# Table of Contents

Digest and Copyright Information ................................................................. 2  
Sponsors and Partners ................................................................. 3  
Exhibitors ................................................................. 4  

General Information ............................................................................. 5  
  Poster Session / Poster Prizes / Instructions for Poster presenters ..................... 5  
  Speakers’ Information ........................................................................ 5  
  Reception ....................................................................................... 5  
  Conference Language / Conference Digest ................................................. 5  
  On-site Facilities ........................................................................ 6  
  Registration Information ................................................................. 6  
  Conference Help Desk / Conference Hours / Photography ......................... 6  
  Conference Management .................................................................. 6  
  Conference Location ........................................................................ 6  
  Information on Austria and Seefeld ......................................................... 7  
  Conference Committee ...................................................................... 8  

Programme at a Glance ........................................................................ 9  

Plenary Talks at a Glance ..................................................................... 12  

Breakthrough Talks at a Glance ............................................................... 13  

Invited Talks at a Glance ..................................................................... 14  

Technical Programme

  Monday ....................................................................................... 17  
  Tuesday ...................................................................................... 21  
  Wednesday .............................................................................. 29  
  Thursday .................................................................................... 34  

Authors’ Index ................................................................................... 36
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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Partner:

- https://www.mdpi.com/journal/photonics
Exhibitors:

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Eglfinger Weg 2
85540 Haar, Germany
Phone: +49 89 420 797 0
Email: info@attocube.com
Web: https://www.attocube.com/

*attocube* systems was founded in 2001 and is recognized for innovation and excellence in the development, the production, and the distribution of cutting-edge components and solutions for nanoscale applications in research and industry. The business sector ‘Nanoscale Analytics’ (formerly neaspec GmbH) designs, manufactures and distributes advanced microscopy solutions for nanoscale-resolved optical imaging and spectroscopy using ground-breaking and patented technologies that enable to surpass the diffraction-limited spatial resolution of conventional microscopes. neaspec instruments combine the best of two worlds – the nanoscale resolution of atomic force microscopy with the analytical power of optical spectroscopy in the visible, infrared and even THz spectral ranges, opening a new era in fundamental and applied research. The products received various prestigious awards and are highly regarded in the scientific community. A skilled team with decades of applications experience guarantees highest levels of instrument performance, consulting competence, comprehensive on-site installation service and excellent after-sales support.

**Heidelberg Instruments Mikrotechnik GmbH**
Mittelgewannweg 27
69123 Heidelberg, Germany
Phone: +49 6221 728899 0
Email: sales@heidelberg-instruments.com
Web: https://heidelberg-instruments.com/

Heidelberg Instruments is a world leader in the development and production of high precision photolithography systems, maskless aligners and nanofabrication tools. With over 35 years of experience and more than 1,000 systems installed worldwide in industrial and academic facilities, we provide lithography solutions specifically tailored to meet all your micro- and nanofabrication requirements – no matter how challenging.

**Nanoscribe GmbH & Co. KG**
Hermann-von-Helmholtz-Platz 6
76344 Eggenstein-Leopoldshafen, Germany
Phone: +49 721 981 980 207
Email: j.zimmer@nanoscribe.com
Web: https://www.nanoscribe.com/

With over 80 highly qualified employees, we develop products and services on the basis of Nanoscribe’s Two-Photon Polymerization technology. Providing hardware, software, materials and processes as a complete solution is the key to our customers’ success today. More than 3,000 active operators of our systems located in over 30 countries benefit from the continuous advancement of our technology. With our market leadership we remain profitable, so we constantly invest more than 25% of our annual sales in the future of microfabrication. Thus, we deliver smart solutions that inspire our customers and enable them to materialize ground-breaking ideas.
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

<table>
<thead>
<tr>
<th>Date</th>
<th>Times</th>
</tr>
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<tbody>
<tr>
<td>Sunday 27 March 2022</td>
<td>17:00-18:00</td>
</tr>
<tr>
<td>Monday 28 March 2022</td>
<td>08:00-12:00 and 16:00-18:00</td>
</tr>
<tr>
<td>Tuesday 29 March 2022</td>
<td>08:30-11:30 and 16:00-18:00</td>
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<td>Wednesday 30 March 2022</td>
<td>08:30-11:30 and 16:00-18:00</td>
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<tr>
<td>Thursday 31 March 2022</td>
<td>08:30-11:00</td>
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Conference Hours

<table>
<thead>
<tr>
<th>Date</th>
<th>Times</th>
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<tbody>
<tr>
<td>Monday 28 March 2022</td>
<td>08:45-12:15 and 16:15-19:45</td>
</tr>
<tr>
<td>Tuesday 29 March 2022</td>
<td>09:00-12:15 and 16:15-19:30</td>
</tr>
<tr>
<td>Wednesday 30 March 2022</td>
<td>09:00-12:15 and 16:15-20:00</td>
</tr>
<tr>
<td>Thursday 31 March 2022</td>
<td>09:00-12:30</td>
</tr>
</tbody>
</table>

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.
Photographs of PowerPoint or other slides are for personal use only and are not to be reproduced or distributed.

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. Nanometra 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.
Programme Committee Members:

- Hatice Altug, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
- Harry Atwater, California Institute of Technology (Caltech), Pasadena, CA, USA
- Dmitri Basov, Columbia University, New York, NY, USA
- Alexandra Boltasseva, Stanford University, Stanford, CA, USA
- Daniel Brunner, University of Franche-Comté, FEMTO-ST, Besançon, France
- Claudio Conti, Sapienza Università di Roma, Rome, Italy
- Mark Dennis, University of Birmingham, Birmingham, United Kingdom
- Daniele Faccio, University of Glasgow, Glasgow, United Kingdom
- Shanhui Fan, Stanford University, Stanford, CA, USA
- Oliver Graydon, Nature Photonics, London, United Kingdom
- Uriel Levy, Hebrew University of Jerusalem, Jerusalem, Israel
- Cun-Zheng Ning, Tsinghua University, Beijing, China
- Ian Osborne, Science Magazine, Cambridge, United Kingdom
- Arno Rauschenbeutel, Vienna University of Technology, Vienna, Austria
- Junsuk Rho, Pohang University of Science and Technology (POSTECH), Pohang, South Korea
- Volker Sorger, The George Washington University, Washington, DC, USA
- Alexander Szameit, University of Rostock, Rostock, Germany

Programme at a Glance

### Monday 28 March 2022

<table>
<thead>
<tr>
<th>Olympia Room</th>
<th>Seefeld/Tirol Room</th>
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<tbody>
<tr>
<td><strong>08:45-10:00</strong></td>
<td><strong>10:15-12:00</strong></td>
</tr>
<tr>
<td>Oral session MON1o</td>
<td>Oral session MON2s</td>
</tr>
<tr>
<td>Opening Remarks and Plenary Talk 1</td>
<td>Electron - Photon Interaction</td>
</tr>
<tr>
<td><strong>10:00-10:15</strong></td>
<td><strong>10:15-12:00</strong></td>
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<tr>
<td>Coffee Break (Olympia lobby)</td>
<td></td>
</tr>
<tr>
<td><strong>10:15-12:15</strong></td>
<td><strong>10:15-19:00</strong></td>
</tr>
<tr>
<td>Oral session MON2o</td>
<td>Oral session MON4s</td>
</tr>
<tr>
<td>Active and Switchable Metamaterials</td>
<td>2D Matter</td>
</tr>
<tr>
<td><strong>12:15-16:15</strong></td>
<td><strong>12:00-16:15</strong></td>
</tr>
<tr>
<td>Lunch Break</td>
<td>Lunch Break</td>
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<tr>
<td><strong>16:15-17:00</strong></td>
<td><strong>17:00-19:00</strong></td>
</tr>
<tr>
<td>Oral session MON3o</td>
<td>Oral session MON4s</td>
</tr>
<tr>
<td>Technology Talk 1 - Heidelberg Instruments Nano AG</td>
<td>2D Matter</td>
</tr>
<tr>
<td><strong>17:00-19:00</strong></td>
<td><strong>17:00-19:00</strong></td>
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<tr>
<td>Oral session MON4o</td>
<td>Oral session MON4s</td>
</tr>
<tr>
<td>Switchable and Dielectric Metamaterials</td>
<td>2D Matter</td>
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<tr>
<td><strong>19:00-19:15</strong></td>
<td><strong>19:00-19:15</strong></td>
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<tr>
<td>Coffee Break (Olympia lobby)</td>
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<td><strong>19:15-19:45</strong></td>
<td><strong>19:15-19:45</strong></td>
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<tr>
<td>Oral session MON5o: Breakthrough Talk 1</td>
<td>Oral session MON5s: Breakthrough Talk 2</td>
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### Programme at a Glance

#### Tuesday 29 March 2022

<table>
<thead>
<tr>
<th>Time</th>
<th>Location</th>
<th>Session Description</th>
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<tbody>
<tr>
<td>09:00-10:00</td>
<td>Olympia Room</td>
<td>Oral session TUE01 Plenary Talk 2</td>
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<tr>
<td>10:00-10:15</td>
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<td>Coffee Break (Olympia lobby)</td>
</tr>
<tr>
<td>10:15-12:15</td>
<td>Seefeld/Tirol Room</td>
<td>Oral session TUE20 Quantum Nanophotonics</td>
</tr>
<tr>
<td>12:15-16:15</td>
<td></td>
<td>Lunch Break</td>
</tr>
<tr>
<td>16:15-17:00</td>
<td>Olympia Room</td>
<td>Oral session TUE30 Technology Talk 2 - Nanoscribe</td>
</tr>
<tr>
<td>17:00-18:30</td>
<td>FOYER Olympia</td>
<td>Poster Session TUE4f With snacks and drinks</td>
</tr>
<tr>
<td>18:30-19:30</td>
<td>Olympia Room</td>
<td>Oral session TUE50 Plenary Talk 3</td>
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### NANOMETA 2022 Programme at a Glance

#### Wednesday 30 March 2022

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<tbody>
<tr>
<td>09:00-10:00</td>
<td>Oral session WED1o Plenary Talk 4</td>
<td></td>
</tr>
<tr>
<td>10:00-10:15</td>
<td>Coffee Break (Olympia lobby)</td>
<td>Oral session WED2s Topological Nanophotonics</td>
</tr>
<tr>
<td>10:15-12:15</td>
<td>Oral session WED2o Nonlinear / Ultrafast Nanophotonics I</td>
<td>10:15-12:15</td>
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<tr>
<td>12:15-16:15</td>
<td>Lunch Break</td>
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<tr>
<td>16:15-17:00</td>
<td>Oral session WED3o Technology Talk 3 - Attocube (Neaspec)</td>
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<tr>
<td>17:00-18:15</td>
<td>Oral session WED4o Novel Topics I</td>
<td>17:00-18:15</td>
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<td>Coffee Break (Olympia lobby)</td>
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<tr>
<td>18:30-20:00</td>
<td>Oral session WED5o Picophotonics</td>
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#### Thursday 31 March 2022

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

TUE01: 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.

TUE05o: 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](image)

**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](image)

**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**

![Mordechai (Moti) Segev, Technion - Israel Institute of Technology, Haifa, Israel](image)
MON5s: Breakthrough Talk 2, 19:15 - 19:45, Seefeld/Tirol room

How light forms atomic-scale picocavities

Jeremy Baumberg¹, Qianqi Lin¹ 1, Shu Hu¹, Tamas Földe², Junyang Huang¹, Demelza Wright¹, Jack Griffiths¹, Bart de Nijs¹, Edina Rosta²; ¹NanoPhotonics Centre, Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom; ²Department 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. MacDonald¹, Tongjun Liu¹, Jun-Yu Ou¹, Nikolay I. Zheludev¹,²; ¹University of Southampton, United Kingdom, ²Nanyang 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 Karst¹, Moritz Floess¹, Monika Ubl¹, Carsten Dingler², Claudia Malacrida², Tobias Steinle¹, Sabine Ludwigs², Mario Hentschel¹, Harald Giessen¹; ¹4th Physics Institute and Research Center SCoPE, University of Stuttgart, Germany; ²IPoC-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 Dennis¹, Danica Sugic¹,², Ramon Droop³, Eileen Otte³, Daniel Ehrmanntraut³, Franco Nori²,⁴, Janne Ruostekoski⁵, Cornelia Denz³; ¹School of Physics and Astronomy, University of Birmingham, United Kingdom, ²Theoretical Quantum Physics Laboratory, RIKEN Cluster for Pioneering Research, Saitama, Japan; ³Institute of Applied Physics and Center for Nonlinear Science (CeNoS), University of Muenster, Muenster, Germany; ⁴Physics Department, University of Michigan, Ann Arbor, USA; ⁵Physics Department, Lancaster University, Lancaster, United Kingdom

11:30 - 12:00, WED2s.5
Topological insulator vertical-cavity laser array
Alex Dikopoltsev¹, Tristan H. Harder², Eran Lustig¹, Oleg A. Egorov³, Johannes Beierlein², Adriana Wolf², Yaakov Lumer¹, Monika Emmeling², Christian Schneider³, Sven Höfling², Moti Segev¹, Sebastian Klembt³; ¹Physics Department, Technion, Haifa, Israel; ²Chair for Applied Physics, Wilhelm-Conrad-Röntgen-Research Center for ComplexMaterial Systems, and Würzburg-Dresden Cluster of Excellence ct.qmat, Würzburg, Germany; ³ITFO, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany; ⁴Institute 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 Both¹, Egor A. Muljarov², Harald Giessen¹, Thomas Weiss¹,³;¹⁴th Physics Institute, University of Stuttgart and Research Center SCOPE, Stuttgart, Germany; ²Cardiff University, School of Physics and Astronomy, Cardiff, United Kingdom; ³Institute 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. Vetalgin¹, Cesare Soci¹, Nikolay I. Zheludev¹,²;¹ Nanyang Technological University, Singapore, Singapore; ²University 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 Miestel, 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.
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.

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

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.

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

Oral

Oral

Oral

Oral
Oral MON2o.4 11:15
Reconfiguring metamaterials with the pressure of light — Jinxiang Li¹, Kevin F. MacDonald¹, and Nikolay I. Zheludev¹,². ¹University of Southampton, Southampton, United Kingdom — ²Nanyang Technological University, Singapore, Singapore
The optical response of a nanowire metamaterial can be controlled by resonant ponderomotive non-thermal forces. The coupling of optical and mechanical resonances facilitates a strong optical nonlinearity enabling all-optical transmission modulation at microwave power levels.

Oral MON2o.5 11:30
Reconfiguring magnetic resonances using the plasmonic phase-change material In3SbTe2 — Lukas Conrad¹, Andreas Hessler¹, Konstantin Wirth¹, Matthias Wuttig¹, 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 Hentschel¹, Kirill Koshelev², Florian Sterl¹, Steffen Both¹, Thomas Weiss¹, Yuri Kivshar², and Harald Giesßen¹. ¹4th Physics Institute and Research Center ScPoE, University of Stuttgart, Stuttgart, Germany — ²Nonlinear Physics Centre, Research School of Physics, Australian National University, Canberra, Australia — ³School of Physics and Engineering, ITMO University, St. Petersburg, Russia — ⁴Institute 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 — Luca Kühner¹, Luca Sortino¹, Rodrigo Berté¹, Juan Wang¹, Hao Ran¹, Stefan A. Maier¹, Yuri S. Kivshar², and Andrea Tittel². ¹Chair in Hybrid Nanosystems and Center for NanoScience, Ludwig-Maximilians-Universität München, Munich, Germany — ²The Blackett Laboratory, Department of Physics, Imperial College London, London, United Kingdom — ³Nonlinear Physics Centre, Australian National University, Canberra, Australia — ⁴MQ Photonics Research Centre, Department of Physics and Astronomy, Macquarie University, Macquarie, Australia — ⁵Instituto 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-invariant in a compact footprint, and utilize them for applications in biomolecular sensing and higher harmonic generation from 2D materials.

Oral MON2o.8 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 MON2o.9 11:30
Electron beam shaping and aberration correction using optical fields — Andrea Koncna¹ and Javier Garcia de Abajo¹,². ¹ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — ²ICREA- 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 MON2o.10 11:45
Ultrafast Pump- Probe Spectral Interferometry without a Laser using Electron-Driven Photon Sources in an Electron Microscope — Masoud Talebi¹, Mario Hentschel², Harald Giesßen², and Nahid Talebi¹. ¹Christian Albrechts University, Kiel, Germany — ²Stuttgart 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.

12:15–16:15: Lunch Break
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.
Monday Sessions

Oral MON4a.4 18:00
High-index topological insulator meta-optics — Danveer Singh, Sukanta Nandi, Shany Cohen, Pekka Nikkala, Nanikashvilli, 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 MON4a.5 18:15
(3+1)D printing for graded index photonic integration — Adria Graculosa, Johnny Moughames, Xavier Porte, Meaher 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 an 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 MON4a.6 18:45
Non-radiative modes in finite arrays of Mie resonators — Mikhail Petrov1, Danil Kornovan1, Roman Savelev1, and Yuri Kivshar2,3 — 1Department of Physics and Engineering, ITMO University, St.-Petersburg, Russia — 2Nonlinear 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 MON4b.4 18:00
Complete coupling of light into 2D polaritons — Eduardo J. C. Dias1 and F. Javier García de Abajo1,2 — 1ICFO - The Institute of Photonic Sciences, Castelldefels, Spain — 2ICREA - 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 MON4b.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 MON4b.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.

MON5a: Breakthrough Talk 1

Time: Monday, 19:15–19:45  Location: Olympia
Breakthrough MON5a.1 19:15
Photonic Time-Crystals — Mordechai (Motti) 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.

MON5b: Breakthrough Talk 2

Time: Monday, 19:15–19:45  Location: Seefeld/Tirol
Breakthrough MON5b.1 19:15
How light forms atomic-scale picocavities — Jeremy Baumberg1, Qianqi Lin1, Shu Hu1, Tamas Földes2, Junyang Huang3, Demelza Wright1, Jack Griffiths1, Bart de Nijs1, and Edina Rosta2 — 1NanoPhotonics Centre, Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom — 2Department 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 < 1nm3. The thousand-fold stronger optical forces depend on nearby molecules as well as temperature and local optical field, and offer a route to single molecule optical tweezers.
Physics itself, performs optimizations in the normal course of dyn-
amical 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.
Tuesday Sessions

Oral TUE2o.4 11:15
Second harmonic enhancement from nonlinear plasmonic metasurface coupled to optical waveguide — •Tsafir Abir1,2, Mai Tal1,2, and Tal Ellenbogen1 — 1Department of Condensed Matter Physics, School of Physics and Astronomy, Tel Aviv University, Tel Aviv, Israel — 2Department 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 non-radiative 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. Gonçalves1 and F. Javier García de Araújo1,2 — 1ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain — 2ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain
We present a concrete proposal for inferring the quantum non-local 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 TUE2o.8 12:15
High-throughput nanofabrication of highly efficient and functional metasurfaces for mid-infrared optics and biosensing — •Aleksandrs Leitis1, Ming Lun Tsen1, Aurelian John-Herpin1, Yuri Kuvshinov2, and Hatice Altug1 — 1École Polytechnique Fédérale de Lausanne, Switzerland — 2Australian 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 TUE2o.9 12:45
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 non-radiative 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 TUE2s.5 11:30
Dynamic terahertz emission in a coupled metal – epsilon near zero metasurface — •Evitar Mirabelli1,2, Symeon Sideris1,2, Jacob Khurgin3, and Tal Ellenbogen1,2 — 1Department of Physical Electronics, School of Electrical Engineering, Tel-Aviv University, Tel Aviv, Israel — 2Center for Light-Matter Interaction, Tel-Aviv University, Tel Aviv, Israel — 3Raymond and Beverly Sackler Faculty of Exact Sciences, School of Physics & Astronomy, Tel-Aviv University, Tel Aviv, Israel — 4Department 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 Buchnev1, James A. Grant-Jacoby1, Robert W. Eason1, Nikolay I. Zheludev1,2, Ben Mills3, and Kevin F. MacDonald3 — 1University of Southampton, Southampton, United Kingdom — 2Nanyang 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 Zekter, 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
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.

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.

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.

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.

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.
cance 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 Götz, 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 Nanodantennas in Near-Field Microscopy — Rebecca Büchner1, Thomas Weber1, Lukas Rüther2, Stefan Maier1,2, and Andreas Tittel1 — 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 Steete1, Jan Kutscher1, Radwan M. Sarhan1, 2, Wouter Koopman1, and Matthias Bargheer1, 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-Tee Yan1, Henna Farheen1, Florian Spreyer1, Christian Schnickriede1, Viktor Myroshnychenko2, Thomas Zentgraf1, Jens Förstner1, and Stefan Linden1 — 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 Sorling1, 2, Panaot G. Zotev1, 2, Ricardo Sapienza3, Stefan A. Maier1, 3, and Alexander I. Tartakovskii3 — 1 Chair in Hybrid Nanosystems, Faculty of Physics, Ludwig-Maximilians-University 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 WS2 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 microphores 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 microphores. 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 M. M. Escudero** 1,2, Andrew Yankovich 1, Battulga Munkhrat 1, Denis Baranov 1,4, Rainer Hillebrand 1,2, Javier Aizpurua 2, Eva Olsson 1, and Timur Shengal 1 — 1Materials Physics Center (CFM), Donostia-San Sebastián, Spain — 2ICIC NanoGUNE BRTA and Department of Electricity and Electronics, Donostia-San Sebastián, Spain — 3Department of Physics, Chalmers University of Technology, Gothenburg, Sweden — 4Center for Photonics and 2D Materials, Moscow Institute of Physics and Technology, Moscow, Russia — 5ICERBASQUE, Basque Foundation for Science, Bilbao, Spain We have experimentally demonstrated broadband nanoscale manipulations for the optical fields but also enable advanced wavefront correction 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 —  **Yihe Shen** 1, Nikitas Papamarinis 2, Mark R. Dennis 3, and Nikolay I. Zheludev 1,3 — 1University of Southampton, Southampton, United Kingdom — 2University of Birmingham, Birmingham, United Kingdom — 3Nanyang 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, Aleksandr Belosludtsev 2, and Vassili Fedotov 1 — 1Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom — 2Optical 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 using gap-surface plasmon (GSP) metasurfaces.

Poster  TUE4f.22  17:00
Infrared nanoscopy of living cells —  **Yasin C. Durrazo**, **Kobrinian Kaltenechter**, **Thorsten Götz**, **Enrico Bau**, and **Fritz Kielmann** — 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 nanochemical 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 Konecka** 1,2, Jiahan Li 1, James Edgar 1, Javier García de Abajo 1,4, and Jordan Hachtel 1 — 1ICFO-Institut de Ciencies Fotoniques, Castelldefels, Spain — 2Central European Institute of Technology, Brno University of Technology, Brno, Czech Republic — 3Tim Taylor Department of Chemical Engineering, Kansas State University, Manhattan, USA — 4ICREA–Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain 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 — 1ICFO - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain — 2ICREA - 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 —  **Everlin Ackerboom**, **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 of 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, **Swapur Deb** 1, **Moshe Ben-Shalom** 1, and **Haim Suchowski** 1,2 — 1Condensed Matter Physics Department, School of Physics and Astronomy, Faculty of Exact Sciences, Tel Aviv University, Tel Aviv, Israel — 2Center 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.
High Fidelity Integrated Photonic Gates using Detuning Modulated Composite Segments — YONATAN PIASETZKY1, MOSHE KATZMAN2, HAIM SUCHOWSKI3, and AVI ZADOK4 — 1Tel Aviv University, Tel Aviv, Israel, 2Bar 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.

Second order transient photo-induced differential reflectivity for unravelling ultrafast response of plasmonic nanostructures — URI ARIELI, DROH 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.

Magnetic field imaging with electron energy loss spectroscopy based on Babinet’s principle — VLASTIMIL KRÁPEK, MICHAŁ HORBÁK, MARTIN HERTOŠ, ANDREA KONEČNÁ, and TOMÁŠ ŠÍKOLA — 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.

Strong coupling of a plasmonic dark mode with photons in a photonic crystal cavity — FANG 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.

All dielectric crescent silicon metasurfaces for biosensing — JUAN WANG1, JULIUS KÜHNE2, THEODOSIOS KARAMANOS3, CARSTEN ROCKSTUHL4, STEFAN MAIER1, and ANDREAS TITTI1 — 1Chair in Hybrid Nanosystems, NanoInstitute Munich, Faculty of Physics, Ludwig-Maximilians-University Munich, Munich, Germany — 2Institute 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.

High-fidelity biexciton generation in GaAs quantum dots by chirped picosecond pulses through Adiabatic Rapid Passage — VIKAS REMESHI1, YUSUF KARLI1, FLORIAN KAPPE1, JULIAN MÜNZBERG1, SANTANU MANNA2, ARMANDO RASTELLI3, and GREGOR WEHS1 — 1Institute for Experimental Physics, University of Innsbruck, Innsbruck, Austria — 2Institute 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.

Atoms near graphene nanoantennas: interplay of optical and electronic coupling — MARVIN MÜLLER1, MIRIAM KOSIK2, MARTA PELC3, GARETT BRYANT1,4, ANDRES AYUEL4, CARSTEN ROCKSTUHL1,4, and KAROLINA SLOWIK1 — 1Institute of Theoretical Solid State Physics, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — 2Institute of Physics, Faculty of Physics Astronomy and Informatics, Nicolaus Copernicus University in Toruń, Toruń, Poland — 3Joint Quantum Institute, University of Maryland and National Institute of Standards and Technology, College Park, USA — 4Nanoscale Device Characterization Division, National Institute of Standards and Technology, Gaithersburg, USA — 5Donostia International Physics Center (DIPC) and Centro de Física de Materiales, San Sebastián / Donostia, Spain — 6Institute 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.

All dielectric crescent silicon metasurfaces for biosensing — JUAN WANG1, JULIUS KÜHNE2, THEODOSIOS KARAMANOS3, CARSTEN ROCKSTUHL4, STEFAN MAIER1, and ANDREAS TITTI1 — 1Chair in Hybrid Nanosystems, NanoInstitute Munich, Faculty of Physics, Ludwig-Maximilians-University Munich, Munich, Germany — 2Institute of Theoretical Solid State Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany

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Distinguishing thermal from non-thermal (“hot”) in plasmonic molecular junctions — Yonatan Dubi1, IengWai Un2, and Yonatan Sivan2 — 1Department of Chemistry, Ben-Gurion University of the Negev, Be’er Sheva, Israel — 2School of Electrical Engineering, Ben-Gurion University of the Negev, Be’er Sheva, Israel

We provide a theory for using plasmonic molecular junctions 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.

Chip-based technology for terahertz near-field microscopy and quantitative determination of the local charge carrier density in silicon — Matthias M. Wiecha1, Alexander V. Chernyadiiev2, Rohit Kapoor3, Alyvdas Liusauskas2,3, and Hartmut G. Roskos1 — 1Physikalisches Institut, Goethe-University, Frankfurt am Main, Germany — 2Center, Institute of High Pressure Physics, Polish Academy of Sciences, Warsaw, Poland — 3Institute of Applied Electrodyamics and Telecommunications, Vilnus University, Vilnus, 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.

Polaritons in Two-Dimensional Parabolic Waveguides — Thies P. Rasmussen1, P. A. D. Gonçalves2, Sanshui Xiao3,4, Sebastián Hoffberth5, N. Ásger Mortensen1,4,6, and Joel D. Cox1,6 — 1Center for Nano Optics, University of Southern Denmark, DK-5230 Odense M, Denmark — 2ICFO - The Institute of Photonic Sciences, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — 3Department of Photonics Engineering, Technical University of Denmark, DK-2800 Kongens Lyngby, Denmark — 4Center for Nanostructured Graphene, Technical University of Denmark, DK-5230 Odense M, Denmark — 5Department of Photonics Sciences, Castelldefels, Spain — 6Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — 1CREA – Institución Catalana de Recerca i Estudis Avançats, Passeig Lluis Companys 23, 08010 Barcelona, Spain, Barcelona, Spain — 4Danish 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.

Polaritons in Two-Dimensional Parabolic Waveguides — Thies P. Rasmussen1, P. A. D. Gonçalves2, Sanshui Xiao3,4, Sebastián Hoffberth5, N. Ásger Mortensen1,4,6, and Joel D. Cox1,6 — 1Center for Nano Optics, University of Southern Denmark, DK-5230 Odense M, Denmark — 2ICFO - The Institute of Photonic Sciences, The Barcelona Institute of Science and Technology, 08860 Castelldefels (Barcelona), Spain — 3Department of Photonics Engineering, Technical University of Denmark, DK-2800 Kongens Lyngby, Denmark — 4Center for Nanostructured Graphene, Technical University of Denmark, DK-5230 Odense M, Denmark — 5Department of Photonics Sciences, Castelldefels, Spain — 6Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, 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.

Interaction-driven Circular Dichroism in Triskelia Nanostuctures — Javier Rodríguez-Álvarez1,2, Albert Guerrero1, David Bricio-Blázquez2, Antonio García-Martín1,3, Arantxa Fraile Rodríguez1,2, Xavier Batlle1,2, and Ámilcar Labarta1,2 — 1Departamento de Física de la Matéria Condensada, Universitat de Barcelona, Barcelona, Spain — 2Institut de Nanociència i Nanotecnologia (IN2UB), Barcelona, Spain — 3Instituto de Microelectrónica de Barcelona (IMB-CNM, CSIC), Bellaterra, Spain — 4Instituto 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.

Surface response functions of noble metals for plasmonic applications — Álvaro Rodríguez Echarrí1, P. André D. Gonçalves1,2,3, Christos Tserkezis1,3, F. Javier García de Abajo1,3, N. Ásger Mortensen1,4, and Joel Cox1,4 — 1ICFO - The Institute of Photonic Sciences, Castelldefels, Spain — 2Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark — 1CREA – Institución Catalana de Recerca i Estudis Avançats, Passeig Lluis Companys 23, 08010 Barcelona, Spain, Barcelona, Spain — 4Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark, Odense, Denmark

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.

Fano resonances in coupled identical spheroidal particles in a symmetric linear arrangement — Manuel Gonçalves1, Petros Petroysan1, Hayk Minassian1, and Armen Melikyan4 — 1Ulm University - Inst. of Experimental Physics, Ulm, Germany — 2Yerevan State University, Yerevan, Armenia — 3A.likhianian National Science Laboratory, Yerevan, Armenia — 4Russian-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).

An efficient way of treating changes of the medium surrounding an optical system — Shaikah Almousa and Egor Mularov — 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.
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 Proskurin¹, Andrey Bogdanov¹, and Denis Baranov² — ¹ITMO University, St. Petersburg, Russia — ²Moscow 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 Tselikov¹, Anton Popov², Georgy Ermolaev¹, Daria Panova¹, Gleb Tikhonovski¹, Alexander Syuy¹, Andrei Kabashin², Alexey Arsenin¹, and Valentyk Volkov¹ — ¹Moscow Institute of Physics and Technology, Dolgoprudny, Russia — ²Moscow Engineering Physics Institute, Moscow, Russia — ³Aix-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.
the ultrafast photo-induced evolution in nanostructures. 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

WED1o: Plenary Talk 4

Time: Wednesday, 9:00–10:00

Plenary WED1o.1 9:00 Quantum choreography with lightwaves – Rüdiger Huber — Department of Physics and Regensburg Center for Ultrafast Nanoscopy, University of Regensburg, Regensburg, Germany

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.
Wednesday Sessions

Oral  WED2o.4  11:15
Strong Exciton-plasmons interactions in WSe$_2$ flakes positioned on top of an Au lattice investigated using cathodoluminescence spectroscopy — Masoud Talebi, Fatemeh Davoodi, Florian Diekmann, Kai Rossnagel, and Nahid Talebi — 1Christian-Albrechts-Universität zu Kiel, Kiel, Germany; 2Ruprecht-Haensel Laboratory, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany

In this study, we use cathodoluminescence spectroscopy to investigate the exciton-plasmon interactions between the WSe$_2$ lattice and the periodic hole structure incorporated gold substrate. Experimental results followed 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, Shai Tessler, Euclides Almeida, and Guy Bartal — 1Technion - Israel Institute of Technology, Haifa, Israel; 2Queens 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, Dmitry Panna, Sebastian Brodbeck, Christian Schneider, Sven Höfling, and Alex Hayat — 1Technion - Israel Institute of Technology, Haifa, Israel; 2University of Würzburg, Würzburg, 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, Bernhard Reineke-Matsudo, Luca Carletti, Xue Zhang, Wenlong Gao, Costantino de Angelis, Lingling Huang, and Thomas Zentgraf — 1Department of Physics, Paderborn University, Paderborn, Germany; 2Department of Information Engineering and National Institute of Optics, University of Brescia, Brescia, Italy; 3School 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$^A$.2.

Oral  WED2s.4  11:15
Topological Floquet engineering of plasmonic waveguide arrays: Fast Thouless pumps and anomalous $\pi$-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 $\pi$-mode at optical frequencies.

Invited  WED2s.5  11:30
Topological insulator vertical-cavity laser array — Alex Dikopoltsev, Tristan H. Harder, Eran Lustig, Oleg A. Egorov, Johannes Beierlein, Adriana Wolf, Yaakov Lumer, Monika Emmerling, Christian Schneider, Sven Höfling, Moti Segev, and Sebastian Klemmt — 1Physics Department, Technion, Haifa, Israel; 2Chair for Applied Physics, Wilhelm-Conrad-Röntgen-Research Center for Complex Material Systems, and Würzburg-Dresden Cluster of Excellence ct.qmat, Würzburg, Germany; 3ITFO, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany; 4Institute 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, M engyao Li, Fedor Benmetskii, Tatjana Ivanova, Svetlana Kiriushchevka, Anton Vakulenko, Sriram Guddala, Dmitry Kirzhnovskiy, Andrea Ali, Anton Samusev, and Alexander Khanikaev — 1Department of Physics, ITMO University, St. Petersburg, Russia; 2Department of Electrical Engineering, City College of New York, New York, USA; 3Physics Department, City College of New York, New York, USA; 4Physics Program, Graduate Center of the City University of New York, New York, USA; 5Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom; 6Photonics 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

- 30 -
**WED3o: Technology Talk 3 - Attocube (Neaspec)**

Time: Wednesday, 16:15–17:00  
Technology  
Infrared correlation nanoscopy with unprecedented spectral coverage — Andrea Cordaro, 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 2-18 µm. 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  
Solving integral equations in free-space with inverse-designed ultrathin optical metagratings — Andrea Cordaro, Brian Edwards, Vahid Nikkhah, Andrea Alù, Nader Engheta, and Albert Polman — AMOLF, Amsterdam, Netherlands — University of Pennsylvania, Philadelphia, USA — Advanced Science Research Center - CUNY, New York, USA  
Inversion 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.

**WED4s: Nonlinear / Ultrafast Nanophotonics II**

Time: Wednesday, 17:00–18:15  
Location: Seefeld/Tirol  
Oral  
Nonlinear and nonlocal plasmonic response of crystalline atomically-thick films — Álvaro Rodríguez Echarri, Joel Cox, Fadi Itikawa, and F. Javier García de Abaro — ICFO - The Institute of Photonic Sciences, Castelldefels, Spain — Center for Nano Optics, University of Southern Denmark, Odense, Denmark — Danish Institute for Advanced Study, University of Southern Denmark, Odense, Denmark — 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**

**Oral**

**Oral**

**Oral**

**Oral**

**Oral**
Wednesday Sessions

Oral

Wednesday

Oral withdrawn

Wednesday

Oral

Resonant Electronic Transport in Strongly Coupled Metasurfaces — • Benedikt Limbacher1,2, Martin A. Kainz1,2, Sebastian Schönhuber1,2, Moritz Wenclawiak1,2, Christian Derni1,2, Aaron M. Andrews2,3, Hermann Deitze2,3, Gottfried Strasser1,2, Andreas Schwaighofer1,2, Bernhard Lendl1, Juraj Darmo1, and Karl Unterrainer1,2 — 1Photons Institute, TU Wien, Vienna, Austria — 2NanoCenter, TU Wien, Vienna, Austria — 3Institute of Solid State Electronics, TU Wien, Vienna, Austria — 4Central European Institute of Technology, Brno, Czech Republic — 5Institute 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 development in the field of intersubband polaritons.

Oral

Wednesday

Infrared-visible sum-frequency generation microscopy of phonon polariton resonances in SiC nanostuctures — • Sören Wasseroth1, Richarda Niemann1, Guanyu Lu1, Christopher R. Gubbin1, Martin Wolf1, Simone De Liberato1, Joshua D. Caldwell2, and Alexander Paarmann1 — 1Fritz-Haber-Institute, Berlin, Germany — 2Vanderbilt University, Nashville, USA — 3University 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

Wednesday


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

WED5s: Picophotonics

Time: Wednesday, 18:30–20:00

Invited

WED5s.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

Wednesday

WED5s.2 19:00

Coordinate nanometrology of coronavirus-like nanoparticle with topologically structured light — • Yu Wang1, Kevin F. MacDonald1, Eric Plum1, Jun-Yu Ou1, and Nikolay I. Zheludev1,2 — 1Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — 2Centre 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

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 superposition states in extreme near fields shaping electron wavepackets in space and time.

Oral

Wednesday

WED5s.2 19:00

Modulation of Cathodoluminescence Emission by Interference with External Light — • Valerio Di Giulio1, Ofer Kfir2, Claus Ropers1, and F. Javier García de Abajo1,2 — 1ICFO - The Institute of Photonic Sciences, Castelldefels, Barcelona, Spain — 2Tel Aviv University, School of Electrical engineering, Tel Aviv, Israel — 3MPIBPC - Max Planck Institute for Biophysical Chemistry, Göttingen, Germany — 4University of Göttingen, IV. Physical Institute, Göttingen, Germany — 5ICREA - 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 Ou¹, Dimitrios Papas¹, Tongjun Liu¹, Jinxian Li¹, Eric Plum¹, Kevin F. MacDonald¹, and Nikolay I. Zheludev²,³ — Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom — 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 Arqués-López¹, Valerio Di Giulio¹, and F Javier García de Abajo¹,² — ICREA-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain — ICREA-Institut 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”? — Yoanatan Sivan, Ieng Wai Un, Joshua Baraban, and Yoanatan 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 Mancini¹, Christopher R. Gubbins², Rodrigo Berté³, Francesco Martini³, Alberto Polití³, Emiáno Cortés¹, Yi Li³, Simone De Liberato³, and Stefan A. Maier¹ — Chair in Hybrid Nanosystems, Nanoinstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, Munich, Germany — School of Physics and Astronomy, University of Southampton, Southampton, United Kingdom — 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.
Thursday Sessions

THU1o: Plenary Talk 5

Time: Thursday, 9:00–10:00

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 car-
rriers 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

Invited

THU2o.1 10:15

Nanophotonic chiral sensing: How does it actually work? —
Steffen Both1, Egor A. Muljarov2, Harald Giessen1, and
Thomas Weiss1,3 — 14th Physics Institute, Univ. of Stuttgart
and Research Center ScOPE, Stuttgart, Germany — 2Cardiff Uni-
versity, School of Physics and Astronomy, Cardiff, United King-
dom — 3Institute 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 Boultaeva 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 Morozov1,2, Christian Wolff1, and N. Asger
Mortensen1,2,3 — 1Center for Nano Optics, University of
Southern Denmark, Odense, Denmark — 2Center for Nano-
structured Graphene, Technical University of Denmark, Kongens
Lyngby, Denmark — 3Danish Institute for Advanced Study,
University of Southern Denmark, Odense, Denmark

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

THU2s: Mixed Topics II

Time: Thursday, 10:15–12:15

Invited

THU2s.1 10:15

Novel approaches for chip scale light vapor interactions —
Roy Zektser, 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 confine-
ment 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 opportunities for harnessing plas-
monic hot carriers and modulating dielectric nano-antennas.

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 wave-
guides 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. Veltugin1, César Soc1, and
Nikolay I. Zheltukhin1,2 — 1Nanyang Technological University,
Singapore, Singapore — 2University 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 metama-
terial using a “quantum copy” of the physical experiment repli-
cated on the transmon, a superconducting charge device of the
IBM quantum computer.
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)

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.
Authors’ Index

The index entries consist of the following data: < <session key>> <paper in the session> > <page>

A
Abir, Tsafrrir ........................................... TUE2o.4-p22
Adiv, Yuval ............................................ MON2s.2-p17
Aigner, Andreas ....................................... TUE4.1-p22
Aizpurua, Javier ...................................... TUE4.18-p25
Akerboom, Evelijn ..................................... TUE4.25-p25
Alcaraz, D. ............................................... MON4.2-p19
Almeida, Euclides ..................................... WED2o.5-p30
Almousa, Shalah ...................................... TUE4.46-p27
Alonso, Calafell, I .................................... TUE4.2-p19
Altug, Hatic ............................................. TUE2.4-p22
Alu, Andrea ............................................ MON2o.3-p17
Amirtharaj, Sakthi Priya ................................ THU2o.4-p35
Andrews, Aaron M. .................................... WED4.5-p32
Arieli, Uri ................................................ TUE4.7-p25
Aqué, López, Eduardo ................................ WED3.5-p33
Aresen, Aleksey ........................................ TUE4.49-p28
Aspelmyer, Markus .................................... WED2o.4-p30
Atwater, Harry .......................................... TUE4.35-p26
Ayuela, Andres ......................................... TUE4.3-p23
B
Bahar, Eyal .............................................. TUE4.27-p25
Balasubramanian, Krishna ............................... TUE2o.2-p21
Baraban, Joshua ......................................... TUE4.1-p33
Baranov, Denis ......................................... TUE4.18-p25
Barriero, Mathias ....................................... TUE4.12-p24
Barreda, Angela I ....................................... THU2o.4-p35
Bartal, Guy .............................................. MON2o.2-p17
Batt, Amit ............................................... WED2o.5-p30
Blechman, Yaël ........................................... TUE4.14-p24
Beierlein, Johannes .................................... WED2o.5-p30
Beneice, Daniel .......................................... TUE4.3-p22
Belosludtsye, Alexander ............................... WED2o.2-p39
Ben-Shalom, Moshe .................................... TUE4.27-p25
Ben-David, Peter ........................................... WED2o.5-p32
Benitez, Jesús ........................................... WED2o.6-p30
Benmimmi, Fedor ........................................ WED2o.7-p18
Bert, Rodrigo ........................................... WED2o.6-p33
Bieliski, H. ................................................ MON4.2-p19
Bittorf, Paul H ........................................... TUE4.14-p24
Bleichman, Yaël ........................................... TUE4.5-p30
Bogdanov, Andrei ....................................... TUE4.47-p27
Boltasseva, Alexandra ................................ THU2o.2-p34
Both, Stefan ............................................. THU2o.1-p34
Bouscher, Shlomi ....................................... TUE2o.2-p21
Bozhevolnyi, Sergei .................................... TUE2o.1-p21
Bozhevolnyi, Sergei I .................................. MON4o.3-p19
Bricio-Blázquez, David ................................ TUE4.42-p27
Broedbo, Sebastian ..................................... WED2o.6-p30
Bromersma, Mark ...................................... MON2o.1-p17
Brunner, Daniel ........................................ MON4o.5-p20
Bryant, Garnett .......................................... TUE4.35-p26
Bucher, Tomer .......................................... WED2o.2-p29
Büchler, Rebecca ....................................... TUE4.11-p24
Buchnev, Oleksandr ................................... TUE4.8-p22
Butler, Paul ............................................. TUE4.3-p23
Caldwell, Joshua D. .................................. WED4o.4-p32
Carletti, Luca ........................................... TUE2o.7-p30
Carmeli, Itai ............................................. TUE2o.3-p17
Chaban, Jana ........................................... MON3o.1-p19
Chen, Hongsheng ...................................... MON2o.2-p17
Chen, Wen ............................................... THU2o.4-p35
Chernyadiev, Alexander V ................................ TUE4.40-p27
Chernovskiy, Oras ...................................... TUE4.29-p26
Chloba, Thomas ........................................ TUE2o.7-p22
Cohen, Kobi ............................................ WED2o.2-p29
Cohen, Shany ........................................... MON4o.4-p20
Conradts, Lukas ........................................ MON4o.5-p18
Cordaro, Andrea ........................................ TUE4o.1-p31
Cortés, Emiliano ........................................ TUE4.3-p25
Cortes, Emilianito ...................................... TUE4.3-p25
Cox, J. D. ................................................ MON4o.2-p19
Cox, Joel ................................................ TUE4.43-p27
D
D. Goncalves, P. André ................................ TUE4.43-p27
Dahan, Raphael ......................................... MON4o.2-p17
Darmo, Juraj ............................................ TUE4.5-p32
Davis, Tim ................................................ WED2o.2-p29
Davoodi, Fatemeh ...................................... TUE4.14-p24
De Abajo, F. Javier García de Angelis, Costantino .... TUE4.43-p27
De Liberato, Simone .................................. WED4o.2-p30
Dias, Eduardo J. C. .................................... MON4o.4-p20
Diekmann, Florian ...................................... WED4o.2-p30
Dikopoltsev, Alex ..................................... TUE2o.2-p34
Ding, Fei ................................................. TUE2o.3-p22
Dingler, Carsten ........................................ MON4o.1-p19
Dreher, Pascal ........................................... WED2o.2-p29
Droop, Ramon ........................................... WED2o.1-p29
Dub, Yonatan ........................................... TUE4.38-p26
Durmas, Taysin .......................................... TUE4.22-p25
Eason, Robert W. ........................................ TUE4.6-p22
Edelstein, Shahar ....................................... TUE2o.2-p21
Edgar, James ............................................. TUE4.1-p25
Edrei, Eitan .............................................. WED4o.5-p32
Edwards, Brian .......................................... MON4o.1-p31
Efetov, D. K. ............................................. MON4o.2-p19
Egorov, Oleg A ......................................... WED2o.5-p30
Ehrmantraut, Daniel .................................... WED2o.1-p29
Ehrenbogen, Tal ........................................ TUE4.24-p22
Emmerling, Monika .................................... WED2o.5-p30
Engheta, Nader .......................................... WED4o.1-p31
Englung, D. R. .......................................... MON4o.2-p19
Ermolaev, Georgy ....................................... TUE4.49-p28
E
Farheen, Henna ........................................ TUE4.13-p24
Fölsch, Claudia ......................................... TUE4.7-p23
Falci, Philipp ........................................... MON4o.2-p19
Fleiss, Eoin .............................................. MON4o.1-p19
Flosdottir, Helga ........................................ TUE4.3-p23
Fölsch, Thomas ......................................... MON5o.1-p20
Föhr, Christian .......................................... TUE4.13-p24
Friedel, Christin ......................................... MON2o.2-p17
Friedenbach, Christian ................................ TUE4.5-p32
G
Galif, Emanuele ......................................... MON3o.3-p17
Galland, Christoph ...................................... THU2o.4-p35
Gao, Wenchong ......................................... WED2o.7-p30
García de Abajo, E. Javier ............................. MON4o.2-p19
Garcia de Abajo, Javier ................................ MON3o.3-p17
Garcia de Abajo, Javier ................................ MON3o.3-p17
Garcia de Abajo, Javier ................................ MON3o.3-p17
Garcia de Abajo, Javier ................................ MON3o.3-p17
Garcia de Abajo, Javier ................................ MON3o.3-p17
Garcia de Abajo, Javier ................................ MON3o.3-p17
G
Galif, Emanuele ......................................... MON3o.3-p17
Galland, Christoph ...................................... THU2o.4-p35
Gao, Wenchong ......................................... WED2o.7-p30
García de Abajo, E. Javier ............................. MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
Garcia de Abajo, E. Javier ................................ MON4o.2-p19
<table>
<thead>
<tr>
<th>Authors</th>
<th>Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walther, P.</td>
<td>MON4s.2-p19</td>
</tr>
<tr>
<td>Wang, Juan</td>
<td>MON2o.7-p18</td>
</tr>
<tr>
<td>Wang, Kangpeng</td>
<td>MON2s.4-p18</td>
</tr>
<tr>
<td>Wang, Yu</td>
<td>WED5o.2-p32</td>
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<tr>
<td>Wasserroth, Sören</td>
<td>WED4s.4-p32</td>
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<tr>
<td>Weber, Thomas</td>
<td>WED4l.11-p24</td>
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<tr>
<td>Weidemann, Sebastian</td>
<td>WED4o.2-p31</td>
</tr>
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<td>Weigand, Helena</td>
<td>TUE4l.16-p24</td>
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<tr>
<td>Weigand, Helena C.</td>
<td>WED4s.2-p31</td>
</tr>
<tr>
<td>Weihs, Thomas</td>
<td>TUE4f.34-p26</td>
</tr>
<tr>
<td>Weiss, Thomas</td>
<td>THU2o.1-p34</td>
</tr>
<tr>
<td>Wenclawiak, Moritz</td>
<td>WED4o.5-p32</td>
</tr>
<tr>
<td>Wendisch, Fedja</td>
<td>TUE4l.6-p23</td>
</tr>
<tr>
<td>Whittaker, Tom</td>
<td>WED4o.3-p31</td>
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<td>Whittow, Will</td>
<td>WED4o.3-p31</td>
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<td>Wiecha, Matthias M.</td>
<td>TUE4l.11-p24</td>
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<td>Winiger, Joel</td>
<td>WED2o.2-p31</td>
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<td>Wirth, Konstantin</td>
<td>MON2o.5-p18</td>
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<tr>
<td>Wolf, Adriana</td>
<td>WED2o.5-p30</td>
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<tr>
<td>Wolf, Martin</td>
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<td>Wolf, Christian</td>
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<td>Wood, Vanessa</td>
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<td>Wu, ZhengMin</td>
<td>MON3o.1-p19</td>
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<td>Wuttig, Matthias</td>
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<td>Xiao, Sanshui</td>
<td>TUE4l.41-p27</td>
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<td>Yablokovitch, Eli</td>
<td>TUEo1.1-p21</td>
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<td>Yan, Lok-Yee</td>
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<td>Yankovich, Andrew</td>
<td>TUE4f.18-p25</td>
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<tr>
<td>Yin, Shixiong</td>
<td>MON2o.3-p17</td>
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<td>Zadok, Avi</td>
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<td>Zalevsky, Zeev</td>
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<td>Zentgraf, Thomas</td>
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<td>Zehludev, Nikolay</td>
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<td>Zehludev, Nikolay I</td>
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<td>Zelinskii, Maxim</td>
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<td>Zheltov, Dmitry</td>
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<tr>
<td>Zheltov, Dmitry II</td>
<td>WED5o.3-p33</td>
</tr>
<tr>
<td>Zimmer et al., Jochen</td>
<td>THU2o.5-p35</td>
</tr>
<tr>
<td>Zotev, Panait G</td>
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</tr>
</tbody>
</table>