven photonic bound states in the continuum — •Lucca Kühner[1], Fedja Wendisch[1], Stefan A. Maier[1,2], and Andreas Tittl [1] — [1]Chair for Hybrid Nanosystems, Ludwig-Maximilians-Universität , München, Germany — [2]The Blackett Laboratory, Imperial College, London, United Kingdom

We demonstrate a novel approach for symmetry breaking in BIC metasurfaces via the resonator height, which can be extended to metasurfaces with arbitrary height differences of individual elements.

Poster TUE4f.7 17:00

Ultrafast and nonlinear characterization of Weyl semimetal niobium phosphide thin films — •Benjamin Tilmann[1], Avanindra Pandeya[2], Gustavo Grinblat[3], Leonardo de S. Menezes [1,4], Yi Li[5], Chandra Shekhar [6], Claudia Felser[6], Stuart S.P. Parkin[2], Amilcar Bedoya-Pinto[2], and Stefan A. Maier[1,7] — [1]Ludwig-Maximilians Universität , München, Germany — [2]Max-Planck Institute of Microstructure Physics, Halle (Saale), Germany — [3]Universidad de Buenos Aires, Buenos Aires, Argentinia — [4]Universidade Federal de Pernambuco, Recife, Brazil — [5]Southern University of Science and Technology, Shenzhen , China — [6]Max Planck-Institute for Chemical Physics of Solids, Dresden, Germany — [7]Imperial College, London, United Kingdom

Weyl semimetals are topological materials with promising electronic and optical properties. This work thoroughly characterises the nonlinear optical properties of epitaxial grown thin films of the Weyl semimetal niobium phosphide by using third-harmonic generation and nondegenerate pump-probe spectroscopy. The results pave the way towards efficient on-chip nano photonics based on Weyl semimetal thin films.

Poster TUE4f.8 17:00

Time-resolved pump-probe cathodoluminescence spectroscopy on Cu2ZnSnS4 — •N. van Nielen, M. Sola-Garcia, K. Mauser, M. Vreugdenhil, and A. Polman — AMOLF, Center for Nanophotonics, Amsterdam, Netherlands

Recombination dynamics of optically-induced carriers in Cu2ZnSnS4 were studied using pump-probe cathodolumines-

Tuesday

cence spectroscopy, a novel technique that enables studies of ultrafast dynamics in nanoscale materials and metasurfaces. We found the filling and recombination rates of native and induced defects that limit the conversion efficiency of this semiconductor.

Poster TUE4f.9 17:00

Phase-resolved near-field microscopy on plasmonic chiral couplers — •Hans-Joachim Schill and Stefan Linden — Physikalisches Institut, Bonn, Germany

We report on phase-resolved near-field microscopy on curved plasmonic waveguides. The structures act as chiral couplers that convert the spin angular momentum of circularly polarized light into orbital angular momentum. Our near-field measurements demonstrate the directional excitation of surface plasmon polaritons controlled by the polarization of the incident beam.

Poster TUE4f.10 17:00

The depth range of infrared near-field probing into a "nano-aquarium" — •Enrico Bau, Thorsten Gölz, Stefan A. Maier, and Fritz Keilmann — Chair in Hybrid Nanosystems & Center for NanoScience, Ludwig-Maximilians-Universität, Munich, Germany

We study how deeply s-SNOM nano-spectroscopy can explore objects in a membrane-covered water layer. Our experimental nano-FTIR measurements are well supported by theory based on the finite dipole model for multilayers. We find that the tip radius r is the most important parameter to reach deeply into the liquid.

Poster TUE4f.11 17:00

Tip Coupling and Array Effects of Gold Nanoantennas in Near-Field Microscopy — Rebecca Büchner[1], •Thomas Weber[2], Lucca Kühner[2], Stefan Maier[2,3], and Andreas Tittl[2] — [1]Nanophotonic Systems Laboratory, Department of Mechanical and Process Engineering, ETH Zurich, 8092 Zurich, Switzerland — [2]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-University Munich, 80539 Munich, Germany — [3]The Blackett Laboratory, Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom

We investigate the response of gold nanorod arrays locally excited in the near-field by metallic s-SNOM tips and reveal an intricate behavior governed by radiative coupling and plasmon hybridization.

Poster TUE4f.12 17:00

Plasmon assisted catalysis: the role of heat — •Felix Stete[1], Jan Kutschera[1], Radwan M. Sarhan[1,2], Wouter Koopman[1], and Matias Bargheer[1,2] — [1]Institut für Physik & Astronomie, Universität Potsdam, Potsdam, Germany — [2]Helmholtz Zentrum Berlin, Berlin, Germany

We employ nanothermometry to monitor the local heat in plasmonic nanoparticles while measuring the reaction rates in plasmon assisted catalysis. This way, we investigate the role of electronic and phononic heat in different chemical reactions.

Poster TUE4f.13 17:00

Directional Emission from Dielectric Multi-Mode Interference Antennas — •Lok-Yee Yan[1], Henna Farheen[2], Florian Spreyer[3], Christian Schlickriede[3], Viktor Myroshnychenko[2], Thomas Zentgraf[3], Jens Förstner[2], and Stefan Linden[1] — [1]Physikalisches Institut, Bonn University, Bonn, Germany — [2]Theoretical Electrical Engineering, Paderborn University, Paderborn, Germany — [3]Department of Physics, Paderborn University, Paderborn, Germany

Dielectric materials can serve as an attractive platform for travelling wave optical antennas. Here, we investigate three different designs of low-loss dielectric guided-wave antennas that feature strong directivity. Their emission profiles can be explained by multi-mode interference.

Poster TUE4f.14 17:00

Imaging and analyzing the far-field radiation of scattered plasmons at a plasmonic square lattice by using cathodoluminescence spectroscopy — •Paul H. Bittorf, Fatemeh Davoodi, Masoud Taleb, and Nahid Talebi — Institute for Experimental and Applied Physics, Kiel, Germany

By using complementary cathodoluminescence spectroscopy and angle-resolved mapping, we explored the optical response of a two-dimensional plasmonic crystal incorporated inside a thin gold layer. Our results unravel the spatial distribution of scattered optical modes in real and reciprocal spaces, placing cathodoluminescence spectroscopy as a versatile tool for investigating surface lattices.

Poster TUE4f.15 17:00

Bright single photon emitters with enhanced quantum efficiency in a 2D semiconductor coupled with dielectric nano-antennas — •Luca Sortino[1,2], Panaiot G. Zotev[2], Riccardo Sapienza[3], Stefan A. Maier[1,3], and Alexander I. Tartakovskii[2] — [1]Chair in Hybrid Nanosystems, Faculty of Physics, Ludwig-Maximilians-Universitat Munchen, Munich, Germany — [2]Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom — [3]The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom

Single-photon emitters in 2D semiconductors can be deterministically positioned using localized strain. Here, we couple monolayer WSe_2 to gallium phosphide dielectric nano-antennas and report high quantum efficiency, reaching up to 86%, and reveal a ns-scale luminescence lifetime related to the dark exciton reservoir feeding the quantum emitting state.

Poster TUE4f.16 17:00

Active control of light on a ferroelectric/semiconductor interface — •Artemios Karvounis, Helena Weigand, Viola Vogler-Neuling, and Rachel Grange — ETH Zurich, Department of Physics, Institute for Quantum Electronics, Optical Nanomaterial Group, Zürich, Switzerland

We harness the photo-excited charges of lead-free ferroelectric crystals, to produce direction-dependent space-charges that can modify optical properties of a lithium niobate/semiconductor interface. The laser-induced reversible, transmission change exceeds 80% at near-infrared wavelength, therefore paves the way for a novel active nanophotonic platform based on a lithium niobate technology.

Poster TUE4f.17 17:00

Multiple scattering and second-harmonic generation in disordered microspheres of LiNbO3 nanocubes — •Andrea Morandi, Romolo Savo, Jolanda Simone Müller, Simeon Reichen, and Rachel Grange — ETH Zurich, optical nanomaterial group, Zurich, Switzerland

We assemble 100-400 nm size lithium niobate nanocubes into microspheres. We show that they are strongly scattering in the visible spectrum and generate broadband second-harmonic with the random quasi-phase-matching scheme. They constitute an ideal platform to investigate light propagation and generation in nonlinear disordered media.

Poster TUE4f.18 17:00

Visualizing anapole and anapole-exciton polariton states using electron energy loss spectroscopy — •Carlos Maciel Escudero[1,2], Andrew Yankovich[3], Battulga Munkhbat[3], Denis Baranov[3,4], Rainer Hillenbrand[2,5], Javier Aizpurua[1,6], Eva Olsson[3], and Timur Shegai[3] — [1]Materials Physics Center (CFM), Donostia-San Sebastián, Spain — [2]CIC NanoGUNE BRTA and Department of Electricity and Electronics, Donostia-San Sebastián, Spain — [3]Department of Physics, Chalmers University of Technology, Gothenburg, Sweden — [4]Center for Photonics and 2D Materials, Moscow Institute of Physics and Technology, Moscow, Russia — [5]IKERBASQUE, Basque Foundation for Science, Bilbao, Spain — [6]Donostia International Physics Center (DIPC), Donostia-San Sebastián , Spain

Here we study optical anapole states in WS2 nanodisks by using electron energy loss spectroscopy (EELS). Our results show that anapole state emerges as a dip in the EEL spectra. Interestingly, by varying the WS2 nanodisk dimensions, the anapole can be tuned to overlap an exciton transition of WS2.

Poster TUE4f.19 17:00

Superoscillatory Space-Time Nonseparable Optical Pulses — •Yijie Shen[1], Nikitas Papasimakis[1], Mark R. Dennis[2], and Nikolay I. Zheludev[1,3] — [1]University of Southampton, Southampton, United Kingdom — [2]University of Birmingham, Birmingham, United Kingdom — [3]Nanyang Technological University, Singapore, Singapore

We show that space-time non-separable band-limited light fields can exhibit superoscillations simultaneously in the spatial and temporal domains, i.e. can oscillate faster that the highest harmonics of their spectra. We demonstrate that such behavior is exhibited by the supertoroidal light pulses and discuss possible applications of the effect.

Poster TUE4f.20 17:00

Observation of an anomalous Tamm plasmon state in near-IR — •Oleksandr Buchnev[1], Alexsandr Belosludtsev[2], and Vassili Fedotov[1] — [1]Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — [2]Optical Coating Laboratory, Center for Physical Sciences and Technology, Vilnius, Lithuania

We report on the first experimental observation of a Tamm plasmon characterised by anomalously high energy located in the upper half of the photonic bandgap. We show that the anomaly cannot be captured by the effective medium approach and transfer matrix method commonly employed in the analysis of Tamm plasmons.

Poster TUE4f.21 17:00

Manipulating circularly polarized light with gap-surface plasmon metasurfaces — •Fei Ding — University of Southern Denmark, Odense, Denmark

We have experimentally demonstrated broadband nanoscale quarter-wave plates (nano-QWPs) that can not only allow broadband and efficient conversion between circular and linear polarizations for the optical fields but also enable advanced wavefront manipulation by using gap-surface plasmon (GSP) metasurfaces.

Poster TUE4f.22 17:00

Infrared nanoscopy of living cells — Yasin C. Durmaz, Korbinian Kaltenecker, Thorsten Gölz, Enrico Bau, and •Fritz Keilmann — LMU, Fakultät für Physik & Center for Nanoscience, München, Germany

s-SNOM is applied to biological cells living inside a "nano-aquarium", adhering to its 10-nm thin SiN window. Nano-FTIR spectra taken from outside identify water, protein and lipid at 150-nm resolution, while topography maps a cell's adhesion footprint. Our leak-tight, robust and affordable setup enables nano-chemical analysis of any liquid-based, dynamical process.

Poster TUE4f.23 17:00

Revealing nanoscale confinement effects on hyperbolic phonon polaritons with an electron beam — •Andrea Konecna[1,2], Jiahan Li[3], James Edgar[3], Javier Garcia de Abajo[1,4], and Jordan Hachtel[5] — [1]ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — [2]Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic — [3]Tim Taylor Department of Chemical Engineering, Kansas State University, Manhattan, USA — [4]ICREA- Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain — [5]Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge, USA

We explore the sensitivity of hyperbolic phonon polaritons (HPhPs) in hexagonal boron nitride (hBN) to nanoscale environment using electron energy-loss spectroscopy with focused electron probes. We reveal that geometrical heterogeneities in thin hBN samples significantly influence HPhPs and induce localized modes that affect the design and performance of HPhPs-based devices.

Poster TUE4f.24 17:00

Plasmon satellites in photoemission: Plasmonic nanoparticles — •P. André D. Gonçalves[1] and F. Javier García de Abajo[1,2] — [1]ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain — [2]ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

Here, we present a theoretical account of electron–plasmon interaction ensuing photoemission from plasmonic nanoparticles. We show that LSPs lead to well-resolved plasmon satellites, whose intensity depends on the net effect from so-called intrinsic and extrinsic plasmon effects, nanoparticle geometry, and initial state of the plasmon field.

Poster TUE4f.25 17:00

3D Reconstruction of the Optical Near Fields in Au nanoparticles with Coherent Cathodoluminescence using a recoil model — •Evelijn Akerboom, Nick Schilder, and Albert Polman — Center for Nanophotonics, NWO-Institute AMOLF, Amsterdam, Netherlands

We reconstruct the optical near field of Au nanoparticles in 3D by measuring the coherent cathodoluminescence emission probability at different electron energies. Going beyond the non-recoil approximation, the emission probabilities are calculated, considering the penetration depth and the energy loss along the electron trajectory. The CL measurements confirm these calculations.

Poster TUE4f.26 17:00

withdrawn

Poster TUE4f.27 17:00

Coherent control of the excitonic resonance in WSe2 — •Omri Meron[1,2], Uri Arieli[1,2], Eyal Bahar[1,2], Swarup Deb[1], Moshe Ben-Shalom[1], and Haim Suchowski[1,2] — [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 pulse-shape based coherent control of the A-exciton resonance in monolayer WSe2. Utilizing our ultra-broadband pulse-shaper, we tailor the third-order nonlinear response, steering it from fully destructive to constructive interference. Our results outperform the transform limited case by 2.3 enhancement factor and coincide with the anharmonic oscillator model.

Poster TUE4f.28 17:00

High Fidelity Integrated Photonic Gates using Detuning Modulated Composite Segments — •Yonatan Piasetzky[1], Moshe Katzman[2], Haim Suchowski[1], and Avi Zadok[2] — [1]Tel Aviv University, Tel Aviv, Israel — [2]Bar Ilan University, Ramat Gan, Israel

We demonstrate a high-fidelity single-qubit gate in photonic integrated waveguides, utilizing a novel scheme of detuning modulated composite segments. We reduce the wavelength dependence of long directional couplers by an order of magnitude, indicating significantly increased robustness for fabrication errors. These results show great promise for integrated quantum optics.

Poster TUE4f.29 17:00

Second order transient photo-induced differential reflectivity for unravelling ultrafast response of plasmonic nanostructures — •Uri Arieli, Dror Hershkovitz, Sudarson Sekhar Sinha, Haim Suchowski, and Ori Cheshnovsky — Tel Aviv University, Tel Aviv, Israel

We explore the ultrafast response of plasmonic nanostructures using a novel experimental pump probe scheme that allows the measurement of both first and second order differential reflection. We show that the second order response cannot be explained by linear changes in the dielectric function.

Poster TUE4f.30 17:00

withdrawn

Poster TUE4f.31 17:00

Magnetic field imaging with electron energy loss spectroscopy based on Babinet's principle — •Vlastimil Křápek, Michal Horák, Martin Hrtoň, Andrea Konečná, and Tomáš Šikola — Brno University of Technology, Brno, Czech Republic

We demonstrate the possibility to visualize the electric and magnetic field of localized surface plasmon modes together with the charge and current distribution with electron energy loss spectroscopy combined with Babinet's principle. We also discuss the quantitative limits of this method.

Poster TUE4f.32 17:00

Strong coupling of a plasmonic dark mode with photons in a photonic crystal cavity — Fanqi Meng, Hantian Gu, Mark D. Thomson, and •Hartmut G. Roskos — Physikalisches Institut, Goethe-University, Frankfurt am Main, Germany

We observe strong coupling between the plasmonic dark mode of a metamaterial, designed for electromagnetically induced transparency (EIT), with the photons of a terahertz cavity. The coupling is found to be hierarchical, with the plasmonic dark mode coupling to the polaritons pre-formed between the bright mode and the cavity photons.

Poster TUE4f.33 17:00

All dielectric crescent silicon metasurfaces for biosensing — •Juan Wang[1], Julius Kühne[1], Theodosios Karamanos[2], Carsten Rockstuhl[2], Stefan Maier[1], and Andreas Tittl[1] — [1]. Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, Munich, Germany — [2]Institute of Theoretical Solid State Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany

We demonstrate an all-dielectric crescent metasurface, supporting both photonic quasi-bound states in the continuum (quasi-BICs) and higher-order resonances with tunable quality factors and enhanced electromagnetic fields. We leverage this concept as a label-free sensor for bioassays, where the higher-order resonance outperforms the quasi-BIC for the detection in buffer solution.

Poster TUE4f.34 17:00

High-fidelity biexciton generation in GaAs quantum dots by chirped picosecond pulses through Adiabatic Rapid Passage — •Vikas Remesh[1], Yusuf Karli[1], Florian Kappe[1], Julian Münzberg[1], Santanu Manna[2], Armando Rastelli[2], and Gregor Weihs[1] — [1]Institute for Experimental Physics, University of Innsbruck, Innsbruck, Austria — [2]Institute of Semiconductor and Solid State Physics, Johannes Kepler University of Linz, Linz, Austria

Resonant excitation of the biexciton state in a quantum dot results in entangled photon pair production. We demonstrate a robust, high fidelity preparation of the biexciton state that is insensitive to laser intensity fluctuations and transition dipole moment using chirped laser pulses by adiabatic rapid passage, supported by theoretical simulations.

Poster TUE4f.35 17:00

Atoms near graphene nanoantennas: interplay of optical and electronic coupling — Marvin Müller[1], Miriam Kosik[2], Marta Pelc[2], Garnett Bryant[3,4], Andres Ayuela[5], Carsten Rockstuhl[1,6], and •Karolina Słowik[2] — [1]Institute of Theoretical Solid State Physics, Karlsruhe Institute of Technology (KIT, Karlsruhe, Germany — [2]Institute of Physics, Faculty of Physics Astronomy and Informatics, Nicolaus Copernicus University in Toruń, Toruń, Poland — [3] Joint Quantum Institute, University of Maryland and National Institute of Standards and Technology, College Park, USA — [4]Nanoscale Device Characterization Division, National Institute of Standards and Technology, Gaithersburg, USA — [5]Donostia International Physics Center (DIPC) and Centro de Física de Materiales, San Sebastián / Donostia, Spain — [6] Institute of Nanotechnology, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

A tight-binding approach to model atoms coupled to graphene flake nanoantennas is developed and applied to investigate how generic quantum optical phenomena: the Purcell emission enhancement or Rabi flopping are modified as optical interactions between the flake and the atom are gradually dominated by interactions through electron hopping at short distances.

Poster TUE4f.36 17:00

withdrawn

Poster TUE4f.37 17:00

Strong coupling with WS_2-intrinsic bound states in the continuum — •Thomas Weber[1], Lucca Kühner[1], Julius Kühne[2], Stefan Maier[1,3], and Andreas Tittl[1] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-University Munich, 80539 Munich, Germany — [2]Department of Physics, Technical University Munich, 85748 Garching, Germany — [3]The Blackett Laboratory, Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom

We experimentally demonstrate the existence of bound states in the continuum in extended bulk WS_2 metasurfaces and investigate their enhanced interaction with the A-exciton in the strong-coupling regime.

Poster TUE4f.38 17:00

"Hot" Photoluminescence from metals – theory and comparison to experiments — •Yonatan Sivan and Yonatan Dubi — Ben-Gurion University, Be'er Sheva, Israel

We provide a quantitative theory for the "hot" photoluminescence from illuminated metal nanostructures under continuous wave and pulsed illumination. We show that our theory resolves several decades-long arguments in the literature, and that its predictions match well various experimental predictions, including anti-Stokes emission based thermometry studies.

Poster TUE4f.39 17:00

Distinguishing thermal from non-thermal ("hot") in plasmonic molecular junctions — •Yonatan Dubi[1], IengWai Un[2], and Yonatan Sivan[2] — [1]Department of Chemistry, Ben-Gurion University of the Negev, Be'er Sheva, Israel — [2]School of Electrical Engineering, Ben-Gurion University of the Negev, Be'er Sheva, Israel

We provide a theory for using plasmonic molecular junctions to to distinguish non-thermal electrons from thermal ones in an illuminated plasmonic system. We show how non-thermal electrons can be measured directly and separately from the unavoidable thermal response, and discuss the relevance of our theory to recent experiments.

Poster TUE4f.40 17:00

Chip-based technology for terahertz near-field microscopy and quantitative determination of the local charge carrier density in silicon — Matthias M. Wiecha[1], Alexander V. Chernyadiev[2], Rohit Kapoor[1], Alvydas Lisauskas[1,2,3], and •Hartmut G. Roskos[1] — [1]Physikalisches Institut, Goethe-University , Frankfurt am Main, Germany — [2]CENTERA, Institute of High Pressure Physics, Polish Academy of Sciences, Warsaw, Poland — [3]Institute of Applied Electrodynamics and Telecommunications, Vilnius University, Vilnius, Lithuania

The conductivity of photo-excited and doped silicon samples is measured quantitatively with high spatial resolution with a terahertz (THz) scattering-type Scanning Near-field Optical Microscope (s-SNOM). The setup uses a field-effect transistor for THz detection. Also, first results with CMOS oscillator chips as radiation sources for the s-SNOM are presented.

Poster TUE4f.41 17:00

Polaritons in Two-Dimensional Parabolic Waveguides — •Theis P. Rasmussen[1], P. A. D. Gonçalves[2], Sanshui Xiao[3,4], Sebastian Hofferberth[5], N. Asger Mortensen[1,4,6], and Joel D. Cox[1,6] — [1]Center for Nano Optics, University of Southern Denmark, DK-5230 Odense M, Denmark — [2]ICFO - The Institute of Photonic Sciences, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — [3]Department of Photonics Engineering, Technical University of Denmark, DK-2800 Kongens Lyngby, Denmark — [4]Center for Nanostructured Graphene, Technical University of Denmark, DK-2800 Kongens Lyngby, Denmark — [5]Institute of Applied Physics, University of Bonn, D-53115 Bonn, Germany — [6]Danish Institute for Advanced Study, University of Southern Denmark, DK-5230 Odense M, Denmark

We introduce a formalism to describe channel polaritons propagating in parabolic two-dimensional waveguides, which we apply to the case of graphene plasmons to demonstrate their ability to produce extreme field localization at the parabola vertex that can strongly influence the dynamics of proximal quantum light emitters.

Poster TUE4f.42 17:00

Interaction-driven Circular Dichroism in Triskelia Nanostructures — •Javier Rodríguez-Álvarez[1,2], Albert Guerrero[3], David Bricio-Blázquez[3], Antonio García-Martín[4], Arantxa Fraile Rodríguez[1,2], Xavier Batlle[1,2], and Amílcar Labarta[1,2] — [1]Departament de Física de la Matèria Condensada, Universitat de Barcelona, Barcelona, Spain — [2]Institut de Nanociència i Nanotecnologia (IN2UB), Barcelona, Spain — [3]Institut de Microelectrónica de Barcelona (IMB-CNM, CSIC), Bellaterra, Spain — [4]Instituto de Micro y Nanotecnología IMN-CNM, CSIC, CEI UAM+CSIC, Tres Cantos, Spain

A plasmonic nanostructure with three-fold symmetry showing large dichroic response is studied. Simulations indicate that the interactions between the two elements play a key role on determining the circular dichroism in the total optical loss.

Poster TUE4f.43 17:00

Surface response functions of noble metals for plasmonic applications — •Alvaro Rodriguez Echarri[1], P. André D. Gonçalves[1,2], Christos Tserkezis[2], F. Javier García de Abajo[1,3], N. Asger Mortensen[2,4], and Joel Cox[2,4] — [1]ICFO - The institute of Photonic Sciences, Castelldefels, Spain — [2]Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — [3]ICREA – Institució Catalana de Recerca i Estudis Avançats, Passeig Lluís Companys 23, 08010 Barcelona, Spain, Barcelona, Spain — [4]Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark

We determine a set of surface response functions known as "Feibelman d-parameters" for a variety of noble metals and different crystallographic orientations. We use a rigorous quantum mechanical model to compute them and propose a variety of cases for their use in plasmonic applications.

Poster TUE4f.44 17:00

Optical modes and interaction mechanisms of multiple optical Tamm states in photonic and plasmonic planar crystals — •Manuel Gonçalves — Ulm University - Inst. of Experimental Physics, Ulm, Germany

The coupling of two or more optical Tamm states in planar photonic crystals leads to the formation of two families of topological optical modes in the band gap. In this contribution the physical origin and the optical properties of the modes are analyzed.

Poster TUE4f.45 17:00

Fano resonances in coupled identical spheroidal particles in a symmetric linear arrangement — •Manuel Gonçalves[1], Petros Petrosyan[2], Hayk Minassian[3], and Armen Melikyan[4] — [1]Ulm University – Inst. of Experimental Physics, Ulm, Germany — [2]Yerevan State University, Yerevan, Armenia — [3]A. Alikhanian National Science Laboratory, Yerevan, Armenia — [4]Russian-Armenian (Slavonic) State University, Yerevan, Armenia

The excitation of Fano resonances in plasmonic nanostructures requires a symmetry breaking, or particles of distinct geometries. We show that quadrupole modes, typically non-radiant, can also be collectively excited in an axial symmetric configuration of identical particles, resulting in radiant modes (anti-Fano).

Poster TUE4f.46 17:00

An efficient way of treating changes of the medium surrounding an optical system — •Shaikhah Almousa and Egor Muljarov — Cardiff University, Cardiff, United Kingdom

A novel rigorous approach to calculation of spectral changes of an optical system caused by perturbations of the medium surrounding it is presented. The approach is based on the resonant-state expansion. Experimentally relevant illustrations focus on localized surface plasmon modes of gold nanoparticles and whispering-gallery modes of dielectric micro-resonators.

Poster TUE4f.47 17:00

Bound states in the continuum in finite-size acoustic resonators — •Ilya Deriy, Ivan Toftul, Mihail Petrov, and Andrey Bogdanov — Department of Physics and Engineering, ITMO University, Saint-Petersburg, Russia

We reveal that finite-size solid acoustic resonators immersed in fluid can support genuine bound states in the continuum completely localized inside the resonator. We believe that the revealed novel states will push the performance limits and will serve as high-Q building blocks for various acoustic devices.

Poster TUE4f.48 17:00

Perfect absorption of a focused light beam by a single deep-subwavelength nanoparticle — Alexey Proskurin[1], •Andrey Bogdanov[1], and Denis Baranov[2] — [1]ITMO University, St. Petersburg , Russia — [2]Moscow Institute of Physics and Technology, Dolgoprudny, Russia

We show theoretically that a single deep subwavelength nanoparticle placed on a conducting substrate can perfectly absorb a precisely tailored light beam. Our findings significantly expand the class of the perfect absorption phenomena and offer a new tool for electromagnetic energy harvesting.

Poster TUE4f.49 17:00

Transition metal dichalcogenides nanoparticles produced by femtosecond laser ablation in liquid ambiance for nanophotonic applications — •Gleb Tselikov[1], Anton Popov[2], Georgy Ermolaev[1], Daria Panova[1], Gleb Tikhonowski[2], Alexander Syuy[1], Andrei Kabashin[2,3], Aleksey Arsenin[1], and Valentyn Volkov[1] — [1]Moscow Institute of Physics and Technology, Dolgoprudny, Russia — [2]Moscow Engineering Physics Institute, Moscow, Russia — [3]Aix-Marseille Université, Marseille, France

We demonstrate spherical nanoparticles of tungsten and molybdenum disulfides produced by femtosecond laser ablation in liquids. Performed analysis reveals that produced nanospheres preserve the crystalline structure, high refractive index, support strong excitons and Mie resonances in spectral range 400-700 nm, resulting in enhanced photothermal response probed by Raman spectroscopy

TUE5o: Plenary Talk 3

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

Plenary TUE5o.1 18:30

Nanophotonic tailoring of electron-light interactions — •Marin Soljacic — MIT, Cambridge, USA

We present our recent work on understanding nano-scale phenomena in photonics. We also present our work on interaction on fast electrons with nano-structured materials to produce light. Finally, we discuss novel ways to tailor and enhance scintillation phenomena.

WED1o: Plenary Talk 4

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

Plenary WED1o.1 9:00

Quantum choreography with lightwaves — •Rupert Huber — Department of Physics and Regensburg Center for Ultrafast Nanoscopy, University of Regensburg, Regensburg, Germany

Intense infrared field transients can drive electrons in van der Waals materials along fascinating quantum trajectories, facilitating novel strong-field physics – from optical band structure reconstruction to topological high harmonic generation. In a scanning-tunneling microscope, lightwaves enable ultrafast orbital videography and coherent control of a single-molecule switch by femtosecond atomic forces.

10:00–10:15: Coffee Break

WED2o: Nonlinear / Ultrafast Nanophotonics I

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

Invited WED2o.1 10:15

Real-time imaging of surface waves with nonlinear near-field optical microscopy — •Guy Bartal — The Andrew and Erna Viterbi faculty of electrical and computer engineering, Technion, Haifa, Israel

We introduce a new approach for real-time near-field imaging of evanescent waves using the optical nonlinearity inherent in metals and dielectric surfaces. Our approach provides phase-resolved polarization- and spin-sensitive mappings of near-field patterns using only standard optical components and could be extended to deep sub-wavelength imaging of polaritons in 2D materials and swift characterization of integrated-photonic devices.

Oral WED2o.2 10:45

High Aspect-Ratio Metalenses from Barium Titanate for Nonlinear Applications — •Helena Weigand[1], Viola Vogler-Neuling[1], Oliver Pitz[1], Uelle-Linda Talts[1], Flavia Timpu[1], Artemios Karvounis[1], Joel Winiger[2], Peter Benedek[3], Vanessa Woods[3], Juerg Leuthold[2], and Rachel Grange[1] — [1]ETH Zurich, D-PHYS, Institute for Quantum Electronics, Zurich, Switzerland — [2]ETH Zurich, D-ITET, Institute for Electronics, Zurich, Switzerland — [3]ETH Zurich, D-ITET, Institute of Electromagnetic Fields, , Zurich, Switzerland

Metalenses are powerful thin components for wavefront shaping. While many designs rely on resonances, we present a broadband metalens fabricated by a bottom-up approach from an optically nonlinear material, barium titanate. Achieving an aspect ratio of up to 7, we demonstrate focussing in transmission with 770nm wavelength at 800 μm.

Oral WED2o.3 11:00

Unlocking coherent control of the extreme ultrafast plasmonic excitation — Eyal Bahar, Uri Arieli, Maayan Vizner Stern, and •Haim Suchowski — School of Physics and Astronomy, Faculty of Exact Sciences, Tel Aviv University, Tel Aviv, Israel

We experimentally coherent control the extreme ultrafast excitation in plasmonic nanostructures within their coherence lifetime. We predict and demonstrate a significant enhancement of the nonlinearity greater than the nonlinearity induced by a maximally compressed pulse, suggesting a route for active steering of the ultrafast photo-induced evolution in nanostructures.

WED2s: Topological Nanophotonics

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

Invited WED2s.1 10:15

Skyrmionic Hopfions: particle-like topologies in light — •Mark Dennis[1], Danica Sugic[1,2], Ramon Droop[3], Eileen Otte[3], Daniel Ehrmanntraut[3], Franco Nori[2,4], Janne Ruostekoski[5], and Cornelia Denz[3] — [1]School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom — [2]Theoretical Quantum Physics Laboratory, RIKEN Cluster for Pioneering Research, Saitama, Japan — [3]Institute of Applied Physics and Center for Nonlinear Science (CeNoS), University of Muenster, Muenster, Germany — [4]Physics Department, University of Michigan, Ann Arbor, USA — [5]Physics Department, Lancaster University, Lancaster, United Kingdom

We design, create and measure a topological 3D skyrmionic hopfion in fully structured light. From tailored polarization and phase, every possible optical state occurs in the propagation volume, giving a quantised topological charge of 0.945. This offers photonic analogues to particle-like 3D topological textures, from condensed matter to high-energy physics.

Oral WED2s.2 10:45

Revealing topological and thermodynamic properties of quasicrystals by spatio-temporal near-field microscopy — •Shai Tsesses[1], Pascal Dreher[2], David Janoschka[2], Kobi Cohen[1], Tim Meiler[3], Tomer Bucher[1], Shay Sapir[1], Bettina Frank[3], Tim Davis[2,3], Frank Meyer-zu-Herindorf[2], Harald Giessen[3], and Guy Bartal[1] — [1]Technion - Israel Institute of Technology, Haifa, Israel — [2]University of Duisburg-Essen, Duisburg, Germany — [3]University of Stuttgart, Stuttgart, Germany

We demonstrate topological and thermodynamic properties of quasi-crystals, constituting the first experimental implementation of the full charge-density model. Consolidating phase-resolved SNOM and ultrafast 2PPE-PEEM measurements on pentagonal plasmonic quasi-lattices, we reveal their 4D topological charge and a temporal change in their local isomorphism, akin to a change in free energy.

Oral WED2s.3 11:00

Propagating Electromagnetic Skyrmions — Yijie Shen[1], •Nikitas Papasimakis[1], and Nikolay I. Zheludev[1,2] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

We report on a new family of light pulses of toroidal topology - the exact solutions of Maxwell's equation - with skyrmionic field structure, termed Supertoroidal Light Pulses.

Oral WED2o.4 11:15

Strong Exciton-plasmons interactions in WSe2 flakes positioned on top of an Au lattice investigated using cathodoluminescence spectroscopy — •Masoud Taleb[1], Fatemeh Davoodi[1], Florian Diekmann[1], Kai Rossnagel[1,2], and Nahid Talebi[1] — [1]Christian-Albrechts-Universität zu Kiel, Kiel, Germany — [2]Ruprecht Haensel Laboratory, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

In this study, we use cathodoluminescence spectroscopy to investigate the exciton-plasmon interactions between the WSe2 lattice and the periodic hole structure incorporated gold substrate. Experimental results fallowed by numerical simulations enabled us to map the spatio-spectral near-field distribution of the optical modes in the visible to the near-infrared spectral ranges

Oral WED2o.5 11:30

Broadband nonlinear strongly-coupled hybrid nanostructures obtained by near field inverse design — •Yael Blechman[1], Shai Tsesses[1], Euclides Almeida[2], and Guy Bartal[1] — [1]Technion - Israel Institute of Technology, Haifa, Israel — [2]Queens College, City University of New York, Flushing, NY, USA

We develop a simple yet powerful strategy for nonlinear broadband control in hybrid structures of plasmonic metasurfaces coupled to atomically thin semiconductors. Our method is based on inverse design of the metasurface's near-field enhancement which achieves significant strong cavity-emitter coupling, and it is robust to geometric variations of the metasurface.

Oral WED2o.6 11:45

Two-photon pumped exciton-polariton condensation — •Nadav Landau[1], Dmitry Panna[1], Sebastian Brodbeck[2], Christian Schneider[3], Sven Höfling[2], and Alex Hayat[1] — [1]Technion – Israel Institute of Technology, Haifa, Israel — [2]University of Würzburg , Würzburg , Germany — [3]Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

We report the first experimental observation of two-photon pumped polariton condensation, demonstrated by angle-resolved photoluminescence in a GaAs-based microcavity. Our results pave the way towards polariton-based THz lasing and coherent control of collective quantum states with individual qubits.

Oral WED2o.7 12:00

Efficient frequency conversion with geometric phase control in metasurfaces — •Basudeb Sain[1], Bernhard Reineke Matsudo[1], Luca Carletti [2], Xue Zhang[3], Wenlong Gao[1], Costantino de Angelis [2], Lingling Huang[3], and Thomas Zentgraf[1] — [1]Department of Physics, Paderborn University, Paderborn, Germany — [2]Department of Information Engineering and National Institute of Optics, University of Brescia, Brescia, Italy — [3]School of Optics and Photonics, Beijing Institute of Technology, Beijing, China

We present an effective solution for the nonlinear generation and manipulation of light at the nanoscale. We efficiently combined the concept of geometric-phase with the spatial electromagnetic-modes in silicon-metasurface for robust manipulation of the third-harmonic phase and practical realization of nonlinear vortex arrays at a conversion efficiency of 10^-4 W^-2.

Oral WED2s.4 11:15

Topological Floquet engineering of plasmonic waveguide arrays: Fast Thouless pumps and anomalous π-modes — •Anna Sidorenko, Zlata Fedorova, and Stefan Linden — Physikalisches Institut, Universität Bonn, Bonn, Germany

Floquet engineering is a powerful method to tailor topological properties of plasmonic waveguide arrays. Here, we demonstrate that time-periodic modulation of dissipation can restore transport quantization in fast Thouless pumps and report on the observation of the anomalous π-mode at optical frequencies.

Invited WED2s.5 11:30

Topological insulator vertical-cavity laser array — Alex Dikopoltsev[1], Tristan H. Harder[2], Eran Lustig[1], Oleg A. Egorov[3], Johannes Beierlein[2], Adriana Wolf[2], Yaakov Lumer[1], Monika Emmerling[2], Christian Schneider[4], Sven Höfling[2], Moti Segev[1], and •Sebastian Klembt[2] — [1]Physics Department, Technion, Haifa, Israel — [2]Chair for Applied Physics, Wilhelm-Conrad-Röntgen-Research Center for Complex Material Systems, and Würzburg-Dresden Cluster of Excellence ct.qmat, Würzburg, Germany — [3]ITFO, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany — [4]Institute of Physics, University of Oldenburg, Oldenburg, Germany

We present the first experimental demonstration of a topological insulator VCSEL array. Using the crystalline topological insulator model, we implement a 30 vertical-emitter array displaying an extended coherent mode lasing at a single wavelength.

Oral WED2s.6 12:00

Topological spin-Hall exciton-polaritons in transition metal dichalcogenide monolayers — •Ivan Sinev[1], Mengyao Li[2,3,4], Fedor Benimetskiy[1], Tatyana Ivanova[1], Svetlana Kiriushechkina[2], Anton Vakulenko[2], Sriram Guddala[2,3], Dmitry Krizhanovskii[1,5], Andrea Alu[2,4,6], Anton Samusev[1], and Alexander Khanikaev[2,3,4] — [1]Department of Physics, ITMO University, St. Petersburg, Russia — [2]Department of Electrical Engineering, City College of New York, New York, USA — [3]Physics Department, City College of New York, New York, USA — [4]Physics Program, Graduate Center of the City University of New York, New York, USA — [5]Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom — [6]Photonics Initiative, Advanced Science Research Center, City University of New York, New York, USA

We explore topological Z_2 exciton polaritons which are formed in a topological photonic metasurface coupled to $MoSe_2$ and WSe_2 monolayers. We experimentally demonstrate the transfer of topological charge from photonic to polaritonic band with the onset of strong coupling regime and confirm the presence of one-way spin-polarized edge topological polaritons.

12:15–16:15: Lunch Break

WED3o: Technology Talk 3 - Attocube (Neaspec)

Time: Wednesday, 16:15–17:00 Location: Olympia

Technology WED3o.1 16:15

Infrared correlation nanoscopy with unprecedented spectral coverage — •Andreas Huber and Stefan Mastel — Attocube systems AG, Haar, Germany

We introduce a new tunable laser source optimized for IR nanoscopy applications which covers a spectral range of 2-18μm. We demonstrate correlative scattering-type near-field (s-SNOM) and photothermal expansion based point spectroscopy and imaging for studying local chemical composition and the related phase separation in a thin film polymer blend sample.

WED4o: Novel Topics I

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

Oral WED4o.1 17:00

Solving integral equations in free-space with inverse-designed ultrathin optical metagratings — •Andrea Cordaro[1], Brian Edwards[2], Vahid Nikkhah[2], Andrea Alù[3], Nader Engheta[2], and Albert Polman[1] — [1]AMOLF, Amsterdam, Netherlands — [2]University of Pennsylvania, Philadelphia, USA — [3]Advanced Science Research Center - CUNY, New York, USA

Inverse designed metasurfaces can solve prescribed Fredholm integral equations at optical wavelengths. To this end, a mirror is included to provide the feedback required to perform the Neumann series that solves the equation.

Oral WED4o.2 17:15

Observation of strong localization beyond the spectrum of the disorder — •Alex Dikopoltsev[1], Sebastian Weidemann[2], Mark Kremer[2], Andrea Steinfurth[2], Hanan Herzig Sheinfux[3], Alexander Szameit[2], and Mordechai Segev[1] — [1]Physics Deparment, Technion, Haifa, Israel — [2]Institute for Physics, University of Rostock, Rostock, Germany — [3]ICFO - Institute of Photonic Sciences, Barcelona, Spain

Anderson localization was thus far demonstrated for wavepackets whose spectral extent resides within the wavenumber span of the disorder. We observe experimentally that virtual transitions can cause localization beyond the spectrum of the disorder, without any first-order scattering processes. We implement this in time-bin encoded 1+1D lattices in fiber loops.

Oral WED4o.3 17:30

Spherical spoof localised plasmon scatterers at microwave frequencies — •Alexander Powell[1], Tom Whittaker[2], Will Whittow[2], Roy Sambles[1], and Alastair Hibbins[1] — [1]University of Exeter, Exeter, United Kingdom — [2]University of Loughborough, Loughborough, United Kingdom

We demonstrate the first example of a fully 3D structure supporting a series of localised resonances analogous to surface plasmons found in a metallic nanosphere. This design agrees well with an effective medium model for a metal sphere with a microwave plasma frequency. 3D-printed samples show excellent agreement with simulations.

WED4s: Nonlinear / Ultrafast Nanophotonics II

Time: Wednesday, 17:00–18:15 Location: Seefeld/Tirol

Oral WED4s.1 17:00

Nonlinear and nonlocal plasmonic response of crystalline atomically-thick films — •Alvaro Rodriguez Echarri[1], Joel Cox[2,3], Fadil Iyikanat[1], and F. Javier García de Abajo[1,4] — [1]ICFO - The institute of Photonic Sciences, Castelldefels, Spain — [2]Center for Nano Optics, University of Southern Denmark, Odense, Denmark — [3]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark — [4]ICREA – Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

Recent developments in the fabrication of atomically thin metal films with well-defined crystalline orientation support the use of this type of material for the next generation of plasmonic devices. Here, we investigate the nonlinear optical properties of few-atom-tick films through rigorous quantum-mechanical simulations for noble metals and different crystallographic orientations.

Oral WED4s.2 17:15

Nonlinear photonic crystal L3 cavities out of soft-nanoimprinted barium titanate — •Viola Valentina Vogler-Neuling[1], Ülle-Linda Talts[1], David Pohl[1], Helena C. Weigand[1], Artemios Karvounis[1], Joel Winiger[2], Peter Benedek[3], Vanessa Wood[3], Jürg Leuthold[2], and Rachel Grange[1] — [1]ETH Zurich, Department of Physics, Institute for Quantum Electronics, Optical Nanomaterial Group, Zurich, Switzerland — [2]ETH Zurich, Department of Information Technology and Electrical Engineering, Institute of Electromagnetic Fields, Zurich, Switzerland — [3]ETH Zurich, Department of Information Technology and Electrical Engineering, Materials and Device Engineering Group, Zurich, Switzerland

Nonlinear metal-oxides broadly transparent as barium titanate are difficult to top-down nanostructure. We demonstrate bottom-up soft-nanoimprinted L3 cavities from barium titanate with critical dimensions of 60 nm based on a sol-gel chemistry synthesis.

Oral WED4s.3 17:30

Tunable nonlinear vibrational response of monolayer hBN — •Fadil Iyikanat[1], Andrea Konečná[1], and F. Javier García de Abajo[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Barcelona, Spain — [2]ICREA-Institució Catalana de Recerca i Estudis Avançats, Passeig Lluís Companys, Barcelona, Spain

Based on first-principles calculations, we investigate the linear and nonlinear optical response of monolayer hBN in the mid-infrared polaritonic region following time-domain and perturbative schemes. We find that strongly anharmonic potentials associated with atomic vibrations, giving rise to relatively intense second- and third-harmonic generation as well as sizable Kerr nonlinearity.

Oral WED4o.4 17:45
withdrawn

Oral WED4o.5 18:00
Resonant Electronic Transport in Strongly Coupled Metasurfaces — •Benedikt Limbacher[1,2], Martin A. Kainz[1,2], Sebastian Schönhuber[1,2], Moritz Wenclawiak[1,2], Christian Derntl[1,2], Aaron M. Andrews[2,3], Hermann Detz[2,3,4], Gottfried Strasser[2,3], Andreas Schwaighofer[5], Bernhard Lendl[5], Juraj Darmo[1], and Karl Unterrainer[1,2] — [1]Photonics Institute, TU Wien, Vienna, Austria — [2]Nano-Center, TU Wien, Vienna, Austria — [3]Institute of Solid State Electronics, TU Wien, Vienna, Austria — [4]Central European Institute of Technology, Brno, Czech Republic — [5]Institute of Chemical Technologies and Analytics, TU Wien, Vienna, Austria

We present resonant electronic transport in a system with a strong hybridization between the cavity field and intersubband transitions. We show that by applying an electric current we can modulate the optical response of the metasurface and present future developements in the field of intersubband polaritons.

Oral WED4s.4 17:45
Infrared-visible sum-frequency generation microscopy of phonon polariton resonances in SiC nanostructures — •Sören Wasserroth[1], Richarda Niemann[1], Guanyu Lu[2], Christopher R. Gubbin[3], Martin Wolf[1], Simone De Liberato[3], Joshua D. Caldwell[2], and Alexander Paarmann[1] — [1]Fritz-Haber-Institute, Berlin, Germany — [2]Vanderbilt University, Nashville, USA — [3]University of Southampton, Southampton, United Kingdom

I present a new approach of infrared super-resolution microscopy employing infrared-visible sum-frequency generation in a wide field scheme. As first results, I show images of surface phonon polariton resonances in SiC nanopillars and nanorods. The mode structure in arrays of nanopillars and inside of nanorods is resolved.

Oral WED4s.5 18:00
Tunable Fano Resonance in Perovskite thin film coupled to Hyperbolic Metamaterial Nanocavity Array — •S R K Chaitanya Indukuri, Amit Kessel, Christian Frydendahl, Eitan Edrei, Noa Mazurski, and Uriel Levy — Hebrew university, Jerusalem, Israel

We demonstrate experimentally tunable Fano resonance in organic-inorganic perovskite thin-film coupled to nano-scale hyperbolic metamaterial cavity array

18:15–18:30: Coffee Break

WED5o: Picophotonics

Time: Wednesday, 18:30–20:00 Location: Olympia

Invited WED5o.1 18:30
Light emission in extreme nanocavities: from intramolecular resolution to complex single photon emission — •Javier Aizpurua — Center for Materials Physics (CSIC-UPV/EHU), San Sebastian, Spain

We explore the use of plasmonic picocavities to obtain light emission from single organic molecules in a tunnelling junction and interpret their intensity, Purcell effect, and Lamb shift maps. Furthermore, the role of dark states to interpret the complex dynamics of quantum dot emission from a bowtie nanoantenna is unveiled.

Oral WED5o.2 19:00
Coordinate nanometrology of coronavirus-like nanoparticle with topologically structured light — •Yu Wang[1], Kevin F. MacDonald[1], Eric Plum[1], Jun-Yu Ou[1], and Nikolay I. Zheludev[1,2] — [1]Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — [2]Centre for Disruptive Photonic Technologies, School of Physical and Mathematical Sciences & The Photonics Institute, Nanyang Technological University, Singapore, Singapore

Scattering by a subwavelength particle in a structured light field containing phase singularities is highly sensitive to the particle's position. Artificial intelligence-enabled analysis of superoscillatory light field scattering, at a wavelength of 490 nm, provides for experimental determination of the 3D position of 100 nm polystyrene spheres with nanometric accuracy.

WED5s: Electron – Photon Interaction II

Time: Wednesday, 18:30–19:30 Location: Seefeld/Tirol

Invited WED5s.1 18:30
Holography, nanothermometry, and quantum correlations in extreme near fields probed with high-energy electrons — •Albert Polman — NWO-Institute AMOLF, Amsterdam, Netherlands

We use time-resolved cathodoluminescence spectroscopy using 30-keV electrons to reveal the emission statistics of optical emitters, use holography to reveal the phase distribution of plasmonic scattering wavefronts, demonstrate nanothermometry, and let the electrons climb quantum ladders creating superpositions states in extreme near fields shaping electron wavepackets in space and time.

Oral WED5s.2 19:00
Modulation of Cathodoluminescence Emission by Interference with External Light — •Valerio Di Giulio[1], Ofer Kfir[2,3], Claus Ropers[3,4], and F. Javier García de Abajo[1,5] — [1]ICFO - The Institute of Photonic Sciences, Casteldefels, Barcelona, Spain — [2]Tel Aviv University, School of Electrical engineering, Tel Aviv, Israel — [3]MPIBPC - Max Planck Institute for Biophysical Chemistry , Göttingen, Germany — [4]University of Göttingen, IV. Physical Institute, Göttingen, Germany — [5]ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We explore the role of electron wave function plays in cathodoluminescence emission when an external laser pulse is synchronized with the electron probe at the sample. We show the far-field emission being composed by coherent and incoherent contributions where the latter is only tuned by changing the electron density profile.

Oral WED5o.3 19:15

Thermal fluctuations in the optical properties of dielectric and plasmonic nanomechanical metamaterials — •Jun-Yu Ou[1], Dimitrios Papas[1], Tongjun Liu[1], Jinxiang Li[1], Eric Plum[1], Kevin F. MacDonald[1], and Nikolay I. 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

We experimentally observe that fluctuations in metamaterial optical properties peak at the frequencies of the nanostructures' natural mechanical modes, due to 'Brownian' motion. Fluctuations in flexural phonon density are the underlying mechanism for this motion, which is observed as fluctuations in optical properties reaching 1% at room temperature.

Invited WED5o.4 19:30

Harnessing polaritons in extreme nanocavities — •Sang-Hyun Oh — University of Minnesota, Minneapolis, USA

We present new approaches to design and fabricate resonant cavities – both horizontal (image polariton resonator) and vertical (epsilon-near-zero coaxial ring) configurations – and reach the ultrastrong light-matter coupling regime.

Oral WED5s.3 19:15

Atomic Floquet physics revealed by free electrons — •Eduardo Arqué López[1], Valerio Di Giulio[1], and F. Javier García de Abajo[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — [2]ICREA-Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain

We theoretically investigate the ability of free electrons to probe the nonlinear Floquet dynamics of atomic systems under intense illumination. We observe multiple features in the electron energy-loss spectra that originate in the steady-state evolution of the atomic system and are associated with direct electron-photon exchanges and intensity/frequency-dependent Floquet resonances.

WED6s: Novel Topics II

Time: Wednesday, 19:30–20:00 Location: Seefeld/Tirol

Oral WED6s.1 19:30

Hot electrons in metal nanostructures – "reality" or "fake news"? — •Yonatan Sivan, Ieng Wai Un, Joshua Baraban, and Yonatan Dubi — Ben-Gurion University, Beer Sheva, Israel

We provide a first-of-its-kind theory for electron non-equilibrium in metals which reveals the extreme smallness of non-thermal effects compared to thermal effects. Together with extensive numerical simulations, we show that some high-impact plasmon-assisted photocatalysis experiments incorrectly associate their results with non-thermal electrons, while a thermal model explains the data perfectly.

Oral WED6s.2 19:45

Near-field spectroscopy of phonon polariton antenna arrays — •Andrea Mancini[1], Christopher R. Gubbin[2], Rodrigo Berté[1], Francesco Martini[2], Alberto Politi[2], Emiiano Cortés[1], Yi Li[3], Simone De Liberato[2], and Stefan A. Maier[1] — [1]Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maxilimians-Universität München, Munich, Germany — [2]School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom — [3]School of Microelectronics, MOE Engineering Research Center of Integrated Circuits for Next Generation Communications, Southern University of Science and Technology, Shenzhen, China

Applications involving optical antennas often require knowledge of their near-field response. We investigate here the near-field spectral response of arrays of Silicon Carbide antennas supporting localized phonon polaritons in the mid-IR with scattering scanning near field microscopy and discuss the influence of the AFM tip on the experimental results.

THU1o: Plenary Talk 5

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

Plenary THU1o.1 9:00

Quantum Optics with Free Electrons — •Ido Kaminer — Technion, Haifa, Israel

We study free-electron quantum optics at the nanoscale, observing the first coherent interaction of free electrons with photonic cavities and first interaction with the quantum statistics of photons. Looking forward, we envision using free electrons as carriers of quantum information and for measurement of quantum coherence of individual quantum systems

10:00–10:15: Coffee Break

THU2o: Mixed Topics I

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

Invited THU2o.1 10:15

Nanophotonic chiral sensing: How does it actually work? — Steffen Both[1], Egor A. Muljarov[2], Harald Giessen[1], and •Thomas Weiss[1,3] — [1]4th Physics Institute, Univ. of Stuttgart and Research Center SCoPE, Stuttgart, Germany — [2]Cardiff University, School of Physics and Astronomy, Cardiff, United Kingdom — [3]Institute of Physics, University of Graz, and NAWI Graz, Graz, Austria

We present a general and rigorous theory of chiral light-matter interactions in optical resonators. Our theory describes the chiral interaction as a perturbation of the resonant states, also known as quasi-normal modes. We observe two dominant contributions: A chirality-induced resonance shift and changes in the modes' excitation and emission efficiencies.

Invited THU2o.2 10:45

Quantum Photonics Empowered by Plasmonics and Machine Learning — Alexandra Boltasseva and •Vladimir Shalaev — Purdue University, West Lafayette, USA

Recent ideas and developments on how plasmonics and machine learning can advance the field of metasurfaces, and integrated nano- and quantum photonics will be overviewed. Specifically, machine-learning assisted design, quantum measurements and imaging will be discussed.

Oral THU2o.3 11:15

Room–temperature low–voltage manipulation of excitons in transition metal dichalcogenide monolayers — •Sergii Morozov[1,2], Christian Wolff[1], and N. Asger Mortensen[1,2,3] — [1]Center for Nano Optics, University of Southern Denmark, Odense , Denmark — [2]Center for Nanostructured Graphene, Technical University of Denmark, Kongens Lyngby, Denmark — [3]Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark

Charge doping of materials with 2D and 3D quantum confinement is a flexible tool to tailor their excitonic emission. Here, using electron doping experiments on transition metal dichalcogenide (TMD) monolayers, we demonstrate reversible tuning of exciton emission by applying modest voltages, while also controlling the radiative lifetime and intensity.

THU2s: Mixed Topics II

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

Invited THU2s.1 10:15

Novel approaches for chip scale light vapor interactions — Roy Zektzer, Alex Naiman, Noa Mazurski, Eliran Talker, Liron Stern, and •Uriel Levy — HUJI, Jerusalem, Israel

We discuss and demonstrate recent progress related to chip scale interaction between light and atomic vapor at the nanoscale and approaches to overcome limitations imposed by strong confinement of light.

Oral THU2s.2 10:45

Nanoengineering of Light Absorption: from Hot Carriers to Thermo-optical Effects — •Giulia Tagliabue — Laboratory of Nanoscience for Energy Technologies (LNET), EPFL, Lausanne, Switzerland

By engineering light absorption in dielectric and metallic nanoantennas, we explore new opportunites for harnessing plasmonic hot carriers and modulating dielectric nanoresonators.

Oral THU2s.3 11:00

Coupling solid state quantum emitters to low loss plasmonic waveguides — •Paul Steinmann and Stefan Linden — Physikalisches Institut, Universität Bonn, Bonn, Germany

Low loss dielectric loaded surface plasmon polariton waveguides coupled to solid-state quantum emitters offer an exciting framework for quantum circuit applications. Here, waveguides with a MoSe2 monolayer on top are analysed. In addition to the exciton- and trion-emission lines of the monolayer, discrete quantum emitter like emission peaks are observed.

Invited THU2s.4 11:15

Simulating quantum nanophotonics on the IBM quantum computer — •Anton N. Vetlugin[1], Cesare Soci[1], and Nikolay I. Zheludev[1,2] — [1]Nanyang Technological University, Singapore, Singapore — [2]University of Southampton, Southampton, United Kingdom

We show how phenomena and devices of quantum optics can be modelled on a quantum computer. We illustrate this by exploring single-photon quantum interference on the plasmonic metamaterial using a "quantum copy" of the physical experiment replicated on the transmon, a superconducting charge device of the IBM quantum computer.

Oral THU2o.4 11:30

Continuous-Wave Frequency Upconversion with a Molecular Optomechanical Nanocavity — •Wen Chen[1], Philippe Roelli[1], Huatian Hu[2], Sachin Verlekar[1], Sakthi Priya Amirtharaj[1], Angela I. Barreda[3], Tobias J. Kippenberg[1], Miroslavna Kovylina[4], Ewold Verhagen[5], Alejandro Martinez[4], and Christophe Galland[1] — [1]Ecole Polytechnique Fédérale de Lausanne , Lausanne, Switzerland — [2]Hubei Key Laboratory of Optical Information and Pattern Recognition,Wuhan Institute of Technology, Wuhan, China — [3]Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Germany, Germany — [4]Nanophotonics Technology Center, Universitat Politècnica de València, Camino de Vera s/n, Valencia, Spain — [5]Center for Nanophotonics, AMOLF, Amsterdam, Netherlands

I will present the first experimental demonstration of using a dual-band plasmonic nanocavity hosting a few hundred molecules to realize the optomechanical transduction of sub-um continuous wave signals from the mid-infrared onto the visible domain at ambient conditions, with 13 orders of magnitude enhancement in upconversion efficiency. (Science, in press)

Breakthrough THU2o.5 11:45

Optical metrology with sub-atomic resolution — •Kevin F. MacDonald[1], Tongjun Liu[1], Jun-Yu Ou[1], and Nikolay I. Zheludev[1,2] — [1]University of Southampton, Southampton, United Kingdom — [2]Nanyang Technological University, Singapore, Singapore

The relative positions of nanostructures can be measured with picometric resolution using scattering of free electrons or topologically structured light at sharp edges of the structures. Through artificial intelligence-enabled analysis of scattered coherent light, sub-atomic resolution is achievable in single-shot measurements.

Breakthrough THU2s.5 11:45

Active van der Waals optical metasurfaces — •Harry Atwater — California Institute of Technology (Caltech), Pasadena, CA, USA

Abstract

THU3o: Closing Remarks by Nikolay Zheludev and Harald Giessen

Time: Thursday, 12:15–12:30 Location: Olympia

Closing Remarks

12:30–13:30: Beer Reception

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