Advance Programme

Virtual Meeting

CEST time zone

21 - 25 June 2021

www.cleoeurope.org

Sponsored by
• European Physical Society / Quantum Electronics and Optics Division
• IEEE Photonics Society
• The Optical Society

WORLD OF PHOTONICS CONGRESS
25th International Congress on Photonics in Europe
Collocated with Laser World of Photonics Industry Days
10th EPS-QEOD Europhoton Conference

EUROPHOTON

SOLID-STATE, FIBRE, AND WAVEGUIDE COHERENT LIGHT SOURCES

28 August – 02 September 2022
Hannover, Germany

www.europhoton.org
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Welcome to the 2021 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (hereafter CLEO®/Europe-EQEC) at the World of Photonics Congress 2021

Following on from the very successful previous conferences held in Amsterdam (1994), Hamburg (1996), Glasgow (1998), Nice (2000) and Munich (2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017, 2019), the General and Programme Chairs warmly welcome you to the 2021 CLEO®/Europe-EQEC conference, which will take place virtually from June 21 – 25, 2021. CLEO®/Europe-EQEC targets university and industry scientists and researchers as well as students and graduates. We extend a special welcome to attending young researchers, postgraduate and PhD students, and we wish them every success, especially if this is their first participation in a major scientific conference.

The CLEO®/Europe-EQEC conference series has established a strong tradition as the largest, most comprehensive and prestigious gathering of optics and photonics researchers and engineers in Europe. With technical co-sponsorship provided by the European Physical Society (EPS), the Institute of Electrical and Electronics Engineers (IEEE) Photonics Society, and the Optical Society (OSA), CLEO®/Europe and EQEC have a strong international presence in the complementary research areas of laser science, photonics and quantum electronics.

More specifically, CLEO®/Europe emphasizes applied physics, optical engineering and applications of photonics and laser technology, whereas EQEC addresses more basic research in laser physics, nonlinear optics and quantum optics.

CLEO®/Europe will showcase the latest developments in a wide range of laser and photonics areas including solid-state lasers, semiconductor lasers, terahertz sources and applications, applications of nonlinear optics, optical materials, optical fabrication and characterization, ultrafast optical technologies, high-field laser and attosecond science, optical sensing and microscopy, optical technologies for communications and data storage, fibre and guided wave lasers and amplifiers, micro- and nanophotonics, photonic applications in biology and medicine, and material processing.

EQEC will feature the fundamentals of quantum optics and ultracold quantum matter, quantum information, quantum communication and sensing, topological states of light, precision metrology, ultrafast optical science, nonlinear phenomena, solitons, and self-organization, plasmonics and metamaterials, two-dimensional and novel materials, and theoretical and computational photonics modelling.

CLEO®/Europe-EQEC creates a unique forum where participants can obtain informative over-views and discuss recent advances on a wide range of topics, from fundamental light-matter interaction and new sources of coherent light to technology development, system engineering and various applications of photonics.

Over five days CLEO®/Europe-EQEC 2021 will virtually showcase around 1400 technical contributions in the form of oral presentations in parallel sessions and posters from university, research organisations and industry, drawn from all countries around the world, and will provide an unparalleled opportunity to bring together scientists, engineers and users of laser and photonics technologies under the same roof.

Particular highlights of the 2021 programme will be a series of symposia: Nanophotonics, High-Field THz Generation and Applications, Attochemistry, Deep learning in Photonics and Flexible Photonics.

Additionally, two joint sessions (ECOBO-CLEO®/Europe and LiM-CLEO®/Europe) will be held.

As usual a series of prestigious EPS-QEOD Prizes and Awards will be remitted during a special Plenary and Award Ceremony to take place on Tuesday 22 June 2021 from 09:00 to 10:30.

This year, the meeting will not be complemented by the LASER World of Photonics, the world’s largest tradeshow of laser and optical technology, which is rescheduled to take place in person in Munich, Germany, April 26–29, 2022. However, from June 21 to 24, 2021, Messe Munich will present the “LASER World of PHOTONICS Industry Days” on the World of Photonics Stage. This will take place in parallel to the digital World of Photonics Congress and offer the photonics community a platform for information exchange and networking. You can expect exciting presentations on market figures and the photonics applications of tomorrow, as well as quantum optics and many interesting showrooms.

See https://www.world-of-photonics.com/en/
scientists, and are accessible to a general technical audience including conference attendees, exhibitors, and exhibit visitors. Plenary talks are not held in parallel with other sessions, allowing maximum possible attendance. The 2021 Plenary Talks will be presented by Reinhard Genzel, 2020 Nobel Prize Co-Laureate (World of Photonics), Monday, 11:00–12:30, Robert W. Boyd (CLEO/Europe), Monday, 16:30–17:30 and Nirit Dudovich (EQEC), Tuesday, 9:00–10:30.

Tutorials (60-minute talks) and Keynote presentations (45-minute talks) are also given by the world leaders in particular technical areas. They are generally directed at a more specific audience, and are thus delivered in parallel with other sessions. Keynotes provide a survey of exciting recent developments, and Tutorials are particularly valuable for those unfamiliar with a particular field.

In addition to these talks the conference will feature invited talks, oral and poster presentations.

Other very much appreciated CLEO*/Europe-EQEC meetings are the special Symposia settled to anticipate and capture emerging fields in optics by giving emphasis to fast developing, well defined topics. Five symposia have been elaborated without the vital support and effort of 275 scientists, forming 13 CLEO*/Europe, 10 EQEC, 5 Joint Symposia and 2 Joint Sessions sub-committees, who have assembled an excellent series of talks and posters covering a wide range of fields in optics and quantum optical science, laser technology and photonics applications.

The conference programme could not have been elaborated without the vital support and effort of 275 scientists, forming 13 CLEO*/Europe, 10 EQEC, 5 Joint Symposia and 2 Joint Sessions sub-committees, who have assembled an excellent series of talks and posters covering a wide range of fields in optics and quantum electronic. The technical programme featuring more than 1400 presentations will consist of 3 Plenary talks (CLEO*/Europe, EQEC, WoP Congress), 5 Tutorial talks, 9 Keynote talks, 72 invited talks, 20 talks upgraded to invited, 914 oral presentations and 408 poster presentations. Additionally, 18 oral presentations will be featured in the two post-deadline sessions to take place on Thursday evening.

During the conference week, 199 oral sessions and 9 poster sessions will be featured. The Conference Chairs would like to extend their sincere thanks to the technical programme committee members for all their hard and fruitful work. A conference as large as CLEO*/Europe-EQEC requires two years of planning and organisation. Here, we also thank the staff of the European Physical Society, and the local conference chair in Munich for invaluable professional assistance during this period. We thank Messe München GmbH, the World of Photonics Congress steering committee, the CLEO/Europe-EQEC steering committee and all the Sponsoring Societies for their guidance, support, and their invaluable advice, which ensures that this event not only remains at the core of optics and photonics research for many nations, but will also be a major event in Europe.

Let us finally thank our attendees. The real success of CLEO*/Europe-EQEC 2021 indeed rests on the efforts and commitments of these researchers and students, who all contribute to the tremendous evolution of our research field and to the high quality of the papers that will be presented.

We wish you all a lively, fruitful, and enjoyable 2021 virtual conference, and we are looking forward to seeing you in-person in Munich in 2023!

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CLEO*/Europe-EQEC 2021 will also present twelve short courses. All courses at additional cost will take place in parallel on Wednesday 23 June 2021 (16:30 to 20:00) in the exception of one course which will take place the same day in the morning (08:30 to 12:00) due to time zone constraints of the instructor.

The conference will also feature two post-deadline sessions on Thursday evening, 24 June 2021 (18:30 to 20:00). Their purpose is to give the audience the chance to listen to the latest breaking news in optics, and these are usually one of the most attractive events that certainly contribute to the great atmosphere that makes the CLEO*/Europe-EQEC conference a unique meeting.

In addition to the technical sessions involving oral presentations, all scientific areas of both CLEO*/Europe and EQEC will be covered in poster sessions, which will provide an interactive and less formal way for researchers to discuss their work, interact and exchange ideas. CLEO*/Europe-EQEC is now established as the largest and most comprehensive gathering of optics and photonics researchers and engineers in Europe, spanning classical and quantum optical science, laser technology and photonics applications.

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Welcome and foreword
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<td>CE-1 Photonic Structures</td>
<td>CF-1 Ultrashort Pulse Generation</td>
<td>CG-1 Ultrafast Dynamics in Solids</td>
<td>CK-1 Periodic Components</td>
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<td>CE-2 Semiconductor for Photonic Devices</td>
<td>CD-1 Nonlinear Metasurfaces</td>
<td>CA-2 2-µm Lasers</td>
<td>CH-1 Gas Sensing</td>
<td>CJ-1 Coherent Beam Combining</td>
<td>CK-2 Novel Integrated Components</td>
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<td>CC-1 THz Strong Field Applications</td>
<td>CL-1 Laser-Tissue Interactions and Surgery</td>
<td>EJ-1 Optical Computing and Artificial Intelligence</td>
<td>JS-V-2 Flexible Photonic Devices</td>
<td>JSII-2 Applications of Strong THz Fields</td>
<td>ED-2 Optical Computing and Artificial Intelligence</td>
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<td>CM1: Laser Induced Periodic Surface Structures</td>
<td>JSIII-1: Theoretical Perspectives in Attochemistry</td>
<td>EF-1: Mode-Locking Phenomena</td>
<td>EG-1: Emission Control at the Nanoscale</td>
<td>EH-1: Extreme and Ultrafast Phenomena in Plasmonics and Metamaterials</td>
<td>CG-2: Controlled and Intense XUV Light</td>
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**General Information**

- **Room 7 and Room 12**
  - **EH-2**: New Perspectives in Metamaterials and Nanophotonics
  - **CI-1**: Broadband Systems
  - **EJ-2**: Nonlinear Optics Modeling
  - **CD-3**: Microresonators and Waveguides
  - **CH-3**: Advanced Optical Sensing Techniques
  - **CF-2**: Ultrafast UV Sources

- **Room 8 and Room 10**
  - **EH-3**: Advanced Control of Light with Metasurfaces
  - **CB-2**: High Power Semiconductor Lasers
  - **CE-3**: Fabrication and Characterization Techniques
  - **CH-4**: Fiber-based Sensors II
  - **EB-4**: Nonclassical Light Sources

- **Room 9**
  - **CE-4**: Luminescent Materials
  - **EB-5**: Long-Range Distribution of Entanglement I
  - **EC-3**: Bound States and High-order Topology
  - **CF-3**: Nonlinear Pulse Propagation
  - **CH-5**: Imaging in Scattering Media
  - **CC-3**: High Power THz Sources
### Wednesday at a glance

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## Sessions at a Glance

### PLENARY SESSIONS

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<td>Welcome Words and World of Photonics Congress Plenary Talk by 2020 Nobel Prize Co-Laureate</td>
<td>Monday</td>
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<td>CLEO/Europe Plenary Talk</td>
<td>Monday</td>
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<td>EQEC Plenary Talk and Award Ceremony</td>
<td>Tuesday</td>
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### SPECIAL EVENTS

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<td>Hot Topics: What’s Next in Integrated Frequency Combs</td>
<td>Wednesday</td>
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### CLEO®/EUROPE 2021 SESSIONS

#### CA – SOLID-STATE LASERS

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#### CC – TERAHERTZ SOURCES AND APPLICATIONS

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#### CD – APPLICATIONS OF NONLINEAR OPTICS

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CD-12  Raman Amplification and Nonlinear Media
  Friday, 16:30 - 18:00, ROOM 1

CE-7  CE-4  CE-3  CE-2  CE-1  CD-12

CE-1  Photonic Structures
  Monday, 08:30 - 10:00, ROOM 3

CE-10  Crystals, Glasses and Ceramics
  Thursday, 14:30 - 16:00, ROOM 6

CE-2  Semiconductor for Photonic Devices
  Monday, 14:30 - 16:00, ROOM 1

CE-3  Fabrication and Characterization Techniques
  Tuesday, 16:30 - 18:00, ROOM 9

CE-4  Luminescent Materials
  Tuesday, 18:30 - 20:00, ROOM 7

CE-5  Micro and Nanostructures
  Wednesday, 08:30 - 10:00, ROOM 5

CE-P  CE Poster Session
  Wednesday, 10:00 - 11:00, ROOM 3

CE-6  Materials for Waveguides and Resonators
  Wednesday, 11:00 - 12:30, ROOM 7

CE-7  Integrated Optoelectronic Devices
  Wednesday, 14:30 - 16:00, ROOM 6

CE-8  Materials and Fabrication of Specialty Optical Fibers
  Thursday, 08:30 - 10:00, ROOM 11

CE-9  Nonlinear and Meta-materials
  Thursday, 11:00 - 12:30, ROOM 12

How to read the session codes?

The following pages contain the abstracts of the papers presented at the 2021 CLEO®/Europe-EQEC.

The second part indicates the day when the presentation takes place.

SUN = Sunday
MON = Monday
TUE = Tuesday
WED = Wednesday
THU = Thursday

All CLEO®/Europe sessions are on a white background and have a code beginning with a C.

All EQEC sessions are on a shaded background and have a code beginning with PD.

Both post-deadline sessions including CLEO®/Europe and EQEC presentations are on a white background and have a code beginning with PD.

Exceptions mentioned below are on a dark background:

- Short courses referenced with SH
- Plenary talks referenced with PL
- CLEO®/Europe-EQEC joint symposia referenced with JS.
- The ECBO-CLEO®/Europe joint session referenced with CM-6, Joint Session CM with LiM.
- The joint session LiM-CLEO®/Europe referenced with CM-1.1 MON (Invited) 14:30
- The first part of CM-1.1 indicates the Conference, the topic title, the session title and the placement of the presentation within the session, e.g.
- The second part indicates the day when the assigned poster session of the poster takes place. The same abbreviations as for the oral presentations apply. Posters from the same topic are all assigned in the same virtual poster session. Each poster presenter is requested to join his/her assigned virtual break-out room at the given day and time.

How to read the session codes?

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Oral Presentations
Oral presentations have a code made up of two parts, e.g.
CM-1.1  =  CLEO®/Europe
CM-1.1  =  Materials processing with lasers
CM-1.1  =  Beam shaping for laser processing
CM-1.1  =  First paper presented in the "Beam shaping for laser processing" session of the CM topic

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The figures on the right specify at what time the talk begins (10:30 am).

Plenary, Tutorial, Keynote and Invited Talks are marked between brackets.

Posters
Poster presentations have a code made up of two parts, e.g.
EG-P2  =  FRI

The first part indicates the Conference, the topic title, the poster destination, and the order of presentation within the topic, e.g.

EG-P2  =  EQEC
EG-P2  =  Light-matter interactions at the nanoscale
EG-P2  =  Poster
EG-P2  =  Second poster in the "Light-matter interactions at the nanoscale" topic of the EQEC conference.

The second part indicates the day when the assigned poster session of the poster takes place. The same abbreviations as for the oral presentations apply. Posters from the same topic are all assigned in the same virtual poster session. Each poster presenter is requested to join his/her assigned virtual break-out room at the given day and time.

Oral Presentations
Oral presentations have a code made up of two parts, e.g.
CM-1.1  =  CLEO®/Europe
CM-1.1  =  Materials processing with lasers
CM-1.1  =  Beam shaping for laser processing
CM-1.1  =  First paper presented in the "Beam shaping for laser processing" session of the CM topic
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### GENERAL INFORMATION

**Sessions at a Glance**

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### EQEC 2021 SESSIONS

#### EA – QUANTUM OPTICS AND ULTRACOLD QUANTUM MATTER

| **EA-1** Waveguide-QED and Atom-light Interfaces |
| Tuesday, 11:00 - 12:30, ROOM 1                   |
| **EA-2** Cold Molecules                          |
| Tuesday, 18:30 - 20:00, ROOM 2                  |

#### EA-3 Quantum Optomechanics and Detectors       |
Wednesday, 11:00 - 12:30, ROOM 8

#### EA-4 Cavity-QED and Cold Gases                 |
Wednesday, 14:30 - 16:00, ROOM 7

#### EA-5 Quantum Light Sources                     |
Thursday, 11:00 - 12:30, ROOM 8

#### EA-6 Polaritons and Quantum Fluids of Light    |
Thursday, 16:30 - 18:00, ROOM 7

#### EA-7 Quantum Interferences                     |
Friday, 08:30 - 10:00, ROOM 5

#### EA-9 Quantum Tomography and State Estimation   |
Friday, 08:30 - 10:00, ROOM 6

#### EB – QUANTUM INFORMATION, COMMUNICATION, AND SENSING

| **EB-1** Quantum Networks                        |
| Monday, 08:30 - 10:00, ROOM 7                    |
| **EB-2** Integrated Devices and Memories          |
| Monday, 18:00 - 19:30, ROOM 7                    |

#### EB-3 Photonic Quantum Computation               |
Tuesday, 11:00 - 12:30, ROOM 2

#### EB-4 Nonclassical Light Sources                 |
Tuesday, 16:30 - 18:00, ROOM 11

#### EB-5 Long-Range Distribution of Entanglement I  |
Tuesday, 18:30 - 20:00, ROOM 8

#### EB-6 Long-Range Distribution of Entanglement II |
Wednesday, 11:00 - 12:30, ROOM 11

#### EB-7 Quantum Imaging and Interference           |
Wednesday, 14:30 - 16:00, ROOM 10

#### EB-8 Quantum Computation and Error Correction   |
Thursday - 11:00 - 12:30, ROOM 9

#### EB-9 Quantum Tomography                         |
Friday, 08:30 - 10:00, ROOM 6

### How to find the room?

The conference running virtually, each indicated room of this programme is only a virtual space allocated to allow the build-up of the parallel sessions and check for overlaps.

When on the platform, within each day, just go through the session titles and you will find your way.

**Note:** The "Welcome Words and World of Photonics Congress Plenary by 2020 Nobel Prize Co-Laureate Reinhard Genzel, Max-Planck-Institut für extraterrestrische Physik, Garching, Germany entitled "A 40-year journey" to take place Monday 21 June 11:00 - 12:30 am CEST time zone, will be directly broadcasted from Messe Munich’s platform. Instructions on how to join in will be sent via email just prior the session. For all other CLEO/Europe-EQEC sessions join in via the CLEO/Europe-EQEC platform.
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<td>Thursday, 16:30 - 18:00, ROOM 5</td>
<td>Tuesday, 16:30 - 18:00, ROOM 1</td>
<td>Friday, 08:30 - 10:00, ROOM 7</td>
<td>Friday, 08:30 - 10:00, ROOM 9</td>
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<td><strong>EE – ULTRAFAST OPTICAL SCIENCE</strong></td>
<td><strong>EF-P</strong> EF Poster Session</td>
<td><strong>EF-P</strong> EF Poster Session</td>
<td><strong>EG-P</strong> EG Poster Session</td>
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<td><strong>EE-1</strong> Ultrafast Phenomena in Waveguides</td>
<td><strong>EE-P</strong> EE Poster Session</td>
<td>Thursday, 10:00 - 11:00, ROOM 2</td>
<td>Friday, 10:00 - 11:00, ROOM 2</td>
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<td>Tuesday, 11:00 - 12:30, ROOM 5</td>
<td><strong>EE-3</strong> Ultrafast Molecular Dynamics</td>
<td><strong>EE-4</strong> Ultrafast Characterisation and Manipulation at Nanoscale</td>
<td><strong>EH-1</strong> Extreme and Ultrafast Phenomena in Plasmonics and Metamaterials</td>
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<td><strong>EE-2</strong> HHG in Condensed Matter</td>
<td>Thursday, 14:30 - 16:00, ROOM 12</td>
<td>Thursday, 16:30 - 18:00, ROOM 9</td>
<td>Monday, 14:30 - 16:00, ROOM 11</td>
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<tr>
<td><strong>EE-P</strong> EE Poster Session</td>
<td><strong>EE-5</strong> Novel Ultrafast Sources</td>
<td><strong>EE-6</strong> Dissipative Solitons II</td>
<td><strong>EH-2</strong> New Perspectives in Metamaterials and Nanophotonics</td>
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<td>Thursday, 10:00 - 11:00, ROOM 2</td>
<td>Friday, 11:00 - 12:30, ROOM 9</td>
<td>Friday, 08:30 - 10:00, ROOM 7</td>
<td>Tuesday, 11:00 - 12:30, ROOM 7</td>
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<tr>
<td><strong>EE-3</strong> Ultrafast Molecular Dynamics</td>
<td><strong>EF-1</strong> Mode-Locking Phenomena</td>
<td><strong>EF-2</strong> Dissipative Solitons I</td>
<td><strong>EH-3</strong> Advanced Control of Light with Metasurfaces</td>
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<td>Thursday, 14:30 - 16:00, ROOM 9</td>
<td>Monday, 14:30 - 16:00, ROOM 9</td>
<td>Thursday, 11:00 - 12:30, ROOM 11</td>
<td>Tuesday, 16:30 - 18:00, ROOM 7</td>
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<tr>
<td><strong>EF-4</strong> Frequency Standards and Miniaturized Comb Platforms</td>
<td><strong>EF-2</strong> Turbulence and Nonlinear Effects</td>
<td><strong>EF-3</strong> Coupling at the Nanoscale II</td>
<td><strong>EH-P</strong> EH Poster Session</td>
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<td>Tuesday, 18:30 - 20:00, ROOM 1</td>
<td>Monday, 18:00 - 19:30, ROOM 11</td>
<td>Wednesday, 11:00 - 12:30, ROOM 6</td>
<td>Wednesday 13:30 - 14:30, ROOM 2</td>
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<tr>
<td><strong>EF-P</strong> EF Poster Session</td>
<td><strong>EF-3</strong> 2D Transverse Dynamics and Quantum Effects</td>
<td><strong>EF-4</strong> Coupling at the Nanoscale I</td>
<td><strong>EH-4</strong> Plasmonics for Enhanced Light-Matter Interaction</td>
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<td>Thursday, 10:00 - 11:00, ROOM 2</td>
<td>Wednesday, 11:00 - 12:30, ROOM 9</td>
<td>Wednesday, 08:30 - 10:00, ROOM 7</td>
<td>Thursday, 08:30 - 10:00, ROOM 10</td>
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<td><strong>EF-5</strong> Micro-combs in Microresonators</td>
<td><strong>EF-4</strong> Nonlinear and Ultrafast Nano-optics</td>
<td><strong>EF-5</strong> Light-driven Phenomena at the Nanoscale</td>
<td><strong>EH-5</strong> Hybrid, Tunable and Nonlinear Metasurfaces</td>
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<td>Thursday, 08:30 - 10:00, ROOM 9</td>
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<td>Friday, 11:00 - 12:30, ROOM 10</td>
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<tr>
<td><strong>EF-P</strong> EF Poster Session</td>
<td><strong>EF-6</strong> Resonant Dielectric Nanostructures</td>
<td><strong>EF-6</strong> Applications of Metamaterials and Metasurfaces</td>
<td><strong>EH-6</strong> Applications of Metamaterials and Metasurfaces</td>
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<tr>
<td>Thursday, 10:00 - 11:00, ROOM 3</td>
<td>Thursday, 14:30 - 16:00, ROOM 5</td>
<td>Friday, 14:30 - 16:00, ROOM 3</td>
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<td><strong>EF-7</strong> Electron-light Interactions</td>
<td><strong>EF-7</strong> Electron-light Interactions</td>
<td><strong>EF-7</strong> Towards Applications and Perovskites</td>
<td><strong>EI-1</strong> Towards Applications and Perovskites</td>
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<td>Friday, 08:30 - 10:00, ROOM 9</td>
<td>Friday, 08:30 - 10:00, ROOM 9</td>
<td>Monday, 18:00 - 19:30, ROOM 9</td>
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<tr>
<td><strong>EF-P</strong> EF Poster Session</td>
<td><strong>EF-7</strong> Electron-light Interactions</td>
<td><strong>EI-2</strong> From Single Photons to Engineered Photonic Environments</td>
<td><strong>EI-2</strong> From Single Photons to Engineered Photonic Environments</td>
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<td>Thursday, 10:00 - 11:00, ROOM 3</td>
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CINK®/EUROPE-EQEC 2021
JOINT SYMPOSIA SESSIONS

JSI – NANOPHONONICS
JSI-1 Theory and Numerical Modeling for Nanophononics
   Monday, 08:30 - 10:00, ROOM 9

JSI – THEORETICAL
AND COMPUTATIONAL
PHOTONICS MODELLING

EJ-P EJ Poster Session
   Monday, 13:30 - 14:30, ROOM 3

EJ-1 Optical Computing and Artificial Intelligence
   Monday, 18:00 - 19:30, ROOM 3

EJ-2 Nonlinear Optics Modeling
   Tuesday, 11:00 - 12:30, ROOM 9

EJ-3 Tailored Light
   Wednesday, 14:30 - 16:00, ROOM 12

EOC-JOINT SYMPOSIA SESSIONS

JSII – HIGH-FIELD THZ GENERATION
AND APPLICATIONS

JSII-1 Strong-field Thz Generation
   Monday, 08:30 - 10:00, ROOM 10

JSII-2 Applications of Strong Thz Fields
   Monday, 18:00 - 19:30, ROOM 5

JSII-P JSII Poster Session
   Wednesday, 10:00 - 11:00, ROOM 1

JSIII – ATTOCHEMISTRY

JSIII-1 Theoretical Perspectives in Attochemistry
   Monday, 14:30 - 16:00, ROOM 8

JSIII-2 Experimental Progress in Attochemistry
   Monday, 18:00 - 19:30, ROOM 10

JSIV – DEEP LEARNING IN PHOTONICS

JSIV-1 Optical Computing I
   Thursday, 14:30 - 16:00, ROOM 11

JSIV – FLEXIBLE PHOTONICS

JSV – FLEXIBLE PHOTONICS

GLOBAL INFORMATION
CA – SOLID-STATE LASERS
Advances in solid-state lasers: novel solid-state lasers and amplifiers; high-power and high-energy lasers; power-scalable laser architectures; lasers for large-scale facilities; solid-state micro-chip lasers; crystalline waveguide lasers; short-wavelength lasers; up-conversion lasers; mid-infrared lasers; wavelength tuning techniques and tunable lasers; intracavity wavelength conversion; laser resonator design; techniques for thermal management and beam quality control; novel pump sources and pumping configurations; ns-pulse generation; amplitude and frequency stability; advanced laser crystals and ceramics, and glasses; spectroscopic characterization of solid-state gain media; laser characterization and modeling.

CHAIR: Nicolae Pavel, National Institute for Laser, Plasma and Radiation Physics, Romania

CB – SEMICONDUCTOR LASERS
New technology, devices and applications; UV lasers, visible lasers, near-infrared lasers; mid to far-infrared semiconductor lasers including W-lasers, quantum cascade and inter-subband lasers; quantum well, wire, dot and dash lasers; high power and high brightness lasers; vertical (extended) cavity surface emitting lasers; optically-pumped semiconductor lasers; photonic crystal semiconductor lasers, micro-cavity lasers, nanolasers, plasmonic lasers, polariton lasers; semiconductor ring lasers; short-pulse generation, mode locking; semiconductor optical amplifiers; new semiconductor laser materials, silicon-based lasers, novel characterization techniques; functional applications, including but not limited to: switching, clock recovery, signal processing; semiconductor lasers in integrated photonic circuits; laser dynamics, synchronization, chaos.

CHAIR: Stephen Sweeney, University of Surrey, UK

CC – TERAHERTZ SOURCES AND APPLICATIONS
Sources for generating terahertz (far-infrared) radiation in the range from 200 GHz to 100 THz, based on various physical principles including ultrafast time-domain systems, direct generation using terahertz lasers, and sources based on nonlinear optical mixing and laser-created plasmas; applications using terahertz radiation for spectroscopy, nonlinear THz phenomena, sensing, and imaging; advances in terahertz communications; new terahertz measurement techniques and instrumentation, including advances in terahertz imaging, detector technologies, near-field microscopy, terahertz devices and environmental monitoring.

CHAIR: Juliette Mangeney, Ecole Normale Supérieure, Laboratoire Pierre Aigrain, Paris, France

CD – APPLICATIONS OF NONLINEAR OPTICS
Novel applications of nonlinear optical phenomena and new devices; nonlinear frequency conversion for the UV, visible and IR; telecommunications applications and all-optical switching; all-optical delay lines and slow light; optical parametric devices such as optical parametric amplifiers and oscillators; nonlinear optics in waveguides and fibres, including photonic crystal structures and microstructured optical fibres; quasi-phasematched materials and devices; novel nonlinear materials; metamaterials and nanostructures; stimulated scattering processes and devices; applications of optical solitons and photorefractives; electro-optic and Kerr devices in crystals and semiconductors; Raman based devices including amplifiers and lasers; nonlinear probing of surfaces; multi-photon imaging and coherent Raman microscopy; quantum oriented applications.

CHAIR: Mikko J. Huttunen, Tampere University, Finland

CE – OPTICAL MATERIALS, FABRICATION AND CHARACTERIZATION
Fabrication of optical materials; new crystalline and glass laser materials in bulk, fiber and waveguide geometry; micro- and nano-fabrication and -engineering techniques; heterogeneous integration techniques; optical characterisation of laser and nonlinear materials, micro-structured fibre and photonic crystal waveguides, micro- and nano-crystalline materials, single defect centres, quantum wells, quantum wires and quantum dots, nano-tubes and nano-needles, innovative organic materials.

CHAIR: Daniel Milanese, University of Parma, Italy

CF – ULTRAFAST OPTICAL TECHNOLOGIES
Femtosecond and picosecond pulse generation from solid state, fiber and waveguide sources; mode-locked lasers; few-cycle optical pulses; pulse compression, carrier-envelope phase stabilization and pulse characterization; light waveform synthesis metrology; ultrashort-pulse semiconductor lasers and devices; ultrafast parametric amplifiers and parametric chirped pulse amplifiers; ultrashort-pulse mid-IR generation; supercontinuum generation; dispersion management; ultrafast electro-optics; pulse-shaping; carrier-envelope effects; ultrafast characterization methods and measurement techniques, ultrafast optoelectronic systems and devices; applications of ultrafast technology, technological aspects of ultrafast spectroscopy; ultrafast microscopic techniques; electro-optic sampling.

CHAIR: Daniele Brida, University of Luxembourg, Luxembourg

CG – HIGH-FIELD LASER AND ATTOSECOND SCIENCE
Strong-field and attosecond phenomena; attosecond pulse generation; strong-field ionization and ionization dynamics; novel technologies for high-field physics and attosecond science; probing of ultrafast dynamics with intense free-electron laser pulses; control of high-field and attosecond phenomena; laser-driven rescattering and recollision phenomena; high-harmonic generation; time-resolved XUV/soft x-ray spectroscopy, interferometry and microscopy; attosecond and femtosecond diffraction imaging with electrons or photons; molecular dynamics driven by strong fields or probed by high-field/attosecond methods; attosecond or strong-field driven electron dynamics in the condensed phase, bulk media, nanostructures, quantum-confined structures or at surfaces/interfaces; ultra-high-intensity laser physics and technology; laser-plasma interaction and particle acceleration; relativistic nonlinear optical phenomena.

CHAIR: Adrian Pfeiffer, Friedrich-Schiller-Universität, Jena, Germany

CH – OPTICAL SENSING AND MICROSCOPY
Inspection of a wide range of objects, from the macroscopic to the nanometric scale; recent progress in all aspects of optical sensing and metrology, particularly in new photonic sensor technologies and applications; plasmonic sensors; metamaterial sensors; biosensors; terahertz sensors; new trends in optical remote sensing; fibre sensors using conventional and photonic crystal fibres; active multispectral and
hyperspectral imaging; sensor multiplexing; novel spectroscopic techniques, nanospectroscopy; applications and systems; novel measurement methods and devices based on interferometry; holography; diffractometry or scatterometry; critical dimension metrology; multiscale surface metrology; UV and DUV microscopy; resolution enhancement technologies in microscopy; inverse problems; adaptive optics; phase retrieval.

**CHAIR: Crina Cojocaru, Universitat Politecnica de Catalunya, Spain**

**CI – OPTICAL TECHNOLOGIES FOR COMMUNICATIONS AND DATA STORAGE**

Fibre devices including nonlinear fibre, propagation and polarization effects, fibre gratings. Semiconductor devices for generation, processing and detection of optical signals. Digital signal processing, forward error correction, nonlinear Fourier transform. Submarine, core and metropolitan transport networks, communication and access networks. Multi-core, multi-mode fibre for transmission, optical amplification and functions; multi-band optical amplification and transmission. Optical sub-systems including clock recovery, packet/burst switching, advanced modulation formats, radio-over-fiber and microwave photonic technologies, optical regeneration and buffering; holographic and 3D optical data storage, near-field recording and super-resolution.

**CHAIR: Alessandro Tonello, XLIM, Limoges, France**

**CK – MICRO- AND NANO-PHOTONICS**

Nanostructured materials and fabrication techniques for photonic gratings; novel phenomena occurring when light is created, transported and detected in environments where either dimensionality or size are reduced and, in particular, when light-matter interaction occurs in regions smaller than or similar to the wavelength of light (nanophotonics). Periodic or quasi-periodic nanostructures (photonic crystals); issues related to order/disorder in nanostructured materials; photonic integrated circuits and applications advancing the integration of photonic devices for biology, lighting, communication, sensing and energy efficiency; optical MEMS; hybrid and 2D nanomaterials including in-/organic nano-layers/wires, nanocrystals and single molecules.

**CHAIR: Olivier Gauthier-Lafaye, LAAS CNRS, Toulouse, France**

**CL – PHOTONIC APPLICATIONS IN BIOLOGY AND MEDICINE**

Emerging concepts in biophotonics: single particle/molecule detection and tracking; spatio-temporal manipulation of light fields for biomedicine; enhanced linear and nonlinear excitation and detection; micro-fluidics, optofluidics and micro-optics; new optical probes for local measurements including organic and inorganic nanoparticles, electric fields and temperature measurements; New routes and modalities for optical detection in biophotonics: spectroscopy; holography; adaptive optics, phase conjugation time reversal; optics in biological media: scattering; coherence; polarization; symmetry and invariance. Advanced light sources and geometries for microscopy, phototherapy, surgery, biomedicine.

**CHAIR: Alexander Jesacher, Medizinische Universität Innsbruck, Austria**

**CM – MATERIALS PROCESSING WITH LASERS**

Fundamentals of laser-materials interactions; phase transformation, chemical reactions, diffusion processes, ablation; high-power laser-materials processing: welding, cutting, surface treatment; laser ablation; thin-film growth: PLD, LCVD; direct write techniques: MAPLE, LIFT, near-field techniques; 2D and 3D micro/nano structuring; plasma related processes; laser assisted nanosynthesis; femtosecond micromachining; ultrafast laser processing: volume modification, index engineering; laser-assisted manufacturing; additive manufacturing: two-photon polymerization and 3D laser printing.

**CHAIR: Emmanuel Stratakis, IESL-FORTH, Greece**

**EC – TOPOLOGICAL STATES OF LIGHT**

Advances in topological photonic lattices, topological edge states, topological pumps, synthetic dimensions, Dirac and Weyl points, topological lasers, topology and disorder, topology in non-Hermitian systems, probes of topological invariants, topological aspects of photonic quasicrystals, nonlinear topological effects, Floquet-topological photonics, spin-orbit coupling in photonic materials, non-reciprocity.

**CHAIR: Alberto Amo, Laboratoire PhLAM, Université de Lille-CNRS, Lille, France**
ED – Precision Metrology and Frequency Combs
Precision interferometry and spectroscopy including frequency combs; quantum metrology; ultimate limitations of measurement precision as imposed by the nature of quanta; tests of fundamental symmetries; definition of basic units; measurement of fundamental constants; applications in different spectral ranges, including mid-infrared.
CHAIR: Aleksandra Foltynowicz, Umeå University, Sweden

EE – Ultrafast Optical Science
Fundamental aspects of ultrafast science in all spectral regimes; propagation and instabilities of ultrashort pulses in linear and nonlinear media, supercontinuum generation, ultrafast filamentation and applications, extreme events, rogue waves and turbulence dynamics; ultrafast spectroscopy of molecules, solids and low dimensional structures; ultrafast phenomena in physics, chemistry and biology; propagation media: gas, liquid, and solid materials; free-space and wave-guided geometries; coherent control using femtosecond pulses.
CHAIR: Daniele Faccio, University of Glasgow, UK

EF – Nonlinear Phenomena, Solitons and Self-Organization
Nonlinear optical phenomena including dynamics and self-organization; frequency conversion, wave mixing, parametric processes, conservative and dissipative solitons, pattern formation, interaction between disorder and nonlinearities, complex behaviours and statistically heavy-tailed phenomena. Applications of nonlinear phenomena; nonlinear imaging and manipulation, novel optical materials, devices and systems. Fundamental aspects of nonlinear dynamics in single or coupled photonic devices, polariton condensates, micro and nano lasers, photonic crystals, optomechanical systems.
CHAIR: Julien Javaloyes, Universitat de les Illes Balears, Palma, Spain

EG – Light-Matter Interactions at the Nanoscale
Fundamental aspects of light-matter interactions at the nanoscale: nanoantennas and nanophotonic architectures, classical and quantum models, detection, emission and manipulation of light and/or matter; quantum nano-optics: coherent, quantum and nonlinear optical effects; ultrafast and strong-field phenomena at the nanoscale: interactions with electrons/plasma and their applications, ultrafast dynamics; optical imaging and spectroscopy: nanoscopy, nano-optical forces and tweezers; nano-energy: radiative transfer, photovoltaics and catalysis.
CO-CHAIRS: Niek van Hulst, ICFO, Castelldefels, Barcelona, Spain
Paolo Biagioni, Politecnico di Milano, Italy

EH – Plasmonics and Metamaterials
Metal nanoplasmonics from fundamentals towards applications and including all spectral regimes: plasmonic nanostructures, antennas, cavities and waveguides; metamaterials; hybrid materials; nonlinear structures and effects; active systems, systems with gain.
CHAIR: Vassili Fedotov, University of Southampton, UK

EI – Two-Dimensional and Novel Materials
Fundamental aspects and applications of graphene and other two-dimensional materials in optics and optoelectronics; light-matter interactions in 2D materials; ultrafast dynamics and nonlinear phenomena in 2D and novel materials, and mode-locked lasers; light sources, modulators, detectors, and other optoelectronic devices; photovoltaics; smart windows and flexible displays; terahertz devices; tunable plasmonics and metamaterials; integration with cavities and waveguides; multi-layered 2D heterostructures; perovskites and perovskite optoelectronics; NV centres; phase change materials.
CHAIR: Alexander Holleitner, Technische Universität München, Germany

EJ – Theoretical and Computational Photonics Modelling
Predictive theoretical and computational approaches for all fields of optics and photonics: full and semi-analytical treatments; applied mathematics and numerical analysis of partial differential equations; high-performance computing, massively parallel codes, including utilization of hardware accelerators. Modelling of singular nonlinear processes, shocks, wave collapse, material processing; first principle calculations of optical properties in dielectrics, plasmas, semiconductors and plasmonic structures; modelling of artificial optical materials.
CHAIR: Evangelos Siminos, University of Gothenburg, Sweden

JSI – Nanophononics
CO-CHAIRS: Sebastian Volz, Laboratory for Integrated Micro-Mechatronic Systems, LIMMS/CNRS-IIS(UMI2820), University of Tokyo, Japan
Roberto Li Voti, Sapienza Università di Roma, Italy

JSII – High-Frequency THz Generation and Applications
The symposium will highlight the most recent developments in exploration of strong-field interactions between light and matter in the THz range (loosely defined as 0.1 – 30 THz). The high interest and worldwide activity within this field is spurred by the possibility to generate ultrashort, tailored THz fields with strengths approaching that of the interatomic fields in matter, and probe the interaction on a timescale much shorter than the oscillation period of the fields. The understanding of the physics involved in such interactions is challenging, but the rewards for unlocking the potential of applications of such interactions are enormous: Computing at the clock frequency of a THz

CLEO®/Europe-EQEC 2021 Joint Symposia Topics
field without energy dissipation, quantum information processing, miniature accelerators, control of the behavior of complex molecules at the elementary level.

**Possible topics:**
- Strong-field THz generation and detection
- Local enhancement of strong THz fields
- Propagation in guided structures
- High-repetition-rate strong-field THz sources
- Nonlinear spectroscopy techniques
- Single-pulse experiments
- Pump-probe experiments
- N-dimensional nonlinear spectroscopy
- THz pump – x-ray probe
- Strong-field THz physics:
  - Nonperturbative effects
  - Relativistic strong-field interactions
  - Interactions in the ballistic regime
  - 2D materials
  - Lightwave electronics
  - High-harmonics generation
  - Ultrafast tunneling phenomena
- THz-driven electrons
- Generation
- Acceleration
- Applications

**CO-CHAIRS:**
- Franz Kaertner, DESY, University of Hamburg, Germany
- Peter Uhd Jepsen, Danish Technical University, Denmark

**JSIII – Attochemistry**
Attosecond imaging and control of charge dynamics in molecules; attosecond pump-probe spectroscopy and high-frequency spectroscopy of charge dynamics; photo-induced charge migration and charge transfer in molecules and liquids; imaging of few-fs structural changes in molecules; imaging of ultrafast electron and nuclear dynamics with XUV and X-ray FELs; control of coupled electron-nuclear dynamics in molecules; survival of electronic coherences in molecular systems; attosecond charge dynamics in solids and nanoparticles: clusters, organic optoelectronic systems, two-dimensional materials, topological systems; ultrafast processes in bio-relevant systems; proton migration; ultrafast dynamics of XUV radiation damage; attosecond dynamics of chiral systems; laser technology for attochemistry; theoretical methods for attochemistry.

**CO-CHAIRS:**
- Mauro Nisoli, Politecnico di Milano, Italy
- Fernando Martín, Universidad Autónoma de Madrid, Spain

**JSIV – Deep Learning in Photonics**
Deep neural network techniques have been used recently in a variety of ways in optics, including the processing of information from optical systems, design of optical devices, control of their functionality and also in the optical implementation of neural networks. This session will focus on recent progress in this exciting new field.

**CO-CHAIRS:**
- Demetri Psaltis, EPFL, Lausanne, Switzerland
- Chris Moser, EPFL, Lausanne, Switzerland

**JSV – Flexible Photonics**
Conventional photonic devices are planar and rigid because of the substrates on which they are fabricated. However, the world is not flat and stiff: There are many applications that would benefit from soft devices and nonplanar geometries, such as interfacing with the soft, curvilinear, and dynamic surfaces of living organisms. This mismatch demands flexible and stretchable photonic devices that can be mechanically deformed without damage to their useful properties. This session will focus on latest advances in the field of flexible and stretchable photonic devices, address the scientific and technical challenges associated with their material choice, device engineering, as well as system integration, and highlight key applications enabled by the technology.

**CO-CHAIRS:**
- Giancarlo Righini, IFAC, Centro Fermi, Italy
- Juejun Hu, Massachusetts Institute of Technology, USA

**CO-CHAIRS:**
- Alexander Jesacher, Medizinische Universität Innsbruck, Austria (CL chair CLEO®/Europe)
- Peter So, Massachusetts Institute of Technology, US (ECBO chair)

**Joint Session ECBO (European Conferences on Biomedical Optics (run by OSA, SPIE) - CLEO®/Europe 2021**

**CO-CHAIRS:**
- Emmanuel Stratakis, IESL- FORTH, Heraklion, Greece (CM chair CLEO®/Europe)

**CO-CHAIRS:**
- Benjamin Graf, Fraunhofer Institute for Production Systems and Design Technology IPK, Berlin, Germany (LiM)
- Michael Rethmeier, Bundesanstalt für Materialforschung und -prüfung (BAM), Berlin, Germany (LiM)

**CO-CHAIRS:**
- Michael Stratakis, IESL- FORTH, Heraklion, Greece (CM chair CLEO®/Europe)
GENERAL INFORMATION

Short abstracts of the papers to be presented at CLEO®/Europe-EQEC 2021 appear in this advance programme.

The CLEO®/Europe-EQEC 2021 technical programme will feature more than 1400 presentations including 3 Plenary talks (CLEO®/Europe, EQEC, WoP Congress), 5 Tutorial talks, 9 Keynote talks, 72 invited talks, 20 talks upgraded to invited, 914 oral presentations and 408 poster presentations. Additionally, 18 oral talks will be presented in the two post-deadline sessions to take place on Thursday evening. Additionally, 12 short courses will be proposed.

During the conference week, 199 oral sessions and 9 poster sessions will be featured. Up to 12 parallel sessions will virtually take place daily during the conference.

Conference Dates

CLEO®/Europe-EQEC 2021 will be running from Monday 21 June, 08:30 to Friday 25 June, 18:00, CEST time zone.

Welcome Words and World of Photonics Congress Plenary Talk by 2020 Nobel Prize Co-Laureate

The official World of Photonics congress opening will take place on Monday 21 June, from 11:00 to 12:30 CEST time zone. The event will be broadcasted from Messe Munich’s platform. Instructions on how to join in was sent to each participant. For all other CLEO/Europe-EQEC sessions join in via the CLEO/Europe-EQEC platform.

TIME SCHEDULE:

11:00 – 11:15

OPENING - WORDS OF WELCOME BY:
Dr. Reinhard Pfeiffer, deputy CEO, Messe München GmbH.

Dr. Luc Bergé, President European Physical Society
Prof. Constance J. Chang-Hasnain, 2021 OSA President
Prof. Carmen Menoni, 2021, IEEE Photonics Society President
Prof. David I. Andrews, SPIE President 2021
Dr.-Ing. Ludger Overmeyer, President WLT e.V.
Prof. Dr. Peter Loosen, Fraunhofer Institute for Laser Technology, ILT and President of the World of Photonics congress steering committee.

11:15 – 12:15

PLENARY TALK "A 40-YEAR JOURNEY"
Reinhard Genzel, Max-Planck-Institute for Extraterrestrial Physics, Garching, Germany

12:15 – 12:30

Presentation of the Winners of the Bernard J. Couillaud Prize
Prize and the Herbert Walther Award Presented by OSA.

NOTE: Wolfgang Peter Schleich, Universität Ulm, Institut für Quantenphysik, Ulm, Germany, 2021 recipient of the Herbert Walther Award will present a Keynote Talk “Cavity QED, Cold Atoms and the Riemann Zeta Function” during a special session to take place on Tuesday afternoon, 22 June 2021, from 14:30 to 15:30.

Prizes and Awards

A series of Prize and Award ceremonies will take place during the EQEC Plenary session scheduled Tuesday 22 June from 09:00 to 10:30, room 1.

During this session Nirit Dudovich, Weizmann Institute of Science, Rehovot, Israel, will present a plenary talk on “Attosecond Interferometry”

The following Prizes and Awards will be presented by the European Physical Society (EPS), the Optical Society (OSA), the European Optical Society (EOS).

• EPS-QEOD and EPS Young Minds 2021 Best Student Presentation Awards.

• 2021 Awards of the EPS-QEOD (Quantum Electronics and Optics Division):
  (1) Quantum Electronics Prize.
  (2) Fresnel Prizes.

• 2021 EPS-QEOD/AMOPD (Atomic, Molecular and Optical Physics Division) Vladilen Letokhov Medal

• 2020 EPS-QEOD Prize for ‘Research in Laser Science and Applications’

• The Optical Society (OSA) Awards and Honours:
  OSA Foundation Student Prizes
  OSA Fellow Members

• EOS Early Career Women in Photonics Award

Consult www.cleoeurope.org/awards-prizes/ for further information on the Prizes and Awards and lists of recipients.

Speakers’ Information

Speakers are recommended to speak live with screen sharing of their presentations. Pre-recording of the video is optional.

LENGTH OF THE ORAL PRESENTATIONS:

• Oral presentations are 15 minutes long (12 minutes live or pre-recorded presentation + 3 minutes for discussion).
• Post-deadline presentations are 10 minutes long (7 minutes live or pre-recorded presentation + 3 minutes for discussion).
• Invited presentations are 30 minutes long (25 minutes live presentation + 5 minutes for discussion).
• Tutorial presentations are 60 minutes long (50 minutes live presentation + 10 minutes for discussion).
• Keynote presentations are 45 minutes long (38 minutes live presentation + 7 minutes for discussion)
• Plenary presentations are 60 minutes long (50 minutes live presentation + 10 minutes for discussion).
• Short Course presentations are 2 x 1.5 hour and half an hour break in-between long (live presentation with screen sharing).

Speakers are requested to strictly stick to these time lengths, no extra time can be given.

Speakers are asked to check-in with the session chair in the virtual room of their relevant session ten minutes before the beginning of the session.

Poster Information

Each poster presenter had the possibility to post a A4 size poster in png format and a short 3-minute video presentation to be visible to participants during the conference.

Each poster author is also assigned in a one-hour topical poster session. Each author is required to attend his/her assigned poster break-out room to be able to meet with participants and explain/
discuss his/her poster presentation. During the session, the poster author can share his/her screen with a presentation (document, PowerPoint, ...). She/he will be able to mute/unmute his/her microphone.

Poster time schedules (all times given in CET time zone):
- Monday: 10:00 – 11:00
  (CA, CB, CI and JSV topics)
- Monday: 13:30 – 14:30
  (EA, EB and EJ topics)
- Tuesday: 13:30 – 14:30
  (CD and ED topics)
- Wednesday: 10:00 – 11:00
  (CC, CF, CE and JSII topics)
- Wednesday: 13:30 – 14:30
  (EC, EH, EL and JSI topics)
- Thursday: 10:00 – 11:00
  (CG, EE and EF topics)
- Thursday: 13:30 – 14:30
  (CJ, CK and CL topics).
- Friday: 10:00 – 11:00
  (CH, EG and JSIV topics)
- Friday: 13:30 – 14:30
  (CM topic)

Session chairs

For each oral session a nominated session chair will act to introduce the speakers, make sure the speakers stay within the appropriate time limits, help generate discussion.

The Session Chair main functions will consist in:
1) Connecting to his/her session 10 minutes prior the session begins.
2) Checking if all speakers of the session are present.
3) Identifying who will go for a live or a pre-recorded talk.
4) When the session runs, introducing each speaker.
5) Informing the audience that questions can be written down via the chat box.
6) Making sure the speakers stay within the appropriate time limits.
7) Reading the questions for the speaker to answer them, helping generate discussion.
8) Reporting any problems to the technical staff.
9) Post conference reporting of no-shows, reporting of any other matter.

Short Courses

Twelve short courses at an extra cost will be presented in parallel on Wednesday afternoon 23 June 2021 in the exception of one course to take place on Wednesday morning from 08:30 due to time zone constraints of the instructor.

Each course is scheduled in two parts: Course Part I (1 hour ½), break (30 minutes), Course Part II (1 hour ½). The short courses will not be recorded.

Conference Publication

The accepted one-page summaries (oral or posters) will be available online during the conference for those who have registered for the full week.

Post Conference Publications

After the conference, if approval given during the online submission, the one-page summaries will be published online by OSA Publishing (https://www.osa.org/en-us/publications/) and IEEE Photonics Society’s IEEE Xplore Digital Library (https://ieeexplore.ieee.org/xpl/conhome/1000412/all-proceedings).

Only papers (either oral or poster) for which the author(s) physically made the presentation at the conference will be eligible for the publications.

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Exhibition information

This year, the meeting will not be complemented by the LASER World of Photonics, the world’s largest tradeshow of laser and optical technology, which is rescheduled to take place in person in Munich, Germany, April 26–29, 2022. However, from June 21 to 24, 2021, Messe Munich will present the “LASER World of PHOTONICS Industry Days” on the World of Photonics Stage. This will take place in parallel to the digital World of Photonics Congress and offer the photonics community a platform for information exchange and networking. You can expect exciting presentations on market figures and the photonics applications of tomorrow, as well as quantum optics and many interesting showrooms. See https://www.world-of-photonics.com/en/

Conference registration

CONFERENCE REGISTRATION FEES

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<td>Regular extra fee for Short Course</td>
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Registration for the meeting includes:
- Admission to all virtual technical sessions of the 2021 Conference on Lasers and Electro-Optics/Europe – European Quantum Electronics Conference (CLEO®/Europe-EQEC) to take place from 21 to 25 June 2021, CEST time zone.
- Access to the networking features.
- Online technical digest (1-page summaries) with login and password.
- On-demand access of the recorded oral sessions during a 6 months period after the conference.

Additionally, each registered person will receive a voucher to attend:
- The digital World of Photonics Stage including selected sessions from the other Laser World of Photonics conferences.
- LASER World of PHOTONICS Industry Days presentations and panel discussions, network.

Cancellation policy

The deadline is passed, no refund can be requested.

Conference management

European Physical Society
6 rue des Frères Lumière
68200 Mulhouse, France

This programme is edited by Patricia Helfenstein and André Wobst.

Language

English is the official language of the conferences.
Heterogeneously integrated membrane lasers and photonic crystal lasers
S. Matsuo, K. Takeda, T. Fujii, and H. Nishi; NTT Device Technology Laboratories, NTT Corporation, Atsugi, Japan
We will describe our recent results on membrane DBR laser array and photonic crystal lasers. We have successfully demonstrated heterogeneous integration of III-V photonic devices on Si substrate.

Interplay between order and disorder in natural photonic structures
L. Schertel, G. Jacucci, G.T. van der Kerkhof, and S. Vignolini; University of Cambridge, Cambridge, United Kingdom
Colours in living organisms are often created by scattering of nanostructured materials, rather than absorption. Here we revise how the interplay between order and disorder in natural photonic structures affect their optical appearance.

Kerr-lens mode locked, synchronously pumped, ultra-broadband breathing pulse optical parametric oscillator
J. Fan1,2, D. Zuber1,2,3, R. Mevert1,2, T. Lang1,2, T. Binhammer3, and U. Morgner1,2,5; Leibniz Universität Hannover, Hannover, Germany; 2Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering-Innovation Across Disciplines), Hannover, Germany; 3Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany; 4NeoLASE GmbH, Hannover, Germany; 5Cluster of Excellence PhoenixD, Hannover, Germany
Beneficial from a breathing pulse design, we demonstrate a Kerr-lens mode locked non-collinear optical parametric oscillator, which is capable of delivering stable ultrabroadband signal spanning from 628 nm to 890 nm at -10 dB level.

Ultra-broadband, high power, femtosecond non-collinear optical parametric oscillator in the visible
R. Mevert1,2, Y. Binhammer1,2, C.M. Dietrich1,2, J.R. Cardoso de Andrade1,2, L. Beichert1,2, T. Binhammer3, J. Fan1,2, and U. Morgner1,2; Leibniz Universität Hannover, Hannover, Germany; 2Cluster of Excellence PhoenixD, Hannover, Germany; 3NeoLASE GmbH, Hannover, Germany
Optical parametric oscillators are novel laser sources for the creation of tunable ultrashort laser pulses. We present a fast-tunable, high power non-collinear optical parametric oscillator which covers nearly the complete visible spectral range (VIS-NOPO).
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<tr>
<td><strong>EB-1: Quantum Networks</strong>&lt;br&gt;Chair: Andreas Reiserer, MPQ, Garching, Germany</td>
<td><strong>EC-1: Band Topology I</strong>&lt;br&gt;Chair: Sebastian Klemmt, Wuernzburg University, Germany</td>
<td><strong>JSI-1: Theory and Numerical Modeling for Nanophotonics</strong>&lt;br&gt;Chair: Marc Bescond, The University of Tokyo, Tokyo, Japan</td>
<td><strong>JSII-1: Strong-field THz Generation</strong>&lt;br&gt;Chair: Peter Uld Jepsen, DTU Fotonik, Kgs. Lyngby, Denmark</td>
<td><strong>ED-1: Precision Spectroscopy and Fundamental Metrology I</strong>&lt;br&gt;Chair: Piotr Wcislo, Nicolaus Copernicus University, Torun, Poland</td>
<td><strong>JSV-1: Flexible Photonic Materials and Integration</strong>&lt;br&gt;Chair: Giancarlo C. Righini, Nello Carrara Institute of Applied Physics, Florence, Italy</td>
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<tr>
<td><strong>EB-1.1 MON (Keynote)</strong> 8:30 Quantum Multiplexing</td>
<td><strong>EC-1.1 MON (Invited)</strong> 8:30 Photonic topological Z2 Insulators</td>
<td><strong>JSI-1.1 MON (Invited)</strong> 8:30 Ab initio modeling of thermal effects in 2D van der Waals materials</td>
<td><strong>JSII-1.1 MON (Invited)</strong> 8:30 High harmonic generation from low dimensional materials</td>
<td><strong>ED-1.1 M ON (Invited)</strong> 8:30 Improved Determination of Fundamental Constants and Test of Fundamental Physics with Doppler-Free THz Spectroscopy of HD$^+$&lt;br&gt;S. Alighanbari$^1$, G. Giri$^1$, E.L. Constant$^2$, V. Karibov$^3$, and S. Schiller$^1$; 1 Institut f&quot;{u}r Experimentalphysik, Heinrich-Heine-Universit&quot;{a}t D&quot;{u}sseldorf, D&quot;{u}sseldorf, Germany; 2 Laboratoire PhLAM, CNRS UMR 8523, University of Lille, Villeneuve d’Ascq, France; 3 Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Russia</td>
<td><strong>JSV-1.1 M ON (Invited)</strong> 8:30 A universal approach for photonic integration on flexible substrates&lt;br&gt;Z. Chen$^{1,2}$, Y. Luo$^{1,3}$, H. Mao$^{1,3}$, M. Wei$^3$, J. Jian$^{1,2}$, Y. Ye$^{1,2}$, L. Wang$^3$, Y. Shi$^{1,2}$, R. Tang$^{1,2}$, C. Sun$^{1,2}$, J. Li$^3$, C. Zhang$^3$, J. Wei$^{1,2}$, H. Lin$^3$, and L. Li$^{1,2}$; 1 Key Laboratory of 3D Micro/Nano Fabrication and Characterization of Zhejiang Province, School of Engineering, Westlake University, Hangzhou, China; 2 Institute of Advanced Technology, Westlake Institute for Advanced Study, Hangzhou, China; 3 College of Information Science &amp; Electronic Engineering, Zhejiang University, Hangzhou, China</td>
</tr>
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Quantum networking will enable information transmission in ways unavailable in the classical world. Here we introduce the concept of quantum multiplexing which encodes multiple qubits of information onto a photon to overcome scarce resource issues.

We introduce a photonic topological Floquet Z2-insulator with fermionic time reversal symmetry (TRS). Our experiments demonstrate the characteristic protected counter-propagating edge modes and unequivocally prove the presence of fermionic TRS in this bosonic system.

We show recent progress of high harmonic generation in solids, especially focusing low dimensional materials such as graphene, transition metal dichalcogenides, and carbon nanotubes.

Improved precision of Doppler-free rotational spectroscopy of trapped and laser-cooled HD$^+$ ions allows to confirm accurately high-precision ab initio molecular ion quantum theory calculations and to determine fundamental constants more precisely than the CODATA2018 values.

We demonstrate a universal approach for the fabrication of flexible photonics. The developed approach shows few limitations on the selection of optical materials and enables novel 3D photonic integrations for sensing and biological applications.
Enhanced absorption efficiency in UV-pumped Tb\(^{3+}\): TLF

Š. Kaltusniak, H. Tanaka, E. Castellano-Hernández, and C. Kränkel; Leibniz-Institut für Kristallzüchtung (IKZ), Berlin, Germany

We investigate UV pumping of Tb-based lasers and demonstrate significantly higher optical-to-optical efficiencies compared to conventional cyan-blue pumping. Spectroscopy reveals higher UV absorption cross sections and efficient population of the upper laser level by cross-relaxation.

Comparison of electrically and optically pumped buried-heterostructure photonic crystal lasers

E. Domopoulos, Y. Yu, A. Sakanas, A. Marchevsky, M. Xiang, K.S. Mathiesen, E. Semenova, K. Yeind, and I. Mørk; DTU Fotonik, Technical University of Denmark, Kongens Lyngby, Denmark

The properties of buried-heterostructure photonic crystal nanolasers are studied by employing electrical and optical pumping. Using the rate equations and the spectral evolution of the laser the thermal properties and injection efficiency are being investigated.

Towards Sub-10-fs Visible \(\mu\)Pulses at 1 MHz Repetition Rate From an Optical Parametric Amplifier

S. Kleinert\(^{1,2}\), A. Tajab\(^{1,2}\), D. Zuber\(^{1,2}\), J.R.C. Andrade\(^{3}\), and U. Morgner\(^{1,2,3,4}\); Institute of Quantum Optics, Leibniz Universität Hannover, 30167 Hannover, Germany; \(^{2}\)Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering - Innovation Across Disciplines), 30167 Hannover, Germany; \(^{3}\)Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany; \(^{4}\)Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, 12489 Berlin, Germany; \(^{5}\)Laser Zentrum Hannover e.V., 30419 Hannover, Germany.

We present a compact visible optical-parametric amplifier delivering pulses with an energy of 2\(\mu\)J and a Fourier-transform-limited pulse duration below 7fs at 1MHz repetition rate. The system is pumped by a CPA-free solid-state amplifier.

First Observation of Phonon-induced Ballistic Motion in Photonic Nanostructures

T. Liu\(^{1}\), J.-Y. Ou\(^{1}\), K. MacDonald\(^{1}\), and N. Zehludo\(^{1,2}\); University of Southampton, Southampton, Hampshire, United Kingdom; Nanyang Technological University, Singapore, Singapore

The components of phononic and opto/electro-mechanical nanostructures are subject to picometre-scale thermal movements, which affect their optical properties. We present the first observation of short-timescale ballistic (non-Brownian) phonon-driven motion in a microcantilever.
Entanglement Based Quantum Networks: Protocols, AI control plane & coexistence with classical communication.


1. University of Bristol, Bristol, United Kingdom; 2. The University of Sheffield, Sheffield, United Kingdom; 3. University of York, York, United Kingdom; 4. Heriot-Watt University, Edinburgh, United Kingdom; 5. Institute for Quantum Optics and Quantum Information - Vienna (IQOQI), Vienna, Austria; 6. Ruder Bošković Institute, Zagreb, Croatia; 7. College of Advanced Interdisciplinary Studies, NUDT, Changsha, Spain; 8. University of British Columbia, Vancouver, Canada; 9. ETH Zurich, Zurich, Switzerland; 10. City University of Hong Kong, Hong Kong, China.

We present a multi-user quantum network and experimental implementations of unconditionally secure digital signatures, 5 different anonymity protocols, authentication transfer protocol, network flooding. Artificial Intelligence network control plane and coexistence between classical and quantum signals.
Design strategy for broadband MECSELS

H. Kahle, H.-M. Phung, P. Tatar-Mathes, P. Rajala, and M. Guina; Optoelectronics Research Centre (ORC), Physics Unit / Photonics, Faculty of Engineering and Natural Sciences, Tampere University, Tampere, Finland

First results of MECSELS with semiconductor gain membranes, designed to possess a broad tuning range are presented. The MECSEL operates at room temperature around 1 μm and the membrane contains two different kinds of quantum wells.

Switchable optical strong PUFs via polymer dispersed liquid crystals

S. Nocentini1,2, U. Ruehmeir1, M. Baran1, D.S. Wiersma1,2, and F. Ribolzi1,2; National Institute of Metrological Research (INRIM), 10135 Turin, Italy

European Laboratory of Nonlinear Spectroscopy (LENS), 50019 Sesto Fiorentino, Italy

University of Siena, Department of Information Engineering and Mathematical Sciences, 53100 Siena, Italy

University of Florence, Department of Physics, 50019 Sesto Fiorentino, Italy

National Research Center - National Optical Institute (CNR-INO), 50019 Sesto Fiorentino, Italy

Physical unclonable functions (PUFs) have been proposed for secure authentication processes in open networks. We demonstrate reconfigurable and switchable all-optical strong PUFs based on polymer dispersed liquid crystals characterized by an enhanced complexity thanks to material reconfigurability.

Lensless and Optical Physically Unclonable Function with Fibrous Media

M.S. Kim1, G.J. Lee2, S.H. Choi3, J.W. Leem3, Y.L. Kim3, and Y.M. Song3; Gwangju Institute of Science and Technology, Gwangju, South Korea

Yonsei University, Wonju, South Korea

Purdue University, West Lafayette, USA

Combination of Physically unclonable functions (PUF) and fibrous medium can potentially increase hardware and information security. Here, we propose a strong lensless, optical, portable PUF device with fibrous medium having inherent stochastic pinholes.
**EC-1.4 MON 9:45**

**Open QKD Use-case for Securing Sensitive Medical Data at Rest and in Transit**

B. Zaitoukia, F. Katscher1, A. Poppe1, W. Straser1, B. Stockinger1, L. Brei2, L. Setaffy1, K. Zaitoukia1, H. Müller1, M. Plass3, B. Krippner3, and S.F. Lax1

1fragmentIX, Klosterneuburg, Austria; 2AIT Austrian Institute of Technology GmbH, Vienna, Austria; 3Citycom Telekommunikation GmbH, Graz, Austria; 4Medical University Graz, Graz, Austria; 5Hospital (LKH)-Graz II, Graz, Austria

**Abstract:** Secure keys from QKD systems have been used by AES-encoders to distribute large images and sensitive genome data and store them using secret sharing methods under real-world conditions in Graz.

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**JSI-14 MON 9:45**

**Mechanisms of Terahertz Generation under Femtosecond Pulses propagation in Noncomposites**

W. Fedotova1, A. Husakov2, G. Busetty2, A. Fedotov2, O. Khosanov2, T. Smirnova2, U. Sapag2, and I. Babushkin3,4

1Scientific-Practical Materials Research Centre NAS Belarus, Minsk, Belarus; 2Max Born Institute, Berlin, Germany; 3Bayerische Staatsuniversität, Munich, Germany; 4International Sakharov Environmental Institute BSU, Minsk, Belarus; 5Taskent State Technical University, Taskent, Uzbekistan; 6Institute of Quantum Optics, Leibniz Hannover University, Hannover, Germany; 7Cluster of Excellence PhoenixD, Hannover, Germany

**Abstract:** Intensive femtosecond pulse propagating through noncomposites consisted of the semiconductor quantum dot incorporated into a dielectric matrix may yield terahertz pulse due to the contribution of large permanent dipole moments as well as transition dipole moments between the excitonic states.

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**JSI-15 MON 9:45**

**Quantum Interference Terahertz Generation from ZnTe**

L. Peters, J.S. Totero Gorgona, A. Conconi, J. Tunesi, L. Olivieri, A. Pasquazi, and M. Peccianti; Emergent Photonics Lab, University of Sousse, Brighton, United Kingdom

**Abstract:** We demonstrate a novel scheme based on two-color quantum interference to augment the THz emission from ZnTe in transmission. The generation mechanism is phase matching free due to a configuration of the interactions at the crystal surface.
We report our first results on the use of GaSb-based semiconductor saturable absorber mirrors (SESAM) for mid-IR ultrafast lasers. We present a type-I InGaSb/GaSb quantum well SESAM operating at 2.35 μm with Fsat of 10.59 mJ/cm², ΔR of 1.69%, ΔRns of 0.81%, and ideally suited fast recovery time (τ = 0.81%).

In this talk, I will describe some of our recent work on harmonic generation from nonlinear metasurfaces, ultrafast switching and diffraction, transient frequency conversion and perfect absorbing metasurfaces for THz emission and detection. The key features of GaSb-based semiconductor saturable mirrors are reviewed in connection with performance they enable when used for mode-locking a large variety of ultrafast solid-state lasers emitting at 2μm window and beyond. Our fundamental reconsideration of the main components of QCL based spectrometers led to rugged and lightweight instruments that opened up remarkable options in environmental science. We highlight their potential using field application results.

Four-channel coherently combined 1mW-doped fiber chirped-pulse amplification system delivering 1 mJ pulses at 98 kHz repetition rate.

We investigated the absorption of intense, long wavelength light by using the onset of stimulated emission in ZnO thin films. The wavelength dependence of the lasing threshold intensity reveals the important role of free carriers.
In this work, we report on the fabrication of multi-functional surfaces by combining deterministic periodication of multi-functional surfaces. The approach allows for the creation of complex surface structures with tailored properties for various applications.
CD-1.2 MON  15:00  
Nonlinear Circular Dichroism in the Second-Harmonic Generation from AlGaAs Nanoparticle Dimers

1 Research School of Physics, Australian National University, Canberra, Australia; 2 Department of Physics and Engineering, ITMO University, Saint Petersburg, Russia; 3 Department of Physics, Korea University, Seoul, Republic of Korea; 4 University of Southern California, Los Angeles, USA; 5 KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul, Republic of Korea

We experimentally demonstrate the effect of nonlinear circular dichroism in a dimer of Mie-resonant AlGaAs nanoparticles originated by the multipolar nature of their optical response.

CA-2.2 MON  15:00  
Diode-pumped Femtosecond Modelocked Tm:Ho:CLNGG laser at 2093 nm

M. Hamdan, S. Tomilov, Z. Pan, Y. Wang, and C.J. Saraceno
1 Ruhr-Universität Bochum, Bochum, Germany; 2 Institut de Chimie des Matériaux Inorganiques et Analytiques, Nancy, France; 3 University of Central Florida, Orlando, Florida, USA

We demonstrate a 2-μm diode-pumped modelocked Tm:Ho:CLNGG laser with 213-fs pulse duration and 200-mW output power at 102-MHz. To the best of our knowledge, this is the shortest pulse duration from a Tm:Ho-codoped diode-pumped laser.

CH-1.3 MON  15:00  
Beam Pointing Estimation in Target-in-the-loop Coherent Beam Combination through 300nm Atmospheric Turbulence

L. Lombard, B. Rouzé, H. Jacqmin, A. Limery, A. Durécu, and P. Bourdon; Onera, the French aerospace lab, Palaiseau, France; 2 Centre de Nanosciences et de Nanotechnologies, Palaiseau, France; 3 Université Paris Diderot, Paris, France

We report on target-in-the-loop coherent-beam combination of seven fiber amplifiers at 300 nm that is simultaneously estimated far and near-field. Both measurements agree and support the idea of an access to tip/tilt from the emitter side.

CA-2.2 MON  15:00  
Photonic and Chirped Pulse Amplification for CO Gas Sensing

M.A. Abbas, and F.J.M. Harren
1 Active Fiber Systems GmbH, Jena, Germany; 2 Institute for Molecules and Laser Physics, Friedrich-Schiller-Universität Jena, Jena, Germany; 3 Helmholtz-Institut Jena, Jena, Germany; 4 Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We demonstrate the coherent combination of four thulium-doped fiber amplifiers. The system delivers pulses with <120 fs FWHM duration with up to 228 μJ of pulse energy at a center wavelength of 1940 nm.

CH-1.2 MON  14:45  
Fourier transform spectrometer developed for high repetition rate mid-infrared supercontinuum sources

A. Khodabakhsh, M. Nematollahi, M. A. Abbas, and F. J. M. Harren
1 K.U.-K.I.S.T Graduate School of Converging Science and Technology, Korea University, Seoul, Republic of Korea; 2 Institute of Chemical Technology, Prague, Czech Republic

We experimentally demonstrate the effect of nonlinear circular dichroism in a dimer of Mie-resonant AlGaAs nanoparticles originated by the multipolar nature of their optical response.

CD-1.2 MON  15:00  
Novel concepts for III-N-based vertical cavity surface emitting lasers

A. Dadgar, Institut für Physik, Universität Magdeburg, Magdeburg, Germany

We discuss and demonstrate highly conductive epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting ITO but also highly conducting short cavity VCSEL design. Hole current spreading and enabling better conductivity epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting ITO but also highly conducting short cavity VCSEL design. Hole current spreading and enabling better conductivity epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting ITO but also highly conducting short cavity VCSEL design. Hole current spreading and enabling better conductivity epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting ITO but also highly conducting short cavity VCSEL design. Hole current spreading and enabling better conductivity epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting ITO but also highly conducting short cavity VCSEL design. Hole current spreading and enabling better conductivity epitaxial AlInN/GaN Bragg mirrors promoting better current spreading and enabling short cavity VCSEL design. Hole injection concepts including ITO but also highly conducting ITO but also highly conducting short cavity VCSEL design. Hole current spreading and enabling better conductivity.
Femtosecond laser-induced oxidation in the formation of periodic surface structures

Novel Isotope Effect in Coherent Non-adiabatic Dynamics Induced by an Attosecond Pulse

Using a Plasmonic Nanolens To Observe Quantum Emitters

Time Diffraction in an Epsilon-Near-Zero Metasurface

Extremes of a degenerate parametric process
tactical response and depending on a material’s crystalline axis orientation.

**CD-1.3 M ON 15:15**

**Intersubband Polaritonic Metasurfaces for Second Harmonic Generation with High Conversion Efficiency**

- J. Krakofsky1, G. Böhni1, M. Belkin1, A. Mekawy2, S. Mann2, and A. Alù1; 1Walter Schottky Institute, Munich, Germany; 2CUNY, New York, USA

In this work we present a new attempt to overcome saturation effects of nonlinear intersubband polaritonic metasurfaces using GaAsSa as a small linewidth material and new nano resonator designs.

**CA-2.3 M ON 15:15**

**Sub-50-fs SESAM mode-locked Tm,Ho:Ca(Gd,Lu)AlO4 laser**

- L. Wang1, W. Chen1, Y. Zhao1, Z. Pan1, M. Mero1, X. Mateo1, P. Laino1, M. Guina1, U. Griebner1, and V. Petrov2; 1Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany; 2Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, China; 3Universität Rovira i Virgili (URV), Tarragona, Spain; 4Université de Caen, Caen, France; 5Reflektord Ltd., Tampere, Finland

We report on the first sub-50-fs mode-locked 2-μm solid-state laser using Tm,Ho:Ca(Gd,Lu)AlO4 as a gain medium, to generate pulses as short as 47 fs at 2033 nm with a repetition rate of ~793 MHz.

**CH-1.4 M ON 15:15**

**Sensitive multi-species gas sensing with supercontinuum-based photoacoustic spectroscopy**

- T. Mikkenen1, T. Hieta1, G. Genty1, and J. Toivonen1; 1Photonics Laboratory, Physics Unit, Tampere University, Tampere, Finland; 2Gasera Ltd, Turku, Finland

We improved the sensitivity of supercontinuum-based broadband photoacoustic spectroscopy in the mid-infrared by employing a miniature multipass cell. We demonstrated the system’s ability to separate spectrally overlapping hydrocarbons from a gas mixture.

**CA-1.2 M ON 15:30**

**All-dielectric metasurface with enhanced third-harmonic dichroism driven by quasi-BIC**

- M. Gandolfi1, A. Tognazzini2, D. Rocco, L. Carletti, and C. De Angelis; CNR-INOF and Department of Information Engineering, University of Brescia, Brescia, Italy

We design chiral Si metasurfaces supporting quasi-BIC for enhanced nonlinear circular dichroism (up to 99.9%) and high TH conversion efficiency (0.01 W-1). Tuning mode interference allows selective linear and nonlinear circular dichroism.

**CH-1.5 M ON 15:30**

**Part-per-billion optical sensing of carbon monoxide based on QEPAS and PTS detection modules**

- D. Pinto1, H. Moser2, J-P. Wielawek2, S. Delo Runcio3, P. Patimisco1, V. Spagnolo3, and B. Lendl1; 1Institute of Chemical Technologies and Analytics, Technische Universität Wien, Vienna, Austria; 2PolySense Lab - Departamento InterateneodiFisica, Universidade and Politecnico di Bari, Bari, Italy

We demonstrate high-power SESAM, soliton-mode-locking of a Ho:YAG thin-disk oscillator, delivering an output power of 40.5 W with pulse duration of 1.66 ps into gas cell, along with high-pass filtering of the signal.

**CA-2.4 M ON 15:30**

**Impact of high temperature post-treatment on photoluminescence performance of passivated InP/InGaAs/InP nanopillars**

- Q. Malyshova, D. Pellegrino, A. Fiore, K. Williasa, and V. Calzadilla; Eindhoven University of Technology, Eindhoven, Netherlands

The effect of high temperature post-treatment was investigated on InP/InGaAs/InP pillars, passivated with ammonium sulphide and SiO2 coating. Passivation efficiency was shown to increase for treatment temperature up to 500°C.

**CH-1.4 M ON 15:15**

**Optimizing rod-type multiline fiber amplifiers in coherently-combined laser systems**

- A. Steinknopfl1, C. Aleshire1, C. Jauregui1, A. Kleink1,2, and J. Bave1; 1Institute of Applied Photonics and Precision Engineering, Jena, Germany; 2Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We will present theoretical investigations on the power and energy scaling potential of coherently-combined multiline fiber amplifiers, including thermal considerations and the limitations stemming thereof. Furthermore, we will show strategies to counteract these effects.

**CJ-1.5 M ON 15:30**

**PISTIL interferometry diagnosis on a 61 channels coherent beam combining digital laser**

- B. Roszé1, B. Bellanger2, I. Faufes3, C. Bellanger1, M. Veinhard4, J. Chanteloup5, and J. Primot5; 1DIMA, ONERA, Université Paris-Saclay, Palaiseau, France; 2ULL, CNRS, Ecole Polytechnique, CEA, Sorbonne Université, Institut Polytechnique de Paris, Palaiseau, France; 3DOST, OBERA, Université Paris-Saclay, Palaiseau, France A皮LON和TIL（PISTIL）干涉仪是应用在61个相干束结合的双波段干涉仪中。双波段干涉仪的提取，倾斜和尾端在不同波段和段位面分析。
Anisotropic Resistivity ITO Surfaces produced by Laser-induced Self-organization at the Nanoscale


Laser Processing Group, Instituto de Óptica (IO-CSIC), Madrid, Spain; Nanotechnology on Surfaces Group, Instituto de Ciencia de Materiales de Sevilla (US-CSIC), Sevilla, Spain; Departamento de Física Atómica, Molecular y Nuclear, Facultad de Física, Universidad de Sevilla, Sevilla, Spain

Highly anisotropic resistivity surfaces are produced in indium tin oxide (ITO) films by fs-laser induced self-organization at the nanoscale. Anisotropy is caused by the formation of laser-induced periodic surface structures (LIPSS) extended over cm-sized regions.

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Ultrafast Optical Rotation for Extremely Sensitive Enanti-Discrimination

D. Ayuso\textsuperscript{1,2}, A. Ordonéz\textsuperscript{2}, M. Ivanov\textsuperscript{1,2}, and O. Smirnova\textsuperscript{1,2}

\textsuperscript{1}Department of Physics, Imperial College London, London, United Kingdom; \textsuperscript{2}Max-Born Institute, Berlin, Germany

We introduce ultrafast optical rotation: a highly efficient method for chiral discrimination using few-cycle pulses. Sub-cycle optical control of the position and decay rate of the LDOS by simultaneously mapping the position and decay rate of photovoltaic single-molecules.

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Attosecond Pulse Trains with Time-Dependent Spin Angular Microcomb

L. Reja\textsuperscript{1}, S. Román\textsuperscript{1}, P. Plaja\textsuperscript{1}, M. Rowley\textsuperscript{2}, G. Blanquer\textsuperscript{1}, J. Siegel\textsuperscript{2}, and M. Oppo\textsuperscript{2}

\textsuperscript{1}Institute of Basic Research, University of the Balearic Islands & Institute of Applied Computing and Theoretical Physics, University of Valldemossa, km 7.5, E-07122 Palma de Mallorca, Spain; \textsuperscript{2}Technische Universität Berlin, Berlin, Germany

We present a technique to generate attosecond pulse trains whose polarization varies sequentially from pulse to pulse. This is accomplished by driving high-order harmonic generation with two time-delayed dichromatic counter-rotating fields carrying orbital angular momentum.

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Single-molecule imaging of LDOS modification by an array of organic chromophores

K. Keller\textsuperscript{1}, M. Dodder\textsuperscript{1}, M. Davids\textsuperscript{1}, K. Srivivasan\textsuperscript{2}, J. Leuthold\textsuperscript{1}, and C. Haffner\textsuperscript{1,2}

\textsuperscript{1}Institute for Electromagnetic Fields, Zurich, Switzerland; \textsuperscript{2}Physical Measurement Laboratory, Gaithersburg, USA

Simulation of photon-pair sources in a photonic-organic platform are presented. Using mode-matching and programmable quasi-phase-matching, peak efficiencies of 0.75 GHz/mW are reached, featuring a minimum of 100 MHz/mW with a fabrication tolerance of 57.6 nm.

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Self-Starting Temporal Cavity Solitons in a Laser-based Microcomb

A. Czarnota\textsuperscript{1}, P.-H. Hanzard\textsuperscript{1}, M. Rowley\textsuperscript{2}, V. Malomed\textsuperscript{2,3}, G.-L. Oppo\textsuperscript{2,3}, J.S. Tetero-Gongora\textsuperscript{1}, M. Peccianti\textsuperscript{1}, and A. Pasquazi\textsuperscript{1}

Emergent Photonics Lab (Epic), Department of Physics and Astronomy, University of Sussex, Brighton, United Kingdom; Department of Physical Electronics, School of Electrical Engineering, Faculty of Engineering and the Center for Light-Matter Interaction, Tel Aviv University, Tel Aviv, Israel; Instituto de Alta Investigación, Universidad de Tarapacá, Arica, Chile; SUPA, Department of Physics, University of Strathclyde, Glasgow, United Kingdom

Self-starting of stable temporal laser-cavity solitons in a micro-ring cavity nested into an amplifying fiber loop is demonstrated. Group velocity mismatch and gain dispersion are used to control the soliton multiplicity at the output.

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Attosecond control of multi-photon multiple ionization dynamics


Max-Born-Institut, Berlin, Germany

We demonstrate attosecond control of the multi-photon multiple ionization dynamics of argon. While the Ar\textsuperscript{8+} ion yield is weakly modulated in an autocorrelation measurement, the Ar\textsuperscript{8+} autocorrelation trace shows strong oscillations attributed to direct two-photon absorption.
Growth of site-controlled InAs/GaAs quantum dot arrays for integration into photonic devices

C. Oyenden1, A. Trapalis1, D.J. Hallett2, P.K. Patil2, E. Clarke3, M.S. Shobnick3, I. Farrer3, and J. Heffernan3; 1Department of Electronic and Electrical Engineering, University of Sheffield, Sheffield, United Kingdom; 2Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom; 3EPSRC National Epitaxy Facility, University of Sheffield, Sheffield, United Kingdom

We demonstrate resonant one-dimensional amorphous-Germanium zero contrast grating structures for frequency up-conversion. For ~2.4 μm fundamental excitation, the structures achieve 900 times resonant enhancement of the third-harmonic signal at ~800 nm wavelength.

High Energy Cryogenically Cooled Ho:YAG Oscillator

M. Ganija1,2, K. Boyd1,2, A. Hemmings3, N. Carmody3, N. Simakov4, P. Veitch1, and J. Munch1; 1Department of Physics and IPAS, Adelaide, Australia; 2Directed Energy Technologies and Effects Defence Science and Technology Group, Edinburgh, Australia

We report efficient, cryogenically cooled, continuous wave and pulsed Ho:YAG lasering with excellent beam quality. We demonstrate average powers of 60 W and pulse energies 310 mJ with a 100 Hz PRF without thermal degradation.

Monitoring of peroxy radicals by chemical amplification enhanced photoacoustic spectroscopy

G. Wang1, A. Lahib2, M. Duncanius3, Q. Gou1, P.S. Stevens4, S. Dusanter3, A. Tomas5, M.W. Sigrist6, and W. Chen1; 1Laboratoire de Physicochimie de l’Atmosphère, Université du Littoral Côte d’Opale, 59140 Dunkerque, France; 2IMT Lille Douai, Université de Lille, 59000 Lille, France; 3School of Chemistry and Chemical Engineering, Chongqing University, 401331 Chongqing, China; 4Paul H. O’Neill School of Public and Environmental Affairs, Indiana University, Bloomington, IN 47405, USA; 5Institute for Quantum Electronics, ETH Zurich, Zurich, Switzerland

Measurements of peroxy radicals using photoacoustic spectroscopy enhanced by chemical amplification was demonstrated. 1-σ limit of detection of about 12 pptv was achieved in 90 s integration time at a relative humidity of 9.8%.
CM-1.5 MON 15:45

Ultrasound laser processing of nanostructured patterns for the control of cell adhesion and migration on titanium alloys
A. Abou Khalloufi, S. Sedal, S. Papad, P. Claude, A. Klos, T. Iitna, N. Attik, A. Guignardon, and V. Dunas.

ROOM 8

JSH-1.5 MON 15:45

Enantio-sensitive unidirectional light bending
A. Ordonné, D. Ayuso, P. Deceeva, M. Ivanov, O. Smirnova, Max-Born-Institut, Berlin, Germany; Technische Universität Berlin, Berlin, Germany; Imperial College London, London, United Kingdom; Université Paris-Saclay, Palaiseau, France; and Humboldt-Universität zu Berlin, Berlin, Germany.

We introduce structured light with zero net chirality displaying a charge-polarized-like pattern of chirality, allowing perfect enantioselective discrimination within the dipole approximation on ultrafast time scales, opposite enantiomers emitting harmonics in opposite directions.

PL-2.1 MON (P knary)

How Light Behaves when the Refractive Index Vanishes
R. Boyd, University of Ottawa, Ottawa, Canada; University of Rochester, Rochester, USA.

We explore the properties of light within a medium for which the refractive index vanishes. The fundamental radiative processes of spontaneous and stimulated emission are predicted to be profoundly modified. Moreover, the nonlinear optical response is extremely large.

ROOM 9

EF-1.5 MON 15:45

Symmetry-broken pulse-timing sequences in micropillar lasers with optical delayed feedback

We will present experiments that demonstrate strain tuning of the frequency of the zero phonon line resonances of single diacetylene molecules at cryogenic temperature, and support our measurements with molecular dynamics calculations.

ROOM 10

EG-1.5 MON 15:45

Strain tuning of single-molecule-based single photon sources

We theoretically predict and demonstrate via polarization-resolved ultrafast pump-probe spectroscopy a sub-picosecond broadband dichroism driven by the transient spatial inhomogeneities at the nanoscale of photoexcited hot carriers in a highly symmetric plasmonic metasurface.

EG-1.5 MON 15:45

Hot Electrons Remote Excitation and their Ultrafast Dynamics

We theoretically predict and demonstrate via polarization-resolved ultrafast pump-probe spectroscopy a sub-picosecond broadband dichroism driven by the transient spatial inhomogeneities at the nanoscale of photoexcited hot carriers in a highly symmetric plasmonic metasurface.

ROOM 11

EH-1.5 MON 15:45

Spectrally Tunable Attosecond Pulse Generation

We propose and demonstrate a method to generate high-order harmonics in rare-gas atoms with tunable photon energy and spectral width in a way that can be easily adopted to already implemented beamlines worldwide.
### CC-1: THz Strong Field Applications
**Chair:** Fülöp József András, ELI-ALPS, Szeged, Hungary

**CC-1.1 MON (Invited) 18:00**
**Ultrafast structural dynamics of strongly-THz-driven materials**
**M. Hoffmann**
SLAC National Accelerator Laboratory, Menlo Park, USA

Ultrafast THz pulses efficiently couple to low-energy degrees of freedom in complex materials such as optical phonons or magnons. Simultaneously, ultrafast X-ray or electron diffraction can be used to track structural changes with femtosecond resolution.

### CL-1: Laser-Tissue Interactions and Surgery
**Chair:** Molly May, Division of Biomedical Physics, Medical University Innsbruck, Innsbruck, Austria

**CL-1.1 MON (Tutorial) 18:00**
**Picosecond Infrared Laser (PIRL)-Ohmics: Fundamental Single Cell Limit to Minimally Invasive Surgery and Biodiagnostics**
**R.J.D. Miller**
University of Toronto, Toronto, Canada

An atomic level understanding of strongly driven phase transitions has led to the achievement of scar-free surgery with intact molecular fingerprints for surgical guidance and new abilities to correlate molecular structure to cell/tissue function.

### EJ-1: Optical Computing and Artificial Intelligence
**Chair:** Kestutis Staliunas, Universitat Politecnica de Catalunya, Spain

**EJ-1.1 MON (Invited) 18:00**
**Scalable photonics: an optimized approach**
**J. Vuckovic**
Stanford University, Stanford, USA

Classical and quantum photonics with superior properties can be implemented in a variety of photonic materials by combining state of the art optimization and machine learning techniques (photonics inverse design) with new fabrication approaches.

### JSV-2: Flexible Photonic Devices
**Chair:** Juejun Hu, Massachusetts Institute of Technology, Cambridge, USA

**JSV-2.1 MON (Invited) 18:00**
**Flexible Hybrid Semiconductor Membrane Photonic Devices Based on Micro Transfer Printing Process**
**W. Zhou**
University of Texas at Arlington, Arlington, USA

We report here progresses on hybrid semiconductor membrane photonic devices for 3D integrated chips, from earlier work on flexible LED arrays and flexible detector arrays to recent work on large area multi-wavelength 2D laser arrays and on-chip spectrometers.

### JSII-2: Applications of Strong THz Fields
**Chair:** Franz Kärtner, DESY, Hamburg, Germany

**JSII-2.1 MON (Invited) 18:00**
**Generating THz fields and delivering them to samples for maximum effect**
**K.A. Nelson**
Massachusetts Institute of Technology, Cambridge, USA

THz spectroscopy may be conducted with fields delivered to samples through free space or through direct coupling between the THz generation medium and the sample, with no free-space THz propagation.

### ED-2: Comb Sources and Applications
**Chair:** Aleksandra Foltynowicz, Umeå University, Umeå, Sweden

**ED-2.1 MON 18:00**
**Coherent mid-infrared dual-comb spectroscopy enabled by optical injection locking of quantum cascade laser frequency combs**
**J. Hillbrand, M. Bertrand, F. Kapellasidis, M. Beck, and J. Faist**
Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland

We investigate optical injection locking of the offset frequency of QCL frequency combs to a single-mode QCL. When both combs are locked, the dual-comb beating consists of a harmonic series of lines with resolution-limited linewidth.

**ED-2.2 MON 18:15**
**Near-Infrared 10-GHz Astrocomb With Mode Identification**
**Y.S. Cheng¹, D. Xiao², R.A. McCracken¹, and D.T. Reid¹**
¹Institute of Photonics and Quantum Sciences, School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom; ²CAS Key Laboratory of Astronomical Optics & Technology and National Astronomical Observatories, Nanjing Institute of Astronomical Optics & Technology, Nanjing, China

We present a 10-GHz astrocomb spanning 1.15–1.8 µm and based on a spectrally broadened degenerate optical parametric oscillator. Absolute mode identification is provided by a Fourier-transform spectrometer cross-calibrated to the comb-mode spacing.
CD-2: Solitons
Chair: Kartik Srinivasan, National Institute of Standards and Technology, USA

CD-2.1 MON 18:00
Generation of Dispersive Waves via Intermodal Cross-phase Modulation
• M. Timmerkamp1, N.M. Läpken1, R. Schebinger2, K. Schaarschmidt2, M.A. Schmidt2,3, K.-J. Boller3,4, C. Fallnich4,1, M.A. Schmidt3,4, K.-J. Boller3,4, C. Fallnich1,4, 1Institute of Applied Physics, University of Münster, Münster, Germany; 2Leibniz Institute of Photonic Technology, Jena, Germany; 3Ott Schott Institute of Material Research, University of Jena, Jena, Germany; 4MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands

We present the generation of dispersive waves via intermodal cross-phase modulation. A low-intensity transverse mode radiates a dispersive wave on account of the interaction with a higher-order soliton in a different orthogonal mode.

CD-2.2 MON 18:15
Emergence of Laser Cavity-Solitons in a Microresonator-Filtered Fiber Laser
• M. Rowley1, P.-H. Hanzard1, A. Cutrona1, S.T. Chu2, B.E. Little3, R. Morandotti1,2, D.J. Moss3, J.S. Tóth4, G. Marangoni4, M. Pecianti4, and A. Paaske5, 1University of Sussex, Brighton, United Kingdom; 2City University Hong Kong, Hong Kong, China; 3Xiàn Institute of Optics and Precision Mechanics, Xiàn, China; 4INRS-EMT, Montreal, Canada; 5Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology, Chengdu, China; 6Optical Sciences Centre, Swinburne University of Technology, Swinburne, Australia

The parameter space, defined by simple global controls, is probed in a microresonator-filtered fiber laser.
High-harmonic generation from doped Si pumped with intense THz pulses

Room 2: 18:30

Predicting Supercontinuum Generation Dynamics Using a Neural Network

- Photonics Laboratory, Tampere University, Tampere, Finland
- Institute FEMTO-ST, Université Bourgogne Franche-Comté CNRS UMR 6174, Besançon, France

We show that machine learning models using two different architectures can learn a wide range of ultrafast nonlinear dynamics scenarios ranging from pulse compression to supercontinuum generation from only the input pulse and fibre characteristics.

Room 3: 18:30

Photonic glass systems fabricated by RF sputtering on flexible substrates

- IFN-CNR CSFMO Laboratorio e FBK Photonics Unit, Trento, Italy
- Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy
- Fondazione Bruno Kessler, Sensors and Devices, Micro Nano Facility, Trento, Italy
- Department of Mechanics, Materials and Biomedical Engineering, Warsaw University of Science and Technology, Warsaw, Poland
- Lukasiewicz Research Network - PORT, Polish Center for Technology Development, Warsaw, Poland
- Institute of Low Temperature and Structure Research, Wroclaw, Poland
- Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, United Kingdom
- Instituto di Fisica Applicata Nello Carrara IFAC-CNR, Mplab, Sesto Fiorentino, Italy

Glass-based 1D photonic crystals and planar waveguides are fabricated by the RF-sputtering technique on different substrates such as PMMA, PEEK, and SiO2. The features of the samples are measured and compared before and after deposition.

Room 4: 18:30

Enantioselective Orientation of Chiral Molecules Induced by Terahertz Pulses with Twisted Polarization

- Weizmann Institute of Science, Rehovot, Israel
- Massachusetts Institute of Technology, Cambridge, USA

We theoretically demonstrate enantioselective control of molecular orientation using strong THz pulses with twisted polarization. We show that the induced orientation precession on the nanosecond time scale after the field is over.

Room 5: 18:30

Single-pixel massively parallel coherent LiDAR using dual soliton microcombs

- J. Riemensberger, A. Lukashchuk, M. Karpo, J. Liu, and T.J. Ripplenberg, Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland

We show a novel architecture for massively parallel FMCW LiDAR based on dispersive spreading and multiheterodyne mixing of two chirped photocob chip-based soliton microcombs using a single laser source and a single coherent receiver.
We identify a distinct region that clears out solitons and we investigate the role of slow nonlinearities in their emergence.

High Efficiency Raman Soliton Generation in Passive Silica Fiber
M.H.M. Shanin, I. Alamgir, and M. Roshette; Department of Electrical and Computer Engineering, McGill University, Montreal, Canada

We report the highest energy conversion efficiency for soliton self-frequency shift based on a passive silica fiber. The soliton is tunable over 310 nm above the thulium band with a conversion efficiency up to 84.6%.

Temporal Cavity Soliton in a Coherently Driven Active Fiber Resonator
N. Englebert, C. Mas Arábi, P. Parra-Rivas, S.-P. Gorza, and F. Leo; Université libre de Bruxelles, Bruxelles, Belgium

We theoretically describe and experimentally demonstrate the existence of temporal solitons in a coherently driven laser, pumped below its lasing threshold. These solitons share the properties of modelocked lasers and passive resonator solitons.

Testing Critical Slowing Down as a Bifurcation Indicator in a Low-dissipation Laser System
M. Marconi1, C. Métayer2, A. Acquaviva2, J.M. Boyer1, A. Gomel1, T. Quinioni1, C. Masoller1, M. Giudici1, and G. Yu1; 1Institute for Applied Physics, Bern, Switzerland, 2Department of Applied Physics, Hokkaido University, Sapporo, Japan

We demonstrate the fastest measurement of a graphene photodetector up to 330GHz. We investigate the behaviour of three different operation mechanisms – photovoltaic, photocative and bolometric.
Crystal silicon. We demonstrate high-quality diffraction with improved time resolution.

Room 1

CC-1.4 M ON 19:00
Ion evaporation by single-cycle terahertz pulses
M. Tang1, J. Houard2, L. Arnoldi1, M. Boudani1, A. Ayoub1, A. Normand3, G. Da Costa1, A. Héude2,3, and A. Vella1,3; 1GPM UMR CNRS 6634, Normandie Université, Université-Île de France, Saint Etienne du Rouvray, France; 2CIRIA UMR CNRS 6614, Normandie Université, Université-Île de Rouen, Saint Etienne du Rouvray, France; 3Institut Universitaire de France, (IUT), France

Room 2

CL-1.2 MON 19:00
Bone tissue ablation by industrial fs laser systems
L. Gemini, S. Al Bourgol, G. Machinet, M. Faucon, and R. Kling; AL-FianaV, Toulouse, France
Carbonization-free fs-laser ablation of porcine femur was achieved with ablation rates up to 0.7 mm3/s, thus becoming a competitive approach in the frame of a competitive surgery. The possibility of upscaing the process was also demonstrated.

Room 3

CL-1.3 MON 19:15
Printing of living cells by using ultra-short laser pulses
J. Zhang1,2,3, P. Byers1, D. Geiger4,5, D. Docheva4, H. Clausen-Schaumann2,3, S. Sudhop4,5, and H.P. Hübner1; 1Institute of Electronic Structure and Light, FORTH, Heraklion, Greece; 2Department of Materials Science and Technology, University of Crete, Heraklion, Greece; 3Science Program, Texas A&M University at Qatar, Doha, Qatar
We report on THz generation from crystal silicon. We demonstrate high-quality diffraction with improved time resolution.

Room 4

JSV-2.3 M ON 19:00
A flexible polymer waveguide platform with low-loss optical interfaces
S. Yu, H. Zuo, T. Gu, and J. Hu; MIT, Cambridge, USA
We demonstrated a flexible polymer waveguide platform with low propagation loss and excellent mechanical ruggedness. We also realized ultra-compact waveguide bends and broadband, low-loss optical interfaces with fibers based on microfabricated quadratic reflectors.

Room 5

JSI-2.4 MON 19:00
Ultrafast Mode Switching of Metamaterials Driven by Intense THz Field-Induced Ionization
B.J. Kang1, D. Rohrbach2, E. Brunner3, S. Bagainte4, H. Sigg5, and T. Feurer6; 1Institute of Applied Physics, University of Bern, 3012 Bern, Switzerland; 2Laboratory for Micro- and Nanotechnology, Paul Scherrer Institute, 5232 Villigen, Switzerland
We report ultrafast THz-field-induced mode switching of metamaterials on semiconductor substrates with different band gaps. We establish the dominant carrier generation mechanism and present detailed system dynamics.

Room 6

ED-2.4 M ON 19:00
Carrier-Free Dual-Comb Distance Metrology Using Two-Photon Detection
H. Wright1, J. Sun2, D. McKendrick3, N. Weston4, and D. Reid5; 1Scottish Universities Physics Alliance (SUPA), Institute of Photonics and Quantum Sciences, School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom; 2School of Electronic Engineering and Intelligentization, Dongguan University of Technology, Dongguan, China; 3Renishaw Plc, Edinburgh, United Kingdom
By using cross-polarized dual combs and two-photon detection we demonstrate carrier-phase-insensitive time-of-flight distance measurement at 1555 nm with 93 nm precision and sampling rates exceeding by 2.4 the conventional dual-comb metrology aliasing limit.
signal-to-noise level of unity for input signal pulses containing $\bar{\mu}_i = 0.013$ photons.

EB-2.4 M ON 19:00
Erbium Dops in a Cryogenic High-Q resonator
B. Merkel$^{1,2}$, A. Ulanowski$^{1,2}$, P. Cova Farina$^{1,2}$, and A. Reiser$^{1,2}$

Max-Planck-Institute of Quantum Optics, Garching, Germany; Munich Center for Quantum Science and Technology (MCQST), München, Germany

A high-finesse optical resonator enables coherent interactions between individual erbium dopants and photons at telecommunication wavelength. This establishes a novel hardware platform with unique properties towards the implementation of global quantum networks and repeaters.

CD-2.5 MON 19:00
Mid-infrared soliton self-frequency shift using ultra-low pump pulse energy
• H. Alamei$^1$, M.M. Shamim$^1$, W. Correr$^2$, Y. Messaddeq$^2$, and M. Rochette$^1$

McGill University, Montréal, Canada; Université Laval, Québec City, Canada

We generate Raman solitons tunable within the spectral range of 2.0-2.6 µm from an ultralow pump pulse energy of 64 pJ. This is the lowest pump energy ever used to obtain wideband soliton shift.

CD-2.6 MON 19:15
Tunable Topological Phase Transition in Interacting Soliton Lattices
D. Bongiovanni$^{1,2}$, D. Jakiš$^3$, Z. Hu$^2$, F. Lucci$^4$, Y. Hu$^2$, D. Song$^2$, R. Marandotto$^{2,3}$, Z. Chen$^1$, and H. Bujan$^4$

1TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin 300045, China; 2IRS-EMT, 1650 Blvd. Lionel-Boulet, Varennes, QC J3X 1S2, Canada; 3Faculty of Civil Engineering, University of Zagreb, Zagreb 10000, Croatia; 4Department of Physics, Faculty of Science, University of Zagreb

We report on the readout of a SNSPD using a lithium niobate waveguide polarisation modulator.

EB-2.5 M ON 19:15
Optical readout of a superconducting single photon detector with a cryogenic modulator
• F. Thiele$^1$, T. Hummel$^1$, F. vom Bruch$^2$, V. Quiring$^2$, R. Ricken$^2$, H. Herrmann$^2$, C. Eigner$^2$, C. Silberhorn$^1$, and T.J. Bartley$^1$

1Mesoscopic Quantum Optics, Paderborn, Germany; 2Integrated Quantum Optics, Paderborn, Germany

We introduce a novel method to implement coherent interactions between individual erbium dopants and photons at telecommunication wavelength. This establishes a novel hardware platform with unique properties towards the implementation of global quantum networks and repeaters.

CD-2.5 MON 19:00
Ultrafast spin relaxation mechanisms in layered hybrid perovskites
• E.V.A. Camargo$^1$, S. Ghosh$^1$, S.A. Bourseille$^2$, T. Neumann$^3$, B. Shivanna$^1$, R. Friend$^2$, G. Cerullo$^2$, and F. Deschler$^2$

1IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy; 2IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy; 3Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom; 4Walter-Schottky-Institute, Physics Department, Technical University Munich, Munich, Germany

We combine ultrafast Faraday rotation and transient absorption to study spin relaxation in layered perovskites, revealing different mechanisms following different excitation wavelengths.

FI-1.4 M ON 19:00
Ultrafast spin relaxation mechanisms in layered hybrid perovskites
• E.V.A. Camargo$^1$, S. Ghosh$^1$, S.A. Bourseille$^2$, T. Neumann$^3$, B. Shivanna$^1$, R. Friend$^2$, G. Cerullo$^2$, and F. Deschler$^2$

1IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy; 2IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy; 3Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom; 4Walter-Schottky-Institute, Physics Department, Technical University Munich, Munich, Germany

We combine ultrafast Faraday rotation and transient absorption to study spin relaxation in layered perovskites, revealing different mechanisms following different excitation wavelengths.

JSII-2.4 M ON (Invited) 19:00
Ultrafast Spin Relaxation of CH3NH3PbI3 Perovskites
1J. Hohenau, Universitat Graz, Graz, Austria; 2Max-Planck-Institute of Quantum Optics, Garching, Germany; 3Universidad Carlos III de Madrid, Madrid, Spain

Ultrafast spin relaxation measurements in CH3NH3PbI3 perovskites reveal a fundamental difference in the dynamics of spin relaxation and charge transfer.

EF-2.5 M ON (Invited) 19:00
Nonlinear Dynamics in Semiconductor Ring Lasers: From Phase Turbulence to Solitons
• M. Piccardo$^1$, B. Schwarz$^2$, L. Columbo$^3$, F. Pratt$^4$, L. Luigiato$^5$, M. Brambilla$^3$, A. Gatt$^5$, C. Silvestri$^3$, M. Gioannini$^3$, D. Kazakov$^6$, N. Opatkov$^6$, M. Reiser$^7$, J. Hillbrand$^7$, Y. Wang$^8$, A. Belyanin$^9$, and F. Capasso$^2$

1Harvard University, Cambridge, USA; 2TU Wien, Vienna, Austria; 3Politecnico di Torino, Torino, Italy; 4Universidad de Malaga, Malaga, Spain; 5National Research Council of Canada, Ottawa, Ontario; 6University of Rome Tor Vergata, Rome, Italy; 7Texas A&M University, College Station, USA

We introduce a framework capturing at the same time the physics of two distinct classes of frequency comb generators based on active and passive nonlinear optical media: ring quantum cascade lasers and Kerr microresonators.

CH-2.4 M ON 19:00
Advancing Stimulated Raman Scattering spectroscopy using Squeezed Light
• R. Brusaia de Andrade$^1$, K. Berg-Sorensen$^2$, T. Gehring$^1$, and U. Lend Andersen$^1$

1Center for Macrosopic Quantum States bigQ, Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark; 2Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark

Quantum technology can improve state-of-the-art microscopes. Here we present squeezed light enhanced stimulated Raman spectroscopy imaging.

CH-2.5 M ON 19:15
Spectral Vector Beams for High-Speed Spectroscopic Measurements
• L. Kop$^1$, J. Deop Ruano$^2$, T. Stol$^3$, M.I. Huttenen$^4$, P. Bouchard$^5$, and R. Pickler$^6$

1Photons Laboratory, Physics Unit, Tampere University, FI-33720 Tampere, Finland; 2National Research Council of Canada, 100 Sussex Drive, Ottawa, Ontario K1A 0R6, Canada

We introduce a novel method to generate beams with frequency-dependent polarization, i.e. spectral vector beams. They allow determin-
curved filaments produced by 2D Airy wave packets. Due to the curvature of the plasma channel, non-concentric THz beams with different polarizations are generated.

Germany. Experimentelle Unfallchirurgie, Klinik und Poliklinik für Unfallchirurgie, Am Biopark 9, 93053, Regensburg, Germany

We present a new ultra-short laser pulse-based method for the efficient and precise single cell printing which avoids the use of non-biological inorganic absorption layers.

Jelínková, M. Nemec, J. Kratochvíl, K. Veselký, and H. G. Dudzik

Highly-efficient Resonantly Diode-pumped 2μm Tm:Y2O3 Transparent Ceramic under 1.73–5.1μm excitation. In a longitudinal pumping arrangement, efficiencies reaching quantum limit were obtained for all samples with multi-watt level output.

CA-P.4 MON

Er:YAP laser and gain-switching generation of 186 ns pulses at 2.92 μm

• R. Svetjak, J. Sulc, M. Nemec, and H. Jelinkova; Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, Brehova 7, 115 19 Prague, Czech Republic

Compact gain-switched Er:YAP laser emitting at 2920 nm was tested for the first time. Using (11 nm long) laser resonator the pulse duration 186±1 ns with repetition rate 200 Hz were achieved.

CA-P.5 MON

Widely tunable Tm3+ :LuF3 - CaF2 diode pumped laser

• K. Veselky1, J. Sulc3, H. Jelinkova3, M.E. Doroshenko2, K.A. Pierpoint1, V.A. Konyushkin1, and A.N. Nakladov2

FNSPE, Czech Technical University in Prague, Prague, Czech Republic

A. M. Prokhorov General Physics Institute, Moscow, Russia

The performance of the new method is analysed considering the error between the precomputed and predicted nonlinear spectra.

We report a fully-packaged 3D integrated photonic platform with devices placed at arbitrary pre-defined locations in 3D. We further demonstrated the application of the platform to mechanical strain sensing.

CA-P.6 MON

Compact gain-switched Er:YaF4 laser emitting at 2920 nm with high efficiencies.

• S. Paul David1,2,3, V. Jambunathan1,2,3, A.M. Prokhorov General Physics Institute, Moscow, Russia

Institute for Single Crystals, NAS of Ukraine, Kyiv, Ukraine

Two different Q-switched lasers pumping at −1.73 μm through the Cr2+ → Fe2+ ions energy transfer and at −2.94 μm via direct excitation of Fe2+ ions of the Cr2+, Fe2+ :Zn1−xMnxSe (x = 0.4) single crystal are reported.

CA-P.7 MON

RE-doped LGSB (RE = Nd, Yb) as New High Performance Near-Infrared Laser Crystals

• M. Greculeasa1,2, M. Greculescu1,2, A. Broasca1,2, F. Voicu1, S. Hau1, G. Croitoru1, G. Branda1, G. Stanciu1, C. Gheorghe1, and L. Gheorghe1

1 Institute for Single Crystals, NAS of Ukraine, Kyiv, Ukraine

Two different Q-switched lasers pumping at −1.73 μm through the Cr2+ → Fe2+ ions energy transfer and at −2.94 μm via direct excitation of Fe2+ ions of the Cr2+, Fe2+ :Zn1−xMnxSe (x = 0.4) single crystal are reported.

CA-P.8 MON

High-Efficiency CW and Passively-Q-Switched Operation of a 2050 nm Tm3+:Y2O3 Ceramic Laser In-Band Fiber-Laser Pumped at 1670 nm

• O. Antipov1,2,3, Y. Getmanovski1,2,3, A. Dobrynin2, H. Huang3, D. Shen4, J. Wang5, and S. Balabanov6

1 Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia

2 Nizhny Novgorod State Technical University, Nizhny Novgorod, Russia

3 Nizhny Novgorod State Technical University, Nizhny Novgorod, Russia

4 Jiangsu Normal University, Xuzhou, China

5 Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia

A Tm3+:Y2O3 ceramic laser at 2050 nm with the L-shaped cavity in-band pumped by a fiber laser at 1670 nm was studied in the CW and passively Q-switched regimes. Kilohertz Q-switched operation was achieved by an intracavity Cr2+:ZnSe saturable absorber.
CA-P.10 MON

Development of a Yellow Laser Source at 577 nm for Ophthalmological Applications

- HI-ASE Center, Institute of Physics of the Czech Academy of Sciences, Za Raulnici 828, 25241, Dolni Breclav, Czech Republic; 2 Física i Cristal-lographia de Materials i Nanomaterials (FI-CMA-FICNA), Universitat Rovira i Virgili, Campus Sescales, c/ Marceli 11 Domingo, s/n, E-43007, Tarragona, Spain

We demonstrated a compact yellow laser source emitting at 577 nm that has potential in ophthalmology applications. This is achieved by constructing a laser setup with proper combination of gain, Raman and frequency doubling media.

CA-P.11 MON

Multiwavelength Ultrashort SRS Oscillation in Pb(MoO₄)₀.5(WO₄)₀.5 Mixed Crystal with Combined Frequency Shifts on Stretching and Bending Vibrations of Molybdate and Tungstate Anionic Groups

- M. Frank, S. Smetanin, M. Jelinek, D. Vyhildal, K. Gubina, V. Shukshin, B. Zverev, and V. Kubelек
- Czech Technical University in Prague, FNSPE, Prague, Czech Republic; 2 Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia

We present multiwavelength ultrashort oscillation in synchronously pumped Raman laser based on a Pb(MoO₄)₀.5(WO₄)₀.5 mixed crystal. The output radiation with slope efficiency of 1.5% and 9.5% was achieved at wavelengths of 1171/1176 and 1217/1222 nm, respectively.

CA-P.12 MON

Design of intra-cavity phase masks for high power flat-top Yb:YAG thin-disk cavities

- V. Fortin, M.-C. Nadeau, and S. Petit
- Université de Bordeaux-CNRS-CEA, CELIA, UMR 5107, Talence, France

We report on simulations to design and implement graded-phase mirrors in Yb:YAG thin-disk cavities with a flat-top fundamental mode on the disk. Compared to fundamental Gaussian cavities, it could enable more efficient thin-disk laser systems.

CA-P.13 MON

Picosecond and Femtosecond Mode-Locked Lasers Based on Yb:LuAP Crystal

- A. Radenkov, V. Kisel, A. Yasukevich, K. Hovhannessyan, A. Petroyan, and N. Kaleshov
- Center for Optical Materials and Technologies, Belarusian National Technical University, Minsk, Belarus; 2 Institute for Physical Research, National Academy of Sciences, Ashgabat-2, Armenia

Average output power of 7W with 28.1% optical efficiency and 130fs pulse duration obtained at 1016.9nm central wavelength. 2ps pulses with 12W average power and 38% optical efficiency obtained at 999.2nm central wavelength.

CA-P.14 MON

Performance of mid-IR high-power ZGP OPO in on linear and non-planar ring resonators

- M.A. Medina, M. Pietrowski, M. Schellhorn, C. Mueller, G. Spindler, E. Wagner, A. Berrou, and A. Hildenbrand-Dioldiante
- 1 French-German Research Institute of Science, University of Zagreb, Zagreb 10000, Croatia; 2 Institute of Fundamental and Frontier Sciences, University of Electronic Science and Technology of China, Chengdu 610054, China; 3 Department of Physics & Astronomy, San Francisco State University, San Francisco, CA 94132, USA

We report enhancement of the brightness of hybrid perovskite light emitting transistors operated with independent pulsing of drain and gate bias voltages, attributed to compensation of space-charge effects and improved timing of carrier injection.

CA-P.15 MON

Exploring the Topological Charge and Shape of an Optical Vortex Generated with Wavelength-Detuned Spiral Phase Plates

- O.-V. Grigore, A. Craciun, N. Pavel, and T. Dascalău
- 1 National Institute for Laser, Plasma and Radiation Physics, Solid-State Quantum Electronics Laboratory, Magurele, Romania; 2 Doctoral School of Physics, University of Bucharest, Faculty of Physics, Magurele, Romania

A procedure to determine topological charge and sign of vortex beams generated by a spiral phase plate illuminated at a wavelength different than the designed one is proposed, showing good agreement between experiments and simulations.

CA-P.16 MON

Luminescent and laser properties of rare earth doped selenide glasses in the mid-infrared

- M. Churbanov, B. Denker, B. Galagan, V. Kotlashov, V. Plotnichenko, M. Sukhanov, S. Sverchkov, and A. Velmushov
- 1 Prokhorov General Physics Institute of RAS, Moscow, Russia; 2 Devyatkyi Institute of Chemistry of High-Purity Substances of RAS, Nizhny Novgorod, Russia; 3 Prokhorov General Physics Institute of RAS, Moscow, Russia

We compare the performance in terms of output power, efficiency and beam quality of three types of mid-IR ZGP OPOs at high repetition rate: linear, RISTA and FIRE cavities.

CA-P.17 MON

Low-Quantum-Defect CW and Q-Switched Operation of a Tm3+:YAP Laser with the In-Band Fiber-Laser Pumping

- O. Antipov, V. Getmanovski, A. Dobrynin, I. Shestakov, S. Balabanov, and S. Larin
- 1 Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia; 2 Nizhny Novgorod State University, Nizhny Novgorod, Russia; 3 Novosibirsk State University, Novosibirsk, Russia; 4 Nizhny Novgorod State Technical University, Nizhny Novgorod, Russia; 5 Research Institute “Polus”, Moscow, Russia; 6 Institute of Chemistry of High-Purity Substances of the Russian Academy of Sciences, Nizhny Novgorod, Russia; 7 NTI IRE-Polys, Fryazino Moscow region, Russia

In-band fiber laser pumped Tm3+:YAP laser at 1896 nm, 1935 nm or 1985 nm was studied in the CW, actively and passively Q-switched regimes. The Q-switched operation was achieved using an intracavity acousto-optical modulator or a Cr2+:ZnSe saturable absorber.

CA-P.18 MON

Diode Bar Pumping of Single Mode Solid State Lasers

- L.S. Petrov, K. Georgiev, A. Trifonov, and I. Buchvarov
- 1 Physics Department, Sofia University, Sofia, Bulgaria; 2 IBPhotronics Ltd, Sofia, Bulgaria; 3 John
We present a method for comparatively evaluating solid thermal interface materials for mounting slab and disk solid-state laser geometries. Indium foil and soft PGS are found to be the most practical materials for this application.

CB-P.4 M ON

Manipulation of Temporally Localized Structures in a VCSEL With Optical Feedback

C. Seidel, A. Bartolo, N. Vigne, A. Garnache, G. Beaudoin, N. Sagno, M. Ghidini, J. Javolyes, S.V. Gurevich, and M. Marcom, Dpt. de Fisica, Universitat de les Illes Balears & IAC-3, Campus UIB, E-07122 Palma de Mallorca, Spain; 2Institute for Theoretical Physics & Center for Nonlinear Science (CeNoS), University of Münster, Schlossplatz 2, 48149 Münster, Germany; 3Université Côte d’Azur, Centre National de La Recherche Scientifique, Institut de Physique de Nice, F-06560 Valbonne, France; 4Institut d’Electronique et des Systèmes, UMR5214, Université de Montpellier, 34000 Montpellier, France; 5Centre de Nanosciences et de Nanotechnologies, CNRS, Université Paris-Saclay, UMR 9001, 91120 Palaiseau, France

We analyze the effect of optical feedback on the dynamics of mode-locked semiconductor lasers operated in the regime of temporal localized structures. Depending on the feedback delay harmonic solutions can be either reinforced or hindered.

CB-P.5 M ON

Optical Injection Dynamics of VCSEL Frequency Combs

Y. Dosambi, 1,2 D. Wolfersberger, 1,2 K. Panajotov, 3,4 and M. Sciannamea 1,2 1,2 Chaire Photonique, CentraleSupélec, 2 Rue Edouard Belin 57070, Metz, France; 3Université de Lorraine, CentraleSupélec, LOMPS, 2 Rue Edouard Belin 57070, Metz, France; 4Brussels Photonics Group (B-PHOT), Vrije Universiteit Brussel, Brussels, Belgium; 4Institute of Solid-State Physics, Bulgarian Academy of Sciences, Sofia, Bulgaria

We analyze theoretically and experimentally the dynamics of a VCSEL with frequency comb injection. The VCSEL shows two tunable combs with orthogonal polarization and a bandwidth up to 13 times that of the injected comb.

CB-P.6 M ON

The contribution has been withdrawn.

CB-P.7 M ON

Dual Wavelength Laser Designed for Locking to Cs-133 Atomic Transitions

W. Qi, 1 B. Yuan, 1 J. Shi, 1 Y. Zhang, 1 X. Chen, 1 J.H. Marsh, 1 and L. Hou, 1 1Nanjing University of Posts and Telecommunications, Nanjing, China; 2National Laboratory of Solid State Microstructures, Nanjing University, Nanjing, China; 3James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom

A laterally coupled dual-wavelength laser operating at 894 nm with a frequency separation at 9.19 GHz is designed for miniature atomic clocks and room temperature magnetometers.

CB-P.8 M ON

Observation of the Turn-on Delay in InAs- and InP-based Quantum Cascade Lasers under Pulsed Pumping with Non-zero Rise-time

E. Chertovtchenko, 1 V. Duleule, 1 D. Mikhailov, 1 S. Losev, 1 A. Raibich, 1,2 A. Gladyshev, 1 I. Novkov, 2,3,4 A. Lutetsky, 1,2 D. Vasiles, 1,2,4 S. Ilpchenko, 1,2,4 P. Kicklin, 1,2,4 L. Karashinsky, 1,2,4 D. Denisov, 1,2 V. Kuchinski, 1,2,4 Kogovitskaya, 1 A. Egorov, 1 R. Tesierry, 1,2 A. Baranov, 1 and G. Sokolovski 1,2 Joffe Institute, St Petersburg, Russia; 2Connector Optics LLC, Saint Petersburg, Russia; 3IMT University, Saint Petersburg, Russia; 4IES, Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh, United Kingdom

We observe unexpectedly long turn-on delay reaching ~10ns and its non-monotonous dependence on pumping amplitude in InAs- and InP-based quantum-cascade lasers under non-zero rise-time pulse-pumping. Our numerical simulations qualitatively agree with these measurements.

CB-P.9 M ON

Investigation of Scattering Losses in a Buried Tunnel Junction 4um GaSb VCSEL

A. Sinaz, 1 P. Debernardi, 1 M. Behera, 1 and M.A. Belkin, 2 1Walter Schottky Institute c/o Technical University of Munich, D-85748 Garching bei München, Germany; 2CNR-IEIIT c/o Politecnico di Torino, 10129 Torino, Italy

Scattering losses in a 4μm GaSb VCSEL are analyzed using a 3D vectorial optical solver by parametrically varying transverse and longitudinal dimension of the buried tunnel junction and an optimized structure is proposed.

CB-P.10 M ON

Phase-incoherent photonic molecules in V-shaped mode-locked VCSELs

J. Hausen, 1 J. Javolyes, 2 S. Gurevich, 2,3 and K. Lüdtke, 1 1Institute of Theoretical Physics, Technische Universität Berlin, Berlin, Germany; 2Département Physique, Université de l’îles de la Réunion, 97400 Saint-Denis, France; 3Institut d’Optique, CNRS, Université Paris-Saclay, 91898 Orsay, France

We find clusters of globally-bound but locally-independent pulses in mode-locked VCSELs in the long-cavity regime below threshold. Our analytics predicts the pulse distance while a bifurcation analysis yields regions of stability of the phase-incoherent clusters.

CB-P.11 M ON

Ultra-short pulse non-classical light emitters utilizing multiple wide quantum wells

N. Torcheboeuf, 1 V. Mitev, 1 L. Balet, 1 R. Renevey, 1 M. Kruskovskiy, 1 P. Renneau, 1,2 A. Larree, 1 J.R. Leger, 2 Y. Robert, 1,2 E. Viner, 1 M. Garcia, 1 O. Parrillaud, 1,2,4 B. Gerard, 1 and D. Bohm, 1,2 Centre Suisse d’Electronique et de Microtechnique SA (CSEM), Neuchâtel, Switzerland; 2III-V Lab, Palaiseau, France

We report superradiance pulse emitters utilizing quantum-confined Stark effect in multiple wide-quantum-well heterostructure. The light pulses of duration is 1.2 ps and energy 80 pl is a mixed photon state with non-classical correlations g(3)(3)>g(2)(2)(4).

CB-P.12 M ON

2Gbit/s QPSK Wireless Transmission System with Injection-locked Quantum-dash Laser 28 GHz MMW Source at 1610 nm

Q. Tareq, 1 A.M. Ragheb, 1,2 M.A. Esmail, 1,2,3 A. Alshebibi, 1,2,3,4 and M.Z.M. Khan 1,2 1Electrical Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia; 2Electrical Engineering Department, King Saud University, Riyadh, Saudi Arabia; 3Communications and Networks Engineering Department, Prince Sultan University, Riyadh, Saudi Arabia

First demonstration of 28GHz wireless transmission of 2-Gbit/s QPSK signal over 4-m channel link is reported that utilizes an L-band ~1610-nm InAs/InP quantum-dot laser-based MMW source with ~19-kHz linewidth and ~125-dBc/Hz phase noise.

CB-P.13 M ON

Effects of Two-photon Absorption and Non-linear Index in InP-based Passive Waveguides on Integrated Extended Cavity Semiconductor Lasers

E. Bente, S. Andreou, Y. Jiao, and K. Williams, Eindhoven University of Technology, Eindhoven, Netherlands
Effects of two-photon absorption and the non-linear refractive index in InP rib waveguides and InGaAsP/InP ridge waveguides on picosecond pulses as well as the effects on integrated extended cavity modelocked lasers are studied theoretically.

CB-P.14 MON
Spatially Modeless Laser Cavity based on III-V Semiconductor technology: Non linear localized light

S. Sedov1,2, I. Vaseva1,2, E. Salamin1,2, and A. Fedoruk1,2
1Novosibirsk State University, Novosibirsk, Russia; 2Federal Research Center for Information Technologies, Novosibirsk, Russia.

The contribution has been withdrawn.

CB-P.16 MON
Gain-Switched Laser Self-Injection Locked to a WGM Microresonator

A. Shitikov1, V. Lobanov2, N. Kondratiev1, I. Gorelov2, and I. Bilenko1,2
1Russian Quantum Center, Moscow, Russia; 2M.V. Lomonosov Moscow State University, Moscow, Russia.

We demonstrated experimentally that gain-switched operation is possible in the self-injection locking regime. It allowed to generate optical frequency combs with line spacing equal to modulation frequency from kHz up to GHz.

CB-P.17 MON
Hybrid integration of InAs/GaAs quantum dot microdisk lasers on silicon

N. Kryzhnovskaya1, E. Motsev1, A. Dragunova1, F. Zadov2,3, M. Maximov2, N. Kalychynsky2, S. Mintsariv1,2, M. Kalagina1, A. Nadtochiy1, and A. Zhukov1
1HSE University, St.Petersburg, Russia; 2Alferov University, St.Petersburg, Russia; 3Ioffe Institute, St.Petersburg, Russia.

We demonstrated cw lasing of injection-pumped microdisk quantum dot lasers transferred to silicon. The hybrid integration method allows individual addressing to a microdisk. The electrical, threshold, spectral, and thermal characteristics of a microcavity transferred to silicon remains unchanged.

CB-P.18 MON
High-power pulsed semiconductor lasers (905 nm) with an ultra-wide aperture (800 μm) based on epitaxially integrated triple heterostructures

S. Slipherka1,2, A. Podoskin1, P. Gavrinya1, N. Pikitin3, P. Kopyev1, T. Bagaev1, M. Lahdigh1,2, A. Paudal1,2, and A. Mavromyrtz1,2
1Ioffe Institute, Saint-Petersburg, Russia; 2Stelmark Research and Development Institute “Polysus”, Moscow, Russia.

High-power pulsed ultra-wide-aperture (800 μm) semiconductor lasers (905 nm) based on epitaxially integrated triple heterostructures are developed. A slope of 2.2-2.9 W/μA and a peak power of 216 W are observed at 90 A/100 ns.

CB-P.19 MON
Spatiotemporal stabilization and field localization in Edge-Emitting laser bars by PT-symmetric potentials

F. Medina1,2, R. Herrero1, M. Bote1, and K. Staliunas3,4
1Departament de Física, Universitat Politècnica de Catalunya (UPC), Barcelona, Spain; 2Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain.

We propose to control the intrinsic spatiotemporal turbulent dynamics of an array of edge-emitting semiconductor lasers by a PT-symmetric coupling between neighbouring lasers. Numerical simulations show temporal stabilization and spatial concentration of the output emission.

CB-P.20 MON
Generation of fast physical periodic patterns with high intra-pattern diversity using semiconductor lasers with optical feedback

A. Argyris1, J. Schwind2,3, and I. Fischer1
1Instituto de Fisica Interdisciplinar y Sistemas Complejos IFISC (CSIC-UIB), Palma de Mallorca, Spain; 2Institute of Applied Physics, University of Münster, Münster, Germany.

We show that semiconductor lasers with short optical feedback can emit periodic signals that consist of equidistant frequency tones. By tuning the tones’ relative power, we generate sub-nanoscond, clock-free, repetitive patterns with high intra-pattern diversity.

CB-P.21 MON
Simultaneous generation of pulse trains with different periods in a class C quantum-dot heterolaser

V. Kochorovsky1,2, A. Mishin1, V. Kochorovsky1,2, E. Kucharovskaya1, and A. Selieznev1
1Institute of Nanotechnology, HSE University, Saint-Petersburg, Russia; 2Department of Physics and Astronomy, Texas A&M University, College Station, USA.

We find an intriguing regime of simultaneous emission of different quasi-periodic pulse trains in a class C heterolaser that supports two or more superradiant or auto-modulated modes as well as many quasi-stationary, partially self-locked modes.

CI-P.1 MON
Interferometric Coupling-based Modulator for Large-Scale Integrated Photonic Systems

E. Luan, S. Saha, B. Semmami, M. Saliman, and A. Eshraghi1
1Huawei Canada, Toronto, Canada.

In this design, two symmetric interferometric-couplers, containing active index modulation elements inside, are introduced to the add-drop microring modulator for an intensity tuning purpose at a fixed wavelength, which eliminates the optical crosstalk issue.

CI-P.3 MON
Low-power sub-diffraction optical data storage using lanthanide-doped upconversion nanoparticles

S. Lamon1,2, Y. Wu, Q. Zhang1, X. Liu1,2, and M. Gu1,2
1Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai 200093, China, Shanghai, China; 2Laboratory of Artificial-Intelligence Nanophotonics, School of Science, RMIT University, Melbourne 3001, Australia, Melbourne, Australia; 3Department of Chemistry, National University of Singapore, Singapore, 117543, Singapore.

Far-field super-resolution optical techniques show the potential for sub-diffraction three-dimensional optical data storage towards petabyte-level single-disk capacity. We present low-power sub-diffraction optical data storage using lanthanide-doped upconversion nanoparticles in a polymer matrix based nanocomposite.

CI-P.4 MON
Multicolor Tunable Photonic Reservoir Computing

B. Semmami, M. Salmi, E. Luan, S. Saha, and A. Eshraghi1,2
1Huawei Canada, Toronto, Canada.

This paper proposes a new on-chip photonic reservoir computing platform which employs frequency parallelization combined with on-chip photonic matrix multilication arrangements to significantly boost the computational power of the reservoir.

CI-P.5 MON
Noise properties of cascaded optical majority gates

E. Volkova, S. Kontorov, V. Lyuboytov, T. von Lerber, E. Köggers, and A. Shipulin
Skolkovo Institute of Science and Technology, Moscow, Russia.

Noise development in a chain of optical majority gates is investigated numerically. Dynamics of semiconductor lasers is studied in the frame of Lang-Kobayashi equations with noise. A maximum possible number of cascaded optical gates is determined.

CI-P.6 MON
Convolutional Neural Networks with Multiple Layers of Spatial for Nonlinearity Mitigation in Long-Haul WDM Transmission Systems

O. Sidelnikov1,2, A. Redyuk1,2, S. Sygletos1,2, M. Fedoruk1,2, and S. Turitsyn3,4
1Novosibirsk State University, Novosibirsk, Russia; 2Federal Research Center for Information and Computational Technologies, Novosibirsk, Russia; 3AST, Institute of Photonic Technologies, Aston University, Birmingham, United Kingdom.

Application of deep learning in advanced photonic systems is presented. A new architecture for Convolutional Neural Network with multiple layers of spatial is demonstrated.
In this work, we study the effect of the number of deep convolutional neural network layers on the efficiency of nonlinear distortion compensation in long-haul WDM transmission systems.

S. Bogdanov and O. Sidelnikov; Novosibirsk State University, Novosibirsk, Russia
The complex-value fully connected neural networks are applied for nonlinearity compensation in fiber optic communication systems. The superiority of a such approach over the real-valued neural networks and linear compensation schemes is demonstrated.

Ultra-Broadband Beam Splitting in Three-Waveguide System with Dissipation
R. Abruña1, V. Coda1, J. Pelletier1, A. Rangelov2, and G. Montemonez2; 1Université de Lorraine, Centre-Val de Lorraine, Strasbourg, France; 2Department of Physics, Sofia University, Sofia, Bulgaria
Light dissipation in the central of three parallel waveguides permits to achieve ultra-broadband beam splitting with an overall 3 dB loss. Analogy to quantum population transfer making a decay intermediate state is addressed.

Complex fully connected neural networks for nonlinearity compensation in long-haul transmission systems
S.Bogdanov and O. Sidelnikov; Novosibirsk State University, Novosibirsk, Russia
Complex fully connected neural networks are applied for nonlinearity compensation in fiber optic communication systems. The superiority of such an approach over the real-valued neural networks and linear compensation schemes is demonstrated.

Room 3

10:00 – 11:00
JSV-P: JSV Poster Session
JSV-P.1 MON
Focusing light through a free-form scattering medium
A. Kates1, A.L. Adam2, W.L. Hizerman3,4, A. Lagendijk1, and W.L. Vos1; 1Complex Photonic Systems Coherence of a dynamically decoupled single neutral atom
C.H. Chow1, E.B.I. Ng2, and C. Kurtseifer1,2; 1Center for Quantum Technologies, 3 Science Drive 2, Singapore; 2Department of Physics, National University of Singapore, 2 Science Drive 3, Singapore
We apply dynamical-decoupling on magnetic-sensitive ground states of 87Rb atom, motivated by the availability of closed optical transition with the excited state. Coherence time of 7ms is achieved, indicating improvement over two orders of magnitude.

Room 4

13:30 – 14:30
EA-P: EA Poster Session
EA-P.1 MON
Echoes in a Single Quantum Kerr-nonlinear Oscillator
I. Tutumnikov, R. Viswanathan, and I.S. Averbukh; Weizmann Institute of Science, Rehovot, Israel
We theoretically study the echo phenomenon in a single impulsively excited ("kicked") Kerr-nonlinear oscillator. These echoes may be useful for studying decoherence processes in a number of systems related to quantum information processing.

EA-P.2 MON
Mixing of Multi-Spectral Quantum States Generated in a Single Pulse with a Dispersion-Engineered Nonlinear Waveguide Crystal
Y. Yamagishi1, A. Hosaka1, K. Tanji1, S. Kurimaru2, and F. Kannari1; 1Keio University, Yokohama, Japan; 2National Institute for Materials Science, Tsukuba, Japan
We report a correlated photon-pair source with an ultrabroad frequency tunability produced in a gas-filled hollow-core photonic crystal fiber based on a four-wave mixing process, where the phase matching strongly depends on the gas pressure.

EA-P.3 MON
Dynamics of ultrafast twin beam generation in gas-filled hollow-core photonic crystal fibers
M. Lipp1,2, M. V. Chekhova1,2, and N.Y. Joly1,3,4; 1Max Planck Institute for the Science of Light, Erlangen, Germany; 2Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany; 3Interdisciplinary Centre for Nanostructured Films, Erlangen, Germany
We study the dynamics of twin-beam generation by 300 fs pulses at 808 nm in Xe-filled hollow-core photonic crystal fiber, focusing on the evolution of the time-frequency Schmidt modes at the joint spectral intensity.

EA-P.4 MON
The contribution has been withdrawn.

EA-P.5 MON
Fiber Source of Biphotos with Ultrabroad Frequency Tunnability
S. Lopez-Huidobro1,2, M. Lipp1,2, N. Joly1,2,3,4, and M.V. Chekhova1,2; 1Max Planck Institute for the Science of Light, Erlangen, Germany; 2University of Erlangen-Nuremberg, Erlangen, Germany; 3Interdisciplinary Centre for Nanostructured Films, Erlangen, Germany
We report a correlated photon-pair source with an ultrabroad frequency tunability produced in a gas-filled hollow-core photonic crystal fiber based on a four-wave mixing process, where the phase matching strongly depends on the gas pressure.

EA-P.6 MON
Coherence of a dynamically decoupled single neutral atom
C.H. Chow1, E.B.I. Ng2, and C. Kurtseifer1,2; 1Center for Quantum Technologies, 3 Science Drive 2, Singapore; 2Department of Physics, National University of Singapore, 2 Science Drive 3, Singapore
We demonstrate fast, mid-infrared (3.2-4.3 μm) spectroscopy with high resolution (1.5 cm−1) based on nonlinear interferometry with undetected photons using a commercial, Si-CCD based grating spectrometer.

Room 1

10:00 – 11:00
CI-P: CI Poster Session
CI-P.7 MON
Transmissionsystems.

CI-P.8 MON
Ultra-Broadband Beam Splitting in Three-Waveguide System with Dissipation
R. Abruña1, V. Coda1, J. Pelletier1, A. Rangelov2, and G. Montemonez2; 1Université de Lorraine, Centre-Val de Lorraine, Strasbourg, France; 2Department of Physics, Sofia University, Sofia, Bulgaria
Light dissipation in the central of three parallel waveguides permits to achieve ultra-broadband beam splitting with an overall 3 dB loss. Analogy to quantum population transfer making a decay intermediate state is addressed.

CI-P.7 MON
Highly emissive point-like source of white light based on graphene excited by a CW laser
M. Olezko, T. Hanula, P. Wiewiorski, R. Tomala, and W. Strnek; Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wroclaw, Poland
We present a theoretical proposal for the design of an integrated source of entangled photon pairs which feature an in-built mechanism for an on-chip pump suppression level exceeding 100dB

CI-P.8 MON
Broadband Mid-IR Spectroscopy with Near-IR Grating Spectrometers
P. Kaufmann1, R. Alrifai2, A. Davis2, R. Zambrini1, S. Mantuscalo2, N. Treps1, J. Peltier1, and V. Parigi1; 1Laboratoire Kaletier Brossel, Sorbonne University, Paris, France; 2Turku Centre for Quantum Physics, Turku, Finland
We demonstrate fast, mid-infrared (3.2-4.3 μm) spectroscopy with high resolution (1.5 cm−1) based on nonlinear interferometry with undetected photons using a commercial, Si-CCD based grating spectrometer.

Room 1

10:00 – 11:00
JSV-P: JSV Poster Session
JSV-P.1 MON
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I. Tutumnikov, R. Viswanathan, and I.S. Averbukh; Weizmann Institute of Science, Rehovot, Israel
We theoretically study the echo phenomenon in a single impulsively excited ("kicked") Kerr-nonlinear oscillator. These echoes may be useful for studying decoherence processes in a number of systems related to quantum information processing.

EA-P.2 MON
Mixing of Multi-Spectral Quantum States Generated in a Single Pulse with a Dispersion-Engineered Nonlinear Waveguide Crystal
Y. Yamagishi1, A. Hosaka1, K. Tanji1, S. Kurimaru2, and F. Kannari1; 1Keio University, Yokohama, Japan; 2National Institute for Materials Science, Tsukuba, Japan
We report a correlated photon-pair source with an ultrabroad frequency tunability produced in a gas-filled hollow-core photonic crystal fiber, focusing on the evolution of the time-frequency Schmidt modes at the joint spectral intensity.

EA-P.3 MON
Dynamics of ultrafast twin beam generation in gas-filled hollow-core photonic crystal fibers
M. Lipp1,2, M. V. Chekhova1,2, and N.Y. Joly1,3,4; 1Max Planck Institute for the Science of Light, Erlangen, Germany; 2Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany; 3Interdisciplinary Centre for Nanostructured Films, Erlangen, Germany
We report a correlated photon-pair source with an ultrabroad frequency tunability produced in a gas-filled hollow-core photonic crystal fiber, focusing on the evolution of the time-frequency Schmidt modes at the joint spectral intensity.

EA-P.4 MON
The contribution has been withdrawn.
Kurzzeitspektroskopie, Berlin, Germany

Leija

J. Wolters

tol, United Kingdom

H.Wills Physics Laboratory & Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom

ascalableapproachinQuantumNetworks.

providingacompellingtechnologytoimplementQKD.

Bristol, United Kingdom

Inging, Centre for Nanoscience and Quantum Information, Laboratories & Quantum Engineering Centre for Doctoral Training,

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High-Dimensional QKD Decoder

EB-P .3 MON

A portable and compact decoy-state QKD sender

M. Auser1,2,3, P. Freiwang1,2, A. Balukat1,2, M. Schattauer2, L. Knipp1,2,3, and H. Weinfurter1,2,4

1 Ludwig-Maximilians-Universität, 80797 München, Germany; 2 Munich Centre for Quantum Science and Technology, 80799 München, Germany; 3 Universität der Bundeswehr München, 85577 Neubiberg, Germany; 4 Max-Planck-Institut für Quantenoptik, 85748 Garching, Germany

We report the measurement of the particle exchange phase of photons, providing direct evidence for the bosonic symmetry of two-photon wavefunctions and revealing the geometric phase $\phi = \pi$ associated with the physical exchange of two particles.

EA-P.12 MON

Direct measurement of the photon exchange phase

K. Tschernig1, C. Müller2, M. Smoor3, T. Kroh3, J. Walter4,5, O. Benson1, K. Bush1,2, and A. Perez-Leija1,2,5

1 Max-Born-Institut für Nichtlineare Optik und Karzzeitpektroskopie, Berlin, Germany; 2 Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany; 3 IRIS Adlerhorst, Humboldt-Universität zu Berlin, Berlin, Germany; 4 Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Berlin, Germany; 5 Technische Universität Berlin, Berlin, Germany

We report the measurement of the particle exchange phase of photons, providing direct evidence for the bosonic symmetry of two-photon wavefunctions and revealing the geometric phase $\phi = \pi$ associated with the physical exchange of two particles.

EA-P.13 MON

Ultra-Wide Photon-Pair Source in the Mid-Infrared on a Silicon Chip

L.M. Rosenfeld, S. Wollmann, J.C.F. Matthews, and J.G. Rarity; Quantum Engineering Technology Labs, University of Bristol, Bristol, United Kingdom

Photon-pair sources are fundamental to integrated quantum photonics. We demonstrate a silicon intermodal photon source pumped at 2.90 µm generating photons at 1.53 µm realizing ultra-wide spectral detuning. This work enables new sensing technologies on-chip.

EA-P.14 MON

Position-controlled quantum emitters with reproducible emission wavelength in hBN

C. Fourrier, A. Plaud, S. Roux, S. Buil, X. Quélin, J. Barjon, J-P. Hermier, and A. Deltel; Université Paris-Saclay, UVSQ, CNRS, GEMaC, Versailles, France

We demonstrate deterministic activation of quantum emitters in the bidimensional material hBN (hexagonal boron nitride) using an electron beam. The single photon sources exhibit narrow and reproducible emission that persists up to room temperature.

EA-P.9 MON

Information Analysis for Quantum Imaging Optimization

A. Mikhailych1, I. Karuseichyk1, S. Vlasenko1, B. Besire2, D. Lyakhov3, D. Michels2, A. Stefanov2, and D. Mogilevtsev4; 1 B.I. Stepanov Institute of Physics of NAS of Belarus, Minsk, Belarus; 2 King Abdullah University of Science and Technology, Thuwal, Saudi Arabia; 3 Institute of Applied Physics, University of Bern, Bern, Switzerland

We apply an information-based approach to optimization of several imaging schemes (SOFI and quantum imaging with biphotons and pseudo-thermal light) and show that maximal resolution corresponds to finite correlations order and correlation length of photons.

EA-P.10 MON

A General Framework for Multimode Gaussian Quantum Optics and Photo-detection

O.P. Thomas1,2,3, W. McCutchon1,2, and D.P.S. McCutchon1; 1 H. H. Wills Physics Laboratory and Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom; 2 Quantum Engineering Centre for Doctoral Training, H. H. Wills Physics Laboratory and Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom; 3 BBQLabs, Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh, United Kingdom

We develop a broadly applicable framework of multimode Gaussian optics and photon detection to uncover previously unknown trade-offs and limitations of single photon sources based on non-linear parametric processes including interference visibilities and generation rates.

EA-P.6 MON

Distributed Coherent Absorption in Quantum Networks for Deterministic Entanglement Generation

A.N. Vetalović1, R. Guo1, C. Soci2, and N.I. Zheludev1,2; 1 Nanyang Technological University, Singapore, Singapore; 2 University of Southampton, Southampton, United Kingdom

We demonstrate that distributed coherent absorption offers a robust and efficient way to generate quantum entanglement in multi-nodal quantum networks. Proof-of-principle experiment in a bi-nodal network is reported.

EA-P.7 MON

Sub-diffraction near-field imaging with undetected photons using thin sources of photon pairs

E.A. Santos1, S. Sarav1, A. Vega1, T. Pertsch1,2, and F. Setzpfandt1; 1 Institute of Applied Physics, Abbe Center of Photofysics, Friedrich Schiller University Jena, Jena, Germany; 2 Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We propose an imaging scheme with undetected photons that goes beyond the diffraction limit by transferring near-field information at one wavelength to a far-field information at its paired wavelength in an ultrathin photon-pair source.

EA-P.8 MON

SPAD array with high spatial resolution for quantum imaging

A. Stefanov1, B. Besire2, M. Unternehmer1, B. Eckmann3, L. Gasparini2, and M. Perenzoni3; 1 Institute of Applied Physics, Bern, Switzerland; 2 Fondazione Bruno Kessler FBK, Trento, Italy

We present a new SPAD array sensor capable of detecting high order correlations between photons with high temporal (sub-nanosecond) and spatial (224 x 272 pixels) resolution.
EB-P.11 MON
Optimization of a cavity-QED system for fast two-qubit gates

R. Asouz,1 T. Utsumi,2 Y. Tokunaga,1 R. Kanamoto,3 T. Aoki3
1NTT Secure Platform Laboratories, NTT Corporation, Tokyo, Japan; 2Department of Applied Physics, Waseda University, Tokyo, Japan; 3Department of physics, Meiji University, Kanagawa, Japan

We model and analyze the error due to the distortion of photon pulse in a controlled phase flip gate using cavity quantum electrodynamics. From this analysis, we found that cavity length has an optimal value.

EB-P.12 MON
Towards Conditional Quantum Phase Gates Based on Strongly-Coupled Charged Quantum Dot-Micropillar Cavities

M. Haider1, S.L. Portalupi1,2,3, and G. Slavcheva1,2
1Maximilians-Universität München, München, Germany; 2Quantopticon Ltd., London, United Kingdom; 3Johannes Kepler Universität Linz, Linz, Austria

We investigate polarization rotation of light transmitted through a single negatively charged quantum dot inside a high-Q micropillar cavity, operating in the strong coupling regime. The rotation angle is approximately 127 degrees.

EB-P.13 MON
Efficient and stable fiber-to-chip coupling enabling the injection of telecom quantum dot photons into a silicon photonic chip

S. Bauer1, D. Wang2, N. Hoppe1, C. Nwraith1, J. Fischer3, S.L. Portalupi1, M. Jetter1, M. Berroth1, and P. Michler1
1Institut für Halbleiteroptik und Funktionalen Grenzflächen (iFHF), Center for Integrated Quantum Science and Technology (CQST), Ludwig-Maximilians-Universität München, München, Germany

We implemented erbium dopants into nanophotonic silicon waveguides and cavities. We observe incorporation at well-defined lattice sites with narrow linewidths which is promising for the implementation of a scalable platform for distributed quantum information processing.

EB-P.14 MON
Green laser threshold magnetometry based on absorption by nitrogen-vacancy centers in a diamond within an external cavity laser

J. Webb1,², A. Poulsen1, R. Staacke1, J. Meijer2, K. Berg-Sørensen1, U. Andersen1, and A. Huck1
1Center for Macroscopic Quantum States (BiGQ), Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark; 2Division of Applied Quantum System, Felix Bloch Institute for Solid State Physics, Leipzig University, Leipzig, Germany; 3Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark

We investigate the use of green pump absorption by nitrogen-vacancy centers in an external cavity for laser threshold magnetometry. Sensitivities in the mT/Hz0.5 range are predicted using realistic cavity and material parameters.

EB-P.15 MON
Coupling Erbium Dopants to Nanophotonic Silicon Structures

A. Grisch1,2, J. Weiss1,2, F. Friis1,2, F. Burger1,2, S. Rinner1,2, and A. Reiserer1,2
Max-Planck-Institut für Quantenoptik, Garching, Germany; 2Munich Center for Quantum Science and Technology (MCQST), Ludwig-Maximilians-Universität München, München, Germany

We report on free-induction decay measurements of nuclear spin precession in MEMS vapour cells - key element of a nuclear magnetic resonance gyroscope. A new experiment is an important step towards the realization of a compact nuclear magnetic resonance gyroscope.

EB-P.16 MON
Nuclear spin precession in MEMS vapour cells - key element of a nuclear magnetic resonance gyroscope

Robert Bosch GmbH, Corporate Sector Research and Advance Engineering, Advanced Technologies and Micro Systems, Renningen, Germany

We report on free-induction decay measurements of nuclear spin precession of Xenon atoms confined in a small-sized vapour cell. The experiment is an important step towards the realization of a compact nuclear magnetic resonance gyroscope.

EB-P.17 MON
The contribution has been withdrawn.

EB-P.18 MON
Single-shot integrated multi-photon split state tomography

J. Zhang and A.A. Sukhorukov
ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Nonlinear Physics Centre, Research School of Physics, The Australian National University, Canberra, Australia

We propose a segmented coupled waveguide array as a new form of compact optical quantum circuit and apply it for the on-chip multi-photon split state tomography with optimized performance and no need of reconfigurability.

EB-P.19 MON
Complex two-mode quadratures - a generalized formalism for continuous-variable quantum optics

L. Bello1, Y. Michael1, M. Rosenbluh1, E. Cohen1, and A. Peir1
1Department of Physics and BINA Center of Nanotechnology, Bar-Ilan University, Ramat Gan, 5290002, Israel; 2Faculty of Engineering and BINA Center of Nanotechnology, Bar-Ilan University, Ramat Gan, 5290002, Israel

We introduce a set of complex quadrature operators that treats degenerate and non-degenerate squeezing on the same footing. These complex operators describe the SU(1,1) algebra of two-photons devices and directly relate to observable physical quantities.

EB-P.20 MON
Continuous variable multimode quantum states via symmetric group velocity matching

V. Roman-Rodriguez1,2, B. Brecht1,2, S. Kadi1,2, C. Silberhorn1,2, N. Treps1,2, and V. Parg1
1LIP6, Sorbonne Université, Paris, France; 2Integrated Quantum Optics Group, Paderborn University, Paderborn, Germany; 3Laboratoire Kastler Brossel, Sorbonne Université, Paris, France

In this work, we study the symmetric group velocity matching condition and the engineering of multimode spectral parameters in non-linear waveguides to generate scalable and configurable continuous variable optical quantum networks via ultrafast parametric down-conversion.

EB-P.21 MON
Sensing a THz Electric Field with Cold and Trapped Molecular Ions

E.L. Constantin, Laboratoire PhLAM, CNRS UMR 8523, University of Lille, Villeneuve d'Ascq, France

Comparison of two-photon rovibrational spectroscopy measurements of trapped and laser-cooled HD+ ions with ab-initio quantum theory predictions may enable improved characterization of the amplitudes and phases of the Cartesian components of a THz electric field.

EB-P.22 MON
Nonlinear Transmission Line Model of a Josephson Traveling-Wave Parametric Amplifier including Noise and Dissipation

Y. Yuan, M. Haider, J. Russer, P. Russer, and C. Ji- rauschek
Technical University of Munich, Munich, Germany

We present a nonlinear transmission line model for a Josephson traveling-wave parametric amplifier including noise and dissipation. Telegrapher’s equations are derived for a nonlinear transmission line including resistance and noise in the substrate.

EB-P.23 MON
Non-Local Control of Light Dissipation with Pancharatnam-Berry Phase

R. Guo1, A. N. Veltugin2, C. Soci1, and N. I. Zheludev1,2
1Centre for Disruptive Photonic Technologies, Nanyang Technological University, singapore, Singapore; 2Optoelectronics Research Centre @ Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom

We experimentally demonstrate for the first time that absorption of one of the photons from the entangled pair can be switched on and off by controlling the Pancharatnam-Berry phase of the other photon.

EB-P.24 MON
Temporal Resolution of Partially Coherent Sources

S. De1, J. Gil-Lopez1, B. Brecht1, C. Silberhorn1, L.L. Saniel1,2, Z. Huralt3, and J. Rebah4
1Paderborn University, Paderborn, Germany; 2Universidad Complutense, Madrid, Spain; 3Max-Planck-Institut für die Physik des Lichts, Erlangen, Germany; 4Palacky University, Olomouc, Czech Republic

The impact of coherence on the resolution limit is subject to current debate. Here, we unambiguously resolve this dispute by performing precise measurements of the time-shift between optical pulses with varying degrees of mutual coherence.

EB-P.25 MON
Dissipative phase transition in systems with two-photon driving and dissipation near the critical point

Y.Y. Mylnikov, S.O. Potashnik, G.S. Sokolovskii, and N.S. Averkiev
Ioffe Institute, St. Petersburg, Russia

We study dissipative phase transition near the critical point for a system with two-photon driving and dissipation and predict the power-law behavior of the anomalous average both theoretically and with numerical simulations.

EB-P.26 MON
Variation of the Hong-Ou-Mandel interference dip with crystal length

S. Singh1,2, V. Sharma1, V. Kasmar3, and K.G. Samanta1
1Photonic Sciences Lab., Physical Research Laboratory, ahmedabad, India; 2Indian Institute of Technology-Gandhinagar, Gandhinagar, India

We experimentally studied the variation of Hong-Ou-Mandel (HOM) interference characteristics with the length of the nonlinear crystal producing single photons and achieved a HOM dip of width as narrow as 8.2±0.2 μm using continuous-wave pumping.
EB-P.27 MON
Divergence of single photons with different orbital angular momentum
• V. Kumar, V. Sharma, S. Singh, and G. K. Samanta; Physical Research Laboratory, Ahmedabad, India

We experimentally measure the divergence of single-photon carrying different orbital-angular-momentum (OAM). Using vortex beam pumped parametric-downconversion process, we observed that the single-photons detected through the coincidence imaging has OAM dependence divergence similar to the pump.

EB-P.28 MON
Coupling light to higher order transverse modes of a near-concentric optical cavity
A.N. Umapathy1, C.H. Chow1, C.H. Nguyen1, and C. Kartsufer1,2; 1 Centre for Quantum Technologies, 3 Science Drive 2, Singapore; 2 Department of Physics, National University of Singapore, 2 Science Drive 3, Singapore

We investigate the mode matching to selective higher order transverse modes in a near-concentric cavity by shaping the wavefront of an incoming Gaussian beam using a phase spatial light modulator.

EB-P.29 MON
Pulsed double-pass tapered amplifier for a multi-rail quantum memory in warm Cs vapor
L. Meffner1,2, L. Esquerda1,2, M. Gündoğan1,3, and J. Wolters1,2; 1 Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Institute of Optical Sensor Systems, Berlin, Germany; 2 Technische Universität Berlin, Institut für Optik und Atomare Physik, Berlin, Germany; 3 Institut für Physik, Humboldt-Universität zu Berlin, Berlin, Germany

We present a laser source for use in multi-rail EIT quantum memory experiments in warm Cs vapor cells.

EB-P.30 MON
A fully integrated efficient and tunable surface plasmon graphene-based plasmon coupler for the infrared
A. Natarajan, G. Demésy, and G. Renversez; Aix-Marseille Univ, CNRS, Centrale Marseille, Institut Frestel, 13013, Marseille, France

A fully integrated efficient and tunable surface plasmon coupler composed of a realistic non-tapered dielectric waveguide with graphene patches and sheet is designed for the infrared and optimized through rigorous numerical and theoretical studies.

NOTES
This session will feature a plenary talk presented together with a series of prestigious EPS-QEOD, OSA and EOS Prizes and Awards.

**EE-1: Ultrafast Phenomena**
Chair: Tiziana Tizzi, University of Technology, Genova, Italy

**EE-1.1 TUE 11:00**
Nonlinear THz spectroscopy to study the solvent dynamics in water
- M. Havenith, Department of Physical Chemistry II, Ruhr University Bochum, Bochum, Germany
  - The quest of quantum advantage with a photonics platform
    - F. Sciarrino; Sapienza Università di Roma, Roma, Italy
  - Boson sampling is a computational problem that has been proposed as a candidate to obtain an unequivocal quantum computational advantage.
  - We will review recent advances in photonic boson sampling, describing both the technological improvements achieved and the future challenges.

**EE-1.2 TUE 11:15**
Cold atoms trapped around a nanofiber: a tool to probe collective quantum phaenomena
- J. Berroir, T. Ray, N.V. Corzo, J. Raskop, D.V. Kapriyanov, A. Urvoy, and J. Laurat; Laboratoire Kastler-Brossel, Sorbonne Université, CNRS, ENS-Université PSL
  - Spatiotemporal Imaging of 2D polariton wavepackets
  - Directional Coupling of Emitters Into Waveguides: A Symmetry Perspective
    - A. Lampriani, A. Zambrana-Puyalto, C. Rockstuhl, and J. Fernandez-Corbatón; 1Karlsruhe Institute of Technology, Karlsruhe, Germany, 2Istituto Italiano di Tecnologia, Genova, Italy
  - We present a Lab-in-fiber (LIF) device combining loop-mediated isothermal amplification (LAMP), droplet microfluidics, and optofluidics to detect and quantify viral RNA for COVID-19 diagnostics.
  - Our device offers an attractive alternative to well-established Lab-on-chip techniques

**EE-1.3 TUE 11:30**
Energy Noise and Timing Jitter of Few-Femtosecond Pulses Generated by Resonant Dispersive Wave Emission in Hollow-Core Waveguides
- C. Brahms and J.C. Travers; Heriot-Watt University, Edinburgh, United Kingdom
  - We numerically investigate the energy and timing fluctuations of tunable resonant dispersive wave emission in hollow-core waveguides.
  - We find that for saturated generation conditions, the generated pulses can be exceptionally stable while maintaining few-femtosecond duration.

**EE-1.4 TUE 11:45**
Digital droplet microfluidic integrated Lab-in-a-fiber detection of SARS-CoV-2 viral RNA
  - We developed nonlinear terahertz spectroscopy to record precise absorption of solvated samples. Our study unravelled unknown phases of water under nanoconfinement and provided a local, label free probe on protonation state of amino acids

**CL-2: Biological and Clinical Applications**
Chair: Caron Jacobs, University of Cape Town, South Africa

**CL-2.1 TUE (Invited) 11:00**
Digital droplet microfluidic integrated Lab-in-a-fiber detection of SARS-CoV-2 viral RNA
  - We developed nonlinear terahertz spectroscopy to record precise absorption of solvated samples. Our study unravelled unknown phases of water under nanoconfinement and provided a local, label free probe on protonation state of amino acids
  - We numerically investigate the energy and timing fluctuations of tunable resonant dispersive wave emission in hollow-core waveguides.
  - We find that for saturated generation conditions, the generated pulses can be exceptionally stable while maintaining few-femtosecond duration.

**CL-2.2 TUE (Keynote) 11:00**
Nonlinear THz spectroscopy to study the solvent dynamics in water
- M. Havenith, Department of Physical Chemistry II, Ruhr University Bochum, Bochum, Germany
  - Boson sampling is a computational problem that has been proposed as a candidate to obtain an unequivocal quantum computational advantage.
  - We will review recent advances in photonic boson sampling, describing both the technological improvements achieved and the future challenges.

**CC-2: Nonlinear THz Spectroscopy and Techniques**
Chair: Benedict Mudrin, University of Surrey, Guildford, United Kingdom

**CC-2.1 TUE (Invited) 11:00**
Nonlinear THz spectroscopy to study the solvent dynamics in water
- M. Havenith, Department of Physical Chemistry II, Ruhr University Bochum, Bochum, Germany
  - Boson sampling is a computational problem that has been proposed as a candidate to obtain an unequivocal quantum computational advantage.
  - We will review recent advances in photonic boson sampling, describing both the technological improvements achieved and the future challenges.

**CC-2.2 TUE 11:00 – 12:30**
Describing collectively enhanced nonlinearitv in large ensemble of two-level emitters
- M. Cordier, M. Schemmer, P. Schneeweiss, J. Volz, and A. Rauschenbeutel; Humboldt-Universität zu Berlin, Berlin, Germany
  - We present an intuitive analytical model that allows one to calculate, in the low saturation regime, the full temporal and spectral quantum state of light resulting from the interaction with N two-level emitters.

**EB-3: Photonic Quantum Computation**
Chair: Christine Silberhorn, University of Paderborn, Paderborn, Germany

**EB-3.1 TUE (Invited) 11:00**
The quest of quantum advantage with a photonics platform
- F. Sciarrino; Sapienza Università di Roma, Roma, Italy
  - Boson sampling is a computational problem that has been proposed as a candidate to obtain an unequivocal quantum computational advantage.
  - We will review recent advances in photonic boson sampling, describing both the technological improvements achieved and the future challenges.

**EB-3: Photonic Quantum Computation**
Chair: Christine Silberhorn, University of Paderborn, Paderborn, Germany

**EA-1.1 TUE 11:00**
Describing collectively enhanced nonlinearity in large ensemble of two-level emitters
- M. Cordier, M. Schemmer, P. Schneeweiss, J. Volz, and A. Rauschenbeutel; Humboldt-Universität zu Berlin, Berlin, Germany
  - We present an intuitive analytical model that allows one to calculate, in the low saturation regime, the full temporal and spectral quantum state of light resulting from the interaction with N two-level emitters.

**EA-1: Waveguide-QED and Atom-light Interfaces**
Chair: David Wilkowski, Centre for Quantum Technologies, Singapore

**EA-1.2 TUE 11:15**
Cold atoms trapped around a nanofiber: a tool to probe collective quantum phaenomena
- J. Berroir, T. Ray, N.V. Corzo, J. Raskop, D.V. Kapriyanov, A. Urvoy, and J. Laurat; Laboratoire Kastler-Brossel, Sorbonne Université, CNRS, ENS-Université PSL
  - Spatiotemporal Imaging of 2D polariton wavepackets
  - Directional Coupling of Emitters Into Waveguides: A Symmetry Perspective
    - A. Lampriani, A. Zambrana-Puyalto, C. Rockstuhl, and J. Fernandez-Corbatón; 1Karlsruhe Institute of Technology, Karlsruhe, Germany, 2Istituto Italiano di Tecnologia, Genova, Italy
  - We present a Lab-in-fiber (LIF) device combining loop-mediated isothermal amplification (LAMP), droplet microfluidics, and optofluidics to detect and quantify viral RNA for COVID-19 diagnostics.
  - Our device offers an attractive alternative to well-established Lab-on-chip techniques

**EA-2: Ultrafast Phenomena**
Chair: Christine Silberhorn, University of Paderborn, Paderborn, Germany

**EA-2.1 TUE 11:00**
Few-femtosecond pulses generated by resonant dispersive wave emission in hollow-core waveguides
- C. Brahms and J.C. Travers; Heriot-Watt University, Edinburgh, United Kingdom
  - We numerically investigate the energy and timing fluctuations of tunable resonant dispersive wave emission in hollow-core waveguides.
  - We find that for saturated generation conditions, the generated pulses can be exceptionally stable while maintaining few-femtosecond duration.
multi-scale modelling. use of methodologies from the field problem, (b) inverse design, (c) the nanophotonics: (a) multi-physics in the field of computational Idiscuss four recent developments Technology, Karlsruhe, Germany

CI-1: Broadband Systems Chair: Fabio Pittala, Huawei Technologies, Munich, Germany

CI-1.1 TUE 11:00
O+E-band Transmission over 50-km SMF using a Broadband Bismuth Doped Fibre Amplifier
Y. Hong, K.R.H. Boetttril, Y. Wang, N.K. Thippanrapu, J.K. Sahu, P. Petropoulos, and D.J. Richardson; Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom

CI-1.2 TUE 11:15
7-Ring Air-Core Trench-Assisted Fibre Supporting >300 Radially Fundamental OAM Modes Across S+C+L Bands
Y. Wang1, K. Zhu1, Y. Fang1, W. Geng1, W. Zhao1, C. Bao2, Y. Liu1, W. Zhang1, Y. Ren1, Z. Pan1, and Y. Yue1; 1Nankai University, Tianjin, China; 2Institute of Applied Physics, Chinese Academy of Sciences

EJ-2: Nonlinear Optics Modeling Chair: Stefan Skupin, University of Freiburg, Freiburg, Germany

EJ-2.1 TUE 11:00
How carrier memory enters the Haus master equation of mode-locking
J. Hausen1, S. Gurevich2,3, K. Lüdge1, and J. Javaloyes1; 1Institute of Theoretical Physics, Technische Universität Berlin, Berlin, Germany; 2Institute for Theoretical Physics, University of Münster, Münster, Germany; 3Departamento de Física, Universitat de les Illes Balears and IAC-3, Palma, Spain

EJ-2.2 TUE 11:15
Bright localized patterns in singly resonant optical parametric oscillators
P. Parrat-Rivas, C. Mas-Arabi, and F. Leo; Université Libre de Bruxelles, Brussels, Belgium
We study the formation, bifurcation structure and stability of localised states.

CD-3: Microresonators and Waveguides Chair: Francesco Tanti, Max Planck Institute for the Science of Light, Erlangen, Germany

CD-3.1 TUE 11:00
The contribution has been withdrawn.

CD-3.2 TUE 11:15
Low-threshold frequency comb generation using second-order nonlinearities in lithium niobate whispering gallery resonators
J. Scabados1, K. Buse1,2, and I. Breunig1,2; 1Department of Microsystems Engineering - IMTEK, University of Freiburg, Freiburg, Germany; 2Institute of Applied Physics, University of Freiburg, Freiburg, Germany

CH-3: Advanced Optical Sensing Techniques Chair: H. Altyug, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

CH-3.1 TUE 11:00
Collective measurements achieving super resolution
J.O. de Almeida1, M. Lewenstein1,2, and M. Sotomerti0s2; 1ICFO - Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Av. Carl Friedrich Gauss 3, 08860, Castelldefels (Barcelona), Spain; 2ICREA, Pg. Lluis Companys 23, 08010, Barcelona, Spain; 3Física Teórica: Informació i Fenòmens Quànits, Departament de Física, Universitat Autònoma de Barcelona, E-08193, Bellaterra (Barcelona), Spain

CH-3.2 TUE 11:15
Super-Resolved Localization of Overlapping Sources Using SUPPOSE
G. Brinatti Vazquez1, A.M. Lacapmesure1, M. Tovani1, S.R. Martinez2, and O.E. Martínez2; 1Laboratorio de Fotónica, Instituto de Ingeniería Biomédica, CONICET

CF-2: Ultrafast UV Sources Chair: John Tisch, Imperial College London, London, United Kingdom

CF-2.1 TUE (Invited) 11:00
Progress in Soliton Dynamics in Hollow Capillary Fibres
J.C. Travers, C. Brahm, T.F. Grig- orova, A. Lekosiotis, and E. Bell; School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom

We review soliton dynamics in hollow-capillary fibres: self-compression to sub-cycle optical atto-second pulses at gigawatt peak power in the near and mid-infrared, and efficient conversion to few-femtosecond pulses tunable across the VUV and DUV.

Y. Yue1, W. Zhang1, Geng, SMF length of 50km. from 1350nm to 1460nm over a adaptively-loaded DMT transmission experiment utilising a 115-km SMF using A Broadband Bismuth Doped Fibre Amplifier. We demonstrate the first transmission experiment utilising a 115-mm BDAF and achieve >65-Gb/s adaptively-loaded DMT transmission across the wavelength range from 1350 nm to 1460 nm over a SMF length of 50 km.

7-Ring Air-Core Trench-Assisted Fibre Supporting >300 Radially Fundamental OAM Modes Across S+C+L Bands
Y. Wang1, K. Zhu1, Y. Fang1, W. Geng1, W. Zhao1, C. Bao2, Y. Liu1, W. Zhang1, Y. Ren1, Z. Pan1, and Y. Yue1; 1Nankai University, Tianjin, China; 2Institute of Applied Physics, Chinese Academy of Sciences

We study the formation, bifurcation structure and stability of localised states.

We present a generalization of the Haus master equation for mode-locking in which a dynamical boundary condition allows describing complex pulse trains, such as the Q-switched and harmonic transitions, and weak interactions between localized states.

We use techniques of statistical inference, to analyse a measurement strategy to estimate the separation between two incoherent light sources independently of their centroid position, and in the limit of large number of photons.
We report on storage and retrieval of a single collective excitation in an atomic ensemble coupled to an optical nanofiber. We show theoretical and experimental advances on controllable atomic Bragg mirrors and atomic cavity systems.

**EA-1.4 TUE 11:45**

Systematic design of a novel photonic crystal waveguide platform for coupling guided light with trapped cold atoms

*À. Boucas1, A. Urvoy1, J. Berroir2, T. Ray1, M. Kemich1, S. Mahapatra1, F. Reiner1, A. Levenson1, K. Bencheikh2, C. Sauvan1, J.-J. Greffet1, and J. Laurat1*  
1 Laboratoire Kastler-Brossel, Collège de France, Paris, France; 2 Department of Theoretical Physics, St.-Petersburg State Polytechnic University, St.-Petersburg, Russia

We demonstrate collective enhancement of weak atomic nonlinearities. This enhancement manifests itself as an atom-number-dependent change of the second order correlation of the transmitted light from flat over photon anti-bunching to strong photon-bunching.

**EB-3.3 TUE 11:45**

Quantum Optical Implementation of a non-Abelian U(3) Holonomy

*V. Neef, J. Pinske, F. Klausc, L. Teuber, M. Kremer, M. Ehrhardt, M. Heinrich, S. Scheel, and A. Szameit*  
Institut für Physik, Universität Rostock, Rostock, Germany

We experimentally realize a U(3) holonomy. By adiabatically prop-

ties.

**EA-1.3 TUE 11:30**

Correlating Photons Using the Collective Nonlinear Response of Atoms Weakly Coupled to an Optical Mode

*J. Voit1,2, A. Prassad1, J. Hinney2, S. Mahnoodian2, K. Hammerer2, S. Rind3, P. Schneeweiss1,2, M. Schemann1, A. Sørensen1, and A. Rauschenbeutel1,2*  
1 Humboldt-Universität zu Berlin, Berlin, Germany; 2 TU Wien-Atom Institut, Wien, Austria; 3 Leibniz University Hannover, Hannover, Germany

We showcase the power of linear optics through the implementation of a quantum protocol with coherent states. Our work provides evidence for a computational quantum advantage in the interactive setting, drawing near potentially useful applications.

**EB-3.2 TUE 11:30**

Experimental demonstration of quantum advantage for NP verification

*F. Centrone1,2, N. Kamar3, E. Diamanti1, and I. Kerenidis3*  
1 Sorbonne Université, CNRS, LIP6, Paris, France; 2 Université de Paris, CNRS, IRIF, Paris, France; 3 School of Informatics, University of Edinburgh, Edinburgh, United Kingdom

We showcase the power of linear optics through the implementation of a quantum protocol with coherent states. Our work provides evidence for a computational quantum advantage in the interactive setting, drawing near potentially useful applications.

**CC-2.2 TUE 11:45**

Ultrafast Coherent Spectroscopy with Field Resolution at Mid-Infrared and THz Frequencies

*T. Deckert1, J. Allerbeck1,2, L. Spitzner1, T. Kühn2,3, and D. Cirac1,2*  
1 Universität des Saarlandes, Saarbrücken, Germany; 2 Institut für Physik, Universität Rostock, Rostock, Germany

We experimentally realize a U(3) holonomy. By adiabatically prop-

ties.

**CL-2.2 TUE 11:30**

Remote heart sound characterization and classification using computational imaging

*L. Cester1, I. Starshynov2, Y. Jones2, P. Pellicani2, and D. Faccio1*  
1 School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom; 2 Robertson Centre for Biostatistics, University of Glasgow, Glasgow, United Kingdom

We showcase the power of linear optics through the implementation of a quantum protocol with coherent states. Our work provides evidence for a computational quantum advantage in the interactive setting, drawing near potentially useful applications.

**CL-2.3 TUE 11:45**

Thermoregulation of immune cell dynamics

*S. Wieser1, I. Company1, B. Ciraulo1, C. Agazzi3, I. Kerenidis1*  
1 Institute of Technology, Haifa, Israel; 2 ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels (Barcelona), Spain; 3 CNRS, Université Paris-Saclay, Orsay, France; 4 Kansas State University, Manhattan, KS, USA; 5 ICREA-Institució Catalana de Recerca i Estudis Avanats, Barcelona, Spain

We showcase the power of linear optics through the implementation of a quantum protocol with coherent states. Our work provides evidence for a computational quantum advantage in the interactive setting, drawing near potentially useful applications.

**CK-3.2 TUE 11:30**

Second order nonlinearity in Silicon Nitride waveguides via photo-induced self-organized gratings

*C.-S. Bréz, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

We showcase the power of linear optics through the implementation of a quantum protocol with coherent states. Our work provides evidence for a computational quantum advantage in the interactive setting, drawing near potentially useful applications.

**CB-3.3 TUE 11:45**

Effective, low crosstalk and compact programmable photonic circuits by 3D femtosecond laser micromachining

*F. Ceccarelli1,2, C. Pentangelo3,4, S. Atzeni1,2, A. Crespi1,2, and R. Ossabow1,2*  
1 Istituto di Fotonica e Nanotecnologie - Consiglio Nazionale delle Ricerche (IFN-CNR), Milano, Italy; 2 Dipartimento
China; 2University of Southern California, Los Angeles, USA; 3University of Louisiana at Lafayette, Lafayette, USA

we propose and design a multi-ring-air-core trench-assisted fibre with 7 rings each supporting 58 OAM modes (i.e. 406 ones in total) at 1550 nm with low-level interring crosstalk after 100-km fibre propagation.

CI-1.3 TUE (Invited) 11:30
Machine learning enabled Raman amplifiers
• D. Zibar, DTU Fotonik, Kgs. Lynby, Denmark

Advances in machine learning are spurring a new generation of optical communication and measurement systems. We demonstrate how machine learning can be used to realize arbitrary gains of Raman amplifiers in a controlled way.

EJ-2.3 TUE 11:30
Dispersive Instabilities In Passively Mode-Locked Integrated External-Cavity Surface-Emitting Lasers
C. Schelte1,2, • D. Hessel1,2, J. Javoy1, and S. Gurevich1,3; 1Département de Physique, Université de les Illes Balears; 2Institute of Applied Computing and Community Code (IAC-3), Cra. de Valldemossa, km 7.5, E-07122 Palma de Mallorca, Spain; 3Institute for Theoretical Physics, University of Münster, Wilhelm-Klemm-Str. 9, 48149 Münster, Germany; 3Center for Nonlinear Science (CeNoS), University of Münster, Corrensstr. 2, 48149 Münster, Germany

We investigate a pulse instability appearing in passively mode-locked integrated external-cavity surface-emitting lasers. A train of satellites on the leading edge of a pulse becomes unstable due to carrier interaction and order, action and third order dispersion.

EJ-2.4 TUE 11:45
Orbital Edge and Corner States in Su-Schrieffer-Heeger Lattices
D. Bongiovanni1,2, • Z. Hu1, D. Juric1, Y. Hu1, D. Song1, H. Bujan1,2, R. Moraudotti1,2, and Z. Chen1,2; 1EPCA Applied Physics Institute and School of Physics, Nankai University, Tianjin, China; 2INRS-EMT, 1650 Blvd. Lionel-Boulet, Canada

We demonstrated how symmetry-broken states arising from the Kerr nonreciprocity in microresonators can be used for all-optical memories and logic gates. We explore different materials allowing bitrates of 10Gbps or power as low as 1μW.

CD-3.3 TUE 11:30
Optical Memory Based on Counterpropagating Light in Microrings
• L. Del Bino1,2,3, N. Moroney1,2,4, and P. Del’Haye1,2,5; 1Max Planck Institute for the Science of Light, Erlangen, Germany; 2National Physical Laboratory, Teddington, United Kingdom; 3Heriot-Watt University, Edinburgh, United Kingdom; 4Imperial College London, London, United Kingdom; 5FAU Erlangen-Nürnberg, Erlangen, Germany

We demonstrate how symmetry-broken states arising from the Kerr nonreciprocity in microresonators can be used for all-optical memories and logic gates. We explore different materials allowing bitrates of 10Gbps or power as low as 1μW.

CH-3.3 TUE 11:30
Hadamard-transform high spectral resolution and broadband stimulated Raman Scattering microspectroscopy using an acousto-optic tunable filter
• L. Genchi1, A. Bacci1, S.P. Laptén1, K. Gammela2,4, and C. Liberale2,3; 1Center for Theoretical Physics, University of Southern Denmark, Odense, Denmark; 2The Institute of Mathematical Sciences and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia; 3Computer, Electrical and Mathematical Sciences and Engineering, King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

We present a high spectral resolution multiplexing acquisition modality for stimulated Raman scattering microscopy using the Hadamard transform. We demonstrate improved signal-to-noise ratio over conventional acquisitions in the Raman fingerprint and CH-stretch regions.

CF-2.2 TUE 11:30
High repetition rate high harmonic generation with ultra-high photon flux
M. Tschernjashew1,2, • S. Hădărescu1, R. Klaser1,3,4, M. Gebhardt1,3,4, R. Horsten1,5, S. Weerdenburg1,6, P. Putinets7,8, W. Coene9,10, J. Rothhardt11,12, T. Eidam1,12, and J. Limper11,12,4; 1Active Fiber Systems GmbH, Jena, Germany; 2Institut de Photonique, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Jena, Germany; 3Helmholtz-Institute Jena, Jena, Germany; 4Optics Research Group, Delft University of Technology, Delft, Netherlands; 5ASML Netherlands B.V., Veldhoven, Netherlands; 6Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We present a HHG source providing a large photon flux between 66eV and 150eV. It is driven by a 100W fiber-laser system equipped with a post-compression unit whose output is focused into a gas jet.

CH-3.4 TUE 11:45
Finesse-Enhanced Measurement of Thermal Capillary Waves at Liquid-Phase Boundaries
• E. Haber1, M. Dovzidzon1, and T. Carmon1; 1Technion, Israel Institute of Technology, Haifa, Israel; 2Tel Aviv University, Tel Aviv, Israel

We report on a device, that optically interrogates capillary. Our resolution scales with wavelength di-
**Tuesday – Orals**

**EE-1.4 TUE 12:00**
Real-time measurements and simulations of incoherent supercontinuum dynamics and rogue waves in a noise-like pulse dissipative soliton fibre laser

**EE-1.5 TUE 12:00**
Waveguide subwavelength gratings bridged thin-film LiNbO3 ridge-waveguide grating coupler

**EE-2.5 TUE 12:15**
Full-field Real-Time Measurement of Ultrafast Soliton Fission

**EE-3.5 TUE 12:15**
Magnetoplasmonic slot waveguide isolator

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**EA-1.5 TUE 12:00**
Single-Photon Source with Near-Millisecond Memory based on Room-Temperature Atomic Vapour

M. Zugenmaier, *R.* Schmieg, K.B. Diederiksen, and E.S. Polzik; Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

We present a room-temperature single-photon source based on Raman scattering from an atomic vapour cell. The system features a built-in near-millisecond memory that allows deterministic and efficient conversion during readout.

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**EA-1.6 TUE 12:15**
Spectroscopy of Rubidium with a Tuneable Single Photon Source

P. Burdekin1, S. Grusd1,2,2,3,4, R. Newbould, R. Hoggarth1, K. Major1,2, E. Hinds1, A. Clarke1, 1Centre for Cold Matter, Blackett Laboratory, Imperial College London, London, United Kingdom; 2ICFO, Barcelona, Spain

We present our work on single-photon-level spectroscopy of rubidium and on frequency-tuning the cooling quantum states in appropriately designed photonic waveguide systems, we evolve on closed loops within a degenerate subspace of dark states, resulting in a non-Abelian geometric phase.

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**EA-2.4 TUE 12:15**
Handheld instrument for the Measurement of Macular Pigment Optical Density Using structured light

D. Cristaràs1,2, J. Monpeàn3, H. Gint3, and P. Artañ3; 1Department of Research, Athens Eye Hospital, Athens, Greece; 2Laboratorio de Óptica, Universidad de Murcia, Murcia, Spain; 3UCL Institute of Ophthalmology, London, United Kingdom

A handheld instrument for the in vivo measurement of macular pigment optical density was developed. The fundus is illuminated using structured light and a photodetector records the reflected signal resulting to a rapid, accurate and repeatable measurement.

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**EA-3.4 TUE 12:00**
Versatile Photonic Entanglement Synthesizer in the Spatial Domain

D. Barràs1, M. Walshears2, K. Benschók1, V. Parigé2, J.A. Levenson1, N. Treps2, and N. Belaba1; 1Centre de Nanosciences et de Nanotechnologies C2N, Palaiseau, France; 2Laboratoire Kastler Brossel, Paris, France

We present a spatial entanglement synthesizer based on evanescently coupled nonlinear waveguides. Our integrated-optics scheme is platform-independent and thus compatible with future light-based quantum technologies to generate robustly large or versatile multimode entangled states.

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**EB-2.3 TUE 12:00**
Enhanced electro-optic on-chip detection based on integrated nonlinear phase-shifters

A. Ritter1, F.F. Settebennini1, A. Shams-Ansari1, M. Lochar1, J. Füis1, and L.C. Benez-Chelmus1; 1Quantum Optoelectronics Group, ETH Zürich, Zürich, Switzerland; 2Laboratory for Nanoscale Optics, Harvard University, Cambridge, USA; 3Capasso Group, Harvard University, Cambridge, USA

We investigate the potential of thin-film lithium niobate based electro-optic phase shifters, integrated into a on-chip Mach-Zehnder geometry for sub-cycle high-sensitivity electric field measurements in the THz regime.

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**EB-3.5 TUE 12:15**
Quantum Photon Processor based on Programmable Integrated Silicon Nitride Circuits

J. Epping1, C. Taglioni1, R. van der Meer1, H. Snijders1, P. Hooschush1, B. Kassenberg1, M. de Goede1, P. Venderbosch1, C. Toebe1, H. van den Vekker1, P. Pinkus1, and J. Renema1; 1QuIX BV, Enschede, Netherlands; 2University of Twente, Enschede, Netherlands

We report the demonstration of a Noncollinear two-dimensional spectroscopy in the mid infrared enables phase-sensitive investigation of coherent low-energy dynamics in semiconductors and strongly correlated materials in a perturbative excitation regime as shown by preliminary measurements on indium antimonide.

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**EC-2.4 TUE 12:15**
A Novel NIR-Absorber Developed with Mesoporous Silicon Nanoparticles for Photothermal Applications

R. Beyazkili1, S. Akcmen1, Y. Midilli1, B. Ortac2, and C. Elrubken1; 1TU Wien, Photonics Institute, Vienna, Austria; 2Institute of Inorganic Chemistry, Department of Chemistry and Applied Biosciences, ETH Zürich, Zürich, Switzerland; 3Empa-Swiss Federal Laboratories for Material

How fever and cold affect single immune cell dynamics remains an open question. Here we show that immune cell migration and polarization is regulated by temperature variations using a digital holographic thermo-microscope.

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**EC-3.5 TUE 12:15**
Full-field Real-Time Measurement of Ultrafast Soliton Fission

F. Gallazzi1, S. Toeng2, M. Nàrth1, J.M. Dudley1, and G. Gentz1; 1Photons Laboratory, Tampere University, Tampere, Finland; 2Institut FEAMO-ST, Université Bourgogne Franche-Comté CNRS UMR 6303, Dijon, France, Dijon, France

We characterize in real time the full-field associated with soliton fission induced by noise-seeded modulation.
We use a 3.3 GHz emission with rubidium atoms to build a quantum memory.

12-mode quantum photonic processor which is the largest universal quantum photonic processor to date. The processor is a fully reconfigurable linear interferometer using silicon nitride waveguide technology.

We demonstrate that through the quantum confined Stark effect a free-space, ultrafast THz signal can be directly encoded onto an optical signal probing the absorption of a film consisting of CdSe/CdS quantum dots.

Novel photothermal material is developed from mesoporous silica nanoparticles functionalized with a diimmonium-based dye. Nanoparticles show strong NIR absorption and reproducible heat generation performance under NIR light revealing their potential in therapeutic applications.

The presentation is about the design and microfabrication of nanocavities for the visible and telecommunication wavelength regime using topological silicon photonics. We will present the progress in our work on silicon nitride nanocavity resonators, and we will discuss the prospects of this field.

First principles modeling of ultrashort pulse probe spectroscopy.

We study a new type of nanocavity resonator that is based on a quantum dot in a semiconductor nanostructure. The quantum dot is confined in a small volume and interacts with the electromagnetic field in the cavity. We discuss the properties of this system and compare them to other types of nanocavities.

Topological optical frequency combs and dissipative Kerr super-solitons.

We present the generation of nested coherent optical frequency combs and dissipative Kerr super-solitons in a two-dimensional array of coupled ring resonators that creates a synthetic magnetic field, and thereby, exhibits topological edge states for photons.
We show that metamaterial structure is not necessary for the manifestation of optical magnetism: a strong optical magnetic response is an essential characteristic feature of a thin layer of homogeneous dielectrics.

We demonstrate a SiN-based array of 8 end-fire emitters with 800 nm spacing. The device is characterized at a wavelength of 852 nm. By considering 12 thermo-optical phase shifters, a beam steering of ±30° is achieved.

We show that metamaterial structures, where graphene is in-plane and patterned, of highly confining NIR photonic waveguide structures, where graphene is in-plane and patterned.

We show that metamaterial structures, where graphene is in-plane and patterned, of highly confining NIR photonic waveguide structures, where graphene is in-plane and patterned.

The mid-infrared.

ing plastic types that take advantage of a miniaturised, low-cost, robust and mass-produceable NIR spectral sensor based on integrated photonics technology, which opens new horizons for on-site materials sensing applications.
ED-3.2 TUE 16:45
Comb-calibrated Stimulated-Raman Spectroscopy of H2
M. Lampert1, L. Rutkowski2, D. Ronchetti3, D. Gatti1, R. Gotti1, G. Cerullo1, F. Thibault4, H. Juczkiewicz5, S. Wojtowicz6, P. Maslowski2, P. Weidlo6, D. Polli2, and M. Marangoni2; 1Politecnico di Milano, Italy; 2University of Rennes, France; 3Nicolaus Copernicus University, Torun, Poland
H2 is a benchmark system for fundamental physics, yet spectroscopy is hindered by the lack of dipole moment. We present a comb-calibrated coherent Raman spectrometer for advanced studies of its Q(1) 1-0 line transition.

CD-4.2 TUE 17:00
Spontaneous polarization symmetry breaking of light in a microresonator
N. Moroney1, L. Del Bino1, M.T.M. Woodley1, S. Zhang1, L. Hill2, V.J. Wittwer3, T. Südmeyer4, T. Wildi5, G.L. Oppo1, M. Vanner5, V. Brasc3, T. Herr6, and P. Del’Haye6; 1Max Planck Institute for the Science of Light, Erlangen, Germany; 2Imperial College London, London, United Kingdom; 3National Physical Laboratory, London, United Kingdom; 4Heriot-Watt University, Edinburgh, United Kingdom; 5University of Strathclyde, Glasgow, United Kingdom; 6Université de Neuchâtel, Neuchâtel, Switzerland
We show the first dual-comb measurement of widths and positions of enhancement cavity modes delivering molecular absorption and dispersion spectra. This approach does not require reference spectrum or correction for the comb-cavity

CA-3.2 TUE 17:00
Laser power stabilization for Advanced VIRGO
F. Cleva1, J.-P. Coulon1, L.W. Wei1, M. Tarconi1, M. Merzoug1, E. Genin1, G. Pillant1, and F. Kéflians1; 1ARTMIS, Université Côte d’Azur - Observatoire de la Côte d’Azur - CNRS, Nice, France; 2European Gravitational Observatory, Cascina, Italy
We present the laser power stabilization in Advanced VIRGO using very high photocurrent photodiodes with excellent spatial uniformity. The RIN is currently 2.3 E-9 Hz1/2 and will be able to reach 1.26E-9 Hz1/2 for the most sensitive configuration.

EC-2.2 TUE 17:00
First realization of a nonlinearity-induced topological insulator
L. Maczewsky1, M. Heinrich1, M. Kremer1, S.K. Ivanov2, M. Erhardt3, F. Martínez1, Y.V. Kartashov2, V.V. Konotop2, S.Y. Gorchtein4, N. Gisin1, and A. Zozoulenko1; 1University Rostock, Institute für Physik, Rostock, Germany; 2Moscow Institute of Physics and Technology, Moscow, Russia; 3Institute of Spectroscopy, Russian Academy of Sciences, Moscow, Russia; 4CIFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science & Technology, Barcelona, Spain; 5Department of Física, Facultad de Ciencias, Universidad de Lisboa, Lisbon, Portugal; 6Centro de Física Teórica e Computacional, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal; 7Universitat Politècnica de Catalunya, Barcelona, Spain
A nonlinear photonic Floquet topological insulator in graphene enables new perspectives for topological and quantum technologies.

CA-3.2 TUE 17:00
Enhanced light-matter interaction in atomically thin semiconductors and 2D single photon emitters coupled to dielectric nano-antennas
L. Sorino1, P. Zotev2, S. Sapienza2, S. Maier3, and A. Tartakovskii; 1Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom; 2Department of Physics, Imperial College London, London, United Kingdom; 3Chair in Hybrid Nanosystems, Nanoinstitute Munich, Munich, Germany
Mie resonances in dielectric nanostructures represent a novel platform for engineering light-matter interaction at the nanoscale. In our work, we integrated atomically thin WSe2 with gallium phosphate nanooptics and demonstrate the lumenence enhancement in 2D excitons and native quantum emitters.

EC-2.2 TUE 17:00
Gate switchable arrays of single photon emitters in monolayer MoS2
A. Hötger1, K. Barthelmie2, A. Micevic2, J. Klein1, L. Stig3, F. Sigfer2, E. Mitterreiter2, S. Gyger2, T. Taniguchi2, K. Watanabe2, M. Lorke2, M. Florio2, F. Jahnke2, V. Zwiller3, K. Jons9, U. Wurstbauer2, C. Kastl1, A. Tartakovskii; 1Walter Schottky Institute and Physics Department, TUM, Munich, Germany; 2Department of Materials Science and Engineering, MIT, Cambridge, USA; 3KTH Royal Institute of Technology, Stockholm, Sweden; 4National Institute for Materials Science, Tsukuba, Japan; 5Institut für Theoretische Physik, Universität Bremen, Bremen, Germany; 6Department of Physics,
We experimentally demonstrate high-efficiency laser diodes for W-band at 885 nm. Our ridge waveguide diode lasers deliver >1800 mW output power and exhibit a peak electrical to optical efficiency of 42%.

In this work, we present a technique relying on heterodyne interferometry for the characterization of nonlinear waveguides. This method can cope with a small nonlinear phase shift, low power, and large propagation loss.

A highly sensitive ethanol vapour sensor based on the imprinting of micro-ring resonators onto optical fiber tapers is presented. This hybrid, sensing probe readily achieves ethanol detection levels of 0.5 ppm.

We present an in-depth study on resonance fluorescence properties of In(Ga)As quantum dots emitting around 1550 nm are highly promising. We present an in-depth study on resonance fluorescence properties of In(Ga)As quantum dots emitting in the telecom C-band.

We here investigate the emission of indistinguishable single photons and the long-term stability of the emission line.
light is input to a fibre cavity in which the Kerr nonlinearity causes the cavity field to acquire a random chirality.

CD-4.3 TUE 17:15
Nonlinear Frequency Conversion in the Hybrid Si, N₄ - LiNbO₃
Integrated Platform
• M. Charra1, A. Riedhauser2, R.N. Wang1, C. Möhl3, V. Smigeye3, S. Hörs3, T. Bles1, D. Caire3, J. Liu1, Y. Popoff3, P. Siedler3, and T.J. Kippenberg1
1 Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland; 2IBM Research Europe, Rüschlikon, Switzerland; 3ETH Zürich, Zürich, Switzerland
We demonstrate optical frequency comb generation in hybrid high-Q optical microresonators fabricated using direct wafer bonding of photonic Damascene silicon nitride wafer with thin-film lithium niobate-on-insulator (LNOI). The devices enable direct phase control via Pockels effect.

CD-4.4 TUE 17:30
Four-wave mixing and Arnold tongues in high finesse Kerr ring microresonators
• D. Puzyrev, Z. Fan, A. Villosi, and D. Skryabin; University of Bath, Bath, United Kingdom
We find that the four-wave mixing threshold conditions in the high finesse Kerr ring microresonators break the pump laser parameter space into a sequence of Arnold tongues. We report synchronisation and frequency-domain symmetry breaking inside the tongues.

CG-3.2 TUE 17:30
Attosecond Ionization Time Delay Around a Shape Resonance in Nitrogen Measured by the RABBIT-2a method
• V. Loriot1, A. Marciñak1, S. Nandi2, G. Karras2, M. Hervé2, E. Constant2, E. Plesia2, A. Palacios2, F. Martin2, and F. Lépine3,1; 1Institute of Light and Matter, Lyon, France; 2Universidad Autonoma de Madrid, Spain
We implement a self-calibrated variant of the RABBIT protocol (that reduce spectral congestion) to measure the photoelectron trapping (that reduces spectral congestion) to measure the photoelectron trapping to tightly bound excitons and tri-pons. We observe the effect in arrays of coupled waveguides.

CA-3.4 TUE 17:30
Highly tunable, multi-GHz repetition rate optical parametric oscillator driven by an electro-optic comb
• H. Ye1, V. Freysz2, R. Bello-Doasa3, L. Pontagnier3, and J. Bloch1; 1Centre de Nanosciences et Nanotechnologies (C2N), CNRS, Université Paris-Saclay, Palaiseau, France; 2Institut d’Optique, Orsay, France; 3Institut Universitaire de France (IUF), Paris, France
We present an optical parametric oscillator (OPO) synchronously pumped by an electro-optic comb.

CA-3.3 TUE 17:15
160W Cryogenic Regenerative Yb:YLF Amplier
• M. Pergament1, U. Demirbas1, M. Kellert1, T. Thiesing2, H. Hül3, and F. Kaertner2; 1Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany; 2Physics Department, University of Hamburg, Hamburg, Germany; 3The Hamburg Center for Ultrafast Imaging, Hamburg, Germany; 4Laser Technology Laboratory, Antalya Bilkent University, Antalya, Turkey
We demonstrate cryogenic Yb:YLF regenerative amplifier, using E/α and E/β axes. The amplifier generates up to 160 W with 16 mJ pulses at 10kHz has 2.2% RMS noise, and could be compress to sup-ps durations.

EC-2.3 TUE 17:15
Quantized Nonlinear Pumping with Photons
• V. Jürgensenn, S. Mukherjee, and M. Rechtsman; Pennsylvania State University, University Park, PA 16802, USA
We theoretically propose and experimentally demonstrate quantized nonlinear Thouless pumping, despite non-uniform occupation of topological bands; the effect has no analogue in the linear domain. We observe the effect in arrays of coupled waveguides.

EC-2.4 TUE 17:30
Non-linearities in a driven-dissipative SSH lattice
• N. Pernet1, P. St-Jean1, D. Solnyshkov1,2, G. Malpuech2, N. Carlon Zambon1, B. Real2, O. Solanas1, H. Knap1, P. Eilenberger3, O. Egorov4, S. Schneider2, and C. Schneider5; 1University of Oldenburg, Oldenburg, Germany; 2University of Würzburg, Würzburg, Germany; 3Friedrich Schiller University, Jena, Germany; 4Friedrich Schiller University, Jena, Germany; 5Fraunhofer IOF, Jena, Germany
We study room temperature exciton-polaritons in a WS2 monolayer integrated in a fully tunable photonic lattice, imprinted
Vertical design approach for suppressing power saturation in GaAs-based high-power diode lasers

We report a new design approach for GaAs-based high-power diode lasers that significantly reduces power saturation and improves efficiency. The design incorporates novel epitaxial structures and advanced cooling techniques, leading to a 30% increase in power output compared to state-of-the-art devices. This breakthrough opens new possibilities for high-power laser applications in various fields, from telecommunications to material processing.

Role of Temperature Nonuniformity on Longitudinal Current Crowding in High Power Diode Lasers

In this study, we experimentally and theoretically investigate the impact of temperature nonuniformity on longitudinal current crowding in high power diode lasers. Our results reveal that nonuniform temperature distributions can significantly alter the current crowding effect, leading to reduced power conversion efficiency. We propose a novel cooling scheme that ensures uniform temperature distribution, thereby improving laser performance.

Improvement of Geometrically-Resolved Spectroscopy

We present a novel method for geometrically-resolved spectroscopy that significantly enhances spatial resolution and sensitivity compared to traditional techniques. This method enables detailed analysis of complex material systems, with applications in nanotechnology and biomedical diagnostics.

Optical Fibre Humidity Sensor for Assessing the Wetting Condition of Oak Barrels

We developed an optical fibre humidity sensor designed specifically for monitoring the wetting condition of oak barrels. This sensor provides accurate and real-time moisture measurement, crucial for the aging process of wine and other alcoholic beverages. Our sensor outperforms previous technologies in terms of sensitivity and durability, making it an essential tool for the wine industry.

A fast and bright source of coherent single photons

We demonstrate a fast and bright source of coherent single photons, which is essential for quantum computing and quantum communication. Our source combines high quantum efficiency with ultrashort pulse duration, surpassing current state-of-the-art technologies. This achievement opens new prospects for quantum technology applications.
The OPO delivers sub-picosecond signal pulses across 1.5-1.7 μm with flexible repetition rate ranging from 1 to 14 GHz.

The bulk of the Su Schriever Heeger model. Taking advantage of the non-Hermitian nature of our system we unveil new stable solutions that have no counterpart in conservative systems.

in an open cavity. Our study aims at the implementation of a highly versatile platform to study non-linear, interacting bosons in lattices.

the work on the properties of PT-symmetric systems. Our findings will provide a new perspective on the role of non-linearities in PT-symmetric systems, and open up new avenues for the design of practical devices.
Giant Optical Chirality in All-dielectric Halide Perovskite Metasurfaces
Centre for Disruptive Photonic Technologies, TPI, SPMS, Nanyang Technological University, Singapore, Singapore
2 Energy Research Institute @ NTU, Singapore, Singapore
Wavelength stabilized, high-power DBR tapered diode lasers emitting at 783 nm with narrowband outputs up to 7 W and a narrow spectral linewidth below 80 pm will be presented.

Compact Quantum Dots Photoligated with Multifunctional Zwitterionic Coating for Immunofluorescence and Imaging
H. Mattoussi, Florida State University, Department of Chemistry and Biochemistry, Tallahassee, FL 32306, USA
Using symmetry bandgaps to create a line of bound states in the continuum in 3D photonic crystals
A. Cerjan, C. Jörg, W.A. Bennacar, S. Vaidyan, C.W. Hsu, G. von Freymann, and M.C. Rechtschaffen

Guiding of Laser Pulses at the Theoretical Limit – 97% Throughput Hollow-Core Fibers

A Fabry Perot optical fibre sensor with a hydroscopic photo-resin cavity is developed for monitoring the evolution of moisture content along the walls of oak barrels used in wine ageing.

Photonic lantern for multiplexing fiber Fabry-Perot sensors
J. Flores, J. Zubia, and J. Villatoro
University of the Basque Country, Bilbao, Spain
In this work, we report on the use of a photonic lantern for multiplexing fiber Fabry-Perot interferometric sensors, hence to monitor multiple parameters. The interferometers must have proper cavity lengths to avoid crosstalk.

Using symmetry bandgaps to create a line of bound states in the continuum in 3D photonic crystals
A. Cerjan, C. Jörg, W.A. Bennacar, S. Vaidyan, C.W. Hsu, G. von Freymann, and M.C. Rechtschaffen
1,2 Department of Physics, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy, Milano, Italy
We report giant chirality in all-dielectric halide perovskite metasurfaces. With circular dichroism potentially as high as 45% and remarkable light-emission properties, halide perovskite metasurfaces can rival conventional dielectric platforms for low cost, active meta-devices.
optical clocks and their use for fundamental tests of the standard model as well as novel applications of clocks for mapping the Earth's geoid.

The characteristic length of interactions.

pulses at 2 μm from a MHz repetition rate fiber laser can trigger the formation of frequency-shifted solitons up to 2.95 μm with 50 nJ energy and 86 fs duration pulse.

Alamos National Laboratory, Los Alamos, NM, USA

Optical refrigeration has shown record cooling of Yb:YLF crystals to <90K, and cooling of a payload (IR sensor) to 130K. In parallel, exploiting this concept for developing lasers without internal heat generation has been advancing.

We report an ultra-flat octave-spanning (670-1390 nm) coherent supercontinuum using a femtosecond-pumped all-normal dispersion polarization-maintaining fiber with excellent noise (RIN<0.54%) and polarization properties (PER>17 dB).

Experimental characterization of spectro-temporal structure of octave-spanning, coherent fiber supercontinuum pulses is performed and full-field information is retrieved using time-domain ptychography. Fast femtosecond oscillations are observed and traced back to imperfections of the pump pulses.

We present temperature-dependent spectroscopy of Yb:YLF and prospects for laser cooling.

The capability of filter-less tuneable All-Fibre Laser

All Fibre Laser

D. Kirsch and M. Chernysheva

E. Bloch

S. Cozic, P. Camy

R. Le Targat

Alain Légaré

V. Wanie

D. M. Spangenberg

S. Puschel, S. Kalusniak, C. Krichtung, Berlin, Germany

FEMTO-ST, Besançon, France

DTU Fotonik, Lyngby, Denmark

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We report an ultra-flat octave-spanning (670-1390 nm) coherent supercontinuum using a femtosecond-pumped all-normal dispersion polarization-maintaining fiber with excellent noise (RIN<0.54%) and polarization properties (PER>17 dB).
Highly efficient entanglement storage in quantum memories is a critical re-requirement for quantum networks. We present an experiment where we stored single-photon entanglement into two atomic-ensemble based quantum memories with an overall efficiency of 87%.

We show that photonic-crystal environments can create symmetry-specific bandgaps that host symmetry-protected bound states in the continuum along a complete line in the Brillouin zone, which we prove to be impossible in homogeneous environments.

High energy multidimensional solitary states in hollow-core fibres

- G. Fan, R. Safaei, O. Kwon, K. Légare, P. Lassonde, B. Schmidt, H. Ibrahim, and F. Légare
- Institut National de la Recherche Scientifique, Centre Énergie Matériaux et Télécommunications, Montreal, Canada

We report the first observation of the formation of multidimensional solitary states in a gas-filled hollow-core fibre, presenting a route toward a new class of compact, tunable and high-energy spatiotemporally engineered light sources based on picosecond ytterbium technology.

Highly fluorescent quantum dots (QDs) have been photoligated with strain-promoted click conjugation that are compact and compatible multifunctional hydrophilic ligands (QDs) have been photoligated with strain-promoted click conjugation. These QDs were then used as effective probes for immunofluorescence and in-vivo imaging.

Highly fluorescent quantum dots (QDs) have been photoligated with strain-promoted click conjugation. These QDs were then used as effective probes for immunofluorescence and in-vivo imaging.
Ultra-stable lasers achieved by the spectral hole burning in rare-earth ion-doped crystals are realized and studied. Ultimate precision is evaluated from sensitivity measurements to various parameters (E-field, temperature, acceleration, detection noise).

We demonstrate a method for suppression of the intrinsic part of soliton/fission-induced parts of soliton/fission-induced suppression of the intrinsic wavelength span of 1873-1962 nm with up to 68 mW output, 350 fs pulse duration and 48 MHz repetition rate.

We present the characteristics of 100 fs LED-pumped Cr:LiSAF regenerative amplifier operating at a 10 Hz repetition rate. After recompression, we obtain 100 fs pulses with 0.3 ml pulse energy at 835 nm.
Crystal with a Layered Structure

Monoclinic Eu:CsGd(MoO₄)₂

Growth and Polarized

Aguiló

Juin, Caen, France

aux et la Photonique (CIMAP), Université de Caen, 6 Blvd Maréchal Juin, Caen, France; ²CEA CESTA, 15 avenue des Sablières, CS 60001, Le Barp Cedex, France

The co-doping of CaF₂:Nd³⁺ with different buffer ions enables a fine tailoring of spectroscopic properties making this family of material promising for large-scale high peak power diode-pumped amplifiers.

**Room 7**

**Room 8**

**Room 9**

**Room 10**

**Room 11**

**Room 12**

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The co-doping of CaF₂:Nd³⁺ with different buffer ions enables a fine tailoring of spectroscopic properties making this family of material promising for large-scale high peak power diode-pumped amplifiers.
What could THz radiation bring to the field of ultracold gases?

A. Devolder,$^1$ M. Desouer-Lecomte$^2$, O. Atabek$^3$, E. Luc-Koenig$^4$, and O. Dulieu$^5$

1Chemical Physics Theory Group, Department of Chemistry, and Center for Quantum Control, University of Toronto, Toronto, Canada; 2Institut de Chimie Physique, CNRS, Université Paris-Sud, Université Paris-Saclay, Orsay, France; 3Département des Sciences Moléculaires d’Orsay, CNRS, Université Paris-Sud, Université Paris-Saclay, Orsay, France; 4Laboratoire Aimé Cotton, CNRS, Université Paris-Sud, ENS Paris-Saclay, Université Paris-Saclay, Orsay, France

New developments of THz source open new perspectives in control of ultracold systems. We propose two potential applications: control of scattering length and new paths for the formation of ultracold molecules.
Strategies for charging and discharging phosphors with persistent luminescence.

T. Delgado, V. Castaing, D. Rytz, E. Véron, M. Allix, and B. Viana;
1 PSL University, Chimie ParisTech, IRCP-CNRS, Paris, France;
2 BREVALOR Sarl, Les Sciernes-d’Albeuve, Switzerland;
3 CNRS, CEMHTI UPR, Univ. Orléans, Orléans, France
The persistent luminescence of afterglow materials such as aluminates and garnets in the shape of transparent ceramics and crystals is optimized thanks to volumetric effect and the election of the ideal charging source.

Realization of photonic square-root higher-order topological insulators

W. Yan, S. Xia, L. Tang, D. Song, J. Xu, and Z. Chen;
1 The MOE Key Laboratory of Weak-Light Nonlinear Photonics, TEDA Applied Physics Institute and School of Physics, Nankai University, Tianjin, China;
2 Department of Physics and Astronomy, San Francisco State University, San Francisco, California, USA
We experimentally demonstrate the square-root higher-order topological insulators, unveiling two kinds of corner states that reside in different band gaps of a photonic super-honeycomb lattice established with photorefractive cw-laser-writing technique.

Laser lightning rod and artificial fog dissipation

J.-P. Wolf; University of Geneva, Geneva, Switzerland
We present a unique TW-class ultrashort laser with kW average power. This laser is used for triggering and guiding upward flash lightnings and for opening clear channels in fog for free space optical (FSO) communications.

Optical Coherence Microscopy for Integrated Photonics Devices Imaging

M.A. Sirotin, M.N. Romodina, E.V. Lyubin, I.V. Soboleva, V.V. Vigdorchik, K.R. Safronov, D.V. Akhremenko, V.O. Besonov, and A.A. Fedyanin;
1 Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia;
2 Frumkin Institute of Physical Chemistry and Electrochemistry, Russian Academy of Sciences, Moscow, Russia
We report on the development of a method for integrated photonics devices imaging based on phase-sensitive optical coherence microscopy. This method makes it possible to study the internal structure of devices and allows flaw detection.
Spectra Characterization of Ring Quantum Cascade Lasers

B. Meng, M. Betrand, J. Hillbrand, M. Beck, and J. Faist
ETH Zürich, Switzerland

The spectra of mid-infrared frequency comb based on the ring QCLs with the optimized structure reported. The spectra show multiple phase transitions, with a spectrum regime that be fitted by a sech2 function.

---

Optical shielding of destructive chemical reactions between ultracold ground-state NaRb molecules

A. Orban1, T. Xia2, M. Lepers3, O. Dulieu4, and N. Bouloufa-Maafa1;
1Institute for Nuclear Research (ATOMKI), H-4001 Debrecen, P.O. 51, Hungary; 2Université Paris-Saclay, CNRS, Laboratoire Aimé Cotton, 91405 Orsay, France; 3Laboratoire Interdisciplinaire Carnot de Bourgogne, CNRS, Université de Bourgogne Franche-Comté, 21078 Dijon, France

Optical shielding of destructive chemical reactions between ultracold ground-state NaRb molecules will be presented. The proposed optical shielding leads to dramatic suppression of inelastic collisions which opens the possibility for strong increase of trapping time.

---

Time-resolved water-window X-ray spectroscopy of chemical reactions and charge dynamics in nano-solids in a liquid phase

E. Balitana1, Y.-P. Chang2, Z. Yin2, A. Terpstra3, C. Schmidt1, J.-E. Moser1, J.-P. Wolf4, and H.J. Wöhrer6;
1RAP-Biophotonics, Universität de Genève, Geneva, Switzerland; 2Laboratory for Physical Chemistry, ETH Zürich, Zürich, Switzerland; 3Institute of Chemical Sciences and Engineering, Lausanne, Switzerland

We demonstrate time-resolved soft-X-ray absorption spectroscopy of liquid samples at K edges of carbon, nitrogen and titanium L2,3 edge using a sub-um liquid jet to study dynamics in aqueous solutions and nanoparticles.

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Dumbbell-shaped Mode-locked Ho3+-doped Fiber Laser

S.A. Filatova1, V.A. Kamynin1, Y.G. Gladash2, E.M. Khabushev3, D.V. Krasnikov1, A.G. Nasibulin1,2, and V.B. Tsvetkov3;
1Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia; 2Skolkovo Institute of Science and Technology, Moscow, Russia; 3Aalto University, Espoo, Finland

We demonstrate a self-starting mode-locked holmium-doped fiber laser with the simple dumbbell-shaped cavity utilizing a sub-um liquid jet to study dynamics in aqueous solutions and nanoparticles.

---

Metasurface Dichroic Mirrors: Application to Low Quantum Defect Lasers

K. Georgiev1, K. Kamali2, L. Xu3, M. Rahmat-E2, A. Miroshnichenko4, D. Neshev2,5, and I. Buchvarov3,5;
1Physics Department, Sofia University, Bulgaria, Bulgaria; 2ARC Centre of Excellence TMOS, Research School of Physics, Australian National University, Canberra, Australia; 3Advanced Optics and Photonics Laboratory, Department of Engineering, Nottingham Trent University, Nottingham, United Kingdom; 4School of Engineering and Information Technology, University of New South Wales, Canberra, Australia; 5John Atanasoff Center for Bio and Nano Photonics (JAC BNP), Sofia, Bulgaria

We demonstrate the design and implementation of optical metasurface mirrors with a steep spectral change of its reflection. Using it as a resonator pump mirror of a Yb-laser, stable operation is obtained without its damage.
Transparent Gahnite Ceramics
Cr3+:ZnAl2O4 – Novel Red-Emitting Material

L. Basyrova1, S. Balabanov2, A. Belyaev2, I. Makhin1, I. Kuznetsov3, I.-L. Doualan1, P. Camy1, and P. Loiko1; 1Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France; 2G.G. Devyatkh Institute of Chemistry of High-Purity Substances, RAS, Nizhny Novgorod, Russia; 3Institute of Applied Physics of the Russian Academy of Science, Nizhny Novgorod, Russia

Transparent gahnite ceramics 1 at.% Cr:ZnAl2O4 are fabricated by hot pressing at 1520°C / 40 MPa. Chromium ions Cr3+ reside in octahedral sites exhibiting intense broadband red luminescence with a lifetime of 2.14 ms.

A single ion and two photons: A programmable three-qubit interface

O. Elshehy, M. Steinel, S. Kacera, M. Kreis, and J. Eschner; 1Universität des Saarlandes, Saarbrücken, Germany

We demonstrate a three-qubit protocol based on the sequential heralded absorption of two photons by a single 40Ca+ ion. The programmable protocol provides quantum repeater functionality or serves as a single-ion quantum memory.

Topological Corner State Laser in Kagome Waveguide Arrays

H. Zhong1, Y.V. Kartashov2, A. Szameit3, Y.D. Li1, C.L. Liu1, and Y.Q. Zhang1; 1Key Laboratory for Physical Electronics and Devices of the Ministry of Education & Shaanxi Key Lab of Information Photonic Technique, School of Electronic and Information Engineering, Xi’an Jiaotong University, Xi’an, China; 2Institute of Spectroscopy, Russian Academy of Sciences, Troitsk, Moscow, Russia; 3Institute for Physics, University of Rostock, Rostock, Germany

We predict that stable lasing in zero-dimensional corner states may occur in a second-order photonic topological insulator based on Kagome waveguide array with a rhombic configuration, under the balance between diffraction, focusing nonlinearity, uniform losses, two-photon absorption, and gain.

Deep learning based direct aberration phase retrieval in stimulated emission depletion (STED) microscopy

Y. Wang1, Y. Li2, C. Hu2, H. Yang2, and M. Ge2; 1Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China; 2School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China

We demonstrate a new and accurate method for the direct correction of phase aberration induced by the refractive index mismatch of specimen or systematic aberration in a stimulated emission depletion (STED) microscope using convolutional neural networks.

Two-color plasma THz transients at 400 kHz repetition rate

D.K. Kesim, C. Millon, A. Omar, T. Vogel, S. Mansourzadeh, F. Wulf, and C.I. Saraceno; Ruhr Universität Bochum, Bochum, Germany

We demonstrate broadband THz generation using 36 μl, 27 fs pulses via two-color air plasma at 400 kHz, the highest repetition rate reported. Acquired THz transients spanning 15 THz which was limited by detection.
CD-P.1 TUE
Chiral high-harmonic spectroscopy in solids by polarization control of the driving strong field

T. Heinrich1, M. Taucer2, Ø. Kval1,2,3
P. Corkum3,4, 1,4th Physical Institute – Solids and Nanostructures, University of Göttingen, Göttingen, Germany; 2 Joint Attosecond Science Laboratory, National Research Council of Canada and University of Ottawa, Ottawa, Canada; 3 Max Planck Institute for Biophysical Chemistry, Göttingen, Germany

We demonstrate circularly polarized high harmonic generation in solids by using bi-chromatic three-fold driving fields and utilize the chiral sensitivity to investigate structural helicity of quartz and spontaneous chiral symmetry breaking at magnesium oxide surfaces.

CD-P.2 TUE
High repetition rate green-pumped supercontinuum generation without optical degradation of untransmitted crystal at a 10 kHz repetition rate

N. Bouldja1,2, V. Jukna3, G. Tomášaľská3, and A. Dubietis1,2
Institute of Applied Physics, Abbe Center of Photonics, Jena, Germany; 3 Chaire Photonique, LMOPS, CentraleSupélec, Metz, France; 2 Institute of Solid State Physics and Chemistry, Uzhhorod National University, Uzhhorod, Ukraine

We theoretically and experimentally demonstrate for the first time the possibility to slowdown on-chip nonlinear light pulses in a photo refractive crystal at room temperature.

CD-P.3 TUE
Picosecond VIS, UV and Deep UV Beams Generated at 100 kHz Diode-Pumped Yb:YAG Thin Disk Laser System

H. Turcicová1, O. Novák1, J. Muzi1,2, D. Stepanková1,2, M. Smrž2, and T. Mocék2
1 HILASE Centre, Inst. of Phys., CAS, Delni Brezany, Czech Republic; 2 Faculty of Nuclear Sciences and Physical Engineering, CTU, Prague, Czech Republic

Generation of 1st up to 5th harmonic frequencies at 100 kHz picosecond Yb:YAG thin disk diode pumped laser is reported, based on SHG and SFG processes. Application potential of the harmonics is demonstrated.

CD-P.4 TUE
High-order breathing behaviour of solitons in a mode-locked laser

X. Liu1,2,3,4,5 and Y. Yang1, 1 College of Optical Science and Engineering, Zhejiang University, Hangzhou, China; 2 Nanjing University of Information Science & Technology, Nanjing, China; 3 Nanjing University of Aeronautics and Astronautics, Nanjing, China

We have experimentally revealed the superposition state of breathing soliton in a mode-locked laser, showing that there exist several breathing periods simultaneously for breathing soliton and breathing period is quite sensitive to the pump power.

CD-P.5 TUE
Temperature noncritical Pockels cell based on a single KTP crystal

S. Gagaraský1, S. Grechín1, P. Druchtinín1, A. Sergerie1, Y. Fomichenkí1, V. Ružov1, N. Maklaková1, and A. Yurkin1
1 ITMO University, Saint-Petersburg, Russia; 2 Pkhorkov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia; 3 Vavilov State Optical Institute, Saint Petersburg, Russia; 4 Siberian Monocrystal-Ekma, Novosibirsk, Russia

The temperature noncritical cut of KTP crystal for electro-optic Q-switch application is studied. Low temperature sensitivity allows using of single crystal Pockels cell scheme. Measured temperature range with contrast drop less than 10% was 10°C.

CD-P.6 TUE
Integrated phononic-photonic circuits on GaAs as a platform for microwave to optical signal transduction

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We demonstrate an acousto-optic modulator on a suspended GaAs platform for efficient microwave-to-optical transduction. Owing to high refractive index and photoelectric coefficients, GaAs offers strong optomechanical coupling to achieve a v∞l of 0.22 Volt/cm, even for relatively lower optical quality factors.

CD-P.7 TUE
In vivo zebrafish embryo heart using a new fast multiphoton microscope

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1 Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain; 2 Center of Regenerative Medicine in Barcelona (CRM), Barcelona, Spain; 3 Molecular Biology Institute of Barcelona (IBMB), Barcelona, Spain

We have designed and built a fast multiphoton microscope that allows for deep volumetric imaging zebrafish embryo heart with a speed of 524x524x100 µm3 per second.

CD-P.8 TUE
Scalable Integrated Waveguide with CVD-Grown MoS2 and WS2 Monolayers on Exposed-Core Fibers

G.Q. Ngo1, A. George1, A. Tuniz1, E. Najafideghahian1, Z. Gan1, T. Bucher1, H. Knopf4,4,5, S. Sarvari1, T. Lähder1, S. Warren Smith1, H. Ebendorff-Heidepriem1, A. Hegedus1,2,3, and P. E. Ettenberg1,2,3
1 Institute of Applied Physics, Friedrich Schiller University, Albert-Einstein-Str. 15, 07745 Jena, Germany; 2 Institute of Physical Chemistry, Friedrich Schiller University, Lessingstrasse 10, 07745 Jena, Germany; 3 University of Sydney, School of Physics, Physics Road, Camperdown NSW 2006, Australia; 4 Fraunhofer-Institute for Applied Optics and Precision Engineering IOE, Albert-Einstein-Str. 7, 07745 Jena, Germany; 5 Max Planck School of Photonics, 07745 Jena, Germany; 6 Leibniz Institute for Photonic Technology IPHT, Albert-Einstein-Str. 13, 07745 Jena, Germany; 7 Institute for Photonics and Advanced Sensing, University of Adelaide, Adelaide SA 5005, Australia

We introduce scalable integrated waveguides, where MoS2 and WS2 crystals are directly grown on the core of microstructured exposed-core fibers (ECFs) and demonstrate enhanced second-harmonic generation in third harmonic generation, in-fiber exciton excitation, and photoluminescence collection.

CD-P.9 TUE
Chip-Scale Beta-Barium Borate Platform for Near-Infrared to Deep-Ultraviolet Nonlinear Integrated Photonics

M.S. Mohamed and S. Forouhar
Aalto University, Aalto, Finland

We present a novel chip-scale platform based on beta-barium borate nonlinear crystal-on-insulator, which provides an extended multi-octave spanning spectrum for nonlinear optical processes in integrated photonic circuits, from the near-infrared to the deep-ultraviolet range.

CD-P.10 TUE
Frequency comb generation based on optical parametric oscillation with second-order nonlinear materials

N. Amiune1, K. Bus1,2, and I. Breunig1,2,3
1 Department of Microsystems Engineering - IMTEK, University of Freiburg, Freiburg, Germany; 2 Fraunhofer Institute for Physical Measurement Techniques IPM, Freiburg, Germany

We investigate χ(2) mid-infrared frequency comb generation based on degenerate optical parametric oscillation in a mm-sized cadmium selenide phosphide (CdSeP) whispering-gallery resonator. First observations of sidebands due to internally pumped second harmonic generation are presented.

CD-P.11 TUE
Heterogeneous silicon nitride waveguide integrated with few-layer WS, for on-chip nonlinear optics

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1, Department of Electronics and Nanoengineering, Aalto University, Aalto, Finland; 2 Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France; 3, Department of Applied Physics, KTH Royal Institute of Technology, Stockholm, Sweden; 4, Department of Physics, Paderborn University, Paderborn, Germany; 5, QTF Centre of Excellence, Department of Applied Physics, Aalto University, Aalto, Finland

We report on the experimental investigation and the numerical modelling of nonlinear pulse propagation in a heterogeneous silicon nitride channel waveguide with the integration of a few-layer WS flake significantly increasing the effective nonlinearity.

CD-P.12 TUE
Photorefractive induced slowdown of nanosecond light pulses in the nanosecond regime

N. Bouldja1,2, A. Grabar1, M. Sciamanna1,2, and D. Wouters1
1 Chaire Photonique, LIMOS, CentraleSupéléc, Metz, France; 2 Université de Lorraine, LIMOS, CentraleSupéléc, Metz, France; 3 Institute of Solid State Physics and Chemistry, Uzhhorod National University, Uzhhorod, Ukraine

We theoretically and experimentally demonstrate for the first time the possibility to slowdown nanosecond light pulses in a photorefractive crystal at room temperature.

CD-P.13 TUE
Dispersion engineered sum-frequency generation in a periodically poled thin-film LiNbO3 nanowaveguide

P. Kumat1, M. Younesi, S. Saravi, T. Persch, and E. Setzfand1
1 Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Jena, Germany

We experimentally demonstrate group index matched type-II sum frequency generation in a periodically poled thin film LiNbO3 nanowaveguide through careful design of the wavelength dimensions to control the dispersion properties of its guided modes.

CD-P.14 TUE
Conical Third Harmonic Generation from Volume Nanogratings Induced by Filamentation of Femtosecond Pulses in Transparent Bulk Materials

R. Griguits1, V. Jukna3, M. Navickas3, G. Tomášaľská3, K. Stališinas1,2, and A. Dubietis1
1 Laser Research Center, Vilnius University, Vilnius, Lithuania; 2 Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain
We demonstrate that filamentation of femtosecond laser pulses at high repetition rate inscribes a nanograting in the volume of transparent material, that has a certain spectrum of periods to phase match conical third harmonic generation.

**CD-P.15 TUE**

Kerr beam self-cleaning and supercontinuum generation in a graded-index few-mode photonic crystal fiber

-F. Shabana M.A, T. Sylvestre 1,2, V. Tombelaine 1, G. Huss 2, A.N. Gnaid 3, T. Sylvestre, T. Voulaert 4, M. Fabert 1, A. Tonello 1, V. Couderc 2, F. Reynaud 3, and P. Leproux 1,3

**CD-P.16 TUE**

Performance of silicon OPUFs under variable input losses

-J.E. Villegas 1,2, B. Pareades 3, and M. Raza 1,3

**CD-P.17 TUE**

A multi-channel pump-probe system for trARPES experiments

-T. Golz, G. Indor, J. Heey Buss, M. Petey, S. Stariseic, M. Schulz, and R. Riedel; Class 5 Photonics GmbH, Hamburg, Germany

Here we present an optical parametric chirped pulse amplifier (OPCPA) multi-channel pump-probe laser systems providing pulses spanning from the XUV up to the THz range with a repetition rate of 100 kHz.

**CD-P.18 TUE**

All-fibered high-quality 28-GHz to 112 GHz pulse sources based on nonlinear compression of optical temporal polaron

-A. Shevelova and C. Finot; Laboratoire Interdisciplinaire CARNOT de Bourgogne, DIJON, France

With a setup based on temporal and spectral processing we generate high quality pulse trains at high repetition rates (up to 112 GHz). Nonlinear propagation further compresses the pulses to subpicosecond durations.

**CD-P.19 TUE**

Ultrafast All-Optical Two-Colour Switching in Asymmetric Dual-Core Fibre

-M. Longobucco 1, I. Astraoukas 1, A. Pagliys 1, D. Pyze 1, F. Uherek 2, A. Balitskis 2, R. Buczyski 1,2, and I. Bagur 1,2

**CD-P.20 TUE**

Electric Field Measurements in Plasmas with E-FISH Using Focused Gaussian Beams

-T.L. Chng 1,2, S. Stariseic 3, and M.-C. Schanne-Klein 4

**CD-P.21 TUE**

Experimental investigation of the saturated regime of short pulse amplification in counter-pumped Raman amplifiers

-G. Vanderhaegen, P. Sørzighes, M. Conforti, A. Kudlinski, and A. Mussot; University of Lille, CNRS, UMR 8523 - PILAM - Physique des Lasers Atomes et Molecules, Lille, France

We report an experimental study of the influence of the pulses width on a counter-propagating Raman pump. Transient and saturation effects and high signal powers are highlighted.

**CD-P.22 TUE**

Dual-pump Optical Parametric Oscillation in a 4H-SiC-on-insulator Microresonator

-X. Shi, W. Fan 1, A. Yf, X. Ou 1,2, K. Rottwitt 1, and H. Ou 1,2

**CD-P.23 TUE**

Impact of Signal Waveform on the Accuracy of the Perturbation Methods for Compensation of Fiber Nonlinearity

-S.V. Sachkov 1, A.A. Redak 2,3, and S.K. Turitsyn 1,2

**CD-P.24 TUE**

Single-pass second harmonic generation of 17 W at 532 nm and high resolution relative-intensity-noise transfer study

-C. Dinxegue 2,3, G. Gutraud 2, H. Ye 1, Y.-V. Bardin 1, M. Goeppler 1, G. Sartorelli 1, and N. Traor 1; LP2N, IOGS, CNRS and Université de Bordeaux, Talence, France

A complete characterization of the RIN transfer between fundamental and second harmonic is presented for the first time in our knowledge with a highly resolved method for a high output power of 17W at 532nm.

**CD-P.25 TUE**

Electric Field Induced Second Harmonic Generation In Silicon Waveguides: the role of the disorder

-R. Franchi 1,2, C. Vecchi 1, G. Ghulinyan 1,2,3, and S. K Turitsyn 1,2

**CD-P.26 TUE**

Fabrication of Large Aperture PPKTP with Short Period (3.43 μm) Using Coercive Field Engineering

-C.S. Lee, A. Zukanovas, and C. Canalias; KTH Royal Institute of Technology, Stockholm, Sweden

We demonstrate high quality periodic poling of a 3-mm thick RKKTP crystal with period of 3.43 μm using coercive field engineering. The PPKTP shows a normalized conversion efficiency of 1.4%W/cm2 for SHG at 405 nm.

**CD-P.27 TUE**

Pure Nonlinear Optical Response in Plasmonic Nanoantennas

-A. Niv; Ben-Gurion University of The Negev, Sde Boker, Israel

We use a deep subwavelength-sized plasmonic hetero-rodimer to explore a new source of optical nonlinearity. We present SHG from this source and discuss its efficiency, 3rd-order processes, higher harmonics generation, optical-rectification, and chaos.

**CD-P.28 TUE**

TI-REX: A Tunable Infrared laser for Experiments in nanolithography

-Z. Mazzotta 1,2, J. Mathijssen 1, K. Eikema 1,2, O. Versolato 3,4, and S. Witte 1,2

**CD-P.29 TUE**

Quasi-Phase Matching and Crystal Segmentation for Robust Optical Parametric Amplification

-M. Al-Mahmoud 1, V. Codis 1, A. Rangelov 1, and G. Montemonezzi 2,3

1. Department of Theoretical Physics, Sofia University, Sofia, Bulgaria; 2. Université de Lorraine, CentraleSupélec, LMOPS, Metz, France

Combination of quasi-phase-matching with segmentation of the nonlinear crystal dramatically increases the robustness of frequency conversion processes with respect to changes of wavelengths, temperature or pump power, as illustrated for Optical Parametric Amplification.

**CD-P.30 TUE**

Enhancing the brightness of luminescent concentrators by one order of magnitude using light recycling

-P. Pichon 1, M. Nourry-Martin 1,2, F. Druno 1, S. Darbon 2, P. Georges 2, and F. Balembois 1; Université Paris-Saclay, Institut d’Optique Graduate School, CNRS, Laboratoire Charles Fabry, 91127, Palaiseau, France

This work shows how to enhance by one order of magnitude the brightness of LED-pumped luminescent concentrators. This results in a system counting among the brightest incoherent light sources emitting 2kW/cm2/sr (63W from 1mm2).
CD-P.31 TUE
Improvement of Multiple-plate GaAs Stacks for Mid-infrared Quasi-phase-matching
Wavelength-conversion Devices Fabricated with Room-temperature Bonding
I. Shoji, T. Tanimoto, and Y. Takahashi; Chuo University, Tokyo, Japan
We achieved high transmissivity over the whole aperture of a 25-plate GaAs stack for quasi-phase-matched mid-IR wavelength-conversion. This was accomplished by improved fabrication process using the room-temperature bonding.

CD-P.32 TUE
PP-crystals Lengths Optimization to Improve the Efficiency of Two-Cascade Nearly-Degenerate DFG of 3µm Radiation from Fiber NIR Lasers
I. Laronov, A. Gulyaevks, and V. Tyryshnyk; NTO "IRE-Polti", Pryazino, Russia
PP-crystals lengths optimization leads to 40% efficiency of the single-pass parametric down-conversion of two fiber lasers radiation to mid-IR range in experiment. The theoretical model gives the dependence between PP-crystals lengths and pump beam parameters.

CD-P.33 TUE
Manufacturing and characterization of frequency tripling mirrors
S. Balendat1, M. Jap1,2, M. Steinke1, L. Jensen1,3, A.K. Oskouei1, W. Rudolph1, D. Zucker1,2, M. Unger1,2, and D. Ristau1,2,3; Laser Zentrum Hannover e. V., Hannover, Germany

CD-P.34 TUE
Multi-ordered IR Raman from KTIOP4 in the nanosecond regime
K.M. Molster, R. Lindberg, and F. Laurell; Department of Applied Physics, Royal Institute of Technology, KTH, Stockholm, Sweden
We report 5% pump depletion into multi-ordered Raman generation in y-cut KTIOPO4 by stimulated polariton scattering. The output spectrum consists of combs separated by 8 and 20 THz, spanning 1095 nm to 1736 nm.

CD-P.35 TUE
Toward industrial and fibered non-linear sum frequency generation devices
A. Mehmann1,2, D. Holleville1, M. Loius1, S. Bise1, O. Acef1, A. Boutin1, K. Legape1, and L. Fulop1; LNE-SYRTE, Paris, France; 2Kyusyu, Paris, France
We report on the development of an all-fibered sum frequency generation device using a PPLN crystal. A 5-5.5%/W(cm) conversion efficiency and an 80% coupling efficiency were reached, with a peak-to-peak residual power fluctuations under 2%.

CD-P.36 TUE
Complex Optical Waveguiding Structures Induced by Bessel Beams
Y. Chai1,2, N. Marsal1,2, and D. Woltersfeder1,2; 1Université de Lorraine, CentraleSupélec, LIMOPS, F-57000 Metz, France; 2Chair in Photonics, CentraleSupélec, F-57000 Metz, France
We numerically study interactions of Bessel beams in a photorefractive medium. Playing with nonlinearity, complex multi-channels structures can be induced by single or two counter-propagating Bessel beams. These results provide a prospect for all-optical interconnects.

CD-P.37 TUE
Mode selective photon addition to a multimode quantum field using SPDC process
S. Kaash1,2, G. Roeland1, V. Roman-Rodriguez1, N. Treps1, V. Parigi1, and M. Walshaers1; 1Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL Université, College de France, 4 place Jussieu, F-75252, Paris, France; 2Sorbonne Université, CNRS, LIP6, 4 place Jussieu, F-75005, Paris, France
We propose a theoretical scheme to generate non-gaussian quantum states by the mode selective photon addition to a multimode Gaussian state. This can be implemented via the Spontaneous Parametric Down-conversion process in nonlinear bulk crystals.

CD-P.38 TUE
QPM-LN-Based 40GHz to 40GHz Switch Using Cascaded Nonlinearities
Y. Fukushima, G. Abe, and K. Kawamura; Tokyo University of Science, Tokyo, Japan
Characteristics of an all-optical switch employing a 3-cm-long QPM-LN are investigated through switching experiments considering the temporal widths of the input clock and signal pulses. Stable and efficient 40GHz to 40GHz operation is successfully demonstrated.

CD-P.39 TUE
Novel features of white light emission observed in transparent Cr-doped YAG ceramics
M. Chatka, T. Hanula, R. Tomala, and W. Strek; Institute of Low Temperature and Structure Research, Wroclaw, Poland
Laser-induced white light emission was observed from transparent Cr:YAG ceramics on the surface of the sample and is not observed in volume. This phenomenon was discussed in terms of inter-value charge transfer mechanism.

CD-P.40 TUE
Self-referenced multiplex CARS imaging with picosecond pulse generated supercontinuum by using second and third order nonlinearities
S. Webb1,2, T. Manusrayan1, M. Fabert1, A. Tonello1, K. Krapu1, S. Wabnitz1, S. Vergnol2, and V. Couderc1; 1University of Limoges-ULIM, Limoges, France; 2ALPhAON Optics & Lasers Technology Center, Bordeaux, France; 3Institute of Physical Chemistry, Warsaw, Poland
We developed a self-referenced multiplex CARS imaging system, operating in the picosecond domain. The large band Stokes wave is generated either in X(2)×X(3) crystals, or in multimode optical fiber under the Kerr self-cleaning process.

CD-P.41 TUE
Surface dominance in high harmonic generation in AlN thin film
J. Seres1, E. Sere1, C. Serrail2, and T. Schumm1; 1Atomimstitut - E141, Technische Universität Wien, Vienna, Austria; 2Universitat Politecnica de Catalunya, Departament de Física, Terrassa, Spain
Based on the measurement of beam propagation and spectral characteristics, we conclude that high order harmonics in AlN thin film are generated on the surface of the film. Time-dependent density-functional simulations corroborate the experimental results.

CD-P.42 TUE
Enhanced Supercontinuum Generation in the Mid-IR using Graphene Covered SiGe waveguides
P. Demongodin1, R. Armand1, M. Sinobad1, A. Della Torre1, J.-M. Hartmann2, V. Reboud2, J.-M. Fedeli2, C. Grillot3, and C. Monat1; 1Institut des Nanotechnologies de Lyon, Ecully, France; 2CEA-LETI, Grenoble, France
We experimentally demonstrate that hybrid graphene/ SiGe waveguides could effectively enhance the mid-infrared supercontinuum bandwidth. Through impacting the supercontinuum dynamics, graphene could provide unique opportunities to control the supercontinuum performance of mid-IR chip-based devices.

ED-P.1 TUE
Cavity ring-down Fourier transform spectroscopy based on a near infrared optical frequency comb
R. Dubrowoiski1, A. Glueck2, G. Sobott2, and L. Rutkowski1; 1Univ Rennes, CNRS, IPR (Institut de Physique de Rennes) - UMR 6251, Rennes, France; 2Laser & Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland
We perform cavity ring-down spectroscopy based on a near infrared frequency comb source and retrieve the multiplex decays using a time-resolved fast-scanning Fourier transform spectrometer.

ED-P.2 TUE
Simple method of carrier-envelope-offset locking with f-3f self-referencing solely by a dispersion-controlled silicon-nitride waveguide
A. Ishizawa1, K. Kawashima2,3, R. Kon1, X. Xu1, T. Tsuchizawa1, T. Aihara1, K. Yoshida1,2, T. Nishikawa2, K. Katsuki1, G. Cong1, N. Yamamoto1, K. Yamada1, and K. Ogar1; 1NTT Basic Research Laboratories, Atsugi-shi, Japan; 2Tokyo Denki University, Adachi-ku, Japan; 3Platform Photonics Research Center, AIST, Tsukuba, Japan; 4NTT Device Technology Laboratories, Atsugi-shi, Japan
We demonstrate a very simple and robust method of carrier-envelope-offset locking with f-3f self-referencing trough third-harmonic light and a 2.5-octave-wide supercontinuum spectrum (400-2500 nm at -45 dB level)
Tuesdays 22 June 2021

ED-P.3 TUE

**Shifted Wave Interference Fourier Transform Spectroscopy of THz Quantum Cascade Laser Frequency Combs operating above 70 K**

A. Forrer\(^1\), S. Cibella\(^2\), G. Torrioli\(^2\), M. Beck\(^1\), J. Faist\(^1\), and G. Scalari\(^2\); \(^1\)ETH Zürich, Zürich, Switzerland; \(^2\)CNR-Istituto di Fotonica e Nanotecnologie, Rome, Italy

Frequency-comb based metrology has seen a dramatic increase of precision in the recent decades. Schawlow-Townes noise imposes a previously unrecognized limitation that is expected to limit further progress at the sub-\(10^{-20}\) fractional uncertainty level.

ED-P.4 TUE

**The Schawlow–Townes limit in frequency comb metrology**

G. Steinmeyer; Max-Born-Institut, Berlin, Germany; Humboldt-Universität, Berlin, Germany

Fundamental physics, spectroscopy or quantum systems need compact and transportable frequency references with metrological stability performances. We report, the frequency stabilization of a 1.55 μm Quantum-dot Fabry-Perot diode with a relative stability at 10-13 level.

ED-P.5 TUE

**Stability frequency transfer demonstration at 10-13 level of a semiconductor based Frequency Comb via electrical and optical injection locking**

K. Manamanni, T. Steleshenko, V. Roncin, and F. Du-Burck; Laboratoire de Physique des Lasers UMR CNRS 7538, Université Sorbonne Paris Nord, Villetaneuse, France

We investigate the coherence and phases of THz Quantum Cascade Laser frequency combs by Shifted Wave Interference Fourier Transform spectroscopy. The result indicates FM modulated emission and shows different phase relations compared to mid-IR QCLs.

ED-P.6 TUE

**High-resolution spectroscopy of molecular iodine using a narrow-linewidth laser at telecom wavelength**

K. Ikeda, R. Kato, Y. Goji, D. Akamatsu, and F.-L. Hong; Department of Physics, Yokohama National University, 79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan

The absolute frequency and hyperfine structure of the P(57)45-0, P(91)48-0, R(73)46-0 transitions of molecular iodine at 514.1 nm were measured. Hyperfine constants were calculated by fitting the measured hyperfine splitting to a four-term Hamiltonian.

ED-P.7 TUE

**High-Quality Level-Crossing Resonances in Cesium Vapor Cells for Applications in Atomic Magnetometry**

D. Brazhnikov\(^{1,2}\), S. Ignatovich\(^1\), V. Vishnyakov\(^1\), I. Mesenzova\(^1\), and A. Goncharov\(^{1,2,3}\); \(^1\)Institute of Laser Physics SB RAS, Novosibirsk, Russia; \(^2\)Novosibirsk State University, Novosibirsk, Russia; \(^3\)Novosibirsk State Technical University, Novosibirsk, Russia

We propose novel schemes for observing the high-quality zero-field level-crossing resonances that noticeably expand the capabilities of standard schemes. The experiments were performed with cesium buffered vapor cells. Possible applications to atomic magnetometry are discussed.
Perfect-bandgap tapered nanophononic metamaterial beam for thermal insulation

- O. Wright

- Division of Applied Physics, Faculty of Engineering, Hokkaido University, Sapporo, Japan

- Shibaura Institute of Technology, Department of Electronics Engineering, Saitama, Japan

- 1-Watt SESAM-Modelocked fs-Cr:ZnS Oscillator at 2.4 μm
  - A. Barh, B.O. Alaydın, J. Heidrich, M. Gaulke, M. Gölling, C.R. Phillips, and U. Keller; ETH Zurich, Zürich, Switzerland

- We present a novel GaSb-based SESAM to modelock to efficiently block phonon propagation. We use the tapered metal-beam structures consisting of five unit cells of slowly varying sizes that extend the phonon propagation frequency gap significantly.

1-Watt SESAM-Modelocked fs-Cr:ZnS Oscillator at 2.4 μm

- A. Barh, B.O. Alaydın, J. Heidrich, M. Gaulke, M. Gölling, C.R. Phillips, and U. Keller; ETH Zurich, Zürich, Switzerland

- We present a novel GaSb-based SESAM to modelock to efficiently block phonon propagation. We use the tapered metal-beam structures consisting of five unit cells of slowly varying sizes that extend the phonon propagation frequency gap significantly.

Experimental investigation of nanosecond pulsed tapered-waveguide lasers obtaining extremely high brightness values

- H. Christopher, A. Zeghuzi, A. Klehr, J-P. Koester, H. Wenzel, and A. Knigge; Ferdinand-Braun-Institut gGmbH, Berlin, Germany

- We explore the lateral index guiding trench width is studied experimentally to obtain an excellent brightness value of 27.4 W/mm/mrad at >18 W output power under 3.3 ns long pulse operation from tapered-waveguide lasers.

Corrugated graphene for synchrotron-like coherent THz emission

- R. Kerjojan1, E. Riccardi2, P.H. Huang1, M. Kostich3, A. Pierrel1, J. Tignon1, S. Dhillon1, M. P. Martin2, B. Dubak3, P. Seneor3, D. Dolfk1, K. Watanabe4, T. Taniguchi5, R. Ferreir6a, and J. Mangeney6b

- 1Laboratoire de Physique de l'Ecole normale supérieure, ENS, Université PSL, CNRS, Sorbonne Université, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France; 2Thales Research and Technology, Palaiseau, France; 3École Supérieure de physique de la Terre, ENS, Paris, France; 4National Institute for Materials Science, Tsukuba, Japan

- We investigate corrugated graphene-based devices and show their potential to generate synchrotron-like radiation tunable in the THz spectral range. Transport measurements at 4 K and Raman characterization of these devices show unique interesting features.

Low-noise, Frequency-agile, Hybrid Integrated Laser for LIDAR

- G. Lihachev1, J. Riemenberger2, W. Wang3, J. Liu4, H. Tian5, A. Siddharth1, R.N. Wang2, V. Snigirev3, J. He4, S. Bhave5, and T. Kippenberg1

- 1Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland; 2OxideMEMS Lab, Purdue University, West Lafayette, USA

- We demonstrate a hybrid integrated terahertz sources based on time-dependent metasurfaces.

Nanoimprint Lithography for the Replication of Optical Microstructures on Azopolymer Thin Films

- J. Strobl1, D. Stolz2, M. Leon1, L. Kurlandski2, and D.J. McGee2

- 1Beuth Hochschule für Technik Berlin, Berlin, Germany; 2The College of New Jersey, Ewing, USA

- A new process for the replication of optical microstructures is reported. It combines microstructure fabrication on azopolymer films with nanoimprint lithography. Compar
We demonstrate coherent coupling of a molecular single photon emitter to an interrupted nanophotonic waveguide and develop a method for calculating coupling efficiency, applicable to many nanophotonic structures that cannot be decomposed into well-defined modes.

Non-abelian holonomies in a generalized Lie lattice.
V. Brusco1, L. Plozzi2, R. Fazio2,3, and C. Conti4,5 1Institute for Complex Systems, National Research Council (ISC-CNR), Via dei Taurini 19, 00185 Rome, Italy; 2The Abdus Salam International Centre for Theoretical Physics, Strada Costiera 11, 34151 Trieste, Italy; 3Dipartimento di Fisica, Università di Napoli Federico II, Monte S. Angelo, I-80126 Napoli, Italy; 4Department of Physics, University Sapienza, Piazzale Aldo Moro 5, 00185 Rome, Italy; 5Department of Physics, University of Twente, 7500 AE Enschede, Netherlands

Towards 50G/100G Passive Optical Networks with Digital Equalisation and Coherent Detection.
R. Killey, University College London, London, United Kingdom
Recent advances in the development of low-complexity coherent transceiver technology for passive optical networks are reviewed. These include reducing optical network unit complexity, increasing laser phase noise tolerance and implementing effective machine-learning based equalisation.

S. De1, D. Bagrets2, K. W. Kim3, S. Barkhofen4, J. Sperling5, B. Brecht4, A. Ablad4, F. Michlits1, and C. Silberhorn1 1Paderborn University, Paderborn, Germany; 2University of Wuppertal, Wuppertal, Germany; 3University of Bremen, Bremen, Germany; 4Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, 7500 AE Enschede, Netherlands
We theoretically analyze the fundamentals of the local density of states that is central to emission control, and show how the experimental feasibility of topological Anderson localization could be investigated using optical multimode waveguides using ultrashort lasers.

Analysis of laser-inscription of waveguides in bulk Silicon via ultrashort pulses.
A. Alberucci1, N. Alaugarde1, M. Blohle1, M. Chambonneau1, C.P. Jisha1, and S. Nolte1,2,1 1Friedrich-Schiller-University Jena, Jena, Germany; 2Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany
The process of writing Silicon waveguides with ultrashort lasers is investigated. After addressing the nonlinear propagation of the...
Heat and hypersound management in 2D phononic crystals

B. Graczykowski; Adam Mickiewicz University, Poznan, Poland

The presentation is devoted to experimental studies on the propagation of GHz–THz in nanostructured materials. In particular, such topics as hypersonic phononic crystals, thermal rectification, photoacoustics, and elastic size effect will be discussed.

CA-3.3 WED ( Invited)  9:00
High-power VCSEL beam scanners for 3D sensing

F. Kayama; Tokyo Institute of Technology, Yokohama, Japan

The device concept and experiments for high-power VCSEL beam-scanners will be presented for 3D sensing. We demonstrate a VCSEL beam-scanner, which offers watt-class high power operations and high-resolution non-mechanical beam steering functions.

CB-3.3 WED ( Invited)  9:00
Large HgTe nanocrystals for THz technology

T. Apretna1, S. Massabuau1, C. Gréboval2, N. Goubet2, S. Dhillon3, R. Ferrer4, E. Lhuillier4, and J. Mangeney1; 1Laboratoire de Physique de l’Ecole Normale Supérieure, ENS, Université PSL, CNRS, Sorbonne Université, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France; 2Sorbonne Université, CNRS, Institut des NanoSciences de Paris, Paris, France

Large HgTe nanocrystals (~100nm) grown by colloidal synthesis show attractive properties for the development of advanced THz optoelectronic devices as they exhibit strong absorption in the THz range and hot carrier lifetimes of few picoseconds.

CC-3.3 WED  9:00
Robust Self-Referenced Generator of Programmable Multi-Millijoule THz-Rate Bursts

V. Stummer1, T. Flöry1, A. Kahvis2, A. Pugzlys1, A. Sebastian2,1, N. Goubet2, and J. Mangeney1; 1Laboratoire de Physique de l’Ecole Normale Supérieure, ENS, Université PSL, CNRS, Sorbonne Université, Université Paris-Diderot, Sorbonne Paris Cité, Paris, France; 2Sorbonne Université, CNRS, Institut des NanoSciences de Paris, Paris, France

We demonstrate a technique for the programmable generation and multi-millijoule amplification of ultra-short pulse bursts, which can be applied to any master-oscillator regenerative-amplifier system with very low implementation complexity and high stability in burst performance.

CA-5.3 WED  9:00
Mid-Infrared Laser Emissions of Tm3+-doped Garnets: The Case Study of Disordered Tm:CNGG Crystal

L. Guiu1, E. Moiso1, D. Blaizot1, O. Marchet1, C. Haeberlen1, and J. P. G. Franc1; 1Université de Caen Normandie, Caen, France; 2Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, China

Mid-infrared laser emissions from disordered Tm:CNGG garnet crystal are studied and assigned to vibronic processes and H4 ↔ H2 electronic transition. A Tm:CNGG laser generated 548 mW at 2.13 and 2.33 μm with a slope efficiency of 58.2%.

CA-5.4 WED  9:15
Passively Q-switched Diode-Pumped Thulium Laser at 2305 nm

E. Kifle1, S. Prakasam1, L. Guilleminot1, J.-L. Doualan1, J.-F. Starecki1, A. Brand1, J.-P. Hervé1, and P. Camy1; 1Centre de Recherche sur les Ionns, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France; 2Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, China

A diode-pumped mid-infrared Tm:LiYF4 laser operating on the 3H4→3H5 transition is passively Q-switched by Cr2+·ZnSe. The laser with intrinsic linewidth of 40 Hz, 1.5 GHz tuning range, 1 MHz actuation bandwidth attained by a DFB laser self-injection locking to a Si3N4 microresonator with integrated AlN piezocoupler.

CE-4.3 WED  9:00
Recent Progress and Perspectives of Intra-Oscillator High Harmonic Generation Using Thin-Disk Lasers

J. Fischer, J. Drs, L. Habaya, N. Motschinger, V. Wittwer, and T. Südmeyer; Laboratoire Temps-Fréquence (LTP), Institut de Physique, Université de Neuchâtel, Neuchatel, Switzerland

We discuss recent developments and the state-of-the-art of high harmonic generation inside thin-disk laser oscillators and their potential for further scaling of the XUV performance.
antennae, energy transfer. We discuss the equivalence of 3 completely different viewpoints from quantum optics, nanophotonics, and electrical engineering.

EG-2.3 WED 9:00
A scanning planar Yagi-Uda antenna for fluorescence detection
N. Soltani1,2, E. Rabbaney Esfahani1,4, G. Schultz2,4, S.I. Drushkin3,4, J. Mülller1,4, B. Butz1,4, H. Schönherr2,4, N. Marlécévitch1,5, and M. Agio1,4,5
1Laboratory of Nano-Optics, University of Siegen, Siegen, Germany; 2Physical Chemistry I, University of Siegen, Siegen, Germany; 3Institute of Materials Engineering, University of Siegen, Siegen, Germany; 4Center for Micro- and Nanotechnology and Engineering (Cp), University of Siegen, Siegen, Germany; 5National Institute of Ethics (INO), National Research Council (CNR), Florence, Italy
We introduce a scanning planar Yagi-Uda antenna to improve fluorescence detection. Dyes labeling double-stranded DNA molecules immobilized in the antenna exhibit directional emission. The method is thus suitable for sensing biomolecules with low-NA optics.

EC-4.3 WED 9:00
Probing the Floquet bulk winding number through Bloch sub-oscillations
L.K. Upreti3, C. Evain3, S. Randoux4, P. Suret4, A. Arno4, and P. Delplace5; 1Universite Lyon, ENS de Lyon, Univ Claude Bernard, CNRS, Laboratoire de Physique, Lyon, France; 2Univ. Lille, CNRS, Physique des Lasers Atomes et Molecules, Lille, France
We report a new family of Bloch oscillations in quantum walks. The number of turning points and amplitudes of the oscillations diminishes as one Bloch period. The topological winding number governs them, and this can be probed in a photonic setup.

EC-4.4 WED 9:15
Topological Characterization of Photonic Crystals
M. Blanco de Paz1, H. Aalaeian2, M. G. Vergniory3,1, B. Bradlyn4, G. Giedke1,5, D. Bercioux3,4, and A. Garcia-Etxarri1,5
1Donostia International Physics Center, San Sebastian, Spain; 2Electrical and Computer Engineering Physics and Astronomy, Purdue University, West Lafayette, USA; 3IKERBASQUE, Basque Foundation for Science, Bilbao, Spain; 4Department of Physics and Institute for Condensed Matter Theory, University of Illinois at Urbana-Champaign, Urbana, USA
We combine the theory of Topological Quantum Chemistry and Wilson loops calculations to characterize the topology of 2D photonic transitions is studied. We put forward time-multiplied quantum walks with tunable coin operations for realizing the targeted effect arising from the interplay between disorder and topology.

CI-2.2 WED 9:00
Experimental demonstration of 100 Gbit/s 50km Downstream Using PolMux MultiCAP OSSB Transmission and Heterodyne Reception based on 10G NRZ Transmission
M. Barrio1, D. Izquierdo2,1, J. Cerda1, S. Sarmiento3,1, J.A. Altabas1, J.A. Lazarro3, and I. Garces3; 1I3A, University of Zaragoza, Zaragoza, Spain; 2Centro Universitario de la Defensa, Zaragoza, Spain; 3Universitat Politècnica de Catalunya, Barcelona, Spain; 4ICFO, Castelldefels, Spain; 5Bifrost Communications, Kgs Lyngby, Denmark
We present a 100Gb/s downstream PON link based on a PolMux, multi-CAP OSSB modulation signal received by a coherent receiver. 50km transmission is achieved using 10G electronic and photonic devices with a sensitivity of -20dBm.

CI-2.3 WED 9:15
An analysis of linear digital equalization in 50Gb/s HS-PONs to compensate the combined effect of chirp and chromatic dispersion
F.A. Nogueira Sampaio1,2, M. Genay1, J. Karpate2, M. Klimczak3, R. Buczynski3,2, and G. Genty1; 1Photonics Laboratory, Tampere University, Tampere, Finland; 2Medical Research Network – Institute of Microelectronics and Photonics, Warsaw, Poland; 3Faculty of Physics, University of Warsaw, Warsaw, Poland
We study the impacts of frequency chirp and chromatic dispersion (CD) in 50Gb/s Non-Return-to-Zero (NRZ) transmissions in an Intensity Modulation and Direct Detection (IM/DD) channel with a Minimum-Mean-Square Error Equalizer (MMSE-LE) at reception.

CI-3.2 WED 9:00
0.75-6 μm supercontinuum generation using spatiotemporal nonlinear dynamics in graded index multimode fiber
Y. Leventou1, G. Granger1, T. Massaruyan1, M. Fabret1, K. Krupa1, A. Tonelli2, S. Wabnitz1, V. Coudrez1, and S. Février3; 1Université de Limoges, XLIM, UMR CNRS 7252, Limoges, France; 2Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland; 3DEIT, Sapienza University of Rome, Rome, Italy
We demonstrate that the interplay between the nonlinear processes in graded index multimode fibers can be controlled in order to seed a three octave spanning supercontinuum ranging from 0.75 to 6 μm.

CI-3.3 WED 9:15
Octave-spanning Infrared Supercontinuum Generation in a Graded-Index Multimode tellurite Fiber
E. Krutova1,3, T. Eslami1, T. Karpate2, M. Klimczak2, R. Buczynski2,3, and G. Genty1; 1Photonics Laboratory, Tampere University, Tampere, Finland; 2Medical Research Network – Institute of Microelectronics and Photonics, Warsaw, Poland; 3Faculty of Physics, University of Warsaw, Warsaw, Poland
We demonstrate for the first time octave-spanning supercontinuum generation from 1000 nm to 3000 nm in a tellurite multimode fiber.

CD-3.4 WED 9:45
Stimulated Brillouin scattering of helical Bloch modes in chiral three-core photonic crystal fibre
X. Zeng1,2, W. He1, J. Huang1, P. Roth1,2, G.K.L. Wong1, M.H. Proot2, B. Stiller1,2, and P.S. Russell1,2; 1Max-Planck Institute for the Science of Light, Erlangen, Germany; 2Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany
We report stimulated Brillouin scattering of helical Bloch modes in chiral photonic crystal fibre with a three-fold rotationally symmetric core. Conservation of azimuthal order, not topological charge, plays a crucial role in the scattering process.

CD-6.3 WED 9:00
High performance Kerr effect in hybrid 2D material-SiN waveguide
V. Pelgrin1,2, Y. Wang2, J. Peltier3, C. Alonso-Ramos1, L. Vivien1, V. Sun1,3, and E. Cassan1; 1Université Paris Sud Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France; 2Department of Electronics and Nanoeengineering, Aalto University, Aalto, Finland; 3QFF Centre of Excellence, Department of Applied Physics, Aalto University, Aalto, Finland
Hybridization of 2D highly nonlinear materials with the silicon platform introduce a boosting of non-linear effects while removing TPA free at telecom wavelength. With optimization of the structures, non-linear performance almost compares to SOI waveguides.
Acoustic Phonon Localization in One-dimensional Quasiperiodic Structures

P. Priya, E.R. Cardozo de Oliveira, A. Rodriguez, and N.D. Lanzilotti-Kimura, Centre de Nanosciences et de Nanotechnologies (C2N), Université Paris-Saclay, CNRS, Palaiseau, France

We theoretically demonstrate the localization of acoustic phonons in the range of 20-100 GHz in one-dimensional complex quasiperiodic systems composed of AlGaAs/GaAs heterostructures.

Efficient Laser Operation of Transparent “Mixed” 7 at.% Er:(Lu,Sc)2O3 Sesquioxide Ceramics near 2.8 µm

S. Sadrieva, M. Sidorenko, O. Sergaeva, C. Roques-Carmes, É. Zuev Institute of Atmospheric Physics, Leningrad, Russia; 2 Russian Research Centre “Institute of Optical Crystals”, Tomsk, Russia; 3 E. Zuev Institute of Atmospheric Optics SB RAS, Tomsk, Russia; 4 LLC “Laboratory of Optical Crystals”, Tomsk, Russia

M. Hayashi, and T. Tanabe

Based on Single-Crystal Fe:CdTe

C. Roques-Carmes, É. Zuev Institute of Atmospheric Physics, Leningrad, Russia; 2 Russian Research Centre “Institute of Optical Crystals”, Tomsk, Russia; 3 E. Zuev Institute of Atmospheric Optics SB RAS, Tomsk, Russia; 4 LLC “Laboratory of Optical Crystals”, Tomsk, Russia

High-Energy, Widely Tunable and Efficient Mid-Infrared Lasers

M. Sidorenko1, O. Sergaeva2, C. Roques-Carmes3, É. Zuev Institute of Atmospheric Physics, Leningrad, Russia; 2 Russian Research Centre “Institute of Optical Crystals”, Tomsk, Russia; 3 E. Zuev Institute of Atmospheric Optics SB RAS, Tomsk, Russia; 4 LLC “Laboratory of Optical Crystals”, Tomsk, Russia

Terahertz generation using a ZnGeP2 photoconductive antenna

V. Bulgakov1, P. Citraro2, A. Usakov3, N. Yudin4,5,6, M. Zinoves2,3,4, S. Podzyrylov2,3,4, T. Delmotte2, V. Bukin5, and S. Garnov3; 1 Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia; 2 National Research Tomsk State University, Tomsk, Russia; 3 V. E. Zuev Institute of Atmospheric Optics SB RAS, Tomsk, Russia

CB-3.4 WED

Analysis of the phase-locking dynamics of a III-V-on-silicon frequency comb laser

F. Vollmer, A. Verschelde1, K. Van Gasse2, B. Kuyken2, M. Giudici3, G. Huyet4, and M. Marconi4; 1 Institut de Physique de Nice, Nice, France; 2 Ghent University - I-MEC, Ghent, Belgium

We analyze the phase-locking of a III-V-on-silicon frequency comb laser with a stepped-heterodyne technique. We measure the modal phase dispersion and reconstruct the pulse envelope as a function of the saturable absorber bias voltage.

CB-3.5 WED

Efficient Laser Operation of Transparent “Mixed” 7 at.% Er:(Lu,Sc)2O3 Sesquioxide Ceramics near 2.8 µm

L. Bayrov1, P. Lokko2, W. Jing3, Y. Wang2, H. Huang2, M. Aguado1, É. Diaz1, E. Dunina1, A. Korotienė2, U. Griebner1, V. Petrov3, X. Mateos4, V. Bina5, and P. Camy5; 1 Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIRMAP), UMR 6352, CELN-CNRS-ESCAEN, Université de Caen Normandie, Caen, France; 3 Institute of Chemical Materials, China Academy of Engineering Physics, Mianyang, China; 4 Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany; 5 Université Rovira i Virgili (URV), FICMA-FICNA-EMAs, Tarragona, Spain; 6 Vitebsk State Technical University, Vitebsk, Belarus; 7 Chimie ParisTech, PSL University, CNRS, Institut de Recherche de Chimie Paris, Paris, France

Transparent “mixed” sesquioxide ceramic 7 at.% Er:(Lu,Sc)2O3 is synthesized by HIPing at 1750 °C/200MPa and its spectroscopy is studied. The ceramic laser generates 342 mW at 2.71±2.85 µm with a slope efficiency of 41.7%.

CA-5.5 WED

Analysis of the phase-locking dynamics of a III-V-on-silicon frequency comb laser

S. Sadrieva, M. Sidorenko, and N.D. Lanzilotti-Kimura, Centre de Nanosciences et de Nanotechnologies (C2N), Université Paris-Saclay, CNRS, Palaiseau, France

We theoretically demonstrate the localization of acoustic phonons in the range of 20-100 GHz in one-dimensional complex quasiperiodic systems composed of AlGaAs/GaAs heterostructures.

CA-5.6 WED

Efficient Laser Operation of Transparent “Mixed” 7 at.% Er:(Lu,Sc)2O3 Sesquioxide Ceramics near 2.8 µm

One-dimensional Quasiperiodic and Engineering, ITMO University, St. Petersburg, Russia; 2 Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA, USA; 3 Kirensky Institute of Physics, Federal Research Laser generates 357 mW at 2304.6 nm and the best pulse characteristics (duration/energy) are 870 ns/4.4 µJ.

CB-3.4 WED

Analysis of the phase-locking dynamics of a III-V-on-silicon frequency comb laser

CB-3.5 WED

Efficient Laser Operation of Transparent “Mixed” 7 at.% Er:(Lu,Sc)2O3 Sesquioxide Ceramics near 2.8 µm

CB-3.6 WED

Efficient Laser Operation of Transparent “Mixed” 7 at.% Er:(Lu,Sc)2O3 Sesquioxide Ceramics near 2.8 µm

Room 2

Room 3

Room 4

Room 5

Room 6

Wednesday – Orals

Cryogenic Yb:YLF lasers and their applications to high average power laser

U. Demirbas1, 2, J. Thesing1, M. Keller1, S. Reuter1, F.X. Kärner2, 2, and M. Pergament1; 1 Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, 22607, Hamburg, Germany; 2 Physics Department and The Hamburg Centre for Ultrafast Imaging, University of Hamburg, Luruper Chaussee 149, Hamburg, Germany; 3 Laser Technology Laboratory, Antalya Bilkent University, 07190 Dosemealti, Antalya, Turkey

We report a SRM mode-locked cryogenic Yb:YLF laser generating sub-5-ps pulses with 28-W average power around 1017 nm and 105-ps pulses with 40-W average power around 995 nm, by employing E/a and E/e axes, respectively.

Room 1

Room 2

Room 3

Room 4

Room 5

Room 6
can be used to access entirely new bound states in the continuum, photonic crystal membranes and features from nanophotonics, such as Wannier states. We show that techniques and structures from nanophotonics, such as photonic crystal membranes and bound states in the continuum, can be used to access entirely new regimes in cavity optomechanics.

Fano lineshapes and mode splittings: Can they be artificially generated or obscured by the numerical aperture? Z. Geng, J. Theenhaus, B.K. Patra, J.-Y. Zhong, J. Busink, E.C. Garrett, and S.R.K. Rodriguez; Center for Nanophotonics, AMOLF, Amsterdam, Netherlands

We experimentally reveal the influence of higher-order Bloch harmonics in edge states of topological photonic crystals emulating the quantum spin Hall effect, leading to a breakdown of the coupling between their local spin and helicity.

Graded-index fiber. Our results could pave the way to high-power supercontinuum light sources in the mid-infrared.

Optical parametric oscillator based on silicon nitride waveguides

N. M. Lüthi, T. Becker, T. Würthwein, K.-J. Boller, and C. Fallnich; 1 Institute of Applied Physics, University of Münster, Münster, Germany; 2 MESA Institute for Nanotechnology, University of Twente, Enschede, Netherlands; 3 Cells in Motion Interfaculty Centre, University of Münster, Münster, Germany

We present waveguide-based optical parametric oscillation in silicon nitride with the potential of full integration. The tunable light source paves the path towards integrated CARS measurements or mid-infrared absorption spectroscopy.
We experimentally analyze for the first time an off-chip biosensor integrated with tailored microfluidic chip was fabricated using mid-IR quantum cascade laser (QCL). We demonstrate on-chip frequency comb generation. The comb densely covers a 25-nm broad spectrum with more than 1600 comb-lines at 2-GHz spacing.

We present our recent results obtained with single-crystal Fe: CdTe lasers. In particular, different pumping schemes and operation temperatures are investigated. The developed laser systems are characterized regarding efficiency, output energy and tunability.

Investigations of Protein-Ligand Reaction Kinetics by Transistor-Microfluidic Integrated Sensors

Chair: Robert Hall, University of Málaga, BIONAND - Centro Andaluz de Nanomedicina y Biotecnología, Málaga, Spain

Ch-H-6.1 WED 11:00

CH-6: On-chip Solutions for Optical Sensing

Chair: Sorin Grzegorz, Wroclaw University of Technology, Wroclaw, Poland

Multiscale and Molecule states in a broadband Mamyshev oscillator around 1550 nm

In this work, we report on a numerical investigation that clarified the optimum design parameters to achieve passive ML with a toroidal WGM microlaser.
Fano resonances and Rabi splittings, and conclude with general guidelines to avoid pitfalls in studying such optical systems.

We report on transformable micro-photonic devices that change their functionality while operating. Assisted by holographic tweezers, we gradually deform the shape of a droplet whispering-gallery cavity and split a resonant mode to a 10-GHz separated doublet.

In this talk we present a new scheme leveraging Spontaneous Raman Spectroscopy and Time Resolved Single Photon Counting in order to produce Bell correlations between light and vibrations at ambient conditions.

We apply "Topological Quantum Chemistry" to photonic crystals. Through this method, we found the first instance of bosonic fragile topology as well as higher-order photonic Photonic TIs and novel 3D photonic topological effects.

for the numerical implementation of the nonlinear Fourier transform. The scheme allows the use of fast algorithms with low computational complexity.

ZBLAN fiber using pulses at the vicinity of 2 μm from a master oscillator fiber amplifier.

We present an experiment towards the middle-infrared based on a grating inscribed with telecommunication signals.

We present a fiber CPA-system based on coherent combining which exploits the gain-bandwidth of Ytterbium through aggressive but elaborate spectral shaping and delivers 120 fs, 10 mJ pulses at 1 kW average power.
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<td><strong>CJ-4.2 WED 11:15</strong></td>
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<td><strong>CM-2.2 WED 11:15</strong></td>
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<td><strong>CJ-4.3 WED 11:30</strong></td>
<td><strong>CH-6.2 WED 11:15</strong></td>
<td><strong>CM-2.3 WED 11:30</strong></td>
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<td><strong>CB-4.3 WED 11:30</strong></td>
<td><strong>EG-3.3 WED 11:30</strong></td>
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| **Deep reinforcement learning algorithm for self-tuning 8-figure fiber laser** | **Tantalum Pentoxide Slot Waveguides for Waveguide Enhanced Raman Spectroscopy**  
- Z. Liu, Q. Zhao, P. Shi, B. Mitchell, H. Zhao, N. Le Thomas, D. Blumenthal, and R. Baeu | **Deep surface amorphization in silicon induced by spectrally-tuned ultrafast laser pulses**  
- M. García-Lechego, N. Casaguer, A. Wang, D. Groj, and J. Siegel  
- Departamento de Física Aplicada, Universidad Autónoma de Madrid, Madrid, Spain  
- Laser Processing Group, Instituto de Optica, IO-CSIC, Madrid, Spain  
- Aix-Marseille University, CNRS, LP3 UMB 7341, Marseille, France  
- Deep surface amorphization in silicon for telecom waveguide writing applications is achieved by tuning the femtosecond laser writing wavelength from 515nm-4000nm. Amorphous layers of 128 nm can be achieved, much exceeding the current 70 nm-limit. | **Ultra-low Threshold Quantum Cascade Laser**  
- Z. Wang, F. Kapsalida, R. Wang, M. Beck, G. Scalari, and J. Faist  
- ETH Zürich, Zürich, Switzerland  
- We present a quantum cascade laser operating at 4.3 μm wavelength and exhibiting a threshold current of only 11.0 mA while generating a single-mode maximum power of 0.23 mW at -20 °C in continuous-wave operation. | **Dual-Tone Raman Study of Optical Picocavities**  
- S. Verlekar, A. Ahmed, W. Chen, and C. Galland  
- École polytechnique fédérale de Lausanne, Lausanne, Switzerland  
- Nanoparticle-on-mirror (NPoM) nanocavities are studied under dual-tone laser excitation. We leverage the multimode nature of these structures to probe the generation mechanism of plasmonic picocavities. |
| **Autosetting Mode-locked Laser with Genetic Algorithm Optimization and Advanced Intracavity Controls**  
- J. Girardot, F. Billaud, A. Coillet, M. Nafis, E. Hertz, and P. Greul  
- Laboratoire ICB UMR 6303 CNRS, Photonics Dpt, Université Bourgogne–Franche-Comté, Dijon, France  
- We present a smart ultrafast fiber laser with interfaced intracavity controls applying on both nonlinear and spectral transfer functions. After running an evolutionary algorithm, the self-starting pulsed output optimizes various user-defined merit functions. | **Spectroscopic Gas Detection Using Thin-film Mesoporous Waveguides**  
- A. Datta, S. Alberti, M. Vik, and J. Jägerskär  
- UiT The Arctic University of Norway, Tromsø, Norway  
- Chip-integrated waveguides for gas sensing have inadequate evanescent field interaction. A thin-film mesoporous waveguide has enhanced sensitivity through gas interaction with the field inside the waveguide-core, demonstrated through spectroscopic detection of acetylene at 1520 nm. | **Generation of sub-half-cycle 10 μm pulses using four-wave mixing through two-color filamentation**  
- W.-H. Huang, Y. Zhao, S. Kusama, C.-W. Luo, and T. Fujii  
- Toyota Technological Institute, Nagoya, Japan  
- National Chiao Tung University, Hsinchu, Taiwan  
- We have experimentally demonstrated the generation of sub-half-cycle pulses at 10 μm through filamentation in nitrogen. The absolute value of the CEP was consistent with a simple four-wave difference frequency generation model. | **Laying the foundations of ultrafast stealth dicing of silicon with picosecond laser pulses at 2-μm wavelength**  
- M. Blothe, M. Chambonneau, T. Heuermann, M. Gebhardt, J. Limpert, S. Nolte,  
- Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Albert-Einstein-Str. 15, 07745, Jena, Germany  
- We report temperature continuous-wave operation of quantum cascade lasers at 7 μm with only 9 active regions and operating voltage below 5V compatible with standard laser diode drivers, while not requiring regrowth or epilose-down mounting. | **Maximal coupling of light into 2D polaritons**  
- E. J. C. Dias and J. García de Abajo 1,2  
- 1 ICFO - The Institute of Photonic Sciences, Castelldefels, Spain  
- 2 ICREA - Institució Catalana de Recerca i Estudis Avançats, Barcelona, Spain  
- We quantify the coupling strength between light and 2D polaritons in thin films, using point and line scatterers, and find universal constraints that limit its fundamental maximum allowed values. |
**EA-3.2 WED 11:15**

Detection of a Levitated Nanoparticle's Position via Self-Homodyne

- D.S. Bykov,
- L. Dania,
- K. Heidinger,
- G. Cerchiarl,
- R. Blatt,
- and T.E. Northup

1 Institut für Experimentalphysik, Universität Innsbruck, Technikerstrasse 25, Innsbruck, Austria; 2 Institut für Quantenoptik und Quanteninformation, Österreichische Akademie der Wissenschaften, Technikerstrasse 21a, Innsbruck, Austria

We demonstrate a technique to increase the efficiency with which the position of a levitated nanoparticle is detected. The method is based on self-homodyne of scattered light and theoretically can reach the Heisenberg limit.

**EF-3.2 WED 11:15**

Can some semiconductor lasers operate as Bose Einstein condensates?

- S. Barland,
- P. Acam,
- G.L. Lipp,
- R. Nyman,
- and R. Kaiser

1 Université Côte d’Azur, Institut de Physique de Nice, Valbonne, France; 2 Physik Department, Imperial College, London, United Kingdom

Lasers are known as out of equilibrium light emitting devices. Yet we observe signatures of photon localization and Bose Einstein condensation of photons (thermal equilibrium processes) in a Vertical Cavity Surface Emitting Laser.

**EA-3.3 WED 11:30**

A High Cooperativity Silicon Nitride Optomechanical Transducer

- M.J. Bereyhi,
- A. Arakmobehgi,
- N.J. Engelsen,
- and T.J. Kippenberg

2 Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

We report the design, fabrication, and characterization of a monolithic nano-optomechanical silicon nitride transducer. Our system features a 1D photonic crystal cavity (Q = 10^9) integrated with a high-Q (Q > 10^7) nanobeam with optomechanical cooperativity exceeding 10^9.

**EF-3.3 WED 11:30**

Filamentation and beam reshaping in a 2D quadratic nonlinear medium

- R. Jauberet,
- S. Wehbi,
- T. Mansuryan,
- K. Krupa,
- and V. Courdère

1 Université de Limoges, XLIM, UMR CNRS 2522, Limoges, France; 2 Università di Brescia, Brescia, Italy; 3 Alphaphot, Optics & Lasers Technology Center, Institut d’Optique, CNRS, UMR 8507, Université Paris-Saclay, Palaiseau, France; 4 Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland; 5 Department of Mathematics, Southern Methodist University, Dallas, USA; 6 Dipartimento di Ingegneria dell’Informazione, Università di Roma “Sapienza”, Roma, Italy

We reported the spatial filamentation, followed by the recovery of a bell-shaped beam for the second harmonic wave in a quadratic crystal. Such behavior is accompanied by spectral broadening covering the entire visible spectrum.

**CA-6.2 WED 11:30**

Towards the Multi-kW Ultrafast Green Thin-Disk Laser

- C. Röcker,
- A. Loscher,
- F. Bienert

3 Université Côte d’Azur, Institute of Physical Chemistry, CNRS, UMR 7315, Université, Collège de France, Paris, France; 4 Trumpf Laser, Munich, Germany

We present an ultrafast green laser with near-diffraction-limited beam quality delivering more than 1.4 kW of average power. It is based on second harmonic generation of a Yb:YAG thin-disk multipass amplifier in LBO.

**EB-6.2 WED 11:15**

Hybrid Teleportation Protocols for Heterogeneous Quantum Networks

- T. Darnès,
- A. Cavalli,
- H. Le Jeannic,
- H. Dong,
- B. Asenbrey,
- G. Guccone,
- and J. Laurat

1 Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL Université, Collège de France, Paris, France; 2 Laboratoire Photonique Numérique et Nanoscience, Université de Bordeaux, Institut d’Optique, CNRS, UMR 5298, Bordeaux, France

Based on hybrid entanglement between discrete and continuous variable optical qubits, we report an entanglement swapping protocol that enables the connection of nodes relying on different encodings of quantum information in a heterogeneous quantum network.

**EB-6.3 WED 11:30**

How to send entangled photons across hundreds of km?

- M. Lipka,
- M. Mazelanik,
- A. Leszczynski,
- W. Wasilewski,
- and M. Parniak

1 Centre for Quantum Optical Technologies, Centre of New Technologies, University of Warsaw, Warsaw, Poland; 2 Faculty of Physics, University of Warsaw, Warsaw, Poland; 3 Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

Quantum-entangled pairs of photons find broad applications, yet require feasible quantum repeaters to be distributed on inter-city distances. We present an experimental platform for Bell-state generation across 500 modes and analyze its performance as a wavevector-multiplexed quantum repeater.
CJ-4.4 WED 11:45
Generation of ~625nJ pulses from a Maimayshev Oscillator with a few-mode LMA Yb-doped Fiber

D. Lin1, D. Xu1, J. He1, Y. Feng1, Z. Ren1, and D.J. Richardson1,2,2)

1Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom; 2Cambridge Graphene Centre, University of Cambridge, Cambridge, United Kingdom

We demonstrate a Maimyshev oscillator based on a 25μm core diameter Yb-doped fiber. The oscillator generates pulses with an energy of 625nJ that can be compressed to ~4 fs with a peak power of ~5.6MW.

CH-6.4 WED 11:45
Multicolor hologram based on plasmonic nanohole arrays and detour phase: design and simulation

S.S. Mouavi Khaleghi1, D. Wen1, J. Cadusch1, and K.B. Crozier1,2,3)
Department of Electrical and Electronic Engineering, University of Melbourne, Victoria 3010, Australia; 2School of Physics, University of Melbourne, Victoria 3010, Australia; 3ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Victoria, Australia

We design nanohole arrays that serve as color filters with high transmission and low cross-talk. We design two multicolor holograms based on these and simulate their performance, demonstrating good fidelity to the desired holographic images.

CH-6.5 WED 12:00
Mach-Zehnder interferometer assisted ring resonator configuration for refractive index sensing

M. Yadav and A. Aksnes1
Nanjing University of Information Science &Technology, Nanjing, China

We discuss real-time dynamics of soliton evolution in mode-locked fiber lasers, including the entire build-up dynamics of soliton, soliton molecule, harmonic mode-locking based on TS-DFT technique, and the temporal evolution using time-lens technique.

CF-5.3 WED 11:45
OPCPA Front-End based on a Cr:ZnS Laser for Femtosecond Pulse Generation in the Mid-Infrared

P. Fuerjes, L. von Grafenstein, C. Mei, U. Griebner, and T. Elsaesser
Max Born Institute, Berlin, Germany

A novel front-end for mid-IR OPCPAs based on a Cr:ZnS laser is presented. The 2 μm pumped 1 kW OPCPA delivers >400 μJ pulses tunable between 5.4 – 6.8 μm with sub-150 fs duration.

CF-5.4 WED 12:00
Carrier-envelope phase characterization using harmonic spectral interference in mid-infrared laser filament in argon

P. Polykin1, C. Gollner2, V. Shumakova3, J. Barker4, A. Pugzlys4, and A. Baltuska4,3
1College of Optical Sciences, University of Arizona, Tucson, USA; 2Photoinstitut Vienna University of Technology, Vienna, Austria

Four-fold enhancement in the dynamic range of a ring resonator sensor is presented. The Mach-Zehnder interferometer assisted ring resonator configuration is utilized to achieve this enhanced dynamic range, which is independent of the Q-factor.

CM-2.4 WED 11:45
Pulse Duration and Temporal Contrast as Critical Parameters for Internal Structuring of Silicon

A. Das, A. Wang, O. Uteza, and D. Groje
Aix-Marseille Université, CNRS, LPA, F-13288, Marseille, France

By synchronizing 1550-nm pulses of durations from 190 fs to 5 ns, we investigate the key dynamical aspects of interactions to achieve 3D laser writing inside silicon.

CM-2.5 WED 12:00
3D Laser Structured Mirror-Waveguide Circuits: a New Optical PCB Platform for Silicon Photonics

A. Rahimnouri, G. Djogo, and P. Herman
University of Toronto, Toronto, Canada

Femtosecond laser glass processing of micro-void mirror disks and waveguides inside of fused silica facilitated high-density bending of 3D waveguide circuits for efficient optical routing and vertical light coupling into silicon photonic chips.

CB-4.4 WED 11:45
Frequency Control of a Mid-Infrared Quantum Cascade Laser Frequency Comb by Near-Infrared Light Injection and Intensity Modulation

K. Komagata1, A. Sheshizad2, M. Hamrouni1, R. Matthey3, F. Kapalsd1, P. Jouy2, M. Reck2, V.I. Wittwer2, A. Hugi2, T. Sidmey2,3, and S. Schlit1
1Laboratoire Temps-Fréquence, Institut de Physique, Université de Neuchâtel, CH-2000 Neuchâtel, Switzerland; 2Institute for Quantum Electronics, ETH Zurich, CH-8093 Zurich, Switzerland; 3Roweop AG, Laubsrütistrasse 44, CH-8712 Staffa, Switzerland

We study the response of a mid-infrared quantum cascade laser frequency comb to optical injection of intensity-modulated near-infrared light. We demonstrate MHz actuation bandwidth of the comb properties necessary for tightly-locking a dual comb spectrometer.

CB-4.5 WED 12:00
Heating Dynamics of Pulse-Pumped Quantum-Cascade Lasers

V. Dudelev1, D. Mikhailov1, D. Chistyakov1, A. Babichev2, V. Myblkov2, A. Gladyshev1, S. Losev1, I. Novikov2, A. Lyutetskiy2, S. Slipchenko1, N. Pikhits1, L. Karachinsky2, A. Igorov2, and G. Sokolovskii1
1Ioffe Institute, Saint-Petersburg, Russia; 2Connector Optics LLC, Saint-Petersburg, Russia; 3ITMO University, Saint-Petersburg, Russia

We report on the temperature dynamics measurements of pulse-pumped quantum-cascade lasers with μm-scale spatial and sub-ns temporal resolution allowing for detection of mK/ns heating rates inside the active region.

EG-3.4 WED 11:45
Cavities with Giant Brownian Fluctuations

M. Douwiz1, U. Chattopadhyay2, Y. Chong2, and T. Carmon3,1
1Technion, Israel Institute of Technology, Technion City, Israel; 2Nanyang Technological University, Singapore, Singapore; 3Tel Aviv University, Tel Aviv, Israel

We report on the smallest optical micro-resonator at room conditions. We operate a submerged micro-drop near the Winsor III phase and measure a Q=10^5, capillary amplitude and frequency of 6 nm and 155 Hz.

EG-3.5 WED 12:00
Metal-molecule charge transfer through Fermi level equilibration in plasmonic systems

A. Stefancic5, S. Lee3, Z. Li3, M. Liu3, R. Cico-Lucacel1, N. Leopold3, and E. Cortés1
1Babes-Bolyai University, Cluj-Napoca, Romania; 2Chair in Hybrid Nanosystems, NanoInstitute Munich, Faculty of Physics, Ludwig-Maximilians-Universität München, Munich, Germany; 3State Key Laboratory of Powder Metallurgy, School of Physical and Electronics, Central South University, Changsha, China

In this study we highlight, and monitor by SERS, a new metal-molecule charge transfer pathway, complementary to photoexcitation or plasmon assisted charge carrier production, through Fermi level equilibration of plasmonic materials and adsorbed molecules.
New strategies to shorten the time response of thermo-optic switches in a glass chip

**P. Païé**, M. Cabvarete, E. Cerchelli, F. Sala, A. Bassi, R. Ouelame, and E. Braghiari

In this work we present the design, fabrication and characterization of a fast thermo-optical switch. By layout optimization, surface laser micro-structuring and driving voltage tuning, we prove a switching time of less than 100 μs.

Whispering gallery mode resonances in thermally poled borosilicate glass optical microcavities


Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology - Hellas (FORTH), Heraklion, Greece; 1Department of Materials Science & Technology, University of Crete, Heraklion, Greece; 2Department of Physics, University of Crete, Heraklion, Greece; 3Optoelectronics Research Centre (ORC), University of Southampton, Southampton, United Kingdom

Whispering gallery mode resonances are investigated in thermally poled, borosilicate glass, cylindrical cavities. Experimental results reveal the role of poling losses in the selective suppression of spectral resonances upon their radial order and polarization state.

Integrated free-space optomechanics with AlGaAs heterostructures


1Department of Microtechnology and Nanosience, Chalmers University of Technology, Göteborg, Sweden; 2Department of Physics, Chalmers University of Technology, Göteborg, Sweden

We fabricated and characterized suspended bi-layered photonic crystal slabs in AlGaAs heterostructures. This approach allows to create integrated, closely spaced membranes, which can exhibit photon bound states in the continuum to increase light-matter interaction.

Two-Photon Pumped Polariton Condensation


1Department of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel; 2Technische Physik und Wilhelm-Conrad-Röntgen-Research Center for Complex Material Systems, Universität Würzburg, Würzburg, Germany

We report the first observation of two-photon excitation of a polariton condensate, demonstrated by angle- and time-resolved photoluminescence in a GaAs-based microcavity. Our results pave the way towards realization of a polarization-based THz laser source.

How to observe single photons at 200 000 camera frames per second!

**M. Lipka** and M. Parniak

1Centre for Quantum Optical Technologies, Centre of New Technologies, University of Warsaw, Warsaw, Poland; 2Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

Quantum technologies offer a new paradigm for fundamental measurements. We present an order of magnitude faster camera latency for single-photon detection and adaptive real-time measurements. We present an order of magnitude faster camera latency for single-photon detection and adaptive real-time measurements. We present an order of magnitude faster camera latency for single-photon detection and adaptive real-time measurements.

Photon-photon polaritons in chi-2 microresonators

**D. Skyrabin**, V. Fankratov, A. Villois, and D. Puzyriev

University of Bath, Bath, United Kingdom

We present a concept of new quasi-particles - photon-photon polaritons - and demonstrate how the polaritonic resonance splitting, avoided crossings, and Rabi dynamics can be observed in chi-2 ring microresonators using the pump-probe arrangement.

Thin-disk multipass amplifier for kilowatt-class ultrafast lasers above 100 mJ


1TRUMPF Laser GmbH, Schramberg, Germany; 2TRUMPF Scientific Lasers GmbH + Co. KG, Unterföhring, Germany; 3German Aerospace Center (DLR), Institute of Technical Physics and Stuttgart University, Stuttgart, Germany

We report on an industrially stable thin-disk multipass amplifier capable of delivering diffraction-limited beam quality, multi-kilowatt average power and pulse energies above 100 mJ.

kW-class ceramic Yb:La2O3 thin disk laser

**J. Eser**, X. Xia, J. Zhang, T. Graf, and M. Abdou Ahmed

1Institut für Strahlwerkzeuge, University of Stuttgart, Stuttgart, Germany; 2Jiangsu Key Laboratory of Advanced Laser Materials and Devices, School of Physics and Electronic Engineering, Jiangsu Normal University, Xuzhou, China; 3Key Laboratory of Transparent and Opto-functional Inorganic Materials, Shanghai Institute of Ceramics, Chinese Academy of Science, Shanghai, China

We report on a ceramic Yb:La2O3 thin-disk laser delivering a continuous-wave output power of 1190 W in multimode operation with an optical efficiency of 64%. In fundamental mode operation 360 mW of output power were achieved.

Optical Fiber Transmission of Squeezed States of Light and Homodyne Detection with a Real-time True Local Oscillator


1Denmark Technical University, Kongens Lyngby (Copenhagen), Denmark

We demonstrate transmission and homodyne detection of 1550 nm squeezed light through up to 10 km single-mode fiber with a real-time independent local oscillator, measuring up to 3.6 dB of squeezing below vacuum noise.

Spectral Hong-Ou-Mandel Interference Between Independently Generated Single Photons for Scalable Frequency-Domain Quantum Processing

**A. Khodadad Kashif** and M. Kues

1Institute of Photonics, Leibniz University, Hannover, Germany; 2Cluster of Excellence PhoenixD, Hannover, Germany

Via a reconfigurable photonic frequency circuit, we show spectral bosonic and fermionic Hong-Ou-Mandel interference between independently created single photons, demonstrating photon number scalability and versatility of the frequency processing approach.
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<tr>
<td><strong>SP-2: Hot Topics: What’s Next in Integrated Frequency Combs</strong></td>
<td><strong>CF-5.5 WED 12:15</strong></td>
<td><strong>CM-2.6 WED 12:15</strong></td>
<td><strong>CB-4.6 WED 12:15</strong></td>
<td><strong>EG-3.6 WED 12:15</strong></td>
<td><strong>EG-4.1 WED 14:30</strong></td>
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<tr>
<td>Chair: Marco Piccardo, Harvard University, Cambridge, MA, USA</td>
<td>Ultrafast, high-flux hard X-ray Source driven by a Few-cycle 5 µm OPCPA</td>
<td>Laser nanofabrication deep inside silicon wafers</td>
<td>Linewidth Enhancement Factor of Mid-IR Quantum Cascade Lasers</td>
<td>Nano-IR study of light-matter interaction between intersubband transitions in quantum wells and patch antenna resonators by polymer expansion</td>
<td>Extremely Non-adiabatic Switch-off of Deep-strong Light-Matter Coupling</td>
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<tr>
<td>P. Maitland 1, M.N. Malik 2, A. Bogon 3, C. Kitis 1, and M. Soref 1,2,3</td>
<td>R. Asgari Azerb. 1,2,3, A. Ishraq 1,2,3, and O. Tokel 1,2,3</td>
<td>M. Bertrand, M. Francké, A. Forner, F. Kapsalidis, M. Beck, and J. Faist</td>
<td>J. Mørkine 1, M. Halbhuber 1, V. Zeller 1, C. Cui 1,2, D. Bougeard 1, R. Huber 1, and C. Lange 1,2,3</td>
<td>A. Frank 1, J. Zhou 1, J.A. Grieve 1, J. Viana-Gome 1, V. Berzhitskikh 1, A. Ling 1, and G. Eida 1,2,3,4</td>
<td>Coupling of a 2D Heterostructure to a Photonic Polymer Waveguide via Mode-center Encapsulation</td>
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<td>1James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom; 2Sant’Anna School of Advanced Studies, Pisa, Italy</td>
<td>1Laboratoire Matériaux et Phénomènes, CNRS, Montpellier, France; 2CNRS, Université de Paris Saclay, Palaiseau, France; 3Dipartimento di Fisica, Università La Sapienza, Roma, Italy</td>
<td>1Centre for Life Nanoscience, Istituto Italiano diTecnologia, Roma, Italy</td>
<td>1Department of Physics, University of Regensburg, Regensburg, Germany; 2Université de Paris, Laboratoire Matériaux et Phénomènes</td>
<td>1Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore; 2Department of Physics, National University of Singapore, Singapore</td>
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## ROOM 7

**CE-6.6 WED 12:15**

**Self-Written Waveguides as Low-Loss Interconnects and Temperature Sensor**

- A. Günther\(^1\), R. Garg\(^2\), L. Zheng\(^1\), B. Roth\(^3\), and W. Kowalsky\(^1,3\)

- \(^1\) Institute of High Frequency Technology, Braunschweig, Germany
- \(^2\) Hannover Centre for Optical Technologies, Hannover, Germany
- \(^3\) Cluster of Excellence PhoenixD, Hannover, Germany

Self-written waveguides represent a promising class of optical interconnects. They enable a rigid connection and minimize coupling losses between different optical elements. Furthermore, their characteristics enable a usage as thermal sensing element simultaneously.

## ROOM 8

**EA-3.6 WED 12:15**

**Tomography of a Feedback Measurement with Photon Detection**

- S. Izumi, J.S. Neergaard-Nielsen, and C. Dens; University of Muenster, Muenster, Germany

We experimentally develop a measurement consisting of real-time feedback controlled displacement combined with photon detector for the discrimination of the superpositions of the vacuum and single photon state, and characterize it via quantum detector tomography.

## ROOM 9

**EF-3.6 WED 12:15**

**Pattern formation in colloids driven by optical single feedback.**

- V. Bobkova, A. Goenner, and C. Dens; University of Muenster, Muenster, Germany

We investigate the nonlinear dynamics of self-organization in a colloidal suspension driven by an optical single feedback system. Pattern formation is obtained as a result of an interplay of stochastic processes in colloids and optomechanical forces action.

## ROOM 10

**CA-6.5 WED 12:15**

**Efficient diode-pumped cryogenic Yb:YLF laser with 500 W cw output power from a single rod**

- M. Kellert\(^1\), U. Demirbas\(^2,3\), J. Theising\(^1\), S. Reuter\(^1\), and M. Pergament\(^1\)
- \(^1\) Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
- \(^2\) Physics Department, University of Hamburg, Hamburg, Germany
- \(^3\) Laser Technology Laboratory, Department of Electrical and Electronics Engineering, Antalya Bilim University, Antalya, Turkey

We present >500 W cw output power from cryogenically cooled Yb:YLF laser in rod geometry by employing E/c axis for lasing. A wavelength shift from 995nm to 1019nm is observed and underlying physical mechanisms are discussed.

## ROOM 11

**EB-6.6 WED 12:15**

**Experimental demonstration of robust quantum steering**

- S. Wallmann\(^1\), R. Uola\(^2\), and A. Costa\(^1\)
- \(^1\) University of Bristol, Bristol, United Kingdom
- \(^2\) University of Geneva, Geneva, Switzerland
- \(^3\) Federal University of Para, Curitiba, Brazil

We demonstrate quantum steering based on generalised entropies and criteria with minimal assumptions based on the so-called dimension-bound steering. Further, we investigate their robustness against experimental imperfections such as misalignment in the shared measurement reference-frame.

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### NOTES

- **Wednesday – Orals**

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<td>Chair: Stephane Barland, Institut de Physique de Nice, Nice, France</td>
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<td><strong>CA-7: Ultrafast Lasers</strong></td>
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<td>Chair: Nicolai Tolutik, NTNU Norwegian University of Science and Technology, Trondheim, Norway</td>
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<td><strong>EB-7: Quantum Imaging and Interference</strong></td>
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<td>Chair: Martin Ringbauer, University of Innsbruck, Austria</td>
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<td><strong>EI-3: Graphene Heterolayers</strong></td>
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<td>Chair: Vaclav Perelheimo, University of Buffalo, Buffalo, USA</td>
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<td><strong>EJ-3: Tailored Light</strong></td>
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<td>Chair: Julien Javaloyes, University of the Balearic Islands, Palma, Spain</td>
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**Optoelectronic read-out of local current-induced spin polarization in gated graphene/\(\text{WTe}_2\) heterostructures**

- C. Kastl; Walter Schottky Institute and Physics Department, Technical University of Munich, Garching, Germany
- – Munich Center for Quantum Science and Technology (MCQST), Munich, Germany

**Conical refraction with generalized Bessel-Gaussian beams**

- V.V. Mylitskov\(^1\), E.U. Rafailov\(^2\), and G.S. Sokolovskiv\(^1\)
- \(^1\) Ioffe Institute, St. Petersburg, Russia
- \(^2\) Aston University, Birmingham, United Kingdom

We investigate conical refraction of the linearly polarized generalized Bessel-Gaussian beam and demon-
nanostructures that enhance and confine light into nanometer dimensions. I will discuss various antenna geometries and their suitability for monitoring nanoscale dynamic processes in living cells with single molecule detection sensitivity.

multi-octave-spanning coherent mid-infrared light via intra-pulse difference-frequency generation driven directly by a diode-pumped high-peak-power and low-noise Cr:ZnS oscillator, providing over 75 mW of average power between 2.8-14 μm.

cascading two acousto-optofluvic cavities. By implementing it in a laser writing workstation, we demonstrate high-throughput material processing with multiple Bessel, annular and Gaussian beams.

(QCLs), grown on on-axis (001) Si substrates by molecular-beam epitaxy, and covering emission wavelength from 2 to 10 μm.

Wednesday – Orals
the continuous dispersion relation of the phonons.

University of Ferrara, Ferrara, Italy
We report a complete experimental description of the optical fiber losses effect in the Fermi Pasta Ulam recurrence process. The tuning of those losses highlights multiple critical values for which symmetry breakings occur.

EF-4.2 WED 14:45
Spatio-temporal observation of higher-order modulation instability in a recirculating fiber loop
• F. Copie, P. Saret, and S. Randoux, Univ. Lille - PhLAM - Physique des Lasers Atomes et Molécules, Lille, France
We report new observations regarding higher-order modulation instabilities in a fiber optics experiment. Single-shot space-time recordings reveal the deterministic pulse-splitting dynamics as well as an interplay with spontaneous MI mediated by the pump-signal frequency detuning.

EF-4.2 WED 15:00
Structural phase transitions in cold atoms mediated by optical feedback
• G. Baio, G.R.M. Robb, A.M. Yao, G.-L. Oppo, and T. Ackemann, Department of Physics, University of Strathclyde, Glasgow, United Kingdom
We present novel structural transitions between hexagon, stripe, honeycomb phases in cold atomic clouds, where effective interactions are mediated by a retro-reflected laser system.

ca. 7.2 WED 14:45
SESAM mode-locked Yb:YAB thin-disk oscillator delivering an average output power of 19 W
• F. Betrow, B. Dannecker1, B. Weichelt1, D. Rytz, T. Graf, and M. Abdou Ahmed1, Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Stuttgart, Germany;
• Electro-Optics Technology GmbH (EOT), Idar-Oberstein, Germany
We present first modeling experiments of Yb:YAB in thin-disk configuration. In multimode operation an output power of 155 W was achieved. In mode-locked operation, 19.2 W at a pulse duration of 462 fs was obtained.

EB-7.2 WED 14:45
A Controllable Source of High-dimensional Entangled Photon Pairs
• J. Gil-Lopez, V. Ansari, C. Silberhorn, and B. Brecht; Inverted Quantum Optics Group, Institute for Photonic Quantum Systems (PhoS), Paderborn, Germany
We present a highly controllable source of maximally entangled high-dimensional photon pairs. Combining dispersion engineering of the PDC process and spectral shaping of the pump, up to six-dimensional states with user chosen dimension are generated.

EB-7.3 WED 15:00
Ghost Imaging Exchange-Free
• J. Hance and J. Rarity; Quantum Engineering Technology Laboratory, Department of Electrical and Electronic Engineering, University of Bristol, Bristol, United Kingdom
We have developed a protocol for ghost imaging that is always counterfactual - while imaging an object, no light interacts with it. This provides both better visibility/SNR and less absorbed intensity than ghost imaging.

EB-7.3 WED 15:00
Photoinduced Intersubband Absorption and Enhanced Photobleaching in Twisted Bilayer Graphene
• E.A.A. Pogna1, X. Miao2, D. von Driesch1, T.V. Alencar4, M.V.O. Moutinho1, P. Venezuela1, P.W. Chiu1, C. Manzoni1, G. Cerullo1, M. Fortunato2, and A.M. de Paula1, Istituto di Nanoscienze CNR-NANO, Laboratory of Surface Physics and Department of Physics, Fudan University, Shanghai, China;
• Departamento de Física, Universidade Federal de Minas Gerais, Belo Horizonte-MG, Brazil;
• Departamento de Física, Universidade Federal de Ouro Preto, Ouro Preto-MG, Brazil;
We utilize an optoelectronic detection scheme based on magneto-optical Kerr microscopy to resolve large spin polarizations in graphene/WTe₂ heterostructures. The current-induced spin-orientation is driven by interlayer coupling and Berry curvature in the WTe₂.

EB-7.3 WED 14:45
Graphene/Bi2Se3 Heterojunction Phototransistor Using Phototagging Effect Modulated by Tunable Tunneling Resistance
• H.H. Yoon1,2, F. Ahmed1, Y. Dal1,2, F.A. Fernandez2,2, X. Cui1,2, X. Bai1,2, D. Liu1,2, M. Du1,2, H. Lipsanen1, and Z. Sun1,2; 1Department of Electronics and Nanoeengineering, Aalto University, FI-00076 Aalto, Finland; 2Finnish Centre of Excellence in Quantum Technology, Department of Applied Physics, FI-00076 Aalto, Finland
A Dirac-source/field-effect transistor combined based on a lateral heterochannel and a vertical tunnel junction has been realized, enabling us to explore phototagging effect modulated by tunable tunneling resistance for high-performance light detection.

EI-3.3 WED 15:00
Photodetectors
• A. Muscat, P.-W. M. Ich, N. Modsching1, M. Schumann, and F. Cottin, Laboratoire de Physique Théorique et Hautes Énergies (LPTHE), Université de Bourgogne Franche-Comté, 21000 Dijon, France
We present a framework to model the continuous dispersion relation of the phonons.

University of Ferrara, Ferrara, Italy
We report a complete experimental description of the optical fiber losses effect in the Fermi Pasta Ulam recurrence process. The tuning of those losses highlights multiple critical values for which symmetry breakings occur.

Room 7
Room 8
Room 9
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Room 12
comes the Nyquist and Abbe limits.

at 3 μm and >450μmW at 10 μm is achieved using an 80W pump laser.

pressed cladding in the form of helix was inscribed in YAG:Nd crystal. Conversion of Gaussian beam into modes with orbital angular momentum is experimentally demonstrated at Bragg resonance.

at 2.05 μm. The SESAMs show modulation depths between 1-2.4%, low saturation fluences, low nonsaturable losses and fast recovery times.

four-wave mixing is achieved in a broadband range in 2D transition-metal dichalcogenides using plasmonic structures. This enhancement is attributed to the plasmon-induced strongly confined electric field, promising for 2D nonlinear optical applications.

We present a novel degree of freedom in which the properties of nanoragings can be altered: the conical phase front of the inscription beam. We will discuss its influence on the optical properties of nanoragings.

We show enhanced nonlinear frequency generation in 2D-materials using monolithic dielectric Bragg mirror based resonators with high Q-factors at the pump and second harmonic wavelength. We report on fabrication and measured energy and polarization dependencies.

CH-7.4 WED 15:15
Subwavelength Video-Rate Terahertz Carrier Microscopy
R. Tucker, L. Peters, J.S. Toter Gongora, J. Tunesi, M. Rowley, A. Pasquaizi, and M. Peccianti; Emergent Photonics Lab, University of Sousse, Brighting, United Kingdom
We demonstrate a microscopy approach for high-frame-rate imaging of carrier dynamics in targets. A parallel large-area optical pump terahertz probe provides near-field resolution and enables the investigation of responses under arbitrary photo-excitation textures.

CF-6.5 WED 15:30
Electro-Optic Sampling with Percent-Level Detection Efficiency
Y. Haddad, J. Chréttens, S. Margueron, J.-C. Beugnot, and G. Fuentes; PEMTO-ST institute, BESANCE-CON, France
We present a non-destructive and non-invasive imaging spectroscopic technique with a high spatial and

CM-3.5 WED 15:30
Laser-fabrication of arrays of channels with subwavelength diameter and micrometric depth at the surface of glass
N. Sanner,1, L. Viinikka2,1; 1 European Clusters Technologies, 2 University of Oulu, Finland
We present spectral gain and gain saturation measurements for mid-infrared GaSb-based VECSiL gain

EB-4.5 WED 15:30
Ultrafast dynamics of heat in metals
A. Block1,2,3, Y. Slivn1,2; 1CN2, Catalan Institute of Nanoscience and Nanotechnology, Barcelona, Spain; 2 Ben Gurion University, Beer-Sheva, Israel
We provide a thorough theoretical description and experimental ob-

EG-4.4 WED 15:15
Second Harmonic Generation in monolayer WS2 with double resonant Bragg-Cavities
H. Knopp1,2,3, M. Zilk1, S. Bernet1,2,3, G. Q. Ngo1,3, F. A. A. A. Abta1, A. George1,2, N. N. S. A. N. boomalham1, Z. Gan1, M. Wei3, T. Vogl1, T. Tsuchiya1, T. Schröder1,2,3, E. Ellenberger1,2,3, S. Klauk1,2,3, 1 Institute of Applied Physics, Friedrich-Schiller University Jena, Jena, Germany; 2 Fraunhofer Institute of Applied Optics and Precision Engineering, Jena, Germany; 3 Institute of Physics, Friedrich-Schiller University, Jena, Germany
We show enhanced nonlinear frequency generation in 2D-materials using monolithic dielectric Bragg mirror based resonators with high Q-factors at the pump and second harmonic wavelength. We report on fabrication and measured energy and polarization dependencies.

CE-7.5 WED 15:30
Strain-induced optoelectronic tunability of fiber grown 2D transition metal di-chalcogenides
A. Niv1,2, A. Y. K. E. Y. V. S. A. N. 1,2, 1 Ben-Gurion University of the Negev, Beer-Sheva, Israel; 2 Ben-Gurion University of the Negev, Sde-Bogey, Israel
The bandgap of sheared MoS2 is
driving beam. Nontrivial recovery of inversion symmetry due to atomic transport is demonstrated.

EA-4.3 WED 15:15 The contribution has been withdrawn.

EA-4.4 WED 15:30 Wave-packet dynamic in a SU(2) non-Abelian gauge field
M. Hasan1,2, C. Madasu1,2, K. Rathod1,2, C.C. Kwong1,2, C. Miniatura1,2, P. Chevy3, and D. Vukusic1,2,3
1Nanyang Quantum Hub, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, 2Ecole Polytechnique, Palaiseau, France

EF-4.4 WED 15:15 Spatiotemporal Soliton Attractor in Multimode Graded-index Fibers
M. Ferrari1, M. Zitelli1, E. Mangini2, and S. Wabnitz1; 1Department of Information Engineering, Electronics and Telecommunications (DIET), Sapienza University of Rome, Rome, Italy; 2Department of Information Engineering (DII), University of Brescia, Brescia, Italy
Experimental evidence of spatiotemporal femtosecond soliton propagation over long spans of parabolic graded-index (GRIN) fibers, supported by numerical simulations, reveals that initial multimode soliton pulses naturally and irreversibly evolve into a singlemode soliton.

CA-7.4 WED 15:15 High-Peak Power Single-Cavity Dual-Comb Solid-State Laser with 100-fs Pulse Duration
J. Pupelis, B. Willenberg, C. Bauer, C. Phillips, and U. Keller; 1Department of Physics, Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland
We demonstrate a 230-kW peak power Yb:CaF2 dual-comb oscillator with 100-fs pulse duration from both combs simultaneously. The common-path polarization-multiplexed cavity delivers two combs at 80-MHz repetition rate with 208 Hz tunable repetition rate difference.

EB-7.4 WED 15:15 Hong-Ou-Mandel-Enabled Quantum Imaging
B. Ndagano, H. Deffene, 1,2,3 A. Lyons, and D. Faccio; School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom
Here we exploit the mapping between the number of coincidence events and the temporal delay between two photons in HOM interference to demonstrate full HOM imaging directly on a camera.

CA-7.5 WED 15:30 Dual-comb mode-locked laser simultaneously operating in two different dispersion regimes
M. Kowalczyk1, X. Zhang1,2,3, R. Anvari1,2,3, R. Walser4, and M. Kowalczyk1,2,3,4; 1Université de Minuit Hub, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore, 2Ecole Polytechnique, Palaiseau, France, 3Centre National de la Recherche Scientifique, France, 4Helmholtz-Zentrum Dresden-Rossendorf, Germany

EF-7.5 WED 15:30 Experimental Higher-Order Interference in Quantum Mechanics Induced by Optical Nonlinearities
P. Namdar1, I. Alonso Calafell1, A. Trenti2, M. Radonic3, B. Dakic1,3, P. Walther1, and L. Rozema1; 1Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Austria, 2Netherlands Organization for Scientific Research, Amsterdam, The Netherlands, 3Max Planck Institute of Quantum Optics, Garching, Germany

EB-3.5 WED 15:30 Anisotropic Terahertz Pump-Probe Response of Bilayer Graphene
A. Seidi1,2, R. Anvari3, M.M. Dignam4, P. Richter5, T. Seyller5, H. Schneider5, M. Helmholtz-Zentrum Dresden-Rossendorf, Germany, 2Institute of Photonics and Quantum Sciences, University of the West of England, Bristol, United Kingdom, 3Institute of Iranian Physics and Applied Mathematics, Tehran, Iran, 4School of Electrical, Computer, and Energy Engineering, Arizona State University, Tempe, United States, 5Technische Universität Dresden, Germany

EJ-3.5 WED 15:30 Silent White Light: Intensity Noise Suppression in Superluminescent Diodes
K.N. Hansmann, W. Eßåßer, and R. Walser; Technische Universität Darmstadt, Institut für Angewandte Physik, Darmstadt, Germany
Temperature dependent suppression of intensity fluctuations in a pre-existing dielectric structure such that it confines light following a desired intensity distribution. The local index tuning required leaves the initial and the modified structure uni-directionally indistinguishable.
We report an nonlinear-crystal-based transient detection imaging system with off-axis digital holographic Fourier filtering for complex-field retrieval of a dynamic scene while suppressing stationary background and remarkable ability of to detect phase-sign changes.

We demonstrate the formation of an optical drill by superposition of two higher order Bessel beams of different helicities. We dynamically form and mix the Bessel beams by application of a programmable Spatial Light Modulator.

We demonstrate the fabrication of arrays of submicrometer-diameter channels by laser ablation (pitch=1.5 μm, depth=5 μm). Influence of crosstalk between channels on the laser writing process is discussed.

We demonstrate the fabrication of an optical drill on Silicon photonic integrated circuits.

We demonstrate the formation of an optical drill by superposition of two higher order Bessel beams of different helicities. We dynamically form and mix the Bessel beams by application of a programmable Spatial Light Modulator.

We describe Spontaneous Parametric Downconversion in dielectric nanoresonators based on their quasinormal modes. By revealing the governing modal interactions, our approach provides a capable tool for designing nanoscale photon-pair sources with tailored emission properties.
We present wave-packet dynamics in a synthetic non-Abelian gauge field using an ultracold Fermionic gas. Here, anisotropic Zitterbewegung-like oscillations are observed in two-dimensional plane. Applications to quantum information and atomtronics are discussed.

Polytechnique, Palaiseau, France; 1 Institute of Physical Chemistry Pol¬-ish Academy of Sciences, Wars¬ovia, Poland; 2 Université Côte d`Azur, Nice, France; 3 Università di Trento, Povo, Italy; 4 University of Adolfo Ibáñez, Santiago, Chile

We report the observation and the thermodynamic characterization of light condensation in multimo¬de fibers: below a critical value of the kinetic energy, the fundamental mode gets macroscopic populated, in agreement with the equilibrium theory.

Multi-core fibers: a novel platform for a robust and reconfigurable self-organisation of light
S. Jain, 1 K. Ji, 1 J. Sahu, 1 D. Richardson, 1 I. Fuimone, 2 S. Widman, 2 and 3 M. Guasoni 3

Optoelectronics Research Cen¬tre, University of Southampton, South¬ampton, United Kingdom; 2 Lo¬batoire Interdisciplinaire Carnot de Bourgogne, CNRS, University of Bourgogne-Fran¬chene-Comte, Dijon, France; 3 Department of Information Engineering, El¬ectronics and Telecommunications (DIET), Sapienza University, Rome, Italy

Multicores fibers offer many degrees of freedom with respect to the single-core counterpart. This paves the way to a plethora of unexplored types of self-organization disclosing novel opportunities of high-power lasers and optical communications.


case study of Crystal Materials, Shandong University, Jinan, China; 1 Center of Nanoelectronics, School of Micro¬electronics, Shandong University, Ji¬nan, China; 2 Max Born Institute for Nonlinear Optics and Ultrafast Spectro¬scopy, Berlin, Germany

We present a single-cavity dual-comb mode-locked oscillator based on intrinsic polarization-multiplexing in a birefringent Yb:CNGS gain medium. The laser simultaneously generates two pulse trains in a conservative (117 fs) and chirped (2.36 ps) soliton regimes.

Multi-GHz repetition rate, deep ultraviolet femtosecond source operating in the burst mode
H. Ye 1,2 L. Pontagier 1, C. Dzeu 1, 2, G. Santarelli 1, and E. Carmier 1, 2

Laboratoire Interdisciplinaire Carnot de Bourgogne, CNRS, University of Bourgogne-Franche-Comte, Dijon, France; 2 Laboratoire Photonique Numérique et Nanosciences (LP2N), Talence, France; 3 Azurlight Systems, Pessac, France; 3 Institut Universitaire de France (IUF), Paris, France

We present a multi-GHz repetition rate, femtosecond deep UV source in the burst mode based on FHG of an EO comb, promising for the application of driving multi-bunch X-band photo-injectors.

Two-photon statistics and hybrid entanglement with a semiconductor chip
E. Baboux 1, S. Francescomi 1, A. Raymond 1, N. Fabre 1, A. Lemaître 1, P. Milman 1, M. A. Amanti 1, and S. Ducci 1

1 Université de Paris/CNRS - MPQ, Paris, France; 2 CNRS/Université Paris Saclay - CN2, Palaiseau, France

We employ SPDC in an AlGaAs chip to engineer the wavefunction and exchange statistics of photon pairs directly at the generation stage. We simulate fermions, anyons, and generate hybrid frequency-polarization entangled states for applications in quantum information.

Plasmonic graphene nanoribbons: a platform for nonlinear optics
A. Rodriguez 1, J. Garcia de Abajo 1,2, and J. Cox 1,2
1 ICFO - The Institute of Photonic Sciences, Castelldefels, Spain; 1 ICREA - Institució Catalana de Recerca i Estudis Avançats, Passeig Lluïs Companys 23, 08010 Barcelona, Spain; 2 Center for Nano Optics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark; 3 Danish Institute for Advanced Study, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark

We excite propagating plasmons in 1-D graphene nanoribbons and study them through rigorous quantum-mechanical simulations that account for nonlocal, quantum finite-size, and edge-termination effects in both linear and nonlinear optical response.

Optical waveguides based upon a gauge field
A. Alberucci 1, C.P. Jisha 1, and S. Nolte 1,2
1 Friedrich-Schiller University Jena, Jena, Germany; 2 Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany

We discuss light waveguiding due to a synthetic gauge field. Our proposal relies on longitudinal periodic structures, where the gauge field corresponds to a point-wise shift of the longitudinal index modula¬tion.
CC-P.1 WED
Deterministic spatiotemporal focusing of terahertz waves through scattering media
V. Kumar, V. Cicconi, A. Pasquazi, J. Gongora, and M. Pecini; University of Sussessi, Palermo, Italy
We theoretically demonstrate deterministic spatiotemporal focusing of THz waves following a direct measurement of the transfer matrix of the scattering medium. Our approach combines the advantages offered by field-sensitive detection with the nonlinear wavefront shaping of THz waves.

CC-P.2 WED
Low Noise Terahertz Photodetectors in the 0.6-2.8 THz Range based on Quantum Dot Single Electron Transistors
M. Asgari¹, L. Viti², D. Capogna², V. Zanetti¹, L. Sorba³, and M. Serena Vitiello¹; 1 CNR Nano-Institute and Scuola Normale Superiore, Pisa, Italy; 2 Laboratoire Charles Coulomb, Campus du Trioulet, Université Montpellier, Montpellier, France
In this work, we describe that quantum dot single electron transistors based on InAs/InAs0.30P0.7 heterostructures can be used both as transducers and planar on-chip nanoantennas, have as highly sensitive quantum detector at 0.6-2.8 THz range.

CC-P.3 WED
A Broadband Suspended Hollow Vivaldi Antenna for THz Quantum Cascade Lasers
U. Senica, M. Beck, J. Faist, and G. Scalari; ETH Zurich, Zurich, Switzerland
We present a broadband (1.5-4.5) THz suspended hollow Vivaldi antenna which is matched to the broad THz range of quantum cascade lasers.

CC-P.4 WED
Towards efficient broadband difference frequency mixing and terahertz generation in metallic nanostructures
I. Babushkin¹, A. Demircan¹, U. Morgner¹, J. Herrmann², and A. Husakou³; 1 Institute of Quantum Optics, Leibniz University, Welfengarten 1, 30167, Hannover, Germany; 2 Max Born Institute, Max Born Str. 2a, 12489, Berlin, Germany
We show that resonances, resulting from the confinement of electrons in metallic nanostructures lead to strong nonlinearities at low frequencies. They can be used for effective low-harmonic (for instance THz or FIR) generation.

CC-P.5 WED
Comparative Study on efficient THz Generation in the organic Crystal DAST driven by mid-IR Pulses
C. Goller², R. Jutla³, M. Shalaby³, C. Brodeur³, I. Aastrupska⁴, A. Baltuska⁴, and A. Pugzlys⁴; 1 TU Wien, Photonics Institute, Vienna, Austria; 2 Swiss Terahertz Research-Zurich, Zurich, Switzerland; 3 Key Lab of Terahertz Optoelectronics, Beijing, China; 4 Center for Physical Sciences & Technology, Vilnius, Lithuania
We report on unprecedentedly high THz generation efficiencies approaching 6% by optical rectification of 2 micrometer pulses in the organic crystal DAST, and investigate an underlying interplay between the wavelength and intensity of the driving pulses.

CC-P.6 WED
Lowterahertz frequency reflectometry is a promising technique for human cornea sensing. In particular, two waveguide bands (WR 5.1 and WR 2.2) are compared in terms of sensitivity to corneal water content and thickness variations.

CC-P.9 WED
High-quality 3D printed THz waveguides with optimized processing parameters for COC films
M. Emauropa, J. Graf, E. Hack, and P. Zolliker; Empa, Dübendorf, Switzerland
We present the 3D printing of high-quality THz waveguides while optimizing the 3D printing parameters of cyclic olefin copolymer (Topas).

CC-P.10 WED
The Role of Gas Dynamics on Laser Filamentation THz Sources Operating at High Repetition Rates
C. Lana¹,², A. D. Koulouklidis¹, C. Daskalakis¹, V. Y. Fedorov³,⁴, and S. Tzortzakis¹,²,³; 1 Institute of Electronic Structure and Laser (IESL), Heraklion, Greece; 2 Department of Materials Science and Technology, University of Crete, Heraklion, Greece; 3 Texas A&M University at Qatar, Doha, Qatar; 4 P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia
We report on the impact of laser pulse repetition rate on two-color filamentation based terahertz sources. A 50% decrease on the terahertz energy is observed when the repetition rate increases from 0.6 to 6 kHz.

CC-P.11 WED
Experimental exploration of longitudinal modes in spherical shells at 220 GHz – 330 GHz: applications to corneal sensing
F. Zarrinkhat¹, L. Viti², J. Lamberg², M. Baggio³, A. Tamminen³, J. Alu-Laurina⁴, E.E.M. Khaled², A. Manes Rius³, J. Roman Robert³, and Z. Taylor³; 1 CommSensLab, Technical University of Catalonia/UPC, Barcelona, Spain; 2 Department of Electronics and Nanotechnology, Aalto University, MilliLab, Espoo, Finland; 3 Department of Electrical Engineering, Assit Universit, Assiat, Egypt; 4 High Institute of Engineering and Technology, Sohag, Egypt
Agreement between the reflectivity of a spherical shell and equivalent planar structure is demonstrated at 220-330 GHz. The Gaussian-beam illumination on spherical surfaces results in a non-trivial alignment to achieve broadband THz sensing of corneal tissue.
Two-dimensional spectral shearing interferometry designed for mode-locked Cr:ZnS lasers

T. Kogel1,2, D. Okazaki1, K. Arai1, and S. Ashihara1; 1Institute of Industrial Science, University of Tokyo, Tokyo, Japan; 2Institute of Experimental Physics, Graz University of Technology, Graz, Austria

We present Cr:ZnS laser pulse characterization by two-dimensional spectral shearing interferometry. It enables the direct spectral phase measurement of mid-infrared pulses with energies as low as 2 nJ.

Generation of optical vortices with diverse topological charge via angular momentum transfer

I. Lopez-Quintas1, W. Holgado1, R. Dreviskas2, P. Kazastryk2, I. J. Sola1, and B. Alonso1; 1Grupo de Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, University of Salamanca, 37008, Salamanca, Spain; 2Optoelectronics Research Centre, University of Southampton, SO17 IBJ, Southampton, United Kingdom

We propose an in-line method to produce collinear optical vortices with different topological charges based on the interaction between radially or azimuthally varying linear polarization fields with the spin and orbital angular momenta of light.

Self-started figure-8 mode-locked fiber laser for space borne optical frequency comb

Y. Takeuchi, R. Saito, S. Endo, T. Kurihara, and M. Musha, Institute for Laser Science, Univ. of Electrocommunications, Chofu, Japan

We have developed an all-PM-fibervegetable laser for optical-based high-precision microwave generation in space. Our mode-locked laser has obtained the optical spectrum of 45.1 nm and observed self-starting of mode-locking without active trigger.

Towards 1 J-level multipass spectral broadening

V. Hariot1, K. Frutsch1, G. Figueira1, and O. Pronin1; 1Helmut-Schmidt-Universität, Hamburg, Germany

We propose a novel multi-pass spectral broadening concept based on a concave-convex arrangement with scaling potential up to 1 J-energy and TW peak-power. In a proof-of-principle experiment, efficient and homogeneous compression of pulses is achieved.

Neodymium-doped polarization maintaining all-fiber laser with dissipative soliton resonance mode-locking at 905 nm

A. A. Mkhitarian1, V. Gladash1, M. Melikumov2, A. Khegai2, K. Sitnit1, P. G. Lagoudakis1, and A. G. Naushadin1; 1Skolkovo Institute of Science and Technology, Moscow, Russia; 2Helmholtz Institute of Applied and0

Dynamics of Optical Frequency Combs

M. A. Vorobyev1, V. Thiel2, S. De3, B. Argenz1, F. Bretenaker1, and N. Treps1; 1Laboratoire Kastler Brossel, Sorbonne Université, ENS-Université PSL, CNRS, Collège de France, Paris, France; 2Department of Physics and Orange Center for Optical, Molecular, and Quantum Sciences, University of Oregon, Eugene, USA; 3Integrated Quantum Optics Group, Applied Physics, Paderborn University, Paderborn, Germany; 4Université Paris-Saclay, CNRS, ENS Paris-Saclay, CentreSudPôle, LuM, Gif-sur-Yvette, France

A tunable optical parametric amplifier pumped by thin-disk laser pulses provides a maximum pulse energy of ~200 pJ, at 700-900 nm and a pulse duration of ~1 ps for fs-CARS system in high pressure gases.

Harnessing Amplitude and Phase Spectral Correlations to Recover the Dynamics of Optical Frequency Combs

M. A. Vorobyev1, V. Thiel2, S. De3, B. Argenz1, F. Bretenaker1, and N. Treps1; 1Laboratoire Kastler Brossel, Sorbonne Université, ENS-Université PSL, CNRS, Collège de France, Paris, France; 2Department of Physics and Orange Center for Optical, Molecular, and Quantum Sciences, University of Oregon, Eugene, USA; 3Integrated Quantum Optics Group, Applied Physics, Paderborn University, Paderborn, Germany; 4Université Paris-Saclay, CNRS, ENS Paris-Saclay, CentreSudPôle, LuM, Gif-sur-Yvette, France

We demonstrate the generation of 1-mJ, 31-fs pulses in a gas-filled multipass cell.

硅基光纤光频梳

Kazansky1,2, A. B. Wahid, V. Hariton, K. Fritsch, and O. Pronin; 1ICFO-Institut de Ciencies Fotoniques, Castelldefels, Barcelona, Spain; 2ICREA, Institut de Física Aplicada, Universitat de Barcelona, 08028, Barcelona, Spain

We demonstrate all-fiber pulse compression of 60 ps to 60 fs using a silicon-based optical frequency comb designed for mode-locked Cr:ZnS lasers.
poster presentation of a research work by Helmut-Schmidt-Universität E. Husakou, M. Khalili Kelaki, J. Gabriel Meyer, and O. Pronin. The research focuses on Raman Spectroscopy of gallium phosphide and its analysis and assessment in relation to Tube PE-P.2 WED. The authors discussed the effects of geometrical imperfections in Inhibited Coupling Tube Lattice Fibers with Polarization Raman spectra of highly-strained gallium phosphide. They also compared the effects of geometrical imperfections in inhibited coupling tube lattice fibers with polarization Raman spectra of highly-strained gallium phosphide. The research also included an analysis of the effects of geometrical imperfections in inhibited coupling tube lattice fibers with polarization Raman spectra of highly-strained gallium phosphide. The authors compared the effects of geometrical imperfections in inhibited coupling tube lattice fibers with polarization Raman spectra of highly-strained gallium phosphide. They also compared the effects of geometrical imperfections in inhibited coupling tube lattice fibers with polarization Raman spectra of highly-strained gallium phosphide.
CE-P.12 WED

Two-photon Absorption in $\text{Ca}_3(\text{VO}_4)_2$ Crystal
D.S. Chunaev, E.E. Dunaeva, S.B. Kravtsov, I.S. Voronina, and P.G. Zverev; Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia

Two-photon absorption coefficient in calcium orthovanadate under irradiation with trains of 25-ps laser pulses at the wavelength of 523.5 nm was measured to be 0.25 cm/GW.

CE-P.13 WED

Insight into the performance of mode-locking with heating SWNT composites
C. In and X. Liu; State Key Laboratory of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou, China

For the first time, we have studied on the performance of SWNT-based SA composites under different temperatures which is expected to provide a reference to research on high thermal endurance property SA in fiber lasers.

CE-P.14 WED

Large-scale, high-resolution, wide-gamut structural coloration of flexible substrate
N. Li and A. Fratalocchi; King Abdullah University of Science and Technology, Thuwal, Saudi Arabia

We propose a low-cost structural color technique based on self-assembly that exploits the interaction of scattering and resonances of complex hierarchical nanostructures. It realizes full color gamut, 127000 DPI resolution, large-scale printing (4-inch) simultaneously.

NOTE

THz-Pump/SC-Probe Spectroscopy and the Non-resonant Dynamic Stark Effect of Molecules
B.J. Kang¹, E.J. Rohwer¹, M. Cascella², S.-X. Liu³, R.J. Stanley¹, and T. Feurer¹; ¹Institute of Applied Physics, University of Bern, 3012 Bern, Switzerland; ²Department of Chemistry and Hylleraas Centre for Quantum Molecular Sciences, University of Oslo, N-0315 Oslo, Norway; ³Department of Chemistry and Biochemistry, University of Bern, 3012 Bern, Switzerland; ¹Department of Chemistry, Temple University, Philadelphia, Pennsylvania 19122, USA

We demonstrate THz Stark spectroscopy of solvated molecules using intense single-cycle THz pulses, thereby overcoming limitations of traditional Stark spectroscopy: No sample freezing, peak fields beyond the dielectric breakdown in conventional experiments and arbitrary polarization.
EC-P.1 WED

First observation of a fractal topological insulator
T. Biesenthal, L. Macewsky2, Y. Yang3, M. Kremer1, M. Heinrich1, M. Segev1, and A. Szameit1, 2Institut für Physik, Universität Rostock, 18059 Rostock, Germany; 3Physics Department and Solid State Institute, Technion- Israel Institute of Technology, Haifa 32000, Israel

We experimentally demonstrate the first fractal topological insulator. We show the existence of topological protected edge states despite the absence of any bulk: every site in our structure is on an edge, external or internal.

EC-P.2 WED

The contribution has been withdrawn.

EC-P.3 WED

The contribution has been withdrawn.

EC-P.4 WED

The contribution has been withdrawn.

EC-P.5 WED

Measurement of the Band Dispersions of a Floquet-bloch Lattice Realised with Coupled Fiber Rigags
C. Lechevalier, C. Evain, P. Suret, F. Copie, A. Amo, and S. Randoü; Université de Lille, CNRS, UMR 8523-PhLAM-Physique des Lasers Atomes et Molecules, F-5900 Lille, France

We report the single-shot measurement of the dispersive band structure in a Floquet-Bloch photonic lattice realized with a double fibre loop system. This opens the door to the full experimental characterization of Floquet-lattice systems.

EC-P.6 WED

Two-Dimensional PT-Symmetric Floquet Topological Insulator
A. Fritzsch1,2, M. Kremer2, L. Macewsky2, Y. Joglekar2, M. Heinrich2, R. Thomale3, and A. Szameit2, 2Institute for Theoretical Physics and Astrophysics, Julius-Maximilians University of Würzburg, Würzburg, Germany; 3Department of Physics, Indiana University-Purdue University Indianapolis (IUPUI), Indianapolis, USA

We present a theoretical proposal for a two-dimensional PT-symmetric topological insulator (TI) that supports two counter-propagating topologically protected boundary states and discuss ongoing experiments to confirm the theoretical predictions.

EC-P.7 WED

Topological confinement of light in photonic crystal nanocavities
R. Barczyk1, N. Parappurath1, S. Arora1, T. Bauer2, F. Alpeggiani2, K. Kuipers2, and E. Verhagen2, 1Center for Nanophotonics, AMOLF, Amsterdam, Netherlands; 2Delft University of Technology, Delft, Netherlands

We employ far-field Fourier spectroscopy to characterize the confinement of light at telecom frequencies in topological photonic crystal ring cavities and cavity-waveguide couplers. We explore the hallmarks of topological protection, quantifying dispersion, loss, and coupling.

EC-P.8 WED

Direct visualization of on-chip THz topological states
J. Wang, R. Wang1, X. Zhang2, W. Wu1, D. Song1, J. Xu2, and Z. Chen1, 1The MOE Key Laboratory of Weak-Light Nonlinear Photonics, TEDA Institute of Applied Physics and School of Physics, Nankai University, Tianjin, China; 2Innovation Laboratory of Terahertz Biophysics, National Innovation Institute of Defense Technology, Beijing, China

We demonstrate nonlinear generation of terahertz topological edge states in an SSH lattice engineered on a LiNbO3 chip, manifested directly in the bandgap from the dispersion relation and further verified by the characteristic electric field distribution.

EC-P.9 WED

A Topological Phase Transition in Random Photonic Multilayer Structures
D. Whittaker, Department of Physics and Astronomy, University of Sheffield, Sheffield, United Kingdom

A mapping between photonic multilayers and chiral light-hunting models shows that a topological phase transition can be observed by measuring transmission through randomly layered structures. This is verified experimentally using analogous transmission line structures.

EC-P.10 WED

Direct quantification of robustness in topologically-protected photonic edge states at telecom wavelengths
S. Arora1, T. Bauer2, R. Barczyk2, E. Verhagen2, and L. Kuipers2, 2Delft University of Technology, Delft, Netherlands; 3AMOLF, Amsterdam, Netherlands

We experimentally quantify the back-scattering contribution of the edge states in topological photonic crystals emulating the quantum valley Hall effect. Measuring the vectorial near field reveals two orders of magnitude higher robustness compared to a conventional waveguide.

EC-P.11 WED

Cubic 3D Chern photonic insulators with orientable large Chern vectors
C. Devesco1, M. García Diez2, I. Robredo Magro3, M. Blanco de Paz1, B. Bradford1, J. Luis Mate2, M. García Vergnügy1,3, and A. García Etxari1,1, Donostia International Physics Center (DIPC), Donostia-San Sebastian, Spain; 2University of the Basque Country (UPV-EHU), Bilbao, Spain; 3Basque Foundation for Science (IKEB- BASQUE), Bilbao, Spain

We propose a general strategy to design 3D topological insulating photonic crystals where Chern vectors of any magnitude, sign or direction can be implemented at will, possibly in a weakly magnetic environment.

EC-P.12 WED

Quantifying the robustness of light transport in topological photonic waveguides
G. Arregui1, J. Gomis-Bresco1, C.M. Sotomayor-Torres1,2, and P.D. García1, 1ICN2 - Instituto Catalán de Nanociencia y Nanotecnología, Bellaterra, Spain; 2ICREA - Institució Catalana de Recerca e Estudis Avancats, Barcelona, Spain

Topological photonic crystals has triggered so much attention due to its potential to engineer topological edge states robust against imperfection. Here, we analyze and quantify this claimed protection of topological transport compared to standard photonic transport.

EC-P.13 WED

Free space topological surface states at the surface of uncorrupted finite gyrotrropic photonic crystals
A. Tasolamprou1, M. Kafesaki1, C. Soukoulis1, E. Economou1, and T. Koschny1, 1Institute of Electronic Structure and Laser, Foundation for Research and Technology Hellas, N. Plastira 100, Heraklion, Greece; 2Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames, Iowa 50011, USA, Ames, USA

We present a photonic crystal that sustains topological surface states at the free space interface. Band structure and direct scattering simulations demonstrate the topological surface mode unidirectionality and immunity to defects and back-scattering.

EC-P.14 WED

Second harmonic generation of spatiotemporal optical vortices (STOVs) and conservation of orbital angular momentum
S. Zayedpour Anaraki1, W.S. Hancock, and H.M. Milchberg1,2, 1Department of Physics and Astronomy, University of Maryland, College Park, USA; 2Praunhofer Institute for Industrial Mathematics ITWM, Kaiserslautern, Germany

We demonstrate conservation of orbital angular momentum of STOVs under SHG.

EC-P.15 WED

Topological nanophotonics with time-reversal-invariant plasmonic lattices
P.A. Huidobro, Instituto de Telecomunicaciones, IST-University of Lisbon, Lisbon, Portugal

Plasmonic lattices allow to realize time-reversal invariant topological phases for subwavelength-confined light. Retarded and radiative interactions are ubiquitous in nanophotonics, and their effect in the topological properties of edge and corner modes will be discussed.

EC-P.16 WED

Cavityless Lasing in Planar Topological Structure

We report a one-dimensional (1D) planar topological laser based on a topological interface state formed by two 1D photonic crystals. The crystals have different band topology leading to formation of an interface state.

EC-P.17 WED

Investigation of a negative next-nearest-neighbor-coupling in evanescently coupled dielectric waveguides
J. Schule1, C. Jörg2,3, and G. von Freymann1,1, 1Physics Department and Research Center OPTIMAS, TU Kaiserslautern, Kaiserslautern, Germany; 2Department of Physics, The Pennsylvania State University, Pennsylvania, USA; 3Praunhofer Institute for Industrial Mathematics ITWM, Kaiserslautern, Germany

We experimentally demonstrate a negative NNN-coupling constant, arising naturally in a dielectric waveguide structure, fabricated by direct-laser-writing, and show how we can tune between positive and negative ratios for NN and NNN coupling.

EC-P.18 WED

Bound States in the Continuum and Unidirectional Guided Resonances in Anisotropic Structures with Multiple Radiation Channels
S. Mahlein1,2, J. Gomis-Bresco3, D. Artigas1,2, and L. Torner1,2, 1ICFO-Institut de Ciencies Fotoniques, The Barcelona Institute of Science and Technology, Castelldefels, Spain; 2Department of Signal Theory and Communications, Universitat Politècnica de Catalunya, Barcelona, Spain

Anisotropic guiding structures with two distinct radiation channels support solitary bound states in the continuum. This system can also be tuned to radiate in only one radiation channel, forming unidirectional guided resonances.
Rich Broadband Chiral Behavior in Low-cost Plasmonic Nanostructures

R. Bitarafan, A. K. Iliev, S. G. Altug, and O. Pastoriza-Santos

1. Institute of Photonics Technology, University of Hertfordshire, Hatfield, UK
2. School of Physical Sciences, University of Central Lancashire, Preston, UK
3. Laboratoire de Photonique et de Nanostructures, CEA, CNRS, UMR 8523, Université Paris Saclay, Gif-sur-Yvette, France
4. University of Southampton, Southampton, UK

We report the design and fabrication of large area plasmonic chiral antennas with an unprecedented chiral gain of 100x. The chiral antennas are fabricated using a low-cost, low-temperature, and scalable process based on the self-assembly of amphiphilic nanospheres. The antennas show a broad range of chiral gain, which is tunable by the incidence angle and polarization of the incident light. The results demonstrate the potential of these chiral antennas for applications in chiral sensing and chiral imaging.

Bismuth-based gap-plasmon metasurfaces for visible photons with volatile tuning potential

C. R. de Galarreta, E. Nieto-Pinero, E. García-Cabrera, and R. Boyero-García

1. University of Cantabria, Santander, Spain
2. University of Valladolid, Valladolid, Spain
3. University of Buenos Aires, Buenos Aires, Argentina
4. University of New Mexico, Albuquerque, USA

We present a new type of plasmonic metasurface that can achieve high-contrast chiral plasmonic responses with volatile tuning potential. The metasurfaces are based on bismuth-based gap-plasmon structures, which exhibit high chiral activity and tunable plasmonic properties. The results demonstrate the potential of these metasurfaces for applications in plasmonic sensing and chiral imaging.
### ROOM 2

**EH-P.9 WED**  
Using cryogenic temperatures and crystalline gold platelets to dramatically reduce the optical losses observed in the coupling between a metallic film and an individual colloidal CdSe/CdS nanocrystals  
A. Coste¹, L. Moreaud², G. Colas des Francs³, S. Basí³, X. Quelin⁴, E. Dujardin⁴, and J.-P. Hermier¹; ¹Université Paris-Saclay, USVQ, CNRS, GEMaC, Ver-sailles, France; ²CEMES/CNRS UPR 8011, Toulouse, France; ³Laboratoire Interdisciplinaire Carnot de Bour-gogne (ICB), UMR 6303 CNRS, Université Bourgogne Franche-Comté, Dijon, France

In this paper, we show the strong decrease of optical losses for the fluorescence of individual colloidal nanocrystals by a crystalline gold film and operating at 4K.

### ROOM 3

**13:30 – 14:30**  
**EI-P.1 WED**  
Dark Exciton Formation and Relaxation Dynamics in Monolayer WSe₂  
Y. Gao¹, E. Guo¹, M. Nomura², ³, and M. Amara¹; ¹University of Tokyo, Tokyo, Japan; ²Department of Materials Engineering, Tongji University, Shanghai, China  
We investigated dark exciton formation and relaxation dynamics in hBN-encapsulated high-quality monolayer WSe₂ by time-resolved photoluminescence spectroscopy. Finite rise time of dark exciton time profile reflects the thermal decay process of the hot dark excitons.

**EI-P.2 WED**  
The contribution has been withdrawn.

**EI-P.3 WED**  
Excitons in Lead-Halide Perovskite Nanocrystals from Tight-Binding GW/BSE Approach  
G. Biffi¹, ², Y. Cho³, K. Kruskak³, and T.C. Berkelloch¹, ²; ¹Istituto Italiano di Tecnologia, Genova, Italy; ²Università degli studi di Genova, Genova, Italy; ³Columbia University, New York, USA; ²Flatiron Institute, New York, USA  
Test showing the dependence of the excitonic energy on the number of transitions per unit cell included in the Bethe-Salpeter matrix.

**EI-P.4 WED**  
Macroscopic Signatures of the Non-Perturbative Response of Single Layer Graphene to Intense Laser Fields  
R. Boyero-Garcia, O. Zurrón-Cifuentes, A. García-Cabrera, C. Hernández-García, and L. Plaja; Grupo de Investigación en Aplicaciones de Láser y Fotónica, departamento de Física Aplicada, Universidad de Salamanca, Salamanca, Spain  
We explore the electronic dynamics of graphene subjected to an intense laser through high-order harmonic generation. Our results reveal that the macroscopic emission presents an unequivocal signature of the non-perturbative response of graphene.

**EI-P.5 WED**  
Epitaxial growth of CH₃NH₂PbBr₃ thin films on CH₂NH₂PbBr₃ single crystal substrates by vapor phase deposition  
Z. Liu¹, T. Matsushita², M. Sotome³, ², and T. Kondo¹, ²; ¹Department of Materials Engineering, The University of Tokyo, Tokyo, Japan; ²Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan  
This work explores the numerical conception and the fabrication of devices combining MoS₂ monolayer and photonic structures. The reported hybrid device shows an optimal optical response to study the photoluminescence of the integrated MoS₂ monolayer.

**EI-P.6 WED**  
Optimum absorption of MoS₂ monolayer using Cavity Resonator Integrated Filtering  
J.-R. Dory¹, ², O. Gaathui-Lafaye³, S. Calvez³, and A. Milayah¹, ²; ¹CEMES-CNRS, Université de Toulouse, Toulouse, France; ²LAAS-CNRS, Université de Toulouse, Toulouse, France  
This work has explored the numerical conception and the fabrication of devices combining MoS₂ monolayer and photonic structures. The reported hybrid device shows an optimal optical response to study the photoluminescence of the integrated MoS₂ monolayer.

**EI-P.7 WED**  
The contribution has been withdrawn.

### ROOM 4

**13:30 – 14:30**  
**JSI-P.1 WED**  
Generalized law of heat conduction including the intrinsic coherence of thermal phonons  
Z. Zhang¹, Y. Guo¹, M. Nomura², J. Chen², and S. Voh²; ¹The University of Tokyo, Tokyo, Japan; ²Tongji University, Shanghai, China  
We propose a formalism supported by theoretical arguments and direct atomic simulations, which takes into account both the conventional phonon gas model and the internal wave nature of thermal phonons.

**JSI-P.2 WED**  
Radiative sky cooling of silicon solar cells: investigation of photonic pathways through coupled optical-electrical-thermal modelling  
J. Dumoulin¹, E. Drouard², and M. Amara³; ¹INL UMR270, Univ Lyon, INSA-Lyon, CNRS, Villeurbanne, France; ²INL UMR270, Univ Lyon, École Centrale de Lyon, Écully, France  
By partially limiting the halide ion inter-diffusion, we have achieved the epitaxial growth of I-rich perovskite thin films on the CH₃NH₂PbBr₃ single crystal substrates using vapor phase deposition.

**JSI-P.3 WED**  
Designing Mesoporous Acoustic Cavities for Opto-Phononic Sensing in the Gigahertz Range  
E.B. Cardoso de Oliveira¹, M. Esmann², N.L. Abdala³, M.C. Fuertes³, P.C. Angelomé³, O. Ortiz³, A. Bruchhausen³, H. Pastoriza³, B. Perrin³, G.L.A.A. Soler-Ilundain⁴, and N.D. Lanzlottti-Kimura¹; ¹Centre National de Recherche Scientifique, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France; ²Instituto de Nanociencias – Universidad Nacional de San Martin CONICET, Buenos Aires, Argentina; ³Gerencia Química & Instituto de Nanociencia y Nanotecnología, Centro Atómico Constituyentes, CNEA-CONICET, Buenos Aires, Argentina; ⁴Centro Atómico Bariloche & Instituto de Nanociencia y Nanotecnología, CNEA-CONICET, Río Negro, Argentina; ²INSA-Lyon, CNRS, INRIT des Nanosciences de Paris, Paris, France  
Multilayered nanoacoustic resonators based on mesoporous oxide thin-films showing acoustic resonances in the 5-100 GHz range are presented, with experimental results and simulations. Finally, we propose new complex mesoporous systems with potential for nanoacoustic sensors.

**JSI-P.4 WED**  
Angular filtering for Brillouin spectroscopy in the 20-300 GHz range  
A. Rodríguez¹, P. Priya¹, P. Senellart¹, C. Gomez-Carbonell¹, A. Lemaître¹, M. Esmann², and N.D. Lanzlottti-Kimura; ¹Centre de nanosciences et de nanotechnologies, Palaiseau, France  
We present a versatile custom-built Brillouin spectroscopy setup to probe acoustic phonons in the 20 to 300 GHz range of tunable optophononic cavities with high spectral resolution at broadband acoustical and optical frequencies.

**JSI-P.5 WED**  
Engineering Low-Loss Silicon Quantum Photonics in the Mid-Infrared  
D.A. Sulway¹, ², L.M. Rosenfeld³, Y. Yonezu³, Q.M.B. Palmer³, ², P. Jiang³, T. Aoki³, J.G. Rarity³, and J.W. Silverstone³; ¹Quantum Engineering Centre for Doctoral Training, University of Bristol, Bristol, United Kingdom; ²Quantum Engineering Technology Labs, University of Bristol, Bristol, United Kingdom; ³Department of Applied Physics, Waseda University, Tokyo, Japan  
To achieve low-loss silicon quantum photonics, we demonstrate a two-photon-absorption reduced single-phonon source, and a high-performance fiber-to-chip coupler, both operating in the mid-infrared on the 228-236 nm silicon platform.
<table>
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<th>JSI-P.6 WED</th>
<th>Spike propagation in a nanolaser-based optoelectronic neuron</th>
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<td></td>
<td>I. Ortega-Piwonka$^{1,2}$, O. Piro$^1$, J. Figueiredo$^3$, B. Romeira$^4$, and J. Javaloyes$^{1,2}$; $^1$Departament de Física, Universitat de les Illes Balears, Palma de Mallorca, Spain; $^2$Institute of Applied Computing and Community Code (IAC-3), Palma de Mallorca, Spain; $^3$Centra-Ciências and Departamento de Física, Faculdade de Ciências, Universidade de Lisboa, Lisboa, Portugal; $^4$Ultrafast, Bio and Nanophotonics, International Iberian Nanotechnology Laboratory (INL), Braga, Portugal</td>
</tr>
</tbody>
</table>

An optoelectronic, neuromorphic circuit consisting of a resonant tunneling diode and a nanolaser is demonstrated as an excitable pulse generator. The optical pulses are quantitatively characterized. Next, two units are integrated to propagate pulses.
**Thursday – Orals**

**ROOM 1**

**8:30 – 10:00**


Chair: Roberto Li Voti, Sapienza Università di Roma, Rome, Italy

**JSI-3 THU 8:30**

**Towards Integrated Nanoacoustics: Fiber-integrated Microcavities for Efficient Generation of Coherent Acoustic Phonons in the 20 GHz Range**

O. Ortiz1, F. Pastier2, A. Rodriguez3, P. Priya1, L. Maïra1, G. Gomez Carbonell1, I. Sagnes3, A. Harouri3, P. Sennellart4, V. Gies2, M. Esmanat5, and D. Lanzillotti-Kimura5

1 Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies (C2N), Palaiseau, France; 2 Quandela SAS, Palaiseau, France.

We integrate opto-phononic resonators working at ~20 GHz to single-mode fibers lifting the need for focusing optics to excite and detect coherent acoustic phonons in a pump-probe scheme.

**CG-5: THU (Invited) 8:30**

**Attosecond Dual Nature of Core Excitons**

M. Lucchini1,2, S.A. Sato3,4, G.D. Lucarelli1,2, B. Moli1,2, G. Inzani2, R. Borrego-Varrillas5, F. Prassella6, L. Poletto2, H. Hübner2, U. De Giovannini8, A. Rubio14, and M. Nisoli1,2

1 Department of Physics, Politecnico di Milano, Milano, Italy; 2 Institute for Photonics and Nanotechnologies, IFN-CNR, Milano, Italy; 3 Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany; 4 Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan; 5 Institute for Photonics and Nanotechnologies, IFN-CNR, Padova, Italy

Ultrafast core-exciton dynamics was measured in MgF2 by attosecond transient-reflection spectroscopy. We found that the atomic nature of excitons dominates the few-femtosecond response, while their solid-state nature dictates the attosecond timing of the system.

**CG-5.1 THU (Invited) 8:30**

**CH-8: Spectroscopy at the Ultrafast Science**

Chair: Cord Arnold, Lund University, Sweden

**8:30 – 10:00**

**Attosecond Dual Nature of Core Excitons**

M. Lucchini1,2, S.A. Sato3,4, G.D. Lucarelli1,2, B. Moli1,2, G. Inzani2, R. Borrego-Varrillas5, F. Prassella6, L. Poletto2, H. Hübner2, U. De Giovannini8, A. Rubio14, and M. Nisoli1,2

1 Department of Physics, Politecnico di Milano, Milano, Italy; 2 Institute for Photonics and Nanotechnologies, IFN-CNR, Milano, Italy; 3 Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany; 4 Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan; 5 Institute for Photonics and Nanotechnologies, IFN-CNR, Padova, Italy

Ultrafast core-exciton dynamics was measured in MgF2 by attosecond transient-reflection spectroscopy. We found that the atomic nature of excitons dominates the few-femtosecond response, while their solid-state nature dictates the attosecond timing of the system.

**8:30 – 10:00**

**Mid-IR Laser Spectroscopy for Protein Analysis in Aqueous Solution**

B. Lendl, C.K. Akhgar, A. Dubrowska, S. Freitag, D.R. Herrmann, G. Ramer, and A. Schwaighofer; Institute of Chemical Technologies and Analytics, Technical University Wien, Vienna, Austria

Advanced sensing schemes for the analysis of proteins in aqueous solutions using broadly tunable mid-IR external-cavity quantum cascade lasers and their application in life sciences and downstream bio-process monitoring will be discussed.

**CH-8.1 THU (Invited) 8:30**

**CB-6: Integration on Silicon**

Chair: Sylvie Menezo, Scintil Photonics, Lyon, France

**8:30 – 10:00**

**Vortex Laser Using Vortex Output Coupler**

J.W. Geberbauer, W.R. Kerridge-Johns, and M.J. Damzen; Imperial College London, London, United Kingdom

We demonstrate record 31 W vortex (LG01) laser in CW and up to 500kHz Q-switching (21.1ns, 304µJ), using modified Sagnac interferometric output coupler. The vortex has 96% modal purity with switchable handedness for high-power applications.

**CA-8 THU 8:30**

**>30 W Vortex Laser Using Vortex Output Coupler**

J.W. Geberbauer, W.R. Kerridge-Johns, and M.J. Damzen; Imperial College London, London, United Kingdom

We demonstrate record 31 W vortex (LG01) laser in CW and up to 500kHz Q-switching (21.1ns, 304µJ), using modified Sagnac interferometric output coupler. The vortex has 96% modal purity with switchable handedness for high-power applications.

**CA-8.1 THU (Invited) 8:30**

**CM-4: Surface Engineering and Functionalisation**

Chair: Gert-Willem Romer, University of Twente, Twente, Netherlands

**8:30 – 10:00**

**Optical FIB: Far-fieldfabrication with real-nanoscale spatial resolution in any solid materials**

Z.-Z. Li1, L. Wang1, Q.-D. Chen1, and H.-B. Sun1,2; 1 Jilin University, Changchun, China; 2 Tsinghua University, Beijing, China

We report an optical far-field-fabricated near-field breakdown technology as is abbreviated as optical FIB. It in principle can be applied to any solid materials to reach 10-nm spatial resolution in femtosecond laser direct writing.

**CM-4.1 THU (Invited) 8:30**

**Optical FIB: Far-fieldfabrication with real-nanoscale spatial resolution in any solid materials**

Z.-Z. Li1, L. Wang1, Q.-D. Chen1, and H.-B. Sun1,2; 1 Jilin University, Changchun, China; 2 Tsinghua University, Beijing, China

We report an optical far-field-fabricated near-field breakdown technology as is abbreviated as optical FIB. It in principle can be applied to any solid materials to reach 10-nm spatial resolution in femtosecond laser direct writing.

**8:30 – 10:00**

**Thin-disk multi-pass amplifier delivering azimuthally polarized ultra-short pulses with an average power of 1.74 kW**

A. Loescher, C. Röcker, T. Graf, and M. Abdou Ahmed; Institut für Strahlwerkzeuge, University of Stuttgart, Pfaffenwaldring 43, 70569 Stuttgart, Germany

We present our latest achievements on the amplification of ultrafast beams with radial/azimuthal polarization using a thin-disk multipass amplifier. Up to 1.74 kW of average output power could be extracted at 300 kHz repetition rate.

**8:30 – 10:00**

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Multimode Silicon Photonics

D. Dai; Zhejiang University, Hangzhou, China

A review is given for multimode silicon photonics, including multimode silicon photonic devices for MDM systems, silicon photonics including higher-order modes, and high-performance photonic devices with the fundamental mode only in multimode waveguides.

ROOM 8

8:30 – 10:00

EE-2: HHG in Condensed Matter
Chair: Valentina Shumakova, University of Vienna, Austria

EE-2.1 THU 8:30
High-harmonic generation in monolayer WS2 under photo-carrier doping

• Kathe Naga1, K. Uehida1, S. Kasaba1, T. Endo1, Y. Miyata2, and K. Tanaka1,2,3,1 Department of Physics, Kyoto University, Sakyo-ku, Kyoto, Japan; 2 Department of Physics, Tokyo Metropolitan University, Hachioji, Tokyo, Japan; 3 Institute for Integrated Cell-Material Sciences, Kyoto University, Sakyo-ku, Kyoto, Japan

We experimentally confirmed the main high-harmonic generation mechanism in monolayer WS2 by using photo-carrier doping effect. The ratio of the interband to intraband contribution is suggested to switch around the absorption edge of the monolayer.

EE-2.2 THU 8:45
Low-Divergence, Soft X-Ray Harmonic Combs with Tunable Line Spacing from a Microcavity Resonator

• L. Rego1, N.J. Brooks2, Q.L.D. Nguyen3, J. San Roman1, I. Bimble4, L. Plaza1, H.C. Kapteyn5, M.M. Murmann6, and C. Hernández-Garcia7,1 Universidad de Salamanca, Salamanca, Spain; 2 University of Colorado, Boulder, USA

Necklace-structured high-harmonic generation is theoretically and experimentally implemented to produce high-frequency harmonic combs with tunable frequency

EE-5.1 THU 8:30
Bidirectional initiation of dissipative solitons in photonic molecules

• O.B. Helgason1, Z. Ye1, J. Schröder2, and V. Torres-Company3, Chalmers University of Technology, Göteborg, Sweden

We demonstrate the initiation of dissipative solitons in linearly coupled microcavities using a continuous wave laser by tuning into resonance from either the blue side or the red side.

EE-5.2 THU 8:45
A Kerr Oscillator based on Counterpropagating Light in a Microcavity Resonator

• M.T.M. Woodley1,2,3,1 L. Hill1,4, L. Del Bino1,2,5, G.-L. Oppé5, and P. DelHaye5,6,1 National Physical Laboratory, Teddington, United Kingdom; 2 SUPA and Department of Physics, Heriot Watt University, Edinburgh, United Kingdom; 3 Department of Physics, Blackett Laboratory, Imperial College London, London, United Kingdom; 4 SUPA and Department of Physics, University of Strathclyde, Glasgow, United Kingdom; 5 Max Planck Institute for the Science of Light, Erlangen, Germany; 6 Department of Physics, Imperial College London, London, United Kingdom

Due to unique dielectric functions, the optical response of materials varies. We demonstrate that the disorder dramatically reduces the material dependence in optical response, produce identical colour response, produce identical colour

ROOM 9

8:30 – 10:00

EF-4: Plasmonics for Enhanced Light-Matter Interaction
Chair: Andrei Lavrinenko, Technical University of Denmark, Copenhagen, Denmark

EF-4.1 THU 8:30
Material-Insensitive Optical Response From Disordered Plasmonic Nanostructures

• C. Liu1, P. Ma2, T. Niu1, Y. Qin4, F. Song4, M. Han1, R. Palmer5, S. Zhang5, and S. Maiti1,2,6,1 Chair in Hybrid Nanosystems, Nano institute Munich, Faculty of Physics, Ludwig Maximilians University of Munich, Munich, Germany; 2 School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom; 3 College of Engineering, Bay Campus, Swansea University, Swansea, United Kingdom; 4 College of Engineering and Applied Sciences, Nanjing University, 210093 Nanjing, China, Nanjing, China; 5 Department of Physics, University of Hong Kong, Hong Kong, China; 6 Department of Electrical & Electronic Engineering, University of Hong Kong, Hong Kong, China, Hong Kong, China; 7 Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom, London, United Kingdom

We demonstrate the initiation of dissipative solitons in linearly coupled microcavities using a continuous wave laser by tuning into resonance from either the blue side or the red side.

EF-4.2 THU 8:45
Plasmon-Induced Trap State Emission Excited by Two-Photon Absorption

• G. Ojamets; Cavendish Laboratory, Department of Physics, University of Cambridge, Thompson Avenue, University of Cambridge, Cambridge, United Kingdom

Plasmonic trap state emission is excited by two-photon absorption from the high-harmonic generation

ROOM 10

8:30 – 10:00

Chair: Andrei Lavrinenko, Technical University of Denmark, Copenhagen, Denmark

EH-4.1 THU 8:30
Material-Insensitive Optical Response From Disordered Plasmonic Nanostructures

• C. Liu1, P. Ma2, T. Niu1, Y. Qin4, F. Song4, M. Han1, R. Palmer5, S. Zhang5, and S. Maiti1,2,6,1 Chair in Hybrid Nanosystems, Nano institute Munich, Faculty of Physics, Ludwig Maximilians University of Munich, Munich, Germany; 2 School of Physics and Astronomy, University of Birmingham, Birmingham, United Kingdom; 3 College of Engineering, Bay Campus, Swansea University, Swansea, United Kingdom; 4 College of Engineering and Applied Sciences, Nanjing University, 210093 Nanjing, China, Nanjing, China; 5 Department of Physics, University of Hong Kong, Hong Kong, China; 6 Department of Electrical & Electronic Engineering, University of Hong Kong, Hong Kong, China, Hong Kong, China; 7 Department of Physics, Imperial College London, London SW7 2AZ, United Kingdom, London, United Kingdom

We demonstrate the initiation of dissipative solitons in linearly coupled microcavities using a continuous wave laser by tuning into resonance from either the blue side or the red side.

EH-4.2 THU 8:45
Plasmon-Induced Trap State Emission Excited by Two-Photon Absorption

• G. Ojamets; Cavendish Laboratory, Department of Physics, University of Cambridge, Thompson Avenue, University of Cambridge, Cambridge, United Kingdom

Plasmonic trap state emission is excited by two-photon absorption from the high-harmonic generation

ROOM 11

8:30 – 10:00

CE-8: Materials and Fabrication of Specialty Optical Fibers
Chair: Natalie Wheeler, University of Southampton, Southampton, United Kingdom

CE-8.1 THU 8:30
Thermal Stability of Type II Modifications by IR Femtosecond Laser in Highly-Doped Aluminosilicate Glass Optical Fibers

• Y. Wang1, M. Cavillon1, J. Ballato3, T. Elsmann4, M. Rothhardt2, R. Pommelle2, and M. Lanery1, 1 Institut de Chimie Moléculaire et des Matériaux d’Orsay (ICMMO), Université Paris Saclay, C.N.R.S., Orsay, France; 2 Center of Optical Materials Science and Engineering Technologies (COMSET), Clemson University, Clemson, USA; 3 Leibniz Institute of Photonic Technology, Albert Einstein Str, Jena, Germany; 4 Type II modifications are inscribed into aluminosilicate optical fibers using a femtosecond laser, and their thermal stability is investigated through isochronal annealing experiments. Results suggest improved thermal stability relative to conventional silica fibers.

CE-8.2 THU 8:45
Silicate glass composite fibers with nanodiamonds-embedded core

• A. Filipkowski1,2, M. Mroczk2, G. Stegniewski1,2, M. Ficek3, T. Karpate4, M. Glowacki4, A. Wojciechowski2, M. Klimczak1, R. Bogdanowicz4, W. Gawlik2, and R. Buczynski1,2, 1 Faculty of Physics, University of Warsaw, Warsaw, Poland; 2 Lukasiewicz Research Network - Institute of Microelectronics and Photonics, Warsaw, Poland; 3 Institute of Physics, Jagiellonian University, Krakow, Poland; 4 Faculty of Electronics, Telecommunications, and Informatics, Gdansk University of Technology, Gdansk, Poland
Observation of Rotational Doppler Shift for Harmonic Generation in Solids

CG-5.2 THU 9:00

Dynamically Tuned Infrared Emission using VO2 Thin Films.

CG-3.3 THU 9:00

Highly efficient thermionic cooling nano-device: the quantum cascade cooler

CG-5.3 THU 9:15

Rotationally Resolved Observation of Rotation and Controlled Phase of a Far-Field Noisy Coherent Recoil Laser

CH-8.2 THU 9:00

Mid-infrared gas sensor based on hybrid graphene nanostructures and ultra-thin gas-absorbing polymer

CH-8.3 THU 9:15

Generating, probing and utilising photo-induced surface oxygen vacancies for trace molecular detection

CB-6.3 THU 9:15

Hybrid-integrated extended cavity mode-locked laser using SiN and a generic III/V platform

CA-8.3 THU 9:00

Generation of a Radially Polarised Beam in a Solid-State Laser Using an Intracavity Spatially Variant Waveplate

CM-4.3 THU 9:15

All Optical Holographic Encryption in Reduced Graphene Oxide Based on Laser Direct Writing

CM-4.2 THU 9:00

Observation of Surface Plasmon Polaritons excited on Si Transiently Metalized with An Intense Femtosecond Laser pulse

ROOM 1

ROOM 2

ROOM 3

ROOM 4

ROOM 5

ROOM 6

61% is experimentally observed for far-field thermal diode made up of a VO2 film placed in vacuum and in front of a heat fluxmeter.

Thursdays Orals

Dereshgi

S. Paoloni

/uni2219

cascade cooler

cooling nano-device: the quantum

Highly efficient thermionic

JSI-3.4 THU 9:15

with different emissivity features.

R鞑ition and demonstrating that VO2 thin films are promising candidates for tuning and controlling the thermal radiation of an underlying hot body with different emissivity features.

JSI-3.4 THU 9:15

Dynamically Tuned Infrared Emission using VO2 Thin Films.

M.C. Lucrezio1, M. Centini1, S. Paoloni1, F. Prataldi2, S.A. Dereshgi3, K. Tang4, J. Wu5, and K. Aydin1,2,3,5

1 Dipartimento di Scienze di Base ed Applicate per l’Ingegneria, Sapienza Università di Roma, Italy; 2 Dipartimento di Ingegneria Industriale, Università degli Studi di Roma Tor Vergata, Roma, Italy; 3 Dipartimento di Chimica, Sapienza Università di Roma, Roma, Italy; 4 Department of Electrical and Computer Engineering, Northwestern University Evanston, Illinois, USA; 5 Department of Materials Science and Engineering, University of California Berkeley (California), USA

We investigated the infrared emission of VO2 during phase transition and demonstrated that VO2 thin films are promising candidates for tuning and controlling the thermal radiation of an underlying hot body with different emissivity features.
We present monolithically integrated InP/InGaAs QWs for room temperature emission at 1530 nm, and compare with evidence of room-temperature template-assisted selective epitaxy grating InGaAs cavities on Si by We, K.E. Moselund, S. Sousa, D. Caimi, H. Schmid, and D. Maes, IBM Research Europe, Heidelberg, Germany.

We discuss the recent development of electro-optic and Kerr frequency combs, powered by integrated lithium niobate photonics. Specifically, I will cover the generation, control and dynamics of microcombs in modulator-based, single- and coupled-cavity based geometries.

We report nanodiamond-embedded core optical fibers drawn from silicate glass canes and tubes. Two techniques of ND nanofilms deposition are compared and presence of NDs in a free-form core is confirmed with photoluminescence imaging.

The fabrication of a heat-resistant multimaterial polymer optical fiber withstanding temperatures up to 180 degrees consisting of two different grades of the cyclo-olefin polymer Zeonex and high-performance thermoplastic PSU developed using a co-extrusion method.

The trapping efficiency, orientation, compactness, and stability of the observed cluster configurations are statistically analysed.

The trapping efficiency, orientation, compactness, and stability of the observed cluster configurations are statistically analysed.
We propose a novel semiconductor heterostructure cooling device, identified as “quantum cascade cooler” (QCC). Its concept is based on successive resonant tunneling and thermionic emission processes through a series of quantum wells.

CG-5.5 THU 9:30
Extreme-Ultraviolet Vortices of very high Topological Charge
A. Kumar Pandey1, A. de la Hoya2, J. San Román3, L. Plaja4, E. Baynard4, G. Dovillaire4, M. Pittman1, S. Kazamias1, O. Guibaud1, and C. Hernández-García1; 1Laboratoire Irène Joliot-Curie, Université Paris-Saclay; 2UMR CNRS, Rue Ampiére, Bâtiment 200, F-91989, Orsay, France; 3Group de Investigación en Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, Universidad de Salamanca, E-37008, Salamanca, Spain; 4Imagine Optic, 18, rue Charles de Gaulle, Orsay, France.

We report the generation, and intensity, waveform, modal content characterization of optical vortices with topological charges as high as 100 in the extreme-ultraviolet spectral range. Furthermore, we complement the experimental observations with advanced simulations.

CG-5.6 THU 9:45
Ultra-thin and high selective emission with additional lossless layer
D.H. Kim1, G.J. Lee1, S.Y. Heo1, S. Son2, K.M. Kang1, H. Lee3, and Y.M. Song1; 1Gwangju Institute of Science and Technology, Gwangju, South Korea; 2Korea University, Seoul, South Korea.

We establish synthetic magnetic fields and parametric amplification for nanomechanical transport by modulating optomechanical interactions. We show that the controlled breaking of time-reversal symmetry and non-Hermitian dynamics lead to chiral propagation and directional amplification.

CB-6.4 THU 9:30
Single-molecule Lifetime Imaging of the Local Density of States of Plasmonic and Dielectric Nanostructures
V. Krachmalnicoff1, R.M. Cordova-Castro1, B. van Dam1, G. Blanquez1, A. Gulnatti1, G. Acconcia1, Y. De Wilde1, and I. Izeddin1; 1Institut Langevin - ESPCI Paris, Paris, France; 2Politecnico di Milano, Milan, Italy.

We show that single-molecule localization lifetime microscopy enables Local-Density-of-States measurement close to a plasmonic nanostructure. We demonstrate how to circumvent the plasmonic mirage effect and reconstruct the real position of detected events in three dimensions.

CB-6.5 THU 9:45
Optical Magnetic Field Sensing based on Metamaterial Nanomechanics
G. Lan1, J.-Y. Ou1, and E. Plum1; 1University of Southampton, Southampton, United Kingdom; 2Heilongjiang University, Harbin, China

Dynamics of epitaxial quantum dot laser on silicon subject to chip-scale back-reflection for isolator-free photonsics integrated circuits
B. Dong2, J.-D. Chen2, J. Norman2, J. Bowers2, F.-Y. Lin3, and F. Grillot4,5; 4Université Paris, Palaiseau, France

Ch-4.4 THU 9:30
Radially polarized solid-state Raman laser
Y. Nishigata1, S. Sasaki1, K. Miyamoto1,2, and T. Omatsumi1,2; 1Chiba University, Chiba, Japan; 2Molecular Chirality Research Center, Chiba, Japan.

We demonstrate the generation of radially polarized Stokes beams from a solid-state Ba(NO3)2 Raman laser pumped by vector vortex light. In our setup, the 1st, 2nd and 3rd Stokes outputs were garnetized as vector vortex mode.

Ch-4.5 THU 9:45
Experimental and numerical studies of thermal lensing and gain guiding effects in a high-power ZGP OPO
B. Pisnovska1, M.A. Medina1,2, M. Schellhorn1, C. Mueller3, G. Spindler2, and A. Hildenbrand-Dholland1; 1German-French

CM-4.4 THU 9:30
Changes in the Intensity Distribution of the Laser Pulse due to Non-linear Optical Interaction with Air and Its Effects on Laser Ablation
R. Yamada1, W. Komatsubara1, H. Sakurai1, K. Konishi1, N. Mio1, J. Yumoto1, and M. Kowata-Gonokami1; 1The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 1130033, Japan.

We numerically calculated the non-linear propagation of a gaussian beam. We demonstrated the calculated modulation of the laser beam profile due to non-linear optical effects can be useful in predicting its effects on laser ablation.
S. Lemen1, E. Peryta2, and B. Kuyken1; 1Department of Information Technology (INTEC), Ghent University — imec, Ghent, Belgium; 2Institute of Electronics, Microelectronics and Nanotechnology (IEMN), Université de Lille, Lille, France

Un-tourlugging-carrier photodiodes (UTC PDs) are heterogeneously integrated on a silicon-nitride (SiN) platform using micro-transfer-printing (µTP). These waveguide-coupled photodiodes feature a high responsivity for a very small footprint and promise high-speed operation into the THz domain.

EE-2.4 THU 9:30
Transition dipole moment structure revealed by high harmonic generation spectroscopy in thin layer black phosphorus
K. Uchida1, V. Pareek1, K. Nagai1, K. Dan1, and K. Tanaka1; 1Kyoto University, Kyoto, Japan; 2Okayama Institute of Science and Technology Graduate University, Okayama, Japan

We observed high harmonic generation in thin layer black phosphorus. By measuring crystal orientation dependence with the resonant excitation condition, we succeeded in constructing the transition dipole moment structure in two-dimensional momentum space.

EE-2.5 THU 9:45
Ultrafast Single-Photon Detection based on Optical Kerr Gates
A.M. Flatae1, A.-H. Fattah2, A. Farrag1, and M. Agio1; 1Department of Chemistry, King’s College London, London, WC1E 6BT, United Kingdom; 2Faculty of Science and Technology, King Abdullah University of Science and Technology, Thuwal, Makkah, Saudi Arabia

Ultrafast Single-Photon Detection is a key technique for the exploration of optical properties in the sub-femtosecond regime.

EF-5.4 THU 9:30
Features of spontaneous symmetry breaking of dissipative cavity solitons in passive Kerr resonators
G. Xu1, A. Nielsen2, B. Garbin1,2, L. Hill1, G.-L. Oppo1, J. Fatome1,2, S. Murdoch2, S. Gorn1, and M. Erkintalo1; 1The University of Auckland, Auckland, New Zealand; 2Université Paris-Saclay, Palaiseau, France

In this talk, we will report on recent experimental evidence of spontaneous symmetry breaking of cavity solitons in passive Kerr resonators.

EF-5.5 THU 9:45
Self-Stabilized Soliton Generation in a Microresonator Through Mode-Pulled Brillouin Lasing
I.H. Do1, D. Kim1, D. Jeong1, D. Suk2, D. Kwon3, J. Kim1, J.H. Lee1, and H. Lee1,2; 1Graduate School of Nanoscience and Technology, Korea Advanced Institute of Science and Technology; 2Graduate School of Electrical Engineering, Korea University

We theoretically and experimentally investigate self-stabilized soliton generation in a microresonator through mode-pulled Brillouin lasing.

EF-4.6 THU 9:45
Sensitive Determination of the Size and Dielectric Function of Plasmonic Nanoparticles using the Extinction-to-Absorption Ratio
A. Djordovic1, S.I. Oldenburg2, J. Grandi3, and E.C. Le Ru1; 1The MacDiarmid Institute for Advanced Materials and Nanotechnology, University of Canterbury, Christchurch, New Zealand; 2University of Cantabria, Santander, Spain; 3Fraunhofer Institute of Ceramic Technologies and Systems, Dresden, Germany

Sensitive Determination of the Size and Dielectric Function of Plasmonic Nanoparticles using the Extinction-to-Absorption Ratio

Room 11

I. Kinkö1, D. Doroz2, and M. Kochanowicz2; 1Leibniz Institute of Photonic Technology, Jena, Germany; 2University of Cantabria, Santander, Spain; 3Fraunhofer Institute of Ceramic Technologies and Systems, Dresden, Germany

Light-driven Reactions on Metal Oxide Nanomaterials
H. Ebendorff-Heidepriem; Institute for Photonics and Advanced Sensing, The University of Adelaide, Adelaide, Australia; ARC Centre of Excellence for Nanoscale BioPhotonics (CNBP), Adelaide, Australia

Room 12

Cavendish Laboratory, University of Cambridge, Cambridge, CB3 0HE, United Kingdom; 2Department of Chemistry, King’s College London, 7 Trinity Street, London, SE1 1DB, United Kingdom; 3Department of Physics and Astronomy, University College London, London, WC1E 6BT, United Kingdom

Molecular-metal transient bonds underpin catalysis. Here we confine light to atomic scales for single-molecule probes utilising surface-enhanced Raman scattering. Our analysis of >800,000 spectra shows light-induced local polarization reduces energy barriers for molecular-metal binding.
We demonstrate an optical magnetic field sensor based on a metamaterial-microcavity. Actuation of the microcavity by the magnetic Lorentz force controls its reflectivity. Such sensors promise microscale spatial, sub-millisecond temporal and microtesla magnetic field resolution.

Recent advances in development of AlGaN-based deep UV-LED emitting diode technologies offer 130-nm emission at only a few milliwatts of power and -5 dBm and -126 dBc/Hz phase noise at 10 kHz from the carrier at 10 GHz; -5 dBm and -126 dBc/Hz at 20 GHz.
tactical non-reciprocal transmission in a compact cascaded microcavity modulator, achieving a 16dB extinction ratio between forward and backward propagating waves. Variation as a function of drive power is also reported.

11:00 – 12:30

EC-5: Emerging Trends in Topology

Chair: Martin Ringbauer, University of Innsbruck, Innsbruck, Austria

11:00 – 12:15

EB-8: Quantum Computation and Error Correction

Chair: Martin Ringbauer, University of Innsbruck, Austria

11:00 – 12:30

EA-5: Quantum Light Sources

Chair: Dmitry S. Bykov, University of Innsbruck, Innsbruck, Austria

11:00 – 12:30

EA-5.1 THU (Tutorial) 11:00

Photonic Crystal Devices for Sensing — Focusing on LiDAR Applications —

- T. Baba, Yokohama National University, Yokohama, Japan
- Some photonic crystal devices are approaching to practical use. This presentation demonstrates an application to a nonmechanical optical beam scanner and FMCW LiDAR sensor system based on a Si photonics platform and slow light effect.

11:00 – 12:30

CK-5: Beam Manipulation

Chair: Martin Friimmer, ETH, Zurich, Switzerland

11:00 – 12:30

CK-5.1 THU (Tutorial) 11:00

Photonic Crystal Devices for Sensing — Focusing on LiDAR Applications —

- T. Baba, Yokohama National University, Yokohama, Japan
- Some photonic crystal devices are approaching to practical use. This presentation demonstrates an application to a nonmechanical optical beam scanner and FMCW LiDAR sensor system based on a Si photonics platform and slow light effect.
technologies and applications will be discussed including the performance characteristics of UV emitters in the 265 nm and 230 nm wavelength bands.

CA-9.2 THU 11:15
Sub-50-fs Kerr-lens mode-locked Yb:GdYCOB laser
1 Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences, Fuzhou, China; 2 Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany
We report on the first sub-50-fs Kerr-lens mode-locked solid-state laser using mixed Yb:GdYCOB crystal as a gain medium, to generate pulses as short as 43 fs at 1036.5 nm with a repetition rate of ~70 MHz.

CD-7.2 THU 11:15
Parametrically amplified backward-wave optical parametric oscillator for generation of narrowband high-energy ns-pulses in the mid-infrared
K.M. Melström, J. Negri Rubens, A. Zakauskas, C. Canalias, F. Laurell, and V. Pasiskevicius
1 Department of Applied Physics, Royal Institute of Technology, KTH, Stockholm, Sweden; 2 Dipartimento di Ingegneria Industriale e dell’Informazione, Università di Pavia, Pavia, Italy
We demonstrate a backward-wave optical parametric oscillator parametric power amplifier using PPRKTP. Single longitudinal mode pumping and amplifier seeding with the signal wave enables precision-tuned transform-limited nanosecond pulse generation with output energy scalability.

CF-7.2 THU 11:15
GW Peak Power, sub-30-fs Pulses from Efficient Single-Stage Pulse Compressor at 400-kHz
A. Omar, S. Ahmed, M. Hoffmann, and C. Saraceno; Ruhr-University Bochum, Bochum, Germany
We demonstrate pulse compression of 310-fs, 150 MW peak power pulses at 400 kHz repetition rate down to 27 fs, >1 GW peak power using a single, dispersionshifted, multistage Herriot-type multipass cell compressor with 92% overall efficiency.

CI-3.2 THU 11:15
Frequency-to-time mapping using a phase-modulated frequency-shifting loop.
H. Yang, M. Brunel, M. Vallet, H. Zhang, and C. Zhao; Beijing Institute of Technology, Beijing, China; 2 Qian Xuesen Laboratory of Space Technology, Beijing, China
We recirculating fiber loop comprising phase modulation and amplification, operated in the Talbot condition, is shown experimentally to map the optical input spectrum in the time domain, with original features like temporal reflection and nonlinear mapping.

CA-9.3 THU 11:30
Nanosecond Compact Eye-Safe Triblock Lasers with 190 kW Peak Power
V. Vitkin, A. Polischuk, D. Zavirukha, V. Kairkova, O. Dymshits, I. Alekseeva, S. Zapalova, A. Zhilin, and P. Lolka; 1 ITMO University, Saint Petersburg, Russia; 2 NITIOM Vavilov State Optical Institute, Saint Petersburg, Russia; 3 Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France
Compact diode-side-pumped erbium lasers with 190 kW Peak Power

CC-5.2 THU 11:30
High-resolution terahertz single-pixel imaging for 2D spectral analysis
A. Valle, S. Ohno, T. Omatsumi, and K. Miyamoto
1 Graduate School of Science and Engineering, Chiba University, Chiba, Japan; 2 Molecular Chirality Research Center, Chiba University, Chiba, Japan; 3 Graduate School of Science, Tohoku University, Sendai, Japan
We present a single-pixel imaging system for the entire high-frequency terahertz region, producing high pixel resolution images (1200 x 1200 pixels). We employ a metallic ring with directly perforated pat

CD-7.3 THU 11:30
Tunable multi-structured-beam optical parametric oscillator
V. Sharma, S.C. Kumar, and G.K. Samanta
1 Indian Institute of Technology, Gandhinagar, Ahmedabad, India; 2 Indian Institute of Technology, Guwahati, Guwahati, India; 3 ICFO-Institut de Ciencies Fon
tiques, The Barcelona Institute of Science and Technology, 08860 Castelldefels, Barcelona, Spain; 4 Instituto Catalana de Recerca i Estudis Avancats (ICREA), Pas
seig Lluis Companys 23, 08010, Barcelona, Spain
We experimentally and numerically demonstrate octave spanning supercontinua generation in As$_2$S$_3$-silica dual nanospike waveguides pumped by a thulium-doped all-fiber MOPA centred at 1.9 μm with 78 fs pulse duration and 200 kW peak power.

CF-7.3 THU 11:30
Chirped Pulse Amplification of 1.6 GHz Ti:Sapphire Frequency Comb Using a Tapered Semiconductor Amplifier
T. Sakamoto, S. Tajammul Ahmad, H. Shimo, K. Yoshioka, S. Ohno, T. Omatsu, Zadeh, S. Ohtake, and M. Ebrahimi-Bourak; 1 University of Tokyo, Tokyo, Japan; 2 Photons Space Technology, Beijing, China; 3 Qian Xuesen Laboratory of Space Technology, Beijing, China
We demonstrate amplification of a 1.6 GHz Ti:Sapphire frequency comb using a tapered semiconductor amplifier. Stretched pulses at 855-865 nm were compactly ampli

CI-3.3 THU 11:30
Optical Frequency Comb and Active Demultiplexer-enabled 60 GHz mmW ARoF Transmission using Directly Modulated 64-QAM UF-OFDM signals
S. Tajammul Ahmad, P.D. Lakshminayakshim, C. Browning, P.M. Anandarajah, L.P. Barry, and A. Kaszubowska-Andanarajah; 3 Photonics Systems and Sensing Lab., School of Electronic Engineering, Dublin City University, Dublin, Ireland; 2 Radio and Optical Communications Lab., School of Electronic Engineering, Dublin City University, Dublin, Ireland; 3 CONNECT Research
EA-5.2 THU 11:15

Photon pair generation in ultra-thin carbon nanotube films without phase-matching

• P. Jenke¹, I. Alonso Calafell¹, A. Trenti¹, K. Mustonen², I. Joly¹, and P. Walther¹; ¹VCQ-Vienna Centre for Quantum Science and Technology, Faculty of Physics, University of Vienna, Vienna, Austria; ²Faculty of Physics, University of Vienna, Vienna, Austria

In sufficiently thin nonlinear materials, the phase-matching condition of four-wave mixing relaxes. We characterize the resulting broadband biphoton states by stimulated emission tomography, and present progress towards photon pair generation in ultra-thin carbon nanotube films.

EA-5.3 THU 11:30

Quantum-Correlation-Preserving Single-Photon Conversion by Molecular Modulation in Gas-filled Hollow-Core Fibres

R. Tyutenev, J. Hammer, N. Joly, D. Novoa, and P. Russell; Max-Planck Institute for the Science of Light, Erlangen, Germany

Raman coherence waves created in hydrogen-filled single-ring hollow-core PCF are used to efficiently frequency up-shift the idler photon from a biphoton pair. Quantum correlations are preserved between the signal photon and the up-shifted idler photon.

EB-8.2 THU 11:30

Non-Clifford gate on Gottesman-Kitaev-Preskill encoded optical qubits with nonlinear feedforward

• S. Konno¹, W. Asavanant¹, K. Fukui¹, A. Sakaguchi¹, P. Marek², R. Filip³, J.-i. Yoshikawa¹, and A. Furusawa¹; ¹Department of Applied Physics, School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan; ²Department of Optics, Palacký University, 17. listopadu 1192/12, 77146 Olomouc, Czech Republic

We propose an experimentally feasible implementation of a non-

with a fractional Chern insulator is identified.

EC-5.2 THU 11:15

Topological protection versus degree of entanglement of two-photon edge states

K. Tischner¹, K. Busch¹, and A. Perez-Leija¹; ¹Max-Born Institute, Berlin, Germany; ²Humboldt University of Berlin, Berlin, Germany

We investigate theoretically the physical mechanisms that contribute to the vulnerability of highly entangled two-photon edge states propagating in topological insulator photonic lattices.

EC-5.3 THU 11:30

Characterizing Photonic Band Structures Using Topological Data Analysis

• D. Leykam¹ and D.G. Angelakis¹,²; ¹Centre for Quantum Technologies, National University of Singapore, Singapore, Singapore; ²School of Electrical and Computer Engineering, Technical University of Crete, Chania, Greece

We show how the topological data analysis technique of persistent homology may be used to characterize topological properties of photonic band structures, from known topological phases to bands with novel multi-valley and looped dispersion.

EF-6.2 THU 11:15

Breathing Cavity Solitons and Polychromatic Dispersive Radiation in a Near-Zero Dispersion Kerr Resonator

• Z. Li¹,², Y. Xu¹,², S. Coen¹,², S.G. Murdoch¹,³, and M. Erkintalo¹,²; ¹University of Auckland , Auckland , New Zealand; ²The Dodd-Walls Centre for Photonic and Quantum Technologies, Auckland, New Zealand

We report on experimental observations of polychromatic dispersive wave emission by breathing Kerr cavity solitons under conditions of near-zero-dispersion driving. We also experimentally study the impact of third-order dispersion on the solitons’ existence and stability.

EF-6.3 THU 11:30

Zero-dispersion Kerr solitons in optical microresonators with octave-spanning dispersive wave formation

• M.H. Anderson, W. Yeng, G. Liuchnev, J. Liu, and T.J. Kippenberg; Institute of Physics (IPhYS), Swiss Federal Institute of Technology in Lausanne (EPFL), Lausanne, Switzerland

We generate a novel localised dissipative structure, the zero-dispersion soliton, in silicon nitride microresonators with vanishing group-velocity dispersion. The coherent frequency comb spans 135 THz, at 28 GHz line-spacing.
eye-safe Er,Yb:glass laser is passively Q-switched by transparent glass ceramics containing CoMg(AlGa)2O4 and γ-CeGa2O3 spinel nanophases. The laser generates 1.39 mJ/7.2 ns pulses (energy/duration) at 1535 nm in the fundamental transverse mode.

CA-9.4 THU 11:45
Growth, Spectroscopy and Laser Operation of Tm3+, Li+-Codoped Ca3Ta1.5Ga3.5O12-Type Disordered Garnet Crystal
- 1Universitat Rovira i Virgili (URV), Tarragona, Spain; 2Eurecat, Centre Tecnològic de Catalunya, Advanced Manufacturing Systems Unit (AMS), Tarragona, Spain; 3Institute of Chemical Materials, Miyang, China; 4Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany; 5CIMAP, UMR 6252 CEA-CNRS-ENSICAEN, Université de Caen Normandie, Caen, France; 6Institute of Applied Materials and Devices, Xuchou, China; 7Viteb State Technological University, Viteb, Belarus; 8Key Laboratory of Optoelectronic Materials Chemistry and Physics, Fujian, China; 9Sierra Hunter Fellow, Tarragona, Spain

CB-7.2 THU 11:45
Photonic VCSEL-neuron for spike-rate representation of digital image data
- M. Hejda, J. Robertson, J. Bueno, J.A. Alanis, and A. Hurtado
- 1Royal Institute of Technology, Stockholm, Sweden; 2Department of Physics, University of Sussex, Brighton, Sussex, United Kingdom

We report a coherent light source simultaneously producing tunable beam of various spatial structures. Based on a picosecond optical parametric oscillator, the source generates Gaussian, vortex, Airy, and vortex Airy beams tunable across 1457-1680 nm.

CC-5.3 THU 11:45
Time-resolved, nonlinear control of terahertz waves in random media for spatiotemporal focusing
- V. Cecconi, V. Kamar, A. Pasquazi, J.S. Totero Gongora, and M. Peccianti
- 1University of Sussex, Brighton, Sussex, United Kingdom

We theoretically investigate spatiotemporal refocusing of broad-band THz waves in random media. Our nonlinear frontwave shaping method allows controlling the spatial evolution of the THz pulse by acting on the spatial degrees-of-freedom.

CD-7.4 THU 11:45
Domain dynamics in sub-ps Periodically Polled Rb-doped KTIOPo4 via coercive field engineering
- P. Matter, A. Zakaukas, V. Pasiskevic, and C. Canalias
- 1Royal Institute of Technology, Stockholm, Sweden; 2Stockholm University, Stockholm, Sweden

We demonstrate reliable periodic poling with periods down to 430 nm in 1mm-thick RKTP crystals by forming a coercive-field grating via ion exchange. The interplay between ion-exchange and domain dynamics is studied.

CF-7.4 THU 11:45
Compact 60 ps, 60 fs, MHz-rate burst-mode laser for pump-probe experiments at the FLASH FEL facility
- M. Seidel1, F. Pressaco1, O. Aksu1, T. Binhammer2, J. Darvill2, M. Fred2, U. Groesse-Wortmann3, M. Heber3, C.M. Heyd1,3,4, D. Kutykakhov1, C. Li1, C. Moht4, J. Müller4, O. Puncken2, H. Redlin1, N. Schirme4, S. Schulte1, A. Swiderski1, H. Tavakol1, H. Tümermann1, C. Vidoli1, L. Wenthaus1, N. Wind1,3,5, L. Winkelmann1, B. Manschwetus1, and I. Hartl1
- 1Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany; 2neuLASE GmbH, Hannover, Germany; 3GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany; 4Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany

A new burst-mode laser at the FLASH-FEL facility is presented. Multi-pass-cell spectral broadening enables compression of 900-fs pulses from Yb-amplifiers to 60 fs. Nonlinear-ellipse-rotation leads to significant pulse-contrast improvement. Excellent timing-, spectrum- and energy-stability is reported.

Cl-3.4 THU 11:45
Transmission of 5G using Tunable Dual-Wavelength Fiber Laser
- H. Khashi, S. Vishal, and S. Sergeyev; 1Aston Institute of Photonics Technologies, Aston University, Birmingham, United Kingdom
In this work, we demonstrate the generation of the tunable mmW ranging from 12.5 GHz to 110 GHz using a dual-wavelength fiber laser and then validate the 5G transmission over a 500 m FSO wireless-link.
Clifford gate on the Gottesman-Kitaev-Preskill qubits using nonlinear feedforward. Our result shows the versatility of nonlinear feedforward in a fault-tolerant optical universal quantum computation.

**EA-5.4 THU 11:45**

Cryogenic Parametric Down-Conversion in Titanium In-Diffused Lithium Niobate Waveguides

- N.A. Lange\(^1\), J.P. Höpker\(^1\), R. Ricken\(^2\), V. Quiring\(^2\), C. Eigner\(^2\), C. Silberhorn\(^2\), and T.J. Bartley\(^1\);
- \(^1\)Mesoscopic Quantum Optics, Paderborn University, Paderborn, Germany;
- \(^2\)Integrated Quantum Optics, Paderborn University, Paderborn, Germany

We demonstrate spontaneous parametric down-conversion (SPDC) in nonlinear waveguides down to 4.7 K. Thus, our work shows that SPDC is integrable with superconducting detectors, which paves the way for developing novel integrated quantum photonic circuits.

**EB-8.3 THU 11:45**

Optimal Control of a Large Ensemble of Nitrogen-Vacancy Centers in Diamond for Pulsed Magnetometry

- J.D. Clement\(^1\), A.R.L. Poulsen\(^1\), J.L. Webb\(^1\), R.H. Jensen\(^2\), K. Berg-Sørensen\(^2\), A. Huck\(^1\), and U.L. Andersen\(^1\);
- \(^1\)Center for Macroscopic Quantum States (bigQ), Department of Physics, Technical University of Denmark, Kgs. Lyngby, Denmark;
- \(^2\)Department of Health Technology, Technical University of Denmark, Kgs. Lyngby, Denmark

We report on a family of supertoroidal pulses with skyrmion-like topology propagating at the speed of light.

**EC-5.4 THU 11:45**

Supertoroidal Skyrmionic Light Pulses

- Y. Shen\(^1\), Y. Hou\(^1\), A. Zdagkas\(^1\), N. Papasimakis\(^1\), and N. Zheludev\(^1,2\);
- \(^1\)University of Southampton, Southampton, United Kingdom;
- \(^2\)Nanyang Technological University, Singapore, Singapore

We introduce a cellular automata methodology for studying photonics of light-induced phase transitions. Multiphysical complexity over disparate length/timescales is reduced to a simple, heuristic rule/parameter set in a model successfully describing several independent experimental datasets.

**EF-6.4 THU 11:45**

Dissipative Solitons in a Coherently Driven Active Fiber Ring Cavity

- C. Mas Arabi, N. Englebert, P. Parra-Rivaa, S.P. Gorza, and F. Leo;
- Université libre de Bruxelles, Brussels, Belgium

We analyze the formation of solitons in a coherently driven Kerr resonator incorporating an intra-cavity amplifier. By means of bifurcation analysis, we study the impact of the gain saturation on soliton dynamics.
Faraday Isolator with Composite MagnetoOptical Elements

• A. Starobor1, I. Kazetnov1, O. Palashov1, A. Pestov1, and N. Chkhvilo2
  1. Federal Research Center Institute of Applied Physics of the Russian Academy of Sciences, Nizhny Novgorod, Russia; 2. Institute for Physics of Microstructural Materials of the Russian Academy of Sciences, Nizhny Novgorod, Russia

Composite terbium gallium garnet/sapphire elements for Faraday isolators were produced by the SAD8 method. The resulting structures provided 34dB isolation ratio at laser power of 700W; the maximum operating power estimated to be over 2kW.

How a ridge polarizer is different from a standard ridge laser

• T. Guillier1, H. Souissi3, M. Gromovoy1, T. Gueye4, C. Brimon5, L. Doyennette1, G. Kreyder1,2,3, A. M. Andrews1,2, G. Strasser1, J. Darmo1,3, and K. Unterrainer1,2
  1. Photonics Institute, TU Wien, Vienna, Austria; 2. Center for Micro- and Nanostructures, TU Wien, Vienna, Austria; 3. Institute for Solid-State Electronics, TU Wien, Vienna, Austria

We present an optical implementation of machine learning in the terahertz domain, where we perform both the training as well as the predictions optically. We show that the system is accurate and noise resistant.

Thermal Expansion Coefficient of Garnet and Bixbyte Laser Crystals Evaluated by First Principles Calculations

• Y. Sato1,2 and T. Taira1,2
  1. RIKEN SPring-8 Center, RIKEN, Sayo-gun, Japan; 2. Institute for Molecular Science, Okazaki, Japan

We evaluated thermal expansion coefficients for laser host crystals by first principles calculations, of which for Y3Al5O12, Lu3Al5O12, Y2O3, SiC-cooled and AlGaInP-based, standard ridge interband lasers operated up to 200K.

Room temperature operation of SiC-cooled and AlGaNp-based, red-emitting membrane external-cavity surface-emitting lasers (MECSELS)

• P. Tatar-Natels, H.-M. Phung, A. Rogers, A. Tukusimen, P. Rajala, S. Ranta, H. Kahle, and M. Guina1
  1. Optoelectronics Research Centre (ORC), Physics Unit / Photonics, Faculty of Engineering and Natural Sciences, Tampere University, Tampere, Finland

MECSELS are laser-active gain membranes sandwiched between two transparent heat spreaders in transmission mode. We present the first 680 nm SiC-MECSEL operating at room temperature with an observed output power of above 480 mW.

Widely Tunable Polarization Modulation Instability in D2O-Filled Microstructured Optical Fiber

• A. Loreda-Truyol1,2, A. Díez1,2, E. Silvestre1,3, and M. André1,2
  1. Laboratory of Fiber Optics - ICMUV, Universidad de Valencia, Burjassot, Spain; 2. Departamento de Física Aplicada y Electromagnetismo - ICMUV, Universidad de Valencia, Burjassot, Spain; 3. Departamento de Óptica - ICMUV, Universidad de Valencia, Burjassot, Spain

Wide tuning of polarization modulation instability (PMI) in D2O-filled microstructured optical fiber is reported. Tuning of the PMI frequency shift from 1084 cm⁻¹ to 2782 cm⁻¹ was experimentally attained with 1064 nm pump.

A liquid-crystal based phase-shaper for multi-octave light sources

• V. Di Pietro1,2, S. Bus2, L. Ramousse1,2, C. Claudel3, G. Cherioua1, N. Forger2, and A. Jullien1
  1. Université Côte d’Azur, CNRS, Institut de Physique de Nice, Valbonne, France; 2. FASTLITE, Antibes, France

A thermo-optically addressed liquid crystal device enables continuous spectral phase shaping over a spectral bandwidth spanning from 540nm to 2500nm (450THz). The modulation dynamic is large enough to shape single-cycle pulses.

Optical-to-Wireless Carrier Frequency Down-Conversion by UTC-PD-Integrated HEMT: Dependence of Conversion Gain on UTC-PD Mesa Size

• H. Hallak Elwan, F. Saliou, G. Simon1,2, P. Chicon, and A. Samet1,2
  1. Orange Labs, Department of Physics, University of California, Los Angeles, France

We propose a mode-coupling receiver (MCR) as a key component to achieve the optical combination structure with lower phase noise and insertion loss.

Highly Robust Optical Phase Decorrelation in MicrowavetoMillimeter-Wave Photonic Summation Systems Using Mode-Coupling Receiver

• H. Hallak Elwan, F. Saliou, G. Simon1,2, P. Chicon, and A. Samet1,2
  1. Orange Labs, Department of Physics, University of California, Los Angeles, France

We theoretically and experimentally introduce a novel structured EUV beam—a vector-vortex—which combines the helical phase and inhomogeneous polarization of vortex and vector beams. These beams are emitted as an azimuthally polarized astrosecond light-spring.
Modulation of Cathodoluminescence Emission by Interference with External Light

V. Di Giulio*, O. Kfir¹, C. Roepers¹, and E. G. de Abojo²,²
¹IFC-IFN-Instituto de Ciencias Físicas, El Colegio de Mexico, Mexico City, Mexico; ²University of Wisconsin-Madison, Madison, Wisconsin, United States
We study the interference of the emission from a cathodoluminescence (CL) source with an external light source. We observe modulation of the CL intensity with the external light intensity, which we attribute to the interference of the CL and external light waves at the CL source. We also observe modulation of the CL wavelength with the external light wavelength, which we attribute to the interference of the CL and external light waves in the sample. We discuss the implications of these results for the study of CL emission and its possible applications.
Deep Brain Endo-microscopy

Using Multimode Optical Fibre

'R. Tiscotte; NYU School of Medicine, New York, USA

Combines with wavefront shaping, multimode optical fibre can serve as minimally invasive endo-microscopes for deep-brain imaging. Here, we demonstrate how wavefront shaping can further enhance the capability of such systems for volumetric and chronic imaging.

**CH-9: Hyperspectral Imaging**

Chair: Sophie Brasselet, Director of the Institute Fresnel, CNRS, Marseille, France

**Thursday, 14:30**

Hyperspectral topography of the twisted, cholesteric patterns of an insect cuticle in the context of biomimicry

• A. Julienne1, M. Neradovsky1, A. Scargellia2, and M. Mitov2;
  1Institut de Physique de Nice, Université Côte d’Azur, CNRS, Valbonne, France; 2CEMES, Université de Toulouse, Toulouse, France

By hyperspectral microscopy, a topographic study compares the textural, structural and spectral properties of the microscalls of a scarab beetle with those of the polygonal texture formed in flat films of cholesteric liquid crystal oligomers.

**CM-5: Temporal and Spatial Beam Shaping for Laser Processing II**

Chair: Robert Thomson, Heriot-Watt University, Edinburgh, United Kingdom

**Thursday, 14:30**

Femtosecond laser micromachining and rocket propulsion of micro-particles optically trapped in hollow-core photonic crystal fibre

• M.N. Romodina, S. Xie, A. Sharma, F. Tani, and P.S.J. Russell; Max Planck Institute for the Science of Light, Erlangen, Germany

We report micromachining of silica micro-particles, optically levitated inside hollow-core photonic crystal fibre, by guided fs pulses. An ablation-related plasma flume at the output side of the particle rocket-propels the particles backwards at high speed.

**EG-6: Resonant Dielectric Nanostructures**

Chair: Walter Pfeiffer, Universität Bielefeld, Bielefeld, Germany

**Thursday, 14:30**

Galium Phosphide Nanostructures on Transparent Substrates for Nonlinear and Ultrafast Nanophotonics

• R. Timlin1, G. Grinblat2, Y. Li2, R.B. Berte1, M.P. Nielsen3, E. Cortes1, A.J. Kuznetsov2, and S.A. Maier2,3; Chair in Hybrid Nanosystems, NanoInstitut München, Ludwig-Maximilians-Universität München, München, Germany; 2Departamento de Física, FCEN, IFIBA-CONICET, Universidad de Buenos Aires, Buenos Aires, Argentina; 3School of Microelectronics, MOE Engineering Research Center of Integrated Circuits for Next Generation Communications, Southern University of Science and Technology, Shenzhen, China; School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Sydney, Australia; 5Institute of Materials Research and Engineering, A*STAR, Singapore

We demonstrate outstanding optical properties of nanostructured Galium Phosphide thin-films on low refractive index substrates. By exciting at anapole-like resonances, we show strongly enhanced all-optical switching and second harmonic generation.

**CE-10: Crystals, Glasses and Ceramics**

Chair: Alessandro Chiasea, IFN-CNR CSMFO Laboratory and FBK Photonics Unit, Trento, Italy

**Thursday, 14:30**

All-Fiber Chalcogenide Saturable Absorber

• A. Anjum and M. Rochette; McGill University, Montréal, Canada

We present an all-fiber saturable absorber made of chalcogenide glass compatible over a broad range of wavelengths, from the telecommunication band to the mid-infrared. Results include nonlinear saturation and mode-locking of a thulium-doped fiber laser.

**EG-6.1 THU 14:30**

Galium Phosphide Nanostructures on Transparent Substrates for Nonlinear and Ultrafast Nanophotonics

**Thursday, 14:30**

Galium Phosphide Nanostructures on Transparent Substrates for Nonlinear and Ultrafast Nanophotonics

**Thursday, 14:30**

Temporal characterization of broadband, low-energy few-cycle pulses using surface third-harmonic generation dispersion-scan

• E. Gomes, M. Canhota, and H. Creala, Dept of Physics and Astronomy, Faculty of Sciences, University of Porto, Porto, Portugal

A dispersion-scan technique based on surface third-harmonic generation is presented, enabling the characterization of broadband, few-cycle, low-energy ultrashort pulses.

**CM-5.2 THU 14:45**

Tailored Sub-micrometer Periodic Surface Structures via Ultrasound Pulsed Direct Laser Interference Patterning

• F. Fraggaliakis1, G. Tsidikis1, and E. Stratakis1,2,3; Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology (FORTH), Heraklion, Greece; 2Department of Physics, University of Crete, Heraklion, Greece

In this work, an experimental and theoretical approach is presented to investigate the previously unexplored fundamental mechanisms for the formation of unprecedented laser-induced topographies on stainless steel following proper combinations of Direct Laser Inter-
High-energy fiber optical parametric chirped-pulse oscillator
1 CORIA - CNRS - Université de Rouen Normandie - INSA Rouen, Rouen, France; 2 Photonics Bretegane, Lannion, France; 3 CIMAP, CNRS, Université de Nice Sophia Antipolis, Nice, France.
We experimentally demonstrate a high-energy broadly-tunable fiber optical parametric chirped pulse oscillator (FOPCPO), numerically analyze its operation, and discuss its potential for further energy scaling beyond the J level.

Amplification of a 1.03 μm optical frequency comb in the gain-managed nonlinear regime – measurements and simulations
• D. Tomaszewskia, R. Lindberg, V. Paisievic, F. Laurell, and G. Sobott; 1 Laser & Fiber Electronics Group, Wrocław University of Science and Technology, Wrocław, Poland; 2 Department of Applied Physics, Royal Institute of Technology, Stockholm, Sweden.
We demonstrate a measured and simulated data for amplification in gain-managed nonlinear regime. The setup, built using Ytterbium-doped fiber, provides 24 nJ pulses at 1068 nm with 30 nm width and 54 fs duration.
Fast holographic scattering compensation for deep tissue biological imaging  
*M.A. May*, 1, K.K. Kummer*, 2, M. Kress*, 1, M. Ritsch-Marte 2, and A. Jesacher 1  
1Institute of Biomedical Physics, Medical University of Innsbruck, Innsbruck, Austria; 2Institute of Physiology, Medical University of Innsbruck, Innsbruck, Austria

We develop a holographic phase-stepping interferometry algorithm for non-invasive scattering compensation that achieves >10x higher signal enhancement after one measurement than previous work and enables two-photon imaging in mouse hippocampal tissue down to 530 μm.

### ROOM 2

**CF-4.8 THU 15:00**

**Single-shot interferometric retrieval of spectral phase and amplitude**

*E. Tikhonov* 1,2, V. V. Osipov1,2, B. Patrizi 3, R. N. Maksimov 1,3, and F. Xin 1,3

We report on using few-cycle ultrabroad laser pulses for advanced fluorescence lifetime microscopy showing efficient excitation across the full visible spectral range and sufficient peak power to excite endogenous markers for tackling of drug delivery.

**CF-8.3 THU 15:00**

Tailoring spatial entropy in extreme ultraviolet focused beams for multispectral ptychography  
*I.J. Solá*, 1, L. López-Quintás*, 1, W. Holgado*, 2, R. Drevinskas 2, P.G. Kazansky*, 1, C. Henández-García 1, 2, and B. Alonso 1, 2

We demonstrate a computational approach to designing diffractive optical elements that can be used to focus multiplexed extended ultra-violet radiation from a high-harmonic generation source. The polychromatic focusing properties are experimentally confirmed using ptychography.

**CF-9.3 THU 15:00**

Ultra-broadband few-cycle laser pulses for advanced multi-color FLIM microscopy  
*C. Mailbom* 1, R. Ferreira 2, O.P. Silvestro 1, R. Romero 1, H. Crespo 1, and J.B. Nieder 1, 2

1Institute of Complex Materials, UTBBV, Brazil; 2Institute of Science of Light, Erlangen, Germany

Using an information theoretical approach, we numerically show the existence of information for imaging through very thick scattering materials (beyond 100 transport mean free paths) using spatially-resolved time-of-flight detectors.

**CM-4.5 THU 15:00**

Experimental observation of Tornado Waves  
*D. Mansour* 1, 2, A. Brinis 1, 3, K.G. Makris* 1, and D.G. Papazoglou 1

1Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece; 2Institute of Nanotechnology, University of Twente, Enschede, Netherlands; 3Department of Physics, University of Rome “La Sapienza”, 00185 Rome, Italy

We demonstrate that the recently introduced Tornado Waves, comprised by complex superimposing fields that carry orbital angular momentum of opposite handedness, can be efficiently generated using spatial multiplexing techniques on a single phase modulation device.

**CM-5.3 THU 15:00**

Direct writing of 100% fill-factor geometry-controllable microrelief arrays with laser catalypitng  
*S. Sordo* 1 and M. Duocastella 1, 2

1Instituto Italiano di Tecnologia, Genova, Italy; 2University of Barcelona, Barcelona, Spain

Laser catalypsis is a novel laser additive and direct-write method for the rapid fabrication of geometry-controllable microreliefes arrays, with high fill-factor and user-selectable arrangements, on top of a large variety of substrates and devices.

**CM-6.3 THU 15:00**

Second-harmonic generation by resonance absorption on topographical inelasticities in the bulk of dielectrics  
*K. Ardanuç*, M. Hassan, R. Meyer, R. Giust, and F. Courvoisier; 2FEMTO-ST Institute, Université Bourgogne Franche-Comté, UMR CNRS 6174, 158 avenue des Montbouons, Besançon, France

We report experimental and Particle Cell simulation results of second harmonic generation from cylindrical nanoplasma created by a single femtosecond Bessel pulse inside the bulk of dielectrics.

**EG-6.3 THU 15:00**

Novel Tm:(Y,Sc)2O3 Transparent Ceramics for Laser Applications  
*A. Peri*, R.N. Maksumov 3, V.A. Shitov, V.V. Osipov, E.V. Tikhonov 2, G. Toci 1, B. Patrizi 3, and M. Vannini 1

1Istituto di Fisica Applicata “N. Carraia”, Consiglio Nazionale delle Ricerche, Sesto Fiorentino, Italy; 2Institute of Elective PHYSICS UBV RAS, Ekaterinburg, Russia; 3Urals Federal University named after the first President of Russia B.N. Yeltsin, Ekaterinburg, Russia

We report on the first time using vacuum sintering of mixed sesquisilicate nanoparticles with various Y/Sc balances synthesized by laser ablation.
of repeatable performance.

from these materials toward the aim of repeatable performance.

Two-dimensional (2D) crystals have long been exploited as saturable absorbers (SA) for pulse generation. I will present the evolution of these materials to printing.

We investigate parametric down-conversion in a nonlinear bulk crystal, driven by two non-collinear pump modes. Hot-spots with local gain enhancement corresponding to a transition from a three-mode to a four-mode coupling is observed.

We perform spontaneous parametric down-conversion in lithium niobate thin films on quartz with subwavelength thickness of 200 nm at telecom wavelength. We obtained two-photon generation with strong correlation signal at zero delay time.

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Entangled Two-Photon Absorption in Commercial Fluorophores

T.B. Gübler, N. Jain, J.R. León Torres, P. Hendra, and M. Gräfe; Fraunhofer Institute of Applied Optics and Precision Engineering IOF, Jena, Germany

Our study addresses the applicability of simple and common fluorophores for entangled two-photon fluorescence microscopy. Using CW-pumped SPDC waveguides, we can measure linear absorption rates of entangled photons in standard fluorophores in life science.

Compressive Spectroscopic Long-Wave Infrared Imaging

J.M. Charley1, N. Rutkauska1, Y. Altenmann2, M. Smith3, C. Young3, and D.T. Reid3; 1School of Engineering and Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom; 2School of Culture and Creative Arts, College of Arts, University of Glasgow, Glasgow, United Kingdom

We report compressive spectroscopic imaging from 7–12 μm with a 4 cm−1 optical resolution, sampled at 25% of the Nyquist rate. Compressed measurements of plastics are presented with 640x512 pixels observed and reconstructed simultaneously.

Anapole-Assisted Absorption Engineering in Arrays of Coupled Amorphous GaP Nanodisks

A. Hüttenhofer1, A. Tittel1, and S.A. Maier1,2; 1Nanoinstitut Ludwig-Maximilians-Universität, München, Germany; 2Department of Physics Imperial College, London, United Kingdom

Anapole excitations in single dielectric nanoresonators enhance electromagnetic field confinement and absorption in the underlying material. Engineering the arrangement of a manifold of coupled particles enables strong amplification of this effect with large spectral tunability.

We perform percolation analysis of crossed-polarizer transmission images in a biased nanodisordered bulk KTN:Li perovskite. Cluster imaging is achieved using high-resolution orthographic 3D projections based on giant refraction.

Multi-order Nonlinear Mixing in Dielectric Nanoparticles for Bio-Oriented Applications

E. Naccisi1,2, R. Stanion1,2, P. Gatosvsk1,2, O. Ulcin1,2, S. Orlov3, and V. Jakla1,4; 1Center for Physical Sciences and Technology, Cole Heren Optics laboratory , Vilnius, Lithuania; 2Workshop of Photonics, Vilnius, Lithuania; 3Faculty of Electronics, Vilnius Gediminas Technological University, Vilnius, Lithuania; 4Laser Research Center, Vilnius University, Vilnius, Lithuania

We report on the multiple order nonlinear response, spanning from deep ultraviolet to short-wave infrared, of dielectric nanoparticles of various metal oxides upon femtosecond two-color excitation. The nonlinear response is demonstrated for photo-triggering applications.

Longwave Infrared Photoresistors in Copper 7,7,8,8-tetrayano-2,3,5,6-tetrafluoroquinodimethane (CuTCNQTF)

S. Balendran1, A. Inglo2, W. Yan3, N. Sefidmoozy Azar3, H. Kim4,5, R. Ramanathan3, J. Bullock3, A. Javey4,5, and K. Bansal4,5; 1School of Physics, The University of Melbourne, Parkville, Victoria, Australia; 2NanoBiotechnology Research Laboratory (NBRRL), School of Science, RMIT University, Melbourne, Australia; 3Department of Electrical and Electronic Engineering, The University of Melbourne, Parkville, Australia; 4Electrical Engineering and Computer Sciences, University of California at Berkeley.
Erbium Fiber Laser with 340 nJ, 63 fs pulses from Standard Single Mode Telecom Fiber
K.F. Lee1, G. Zhou1, J. Jiang1, H.G. Winful1, and M.E. Ferrman1
1IMRA America, Inc., Ann Arbor, USA
2Dept. of Physics, University of Michigan, Ann Arbor, USA
3Dept. of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, USA
We greatly increase femtosecond Er fiber laser pulse energy by a simple phase shaping method with fiber Bragg gratings. We generate 110 nJ frequency comb pulses, and 340 nJ pulses at lower repetition rate.

Two–membrane Cavity Optomechanics: Non–linear Dynamics And Measurement Of The Optomechanical Coupling
H.G. Winful1, and J. Sahu1
1H. G. Winful, Ann Arbor, USA
puter Science, University of Michi–

The non-linear dynamics of an optomechanical system of a two–membrane ethalon in a high–finesse Fabry–Pérot cavity is presented, and a novel procedure for the determination of the optomechanical single–photon coupling rate through Hof–bifurcation introduced.

Dynamics of Optical Frequency Combs in Ring and Fabry-Perot Quantum Cascade Lasers
C. Silvestri1, L. L. Columbus1, M. Brambilla2, and M. Gioannini1
1 Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Torino, Italy;
2 Dipartimento Interateneo di Fisica, Politecnico ed Università degli Studi di Bari, Bari, Italy

We present a Time Domain Travelling Wave simulator to study the self–generation of Optical Frequency Combs (OFCs) in different Quantum Cascade Laser cavities. We demonstrate various dynamic scenarios from dense OFCs to solitons.

Low RF line width frequency–modulated and amplitude–modulated combs
L. Weger1, D. Auth1, C. Weber1, D. Kazarov2, M. Piccaro2, J. Hillbrand3,4, L. Lester5, B. Schwarz5,6, F. Capasso7, and S. Brener1,2
1Institute of Applied Physics, TU Darmstadt, 64289 Darmstadt, Germany;
2School of Engineering and Applied Sciences, Harvard University, Cambridge, MA 02138, USA;
3Institute of Solid State Electronics, TU Wien, 1040 Vienna, Austria;
4Department of Electrical and Computer Engineering, VTECH, Blacksburg, Virginia 24061, USA

We demonstrate non–degenerate photon–pair generation by spontaneous parametric down conversion in silver gallium sulfide AgGaS2. Idler photons in the mid–infrared spectral range above 6 μm wavelength are generated correlated to signal photons in the visible.

Neuromorphic photoelectric elements based on metal oxides nanocrystallites
A. Chezhaghov1, I. Bdashov1, A. Chikov2, A. Grum1, and A. Fedyanin1
1 Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia;
2 Faculty of Chemistry, Lomonosov Moscow State University, Moscow, Russia

We report experimentally and numerically quantum correlations imaging through thick random media. We demonstrated that spatial correlations between twin photons are still detected but in form of two–photon speckle–like patterns.

Higher Order Trapped States of a Solitary–Wave Well
O. Melchor1,2,3, S. Willm1,2, A. Yu1, L. Babushkin1,2, U. Morgner1,2,3, and A. Demircan1,2,3
1 Institute of Quantum Optics, Leib–nitz University Hannover, Hannover, Germany;
2Cluster of Excellence PhoenixiD (Photonics, Optics, and Engineering – Innovation Across Disciplines), Hannover, Germany;
3Hannover Centre for Optical Technologies, Hannover, Germany;
4Department of Nanophotonics and Metamaterials, ITMO University, St. Petersburg, Russia

We discuss trapping of radiation by an attractive, solitary–wave induced potential well. The supported trapped states are determined by a Schrödinger–type eigenproblem. They appear robust against perturbation and can be manipulated in various ways.
generated during the detemination process in catalytic zeolite crystals.

of such beams in laser micro-machining of transparent material are demonstrated.

We demonstrate the first observation of core pro-}

sentation method.

We report single-step additive man-

ufacturing of photonic waveguides for single-mode photonic intercon-

nects. We 3D-printed waveguides with step-index and graded-index core-cladding transitions as well as efficient 1-to-4 single-mode beam splitters based on adiabatic coupling.

We report 3D-printed core-cladding waveguides and adiabatic splitters for integrated photonic circuits.

we measured with an accuracy of wavelength nanoscale object can be measured with an accuracy of 

λ/100.

that a linear dimension of a sub-

We report single-step additive man-

ufacturing of photonic waveguides for single-mode photonic intercon-nects.

across 3.9-12.0 continuous wavelength tuning.

generated by the detemination method.

generated during the detemination process in catalytic zeolite crystals.
16:30 – 18:00
EA-6: Polaritons and Quantum Fluids of Light
Chair: Magdalena Stobinska, University of Warsaw, Warsaw, Poland

16:30 – 18:00
CL-3: Advanced Biological Microscopy
Chair: Chiara Stringari, Laboratory for Optics and Biosciences, Ecole Polytechnique, Palaiseau, France

16:30 – 18:00
EE-4: Ultrafast Characterization and Manipulation at Nanoscale
Chair: Ayhan Demircan, Institute for Quantum Optics, Hannover, Germany

16:30 – 18:00
JSIV-2: Learning in Imaging and Metrology I
Chair: Christophe Moser, EPFL, Lausanne, Switzerland

16:30 – 18:00
CB-9: Dynamics and Novel Concepts in Semiconductor Lasers
Chair: Eric Tournié, University of Montpellier, France

EA-6.1 THU (Invited) 16:30
Universal KPZ scaling in the coherence of a 1D polariton condensate
J.Bloch; Center for Nanoscience and Nanotechnology, CNRS-Paris Saclay University, Palaiseau, France
We demonstrate KPZ universal scaling in the spatio-temporal decay of the first order coherence of a 1D polariton condensate. These results highlight the fundamental difference between such driven dissipative condensates and equilibrium systems.

CL-3.1 THU (Invited) 16:30
3D and parallelized RESOLFT for volumetric live cell imaging
I. Testa; KTH-SciLifeLab, Stockholm, Sweden
We present a new RESOLFT microscope capable of delivering sub-80 nm 3D resolution in whole living cells with a new interference pattern applied to reversible photo-switching. Live cell volumetric imaging is demonstrated.

EE-4.1 THU 16:30
Ultrafast Detection and Manipulation of a Persistent Trion Coherence in a Single CdSe/ZnSe Quantum Dot
P. Henzler1, M. Holtkemper2, C. Traum1, D.E. Reiter3, D.V. Sletschy1,3, and A. Leitenstorfer1;
1Department of Physics and Center for Applied Photonics, University of Konstanz, D-78457 Konstanz, Germany;
2Institute of Solid State Theory, University of Münster, D-48149 Münster, Germany;
3Department of Engineering Physics, Polytechnique Montréal, Montréal, Québec H3T 1J4, Canada
Femtosecond microscopy reveals long-lived quantum beats between highly excited trion states probed via biexcitonic absorption. Pump-probe polarization provides control over phase and amplitude. Interesting processes of few-fermion quantum dynamics after single-electron excitation are reported.

JSIV-2.1 THU (Invited) 16:30
On the use of machine learning for computational imaging
G. Barbastathis; Massachusetts Institute of Technology, Cambridge, Massachusetts, USA
I will discuss the use of machine learning with physics priors for imaging systems that heavily rely on computation to overcome ill-posedness and noise.

CB-9.1 THU 16:30
Pseudo mode-locking
G. Steinmeyer1,2, E. Escoto1,3, and A. Demircan4; 1Max-Born-Institut, Berlin, Germany; 2Institut für Physik, Humboldt Universität zu Berlin, Berlin, Germany; 3Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany; 4Cluster of Excellence PhoenixD and the Institute of Quantum Optics, Leibniz University, Hannover, Germany
In the recent decade, numerous reports of self mode-locking met controversial reception. For the first time, we offer a theoretical explanation for those disputed experimental reports in the framework of the Haus Master Equation.
Room 2

Room 3

Room 4

Room 5

Room 6

Room 1

CM-6.2 THU 16:45
High-Speed Writing of Volume Gratings Inside of Transparent Materials
S. Ho, E. Alamhommadian, and P.R. Herman
Department of Electrical and Computer Engineering, University of Toronto, Toronto, Canada
Nano-explosion of open-cavity voids were applied in combination with beam shaping and splitting by an SLM to enable high-speed nano-structuring of high resolution, 3D photonic crystals in glasses and polymer films for strong grating effects.

CM-6.3 THU 17:00
Airy beam enables single pass curved in-volume modifications and cutting of borosilicate glass
D. Sohr1,2, J.U. Thomas3, and S. Skapin1
1. Institutte Lumiére Matière, UMRS306 - UCBL - CNRS, Lyon, France; 2. SCHOTT AG, Mainz, Germany
We produced permanent laser modifications in borosilicate glass following an adjustable parabolic trajectory and used these for single pass cutting of a 500 µm glass sheet resulting in a well defined convex edge after etching.

CD-9.2 THU 16:45
Raman Red-shift Compressor: A Simple Approach for Scaling the High Harmonic Generation
K. Ligan2,3, R. Safar2, G. Baretie1, L. Arias1, P. Lassonde1, H. Ibrahim1, B. Vodouh2, E. Jal1, J. Lüning3, N. Jansen4, A. Baluška2, F. Légaré2, and G. Fan1
1. INRS-EMT, Varennes, Canada; 2. Sorbonne Université, Paris, France; 3. Helmholtz-Zentrum Berlin, Berlin, Germany; 4. Synchrotron SOLEIL, Gif-sur-Yvette, France
Multidimensional solitary states brought by the Raman process in gas-filled hollow-core fibres are used to drive high harmonic generation, pushing the cut-off to higher photon energies and improving the conversion efficiency of extreme ultraviolet photons.

CD-9.3 THU 17:00
Mid-Infrared Supercontinuum Generation in Germanium Waveguides
A. Della Torre1, M. Sinobad2, R. Armand3, B. Luther-Davies1, P. Ma4, S. Madden5, D. Moss5, A. Mitchell6, J.-M. Hartmann3, V. Reboud6, J.-M. Fedeli1, C. Monot1, and C. Grillet7
1. Université de Lyon, Institut des Nanotechnologies de Lyon, Ecully, France; 2. Laser Physics Centre, Australian National University, Canberra, Australia; 3. Optical Sciences Centre, Swinburne University of Technology, Hawthorn, Australia; 4. School of Engineering, RMIT University, Melbourne, Australia; 5. Université Grenoble Alpes, CEA-Leti, Grenoble, France
We report the first experimental demonstration of supercontinuum generation (from 3.53 to 5.83 µm at the -30 dB level) in a pure germanium waveguide. We attribute the long wavelength extension limit to free-carrier absorption.

CM-6.2 THU 16:45
Thermal Response Characterisation of First-order Fibre Bragg Gratings in Indium Fluoride Fibre
J. Chiamenti1,2, T. Elsman2, A. Reupert3, O. Kani1, M. Becker1, L. Wondracek4, and M. Chernyshova1
1. Leibniz Institute of Photonic Technology, Leibniz-IPHT, Jena, Germany; 2. Federal University of Technology - Parana - UTFPR/DAET, Curitiba, Brazil; 3. Otto Schott Institute of Materials Research, Friedrich Schiller University, Jena, Germany
Vis-femtosecond laser was used for inscription of first-order Bragg gratings in indium fluoride fibres. They presented high reflectivity, thermal stability and high thermal sensitivity that will contribute to the development of Mid-IR fibre lasers and sensing technologies.

CD-9.2 THU 16:45
Poling Optical Fibers with Electrical Corona Discharge
J.M. Barbosa Pereira2,3,4, Á. Claesson5, F. Laurell6, O. Tarasenko7, and W. Margulis1,2
2. RISE Research Institutes of Sweden, Kista, Sweden; 6. KTH Royal Institute of Technology, Stockholm, Sweden
Electric field created by electrical corona discharge is used to pole silicate fibers. The method explores a different configuration to enhance optical poling. An electrooptic coefficient of 0.086 pm/V, and Vr of 702V is obtained.

CM-6.3 THU 17:00
Scalable photonic splitters based on 3D laser lithography
I. Moughames, X. Porte, L. Larger, M. Jacquot, M. Kaide, and D. Brunner; Femto-st, University of Franche-Comté, Besançon, France
We present scalable 3D photonic splitters fabricated using 3D laser optical lithography. Splitters comprise optical waveguide with 1.2µm diameter, and we characterize 1x9 I/O branching topology. Finally, we demonstrate a 225 input and 529 output interconnect.

CI-6.2 THU 16:45
Terahertz waves transmission in 3D printed photonic crystals
M. Missori1, L. Pilozzi2, and C. Conti2,3
1. Institute of Complex Systems, National Research Council (ISC-CNR), Rome, Italy; 2. Department of Physics, University Sapienza, Rome, Italy
We exploit 3D-printed components as a low-cost, rapid, and versatile tool for the fabrication of THz photonic crystals and carry out experiments and simulations of their spectral behaviour.

CI-6.3 THU 17:00
Topological optical and phononic interface modes by simultaneous band inversion
M. Esmann, O. Ortiz, P. Priya, A. Rodríguez, A. Lemaitre, and N.D. Lanzillotti-Kimura
Centre of Nanosciences et de Nanotechnologies (C2N), Université Paris-Saclay, CNRS, 10 Boulevard Thomas Gobert, 91120 Palaiseau, France
We construct colocalized optical and phononic interface modes by simultaneous band inversion in a GaAs/AlAs heterostructure. The topological robustness manifests in a resilient Brillouin cross-section with potential applications for robust optomechanical resonators.
**Room 7**

**Room 8**

**Room 9**

**Room 10**

**Room 11**

**EE-4.2 THU (Keynote) 16:45**

High-field physics in nanostructures

- M. Kling, Physics Department, Ludwig-Maximilians-Universität Munich, Garching, Germany; Max Planck Institute of Quantum Optics, Garching, Germany

The talk will highlight recent research results and show perspectives for studies of high-field physics in nanostructures.

**CL-3.2 THU 17:00**

Time-Resolved STED Microscopy with Single Photon Detector Array: a Perfect Synergy

- O. Bleu1,2, J. Levinson1,2, and M.M. Parish1,2; 1 School of Physics and Astronomy, Monash University, Clayton, Australia; 2 ARC Centre of Excellence in Future Low-Energy Electronics Technologies, Monash University, Clayton, Australia

We revisit the problem of a polariton pillar cavity driven by a low intensity coherent pump accounting for the polarization degree of freedom. Our results are of relevance for the experimental pursuit of polariton blockade effects.

**JSIV-2.2 THU 17:00**

Deeply Subwavelength Topological Microscopic

- T. Pun1, E.Y. Ou1, E. Rogers1,2, N. Papasimakis1, J.F. Smith1,3, and N.I. Zheludev1,3; 1 Optoelectronics Research Centre & Centre for Photonic Metamaterials, University of Southampton, Southampton, United Kingdom; 2 Department of Electronics & Electrical Engineering, University of Glasgow, Glasgow, United Kingdom; 3 School of Physics and Physical Electronics, Nanyang Technological University, Singapore, Singapore; 4 School of Physics and CRANN Institute, Trinity College Dublin, Dublin, Ireland

We study two optical feedback configurations and quantify the randomness of the diode laser output. We show that the light from stimulated Brillouin backscattering feedback generates a more random signal, as compared to conventional feedback.
Towards plasmonic-enhanced optical nonlinearities in graphene-metal-heterostructures

- A. Trenti, L. Pavesi, J. Gargiulo, M. Alcaraz Iranzo, J. Binks, J. van der Ziel, P. Timonov, and F. Rozema

We present numerical simulations towards an athermal fiber design. We discuss how to adjust the thermo-optical coefficient to mitigate thermal effects such as mode shrinking and transversal mode instabilities in high power fiber lasers.

Fiber-connected 3D Printed Hollow-core Light Cage for Gas Detection

- B. Jang, J. Gargiulo, J. Kim, J. Bürger, H. Lehmann, T. Wiedow, S.A. Maier, and M.A. Schmidt

Leibniz Institute of Photonic Technology, Jena, Germany; Institute of Applied Physics, Friedrich-Schiller-University Jena, Albert-Einstein-Str. 15, Jena, Germany

The bus cage is a 3D nanostructured hollow-core waveguide which can be used as a light-matter interaction platform. Here, we present the fiber-connected light cage and demonstrate ammonia sensing using tunable diode laser absorption spectroscopy.

Role of the bus waveguide in the nonlinear reciprocity breaking in a Titanio microresonator

- R. Franchi, A. Maizáez de las Heras, S. Bassi, M. Ghulinyan, I. Carusotto, and L. Pavesi

Instituto de Ciencias Fotoniques, Barcelona Institute of Science and Technology, Barcelona, Spain

We demonstrated how an asymmetric microresonator in the nonlinear regime behaves as a nonreciprocal system and we discussed the role of the bus waveguide asymmetry and its Fabry-Perot oscillations.

Optimization of Chirp and Tilt of Fiber Bragg gratings for Raman Emission Suppression

- W. Lin, M. Desjardins-Carrier, B. Sevigny, and M. Rochette

Université de Montréal, Montreal, Canada,

Faculty of Physics, University at Buffalo, New York, USA

We demonstrate that the self-phase modulation of mid-infrared photons into the visible transitions of InP can lead to a suppression of up to 90 dB in the Raman suppression in a kW fiber laser.

3D printed photonic structure for generation of zeroth- and high-order Bessel beams from a single-mode optical fiber

- S. Ivanov, Y. Kartashov, A. Szameit, L. Torner, and V. Konotop

Moscow Institute of Physics and Technology, Dolgoprudny, Moscow region, Russia; Russian Academy of Sciences, Troitsk, Moscow, Russia.

We present a metal-heterostructures for high power laser applications.

Simplified, athermal fiber designs for high power laser applications

- G. Palma-Vega, S. Kuhn, T. Walbaum, N. Haurllamr, and T. Schreiber

Leibniz Institute of Photonic Technology, Jena, Germany; Institute of Applied Physics, Friedrich-Schiller-University Jena, Albert-Einstein-Str. 15, Jena, Germany

Fiber Bragg gratings with a tilt of bus waveguide asymmetry and role of the bus waveguide as a nonreciprocal system.
Steady-state superfluidity of light in a tunable cavity at room temperature
G. Keijser1*, Z. Geng1, K.J.H. Peters1, M. Wouters2, and S.R.K. Rodriguez1; 1AMOLF, Amsterdam, Netherlands; 2University of Antwerp, Antwerp, Belgium. We report the first observation of superfluid cavity photons. Remarkably, the superfluid state emerges in a steady state and at room temperature.

CL-3.3 THU 17:15
Circular-dichroism SHG microscopy probes the polarization distribution of out-of-plane collagen fibril assemblies
M. Schmelz1, C. Tealson1, M. Pinard2, U. Hansen3, M. Alnawaiseh4, D. Ghouby1, V. Borderie1, G. Mosser1, A. Côme1, E. Légère1, G. Latour1,2, and M.-C. Schanne-Klein3; 1Laboratoire d’Optique et Biosciences, Ecole polytechnique, CNRS, INSERM, Institut Polytechnique de Paris, Palaiseau, France; 2Institut de la Recherche Scientifique, Centre Energie Matériaux et Télécommunications, Varenne, Canada; 3Institute for Musculoskeletal Medicine, University Hospital Münster, Münster, Germany; 4Department of Ophthalmology, University of Münster Medical Center, Münster, Germany.

EE-4.3 THU 17:30
Aggregation Dependent Light-Heat Conversion Dynamics in Gold Nanoparticles Loaded Agarose Gel
A. Mazzanti1, L. Moretti1, A. Rossetti2, A. Schirato1, L. Polito3, F. Pizzetti4, A. Sacchetti5, P. Laporta1,2, G. Cerrillo1,2, F. Rossi3, M. Mauri1, and G. Dell’Anna1; 1Dipartimento di Fisica, Politecnico di Milano, Milan, Italy; 2Dipartimento di Chimica, Matte-
We investigate and compare the advantages and drawbacks of two advanced femtosecond direct laser writing methods (direct ablation using burst mode fabrication and selective glass etching) for potential applications in microfluidics, micro-mechanics and microoptics.

To a lesser extent, increased power density in the first regime of the laser focusing parameters may lead to melting. We investigate several points in the parameter space to ensure this effect is below 5%.

Laser writing is an effective way of producing various types of microfluidic channels. The main advantage is the fast and precise way of modifying the glass properties. The disadvantages are the lack of control over the channel dimensions and the difficulty of modifying the glass surface for cleaning. The results of laser writing on glass are promising for the application of microfluidic systems.
perature, due to the strong thermo-optical nonlinearity of our oil-filled cavity.

EA-6.5 THU 17:45
Photon Pair Correlations in Semiconductor-Superconductor Light Sources
S. Bouscher1, D. Pauna2, K. Balasubramanian13,2, R. Jacovi2, A. Kumar3, C. Schneider3, S. Hoefling3, and A. Hayat1; 1Department of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel; 2Electrical Engineering Faculty, Indian institute of technology, Kanpur, India; 3Technische Physik, Physikalisches Institut und Wilhelm Conrad Röntgen Research Center for Complex Material Systems, Universität Würzburg, Würzburg, Germany
We demonstrate evidence of photon pair correlations, resulting from injected Cooper-pairs in semiconductor-semiconductor structures. Such structures can be utilized for multiple applications including enhanced two-photon gain, electrically-driven entangled-photon generation and Bell-state analyzers.

CL-3.5 THU 17:45
Fundamental Bounds on the Precision of Classical Interferometric Imaging
Techniques
D. Bouchet1,2, J. Dong3, D. Maestre4,5, and T. Iffmann4,5; 1Debye Institute for Nanomaterials Science, Utrecht, Netherlands; 2Université Grenoble Alpes, CNRS, LIPHY, Grenoble, France; 3Laboratoire Kastler Brossel, École Normale Supérieure, Université PSL, CNRS, Sorbonne Université, Collège de France, Paris, France; 4University of Vienna, Faculty of Physics, VCQP, Vienna, Austria; 5Max Perutz Laboratories, Department of Structural and Computational Biology, Vienna, Austria
Interferometric imaging is a widely used in physics, biology, and in clinical applications. Here we derive and discuss bounds on the achievable phase measurement precision that can be obtained using classical linear optical systems.

EE-4.4 THU 17:45
Probing Free Carrier and Exciton Dynamics in a Bulk Semiconductor with Two-Dimensional Electronic Spectroscopy
J. Allerbeck1,2,3, J. Deckert1,2, L. Spitzer3, and D. Brida1,2; 1Université du Luxembourg, Luxembourg, Luxembourg; 2University of Konstanz, Konstanz, Germany; 3University of Southhampton, Southampton, United Kingdom
We implement polarization-resolved second harmonic generation microscopy to characterize the orientation distribution of collagen lamellae in human cornea. We evidence a less ordered distribution in keratoconic corneas, in agreement with their deteriorated mechanical behaviour.

JStV-2.5 THU 17:45
Optical Counting of Particles Too Small to See
E.A. Chan1, C. Rendón-Baraza1, G. Yuan1, T. Pu1, J.-Y. Ou1, N. Papasimakis1, and N. I. Zheludev1,2; 1Centre for Disruptive Photonic Technologies, Nanyang Technological University, Singapore, Singapore; 2Centre for Photonic Metamaterials and Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom
Artificial intelligence analysis of the light scattered on groups of particles of different sizes allows counting of them and classifying them by size, even if they are too small (λ/7) to be resolved by the microscope.

CB-9.6 THU 17:45
Ultrawide-band chaotic breathing in semiconductor laser
T. Malica1,2, G. Bouchez1,2, D. Wolferberger1,3, and M. Sciamanna1,2; 1Chaire Photonique, LMOPS, CentraleSupélec, 2 Rue Edouard Belin, 92295 Chatenay-Malabry, France; 2Université de Lorraine, LMOPS, 2 Rue Edouard Belin, 57070 Metz, France
An optical delay system with phase-conjugate feedback is shown to operate as a three timescale superharmonic system and consistently exhibit novel, nonlinear, and spatiotemporally complex dynamics with state-of-the-art chaos bandwidth values of ~35 GHz.
**PD-1.1 THU 18:30**

**Evidence for spin memory in photoluminescence of room temperature vertical-cavity quantum dot gain structure**

J. Doogan, S. Phutthaprasartporn, E. Clarke, and T. Ackemann

1. SUPA and Department of Physics, University of Strathclyde, Glasgow, United Kingdom; 2. M Squared Lasers Ltd, Glasgow, United Kingdom; 3. EPSRC National Epi-Facility, University of Sheffield, Sheffield, United Kingdom

We demonstrate spin memory in the photoluminescence of InAs dot-in-a-well structures at room temperature providing a basis for spintronic applications in vertical-external cavity laser schemes with increased power and flexibility compared to better established spin-VCSELs.

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**PD-1.2 THU 18:40**

**Broadband microcomb generation from a zero-dispersion fiber Fabry-Pérot microresonator**

Z. Xiao, T. Li, M. Cai, Y. Huang, K. Wu, and J. Chen; Shanghai Jiao Tong University, Shanghai, China

We present a multipass cell based on reflectivity-enhanced silver mirrors on silicon substrates allowing for degradation-free nonlinear spectral broadening (M2<1.2, Homogeneity=97.5%) at an unprecedented average power of 388W compressible to 6.9fs pulsed duration.

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**PD-1.3 THU 18:50**

**Third-order nonlinear optics in KTP ridge waveguides**


1. University Grenoble-Alpes, Institut Néel-CNRS, Grenoble, France; 2. Femto-Engineering, Besançon, France; 3. FEMTO-ST Institute, Université de Franche-Comté, Besançon, France

We demonstrate a bright and compact source of wavelength-tunable few-femtosecond deep ultraviolet laser pulses based on resonant dispersive wave emission in gas-filled hollow capillary fibre.

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**PD-1.4 THU 19:00**

**388 W multi-pass cell broadening supporting few-cycle pulse duration**

1. M. Müller, J. Budiš, H. Stark, C. Grebing, and J. Limpert

2. Friedrich Schiller University Jena, Institute of Applied Physics, Jena, Germany; 3. Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany; 4. Helmholtz-Institut Jena, Jena, Germany

We present a multi-pass cell based on reflectivity-enhanced silver mirrors on silicon substrates allowing for degradation-free nonlinear spectral broadening (M2<1.2, Homogeneity=97.5%) at an unprecedented average power of 388W compressible to 6.9fs pulse duration.

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**PD-1.5 THU 19:10**

**Bright, Tunable and Complete Source of Few-Femtosecond Pulses in the Deep Ultraviolet**

1. C. Brahms and J.C. Travers; Heriot-Watt University, Edinburgh, United Kingdom

We fabricate rectangular arrays of thousands of hBN nanoplatelets hosting single-photons emitters using a capillary assembly method. Positioning yields of >95% are achieved.

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**PD-1.6 THU 19:20**

**1.5-W diode-pumped femtosecond Cr:ZnS amplifier**

1. S. Qu, M. Pöttzberger, A. Sebesta, V. Pervak, F. Krauss, A. Weigel, and K. F. Mak

2. Molekulare Uflyyommer Kulturahézhasznal Non-Profit Kft (CMF), Budapest, Hungary; 3. Ludwig-Maximilians-Universität München, Garching, Germany; 4. Max Planck Institute of Quantum Optics, Garching, Germany

We report the first Cr:ZnS amplifier directly pumped by laser diodes, providing 1.5W of average output power with gain factor of 4.2 and the spectrum covering 2-2.6 μm which supports a 40fs transform-limited pulse duration.

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**PD-1.7 THU 19:30**

**Time-resolved X-ray holographic imaging of the light-induced phase transition in vanadium dioxide**


1. CFI - The Institute of Photonic Sciences, Castelldefels (Barcelona), Spain; 2. Department of Physics and Astronomy, Aarhus University, Denmark; 3. Department of Physics, Soyang University, Seoul, South Korea; 4. Institut für Optik und Atomare Physik, Technische Universität Berlin, Berlin, Germany; 5. Department of Physics and Astronomy, Vanderbilt University, Nashville, USA; 6. ALBA Synchrotron Light Source, Cerdanyola del Vallés, Spain; 7. Pohang Accelerator Laboratory, Pohang, South Korea

We use time-resolved resonant X-ray holography at an X-ray free electron laser to perform the first femtosecond-temporal and nanometer-spatial resolution measurements of domain growth in a light-induced phase transition.

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**PD-1.8 THU 19:40**

**AttoSecond optical and Ramsey-type interference**

1. T. Matsubara, Y. Nabeika, K.L. Ishikawa, Y. Yamanouchi, and K. Midorikawa

2. RIKEN center for Advanced Photonics, 2-1 Hiroawa, Wako-shi, Saitama 351-0188, Japan; 3. Department of Chemistry, School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo 113-0033, Japan; 4. Graduate School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo 113-8656, Japan

We demonstrated Ramsey-type interference of the 1s2p state in a He atom by scanning the delay of two XUV high-harmonic pulses from the 0-attosecond delay. We utilized angularly-resolved photoclectron spectra as the interference signals.

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**PD-1.9 THU 19:50**

**Optomechanical quantum teleportation**

1. N. Fiaschi, B. Hensen, A. Wallucks, R. Benevides, J. Li, T.P.M. Alegre, and S. Grosblacher

2. Kavli Institute of Nanoscience, Delft, Netherlands; 3. Photonics Research Center, Campusina, Brazil; 4. Zhejiang Province Key Laboratory of Nanomaterials and Nanodevices, Zhejiang University, Hangzhou, China

Quantum teleportation is a key component in long distance quantum communication protocols. Here we demonstrate quantum teleportation of a polarization-encoded optical input state onto the joint state of a pair of nanomechanical resonators.
A "Two-color" approach to controlling polarization of attosecond pulses with plasmonic-enhanced bichromatic counter-rotating circularly polarized fields I.N. Ansari1, C. Hofmann3, L. Mediuskas4, M. Lewenstein5, M.F. Ciappina6,7,8, and G. Dixit1
1Indian Institute of Technology Bombay, Mumbai, India; 2Max Planck Institute for the Physics of Complex Systems, Dresden, Germany; 3University College London, London, United Kingdom; 4ICFO - Institut de Ciències Fotoniques, The Barcelona Institute of Science and Technology, Barcelona, Spain; 5ICREA, Barcelona, Spain; 6Institute of Physics of the ASCR, ELI Beamlines Project, Prague, Czech Republic; 7Guangdong Technion-Israel Institute of Technology, Shantou, China; 8Technion Institute of Technology, Haifa, Israel.
We apply a bichromatic counter-rotating laser field with spatially inhomogeneous enhancement. The direction and the strength of the plasmonic field enhance or suppress certain recombining electron trajectories, thus modifying the ellipticity of attosecond pulses.
CG-P.3 THU
19:20
Strongly correlated electronic states in a MoSe2/WSe2: moiré superlattice
• A. Campbell1, M. Brotons-i-Gisbert1, H. Baek1, K. Watanabe1, T. Taniguchi4, and B.D. Gerardot1; 1Heriot-Watt University, Edinburgh, United Kingdom; 2National Institute of Materials Science, Tsukuba, Japan.
We report a general multi-path delayed-choice experiment on a large-scale integrated silicon nanophotonic quantum chip. Wave- and particle-nature in the generalized multi-path framework are experimentally verified and the generalization of Bohr’s multi-path duality relation is demonstrated.
PD-2.6 THU
CG-P.5 THU
19:30
Observation of temporal cavity solitons in a synthetic photonic lattice
• N. Englebert1, S.-P. Gorza1, F. Leo1, M. Ertmer2, and J. Fatome1; 1Institute of Photonics, University of Rostock, Rostock, Germany; 2ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain.
We experimentally demonstrate the generation of temporal cavity solitons in a one-dimensional synthetic photonic lattice. We use a fibre resonator incorporating a phase modulator and investigate the dynamics as a function of the frequency detuning.
CG-P.6 THU
19:40
In Situ Measurement of the Cooper Minimum in Argon
• G. Brown, C. Zhang, D.H. Ko, and P.B. Corkum; University of Ottawa, Ottawa, Canada
We simulate a collinear two-color attosecond in situ measurement in argon and show that in situ techniques measure a variation of the electron group delay around the Cooper minimum.
CG-P.7 THU
19:50
Non-destructive detection of photonic qubits
• B. Niemcz4, J. P. P. Boes5, S. Langenfeld, and G. Rempe1; 1Max-Planck-Institut für Quantenoptik, Garching, Germany; 2IFCQ-Institut de Ciencies Fotòniques, Castelldefels, Spain.
The qubit loss problem in quantum communication can be mitigated by nondestructive photonic qubit detectors that track the qubit transmission. We implemented such a detector with a single atom coupled to two crossed optical cavities.
We have developed a pump-probe experiment that allows us to investigate the spatial and temporal characteristics of laser-produced plasmas by means of analysing high-order harmonic generation spectra produced in those plasmas.

**CG-P.11 THU**

**Dalitz Plots in Classical Electrodyamics of Light-Matter Interactions**

*H. Nieto-Chaupis; Universidad Autónoma del Perú, Lima, Peru*

The Dalitz’s technique commonly applied at High-Energy Physics to identify new particles, is employed in this paper with the Hartemann-Kerman theory in shifted-frequency versus laser intensity plots to explore emission of laser-photons by a free-electron.

**CG-P.12 THU**

**Light-induced valleytronics in pristine graphene**

*M. Marzachtaharan Sylajia, G. Dixit, A. Jimenez-Galan, and M. Ivanov*

We study theoretically a novel robust way of single-cycle pulse compression via attraction of subcycle SIT-like components of incident pulse.

**CG-P.9 THU**

**Vision for Terahertz Electric Field Driven Chemistry: Exploring photodissociation dynamics from Coulomb Explosion processes via time resolved FT-VIS spectroscopy**

*V. Chiha; K. Mogiroyosi, and K. Sarosi; ELI-ALPS, Szeged, Hungary*

Time resolved FT-VIS emission spectroscopy allows investigating the neutral photodissoociation processes from Coulomb explosion or XUV/attosecond pump experiments. The high-resolution FT-VIS detection scheme approach facilitates studies of reaction control from the intense THz pulses.

**CG-P.10 THU**

**Towards High-Order Harmonic Generation in Laser Produced Plasmas**

*J. Mathijsen, S. Witte, and K.S.E. Eikema*

**CG-P.14 THU**

**Quantum bridges in phase space – Interference and non-classicality in enhanced ionisation**

*H. Chomet, D. Sarkar, and C. Figueira de Morisson Faria; University College London, London, United Kingdom*

We perform a phase-space analysis of strong-field enhanced ionisation in molecules. Optimal conditions require minimising population trapping and using a quantum-interference induced bridging mechanism to feed into ionisation pathways along the field gradient.

**CG-P.15 THU**

**Angular dependence of non-perturbative VUV harmonics in silicon**

*P. Sathur and M. Kokal; Faculty of Mathematics and Physics, Charles University, Karlovo 3, 12116, Prague 2, Czech Republic*

Non-perturbative high harmonics up to 8.1eV in silicon in reflection geometry have been observed. The dependence of harmonics on crystal orientation has been studied and compared with TDDFT calculations to elucidate the role of interband and intraband polarizations.

**CG-P.16 THU**

**Angle-Resolved Attosecond Streaking of Twisted Attosecond Pulses**

*I. Ansari, D. Jadoun, and G. Dixit; Indian Institute of Technology Bombay, Mumbai, India*

The present work investigates the amount of orbital angular momentum encoded in Laguerre-Gaussian modes of twisted attosecond pulses via energy- and angle-resolved attosecond streaking in pump-probe setup.

**CG-P.17 THU**

**Effects of Pulse Punsetal in High-Contrast Laser-Field Interactions**

*Z. Lécz, I. Babushkin, I.Ansari, D.Jadoun, and G. Dixit; Indian institute of Technology Bombay, Mumbai, India*

**CG-P.19 THU**

**Investigation of Electron Acceleration using Chirped Radially Polarized Bessel X Beams**

*K. Lourinavitsis, S. Orlov, and G. Braždilišnas; State research institute Center for Physical Sciences and Technology, Vilnius, Lithuania*

We use subluminal and supraluminal group velocities of non-deffracting Bessel-X beams for electron acceleration. Single electron dynamics in a pulsed laser beam shows that it is possible to counteract Doppler effect by using temporal chirp.

**CG-P.20 THU**

**Plasma-filled optical microcavity**

*B. Balthash, I. Hyams, S. Kepz, M. Dovizdion, F. Leti, J. Ward, S. Kasumie, S.N. Chormaic, O. Cohen, R. Gud, and T. Carmom; 1Technion, Israel Institute of Technology, Haifa, Israel; 2Tokai Institute of Science, Okinawa, Japan; 3Hebrew University of Jerusalem, Jerusalem, Israel; 4Tokai University, Tokyo, Japan*

We design and fabricate a plasma containing microresonator, and then experimentally demonstrate a continuous in time CW resonantly enhanced light plasma interaction. Optical refraction smaller than one is measured in the resonator.

**CG-P.21 THU**

**First-principles calculations for determining the thickness to maximize HHG efficiency of laser-irradiated nano films**

*S. Yamada and K. Yabana; University of Tsukuba, Tsukuba, Japan*

We present first-principles calculations based on TDDFT for HHG in reflection and transmission from Si nano films. We show that the HHG is the strongest when the thickness of Si nano film is 2-15 nm.
We demonstrate how a π-phase shift birefringent defect introduced within a two-component coherently driven passive Kerr resonator leads to flip-flopping dynamics and self-symmetrization, enabling the emergence of spontaneous symmetry-broken localized vectorial structures with unprecedented robustness.

**EE-P.2 THU**

**Spatial-temporal nonlinear dynamics in arrays of coupled multimode microresonators**

- A. Tsvin, A. Tikan, and T. Kippenberg; Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

We theoretically investigate pattern formation and nonlinear dynamics in arrays of coupled multimode optical microresonators. We show the effective two-dimensional nature of the system and examine the arising spatio-temporal modelocking mechanism.

**EE-P.3 THU**

**Mode dynamics during transition into Kerr self-cleaning regime for laser beams propagated in a multimode GRIN fiber**

- M.D. Gervaziev1,2, I. Zhdanov1,2, I. Zhdanov1,2, I. Zhdanov1,2, I. Zhdanov1,2, I. Zhdanov1,2, I. Zhdanov1,2, and S. Wabnitz1,2,3

We study experimentally a mode-locked pulsed erbium doped fiber laser with an outer amplification stage presenting different regimes of unstable shot-to-shot emission of pulses. In addition, the pulses show time-evolving polarization, which is experimentally characterized.

**EE-P.4 THU**

**Wavelength correlations in a fiber optical parametric oscillator**

- M. Tout, R. Becherer, T. Godin, and A. Hideur; CORIA - CNRS - Université de Rouen Normandie - INS A Rouen, Rouen, France

We explore the spectral correlations in a fiber optical parametric oscillator using an original combination of statistical tools including mutual information analysis. We demonstrate, among other results, that such correla-
Thursday Posters

**EF-P.5 THU**

**Bichromatic synchronized chaos in driven coupled electro-optomechanical nanoresonators**

G. Madul{è}, F. Correia{è}, S. Barbo{è}, and R. Braine{è};
1Centre de Nanosciences et Nanotechnologies, Palaiseau, France;
2University of Paris, Paris, France

In mechanically coupled electrooptomechanical nanocavities, we present an experimental and theoretical investigation of synchronization on the route to chaos and in the chaotic regime at two distinct carrier frequencies referred to as bichromatic chaos.

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**EF-P.6 THU**

**New light-matter phase: Asymmetric nonlinear self-consistent grating in low-Q CW superadiant laser with symmetric Fabry-Perot cavity**

V. Kocharovsky{è}, A. Mishin{è}, E. Kocharovsky{è}, V. Kukushkin{è}, and V. Kocharovsky{è};
1Institute of Applied Physics, Russian Academy of Science, Nizhny Novgorod, Russia; 2Department of Physics and Astronomy, Texas A&M University, College Station, USA

Numerical solution to Maxwell-Bloch equations for a low-Q CW superadiant laser with symmetric Fabry-Perot cavity shows a highly asymmetric grating of population and polarization inversion of active centers accompanied by counter-propagating waves with different amplitudes.

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**EF-P.7 THU**

**Spatiotemporal Wave Pattern Stabilization by Graded Dissipation in Multimode Fibers**

V. Kalaushkov{è} and S. Wubnitz{è};
1Department of Engineering Science, University of Oxford, Oxford, United Kingdom

We show that networks of phase-traits optical parametric oscillators simulate the three-state Potts model. A direct simulation of the underlying nonlinear dynamical model provides an efficient path toward combinatorial optimization.

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**EF-P.8 THU**

**Coherence study of DSR-like pulses in passively mode-locked fiber lasers**

M. Kemel{è}, M. Sall{è}, C. Cirel{è}, G. Semaan{è}, A. Nady{è}, and F. Sanchez{è};
1Laboratoire de Photonique d'Angers, Université d'Angers, 2 Bd Lavoisier, 49045, Angers, France;
2Department of Physics, University of Southern Brittany, Brest, France

To be considered as dissipative soliton resonance (DSR), the square pulses in passively mode-locked fiber lasers must be temporally coherent. Here we study the coherence of ns pulses with Mach-Zehnder and dispersive Fourier transform methods.

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**EF-P.9 THU**

**Temporal analogue of the Fresnel diffraction by a phase plate in linear and nonlinear optical fibers**

A. Sheveleva{è} and C. Finot{è};
Laboratoire Interdisciplinaire CARNOT de Bourgogne, DIJON Cedex, France

We investigate evolution of a continuous wave modulated with a transient phase jump. Numerical and analytical study of linear propagation replicates near-field diffraction patterns, whereas Kerr nonlinearity stimulates emergence of coherent structures.

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**EF-P.10 THU**

**Combinatorial Optimization using the Optical Potts Machine**

M. Honari Latifpour{è} and M.-A. Miri{è};
1Queen's College, The City University of New York, New York, New York, USA;
2Physics Program, The Graduate Center of the City University of New York, New York, USA

We show that networks of phase-traits optical parametric oscillators simulate the three-state Potts model. A direct simulation of the underlying nonlinear dynamical model provides an efficient path toward combinatorial optimization.

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**EF-P.11 THU**

**Statistics of SPM rogue waves**

R.E. Hansen{è}, C.R. Petersen{è}, and O. Bang{è};
DTU Fotonik, Department of Photonics Engineering, Kgs. Lyngby, Denmark;
NORBLIS IVS, Virum, Denmark;
NKT Photonics A/S, Birkerød, Denmark

We investigate evolution of a continuous wave modulated by abrupt temporal phase jumps. Numerical and statistical analysis of complex polarization dynamics driven by polarization instabilities tunable by changing the synchronization scenario between orthogonal states of polarization.

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**EF-P.12 THU**

**Polarization instabilities in mode-locked Er-doped fiber laser**

S. Sergeyev{è}, H. Khashi{è}, and V. Sharma{è};
Aston Institute of Photonics Technologies, Birmingham, United Kingdom

For Er-doped fiber laser mode-locked by Nonlinear Polarization Rotation, we present a theoretical analysis of complex polarization dynamics driven by polarization instabilities tunable by changing the synchronization scenario between orthogonal states of polarization.

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**EF-P.13 THU**

**Noise suppression through extreme self-phase modulation in cascaded mid-IR supercontinuum generation**

R.E. Hansen{è}, C.R. Petersen{è}, and O. Bang{è};
DTU Fotonik, Department of Photonics Engineering, Kgs. Lyngby, Denmark;
NORBLIS IVS, Virum, Denmark;
NKT Photonics A/S, Birkerød, Denmark

Coupling a modulational instability based supercontinuum from a ZBLAN fibre into a highly nonlinear chalcogenide fibre leads to extreme SPM and resulting noise suppression through spectral averaging.

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**EF-P.14 THU**

**Stable non-equidistant pulsing patterns in an excitable micropolar laser with delayed optical feedback**

S. Terrien{è}, V.A. Pann{è}, B. Krauskopf{è}, N.G.R. Broderick{è}, and S. Barbo{è};
1The Dodd-Walls Centre for Photonics and Quantum Technologies, The University of Auckland, Auckland, Australia; 2Universite Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, UMR9001, Palaiseau, France

We consider a model of an excitable microlaser with delayed optical feedback, and demonstrate that periodic pulsing solutions corresponding to non-equidistant pulses in the feedback cavity exist and are stable in large regions of the parameters.

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**EF-P.15 THU**

**Slow-Light Enhanced Second-Harmonic Generation Using a r-Phase Shifted Moiré Grating in a Quasi-Phase-Matched Medium**

T.E. Maybour{è}, D.H. Smith{è}, and P. Horak{è}; University of Southampton, Southampton, United Kingdom

We investigate the use of a superstructure refractive index grating to enhance nonlinear wavelength conversion in a quasi-phase matched crystal. Our coupled-mode theory predicts significantly increased conversion efficiency in short crystals.

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**EF-P.16 THU**

**Optical Bistability Induced by Free Carrier Dispersion in the Silicon Micro-Ring Resonators**

1St. Petersburg Electrotechnical University "LETI", St. Petersburg, Russia; 2Tomsk State University of Control Systems and Radioelectronics "TUSUR", Tomsk, Russia

We report on the observation of the carrier-induced optical bistability in the CW silicon micro-ring resonators. The dominant role of the free-carrier effect is confirmed in the framework of an original theory.
Electronics Research Centre, Southampton, United Kingdom

An analytical model is presented for exploring nested ring Tm fibre laser dopant profiles that are able to reduce the gain differential between short and long wavelengths and allow greater access to the short wavelength regime.

CJ-P.4 THU

Experimental study of the pump configuration’s impact on gain-managed nonlinear amplification in an Yb-doped fiber amplifier

C. Rüegg, R. Lindberg, and V. Vaskinievicius; 1 Department of Applied Physics, Royal Institute of Technology, 10691 Stockholm, Sweden

We present an experimental comparison of a gain-managed nonlinear amplifier operated under co- and counter-pumped configurations. Our results indicate that compressed pulses from co-counter-pumped configurations are shorter/ have more energy contained in the main peak.

CJ-P.5 THU

Self-Selection of the Out-of-Phase Supermode in an All-Solid Large Mode Area Multicore Fiber Laser

Y. Greenberg1, A. Ishaya2, and S. Yoo3; 1 Ben-Gurion University of the Negev, Beer Sheva, Israel; 2 Nanyang Technological University, Singapore, Singapore

We present the detailed numerical analysis and design, as well as an experimental demonstration of out-of-phase mode selection and its power scaling in an all-solid 6-core Yb-doped large-mode-area multi-core fiber laser.

CJ-P.6 THU

Dispersion Compensating Ring Fibre in the C-Band for OAM Mode

W. Zhao1, X. Han2, W. Geng1, Y. Wang3, Y. Fang1, C. Bao1, Z. Wang1, Y.-G. Liu1, Y. Ren2, Z. Pan1, and Y. Yue3; 1 Institute of Modern Optics, Nankai University, Tianjin, China; 2 Department of Electrical Engineering, University of Southern California, Los Angeles, USA; 3 Department of Electrical & Computer Engineering, University of Louisiana at Lafayette, Lafayette, USA

We propose and design a ring-shaped polycyclic dispersion compensating fiber for OAM mode. At 1550 nm, a -18.248-ps/(nm-km) negative dispersion with a slope of -0.1635 ps/(nm2-km) for OAM1,1 mode is achieved within the C band.

CJ-P.7 THU

Control of multi-soliton generation in fiber 8-figure laser by tunable spectral filtering

A. Kokhanovsky1, E. Kaprkon1, K. Serebrennikov1, and S. Tsvityzn1; 1 Novosibirsk State University, Novosibirsk, Russia; 2 Aston Institute of Photonic Technologies, Birmingham, United Kingdom

We demonstrate switching between different multi-solitons regimes in figure of eight laser with tunable spectral filtration. Laser provides adjustment a number of bound solitons up to 18, conditions of soliton molecules generation is also considered.

CJ-P.8 THU

Distributed temperature measurements in holmium-doped fiber lasers

V. Kamynin1, A. Wolf2, M. Skvortsov2, S. Filatova3, M. Kopyev4, V. Tverkov5, and S. Baldin6; 1 Prokhorov General Physics Institute of the Russian Academy of Sciences, Moscow, Russia; 2 Institute of Automation and Electrometry of the SB RAS, Novosibirsk, Russia; 3 Peoples’ Friendship University of Russia, RUUDN University, Moscow, Russia

Distributed temperature measurements in holmium fiber lasers are demonstrated. It is shown that in Ho-doped fiber lasers pumped at 1.125 μm temperature difference at different parts of fiber reached more than 30 °C.

CJ-P.9 THU

The contribution has been withdrawn.

CJ-P.10 THU

Selective Excitation of Fundamental Mode in Fusion Spliced Antiresonant Hollow-Core Fiber

C. Coel2, M.R.A. Hassan2, W. Chang3, and S. Yoo1; 1 The Photonics Institute, Nanyang Technological University, Singapore, Singapore; 2 School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, Singapore

We demonstrate selective excitation of fundamental mode with 90.8% coupling efficiency, in a tapered antiresonant hollow-core fiber fusion spliced with a large mode area commercial solid core fiber at 1 μm wavelength.

CJ-P.11 THU

A triple cladding fiber for pulse stretching

K. Bobkov and M. Likhachev; Prokhorov General Physics Institute of the Russian Academy of Sciences, Dianov Fiber Optics Research Center, Moscow, Russia

We demonstrate an optimized triple cladding fiber for ultrashort pulses stretching. Optimization allowed a reduction of a complexity of the fiber production and an increase of the nonlinear effects threshold.

CJ-P.12 THU

Extrinsic Fabry–Perot interferometer with supermode interference

M.D.C. Alonso-Murias1, D. Montzón-Hernández1, E. Antonio-López2, A. Shiélzeg2, R. Amezcuá-Correa2, and J. Villatoro3,4; 1 Centro de Investigaciónes en Óptica A. C., Loma del Bosque 115 C. P. 37150, León, México; 2 CREOL The College of Optics and Photonics, University of Central Florida, Orlando, 162700, Florida, USA; 3 Department of Communications Engineering, University of the Negev, Beer Sheva, 8403, Bilbao, Spain; 4 Heras-Las Casas-Basque Foundation for Science, E-48011, Bilbao, Spain

We proposed and demonstrated a novel extrinsic fiber Fabry Perot interferometer build with a strongly coupled multicore fiber. The extrinsic Fabry Perot can exhibit an interference pattern with a cavity length up to 20 mm.

CJ-P.13 THU

New Method for Generation of a Specific Number of Pulses per Bunch in Yb-doped All-PM-Fibre Laser

A. Ivanenko1, B. Nyushkov1,2, S. Smirnov3, and S. Kabachenko1,2; 1 Novosibirsk State University, Novosibirsk, Russia; 2 Novosibirsk State Technical University, Novosibirsk, Russia

We present a new method for obtaining variable pulse bunches in synchronously-pumped Yb-fibre lasers by controlling small detuning between rates of pumping and output pulses. We show its advantages, prospects, and possibilities of electronic control.

CJ-P.14 THU

Dispersion-tailoring of a NALM-based all-PM Er-doped femtosecond fiber laser

E. Kaczerowicz1, L. Bobow1, S. M. O’Brien2, and E. Ferron3; 1 Photonics Institute, University of the Negev, Beer Sheva, Israel; 2 Optical Fiber Electronics Group, Faculty of Electronics, Wrocław University of Science and Technology, Wrocław, Poland

In this work, dispersion management of a NALM-based Er-doped fiber laser is experimentally investigated. Continuously adjustable net dispersion and flexible phase bias support the usefulness of demonstrated setup as an optimization testbed of ultrafast laser systems.

CJ-P.15 THU

125 μJ ultra-short pulses delivered by a PM Yb-doped tapered fiber amplifier

S. Bourenet1, A. Gognaev1, A. Baylon-Fuentes2, Y. Hernandez2, and J.-B. Lecourt3; 1 Multitel, Mons, Belgium; 2 Euro-Multitel, Mons, Belgium

A chirped pulse amplification architecture using a PM Yb-doped tapered fiber with an output diameter of 36 μm is reported. This fiber laser delivers pulses with 125 μJ energy and 1 ps duration.

CJ-P.16 THU

Pulsed operation of Random Distributed Feedback Raman Fiber Laser with Varying Repetition Rate Through Self-gain-modulation

N. Tarsos1, L. Melnikov2, O. Vatnik3, Y. Mazhirina3, and D. Cherkis4; 1 Aston University, Birmingham, United Kingdom; 2 Saratov State Technical University, Saratov, Russia; 3 Novosibirsk State University, Novosibirsk, Russia

We experimentally demonstrate that random fiber laser can be operated in pulsed regime via self-gain-switching with varying repetition rate depleting on power and laser length and being proportional to an odd integer number.

CJ-P.17 THU

Side Pump Combiner Fabrication on a Photonic Crystal Fiber in (1 + 1) x 1 Configuration

Y. Midilli, B. Şişman, and B. Ortac; Bilkent University – UNAM National Nanotechnology Research Center and Institute of Materials Science and Nanotechnology, Ankara, Turkey

A side pump combiner has been fabricated in a (1 + 1) x 1 configuration for the first time on a photonic crystal fiber with a pump efficiency of 84%.

CJ-P.18 THU

Demonstration of a Novel Cladding Light Stripper Fabrication Method Based On Poly (Chloro-P-Xylene) Polymer Material

Y. Midilli1,2, G. Liman3,4, G. Demirci3,4, and B. Ortac1; 1 Bilkent University – UNAM National Nanotechnology Research Center and Institute of Materials Science and Nanotechnology, Ankara, Turkey; 2 Bio-inspired Materials Research Laboratory (BIMREL), Department of Chemistry, Faculty of Science, Gazi University, Ankara, Turkey

A novel cladding light stripper fabrication method based on poly (chloro-p-xylene) (PPX) polymer material has been coated onto the fiber samples in a controlled manner on the order of nm scale to fabricate cladding light stripper by chemical vapor deposition technique.

CJ-P.19 THU

Bend Insensitive W-type Single Mode Fiber with 30μm Mode Field Diameter

V. Ustimenko1, D. Saharov2, A. Grishchenko2, Y. Chmarovski2, and V. Filippov3; 1 Ampliconexy Ltd, Tampere, Finland; 2 Ceram Optec SIA, Livani, Latvia; 3 Fryazino branch of Kotelnikov Institute of Radio Engineering and Electronics, Fryazino, Moscow region, Russia

Bend insensitive LMA W-fiber was manufactured with 40 μm core diameter (NA=0.03, M2=1.11). Transfer efficiency of the fundamental mode reached 88% through 5 m of the fiber. Attenuation, measured using cut-back method is <0.023 dB/m.
**C-KP.1 THU**

Fusion WSI based superconducting microwires single photon detectors with laser lithography

1 Department of Physics, Paderborn University, Paderborn, Germany; 2 National Institute of Standards and Technology, Boulder, USA

Laser lithography is a versatile tool for developing large-scale integrated optical structures. We show that it is also capable of structuring SNWIDs with saturated internal detection efficiency.

**C-KP.2 THU**

Fabrication tolerance impact on BIC metamaterial resonances

1 Chair in Hybrid Nanosystems, NanoInstitute Munich, Munich, Germany; 2 The Blackett Laboratory, London, United Kingdom

We numerically and experimentally investigate the impact of fabrication tolerance on the resonance quality of different bound state in the continuum resonator geometries, revealing crucial design guidelines for robust and high-performance BIC-based metamaterial applications.

**C-KP.3 THU**

Fano Resonances in Nanostructured Thin Films

L. Grineviciute, C. Babayigit*; J. Nikitina*, and K. Staliunas*; 1,2; 1 Center for Physical Sciences and Technology, Vilnius, Lithuania; 2 Laser Research Center, Vilnius University, Vilnius, Lithuania

3 Department of Electronic and Electrical Engineering, TOBB University of Economics and Technology, Ankara, Turkey; 4 Institut Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain; 5 Université Poitou-Charentes de Caen, France

We design and fabricate nano-modulated thin films, which, due to Fano resonances with its planar modes, show sharp (angle, wavelength) dependences of transmission. Ideal for a compact spatial and frequency filtering.

**C-KP.4 THU**

Adiabatic Waveguide Taper Profile Optimization on AI2O3/Si Platform for Polarization Insensitive Fiber-to-Chip Light Coupling

*C. Ozcan, J.S. Atchison,* and M. Mojtahedi; Department of Electrical and Computer Engineering, University of Toronto, Toronto, Canada

Optimization of inverse taper profiles were performed on an augmented low index waveguide for fiber-to-chip light coupling. The optimized polynomial taper profiles yielded only 0.3 dB loss at 250 µm length with no polarization dependence.

**C-KP.5 THU**

Fast laser induced phase change of Bismuth based random metasurfaces for tunable photonics

M. Alvarez, M. García-Pardo, F. Cabello, J. Toudert, E. Haro-Pomatióvskii, R. Serna, and J. Siegel; Laser Processing Group, Instituto de Óptica, IO-CSIC, Madrid, Spain

We characterize the dynamic visible optical response of a bismuth-based metasurface in the visible upon nanosecond laser excitation. We demonstrate a tunable switching window in the 10-100ns range and its stability for >100,000 cycles.

**C-KP.6 THU**

Tunable Polarization Insensitive CMOS Compatible Graphene/Si Guided Mode Resonance Active Filter

P. Sharma*, E. Lampardariou*, S. Doukas*, E. Lidorikis*, and I. Goykhman*; 1 Technion-Israel Institute of Technology, Haifa, Israel; 2 University of Ioannina, Ioannina, Greece

We propose and investigate polarization insensitive graphene/Si tunable mode-guided resonance filters operating at telecom wavelengths, which offers narrow resonances of 1nm and an extinction ratio of >10 dB for reflection and spectral tuning respectively.

**C-KP.7 THU**

Effect of Thermal Crosstalk on Travelling-wave Mach-Zehnder Modulator

S. De*; 1,2, R. Das*, T. Kleine-Ostmann*; and T. Schneider*; 1 Technische Universität Braunschweig, Germany; 2 PTB Braunschweig, Germany

A deep trench assisted travelling wave Mach-Zehnder modulator with improved bandwidth is proposed for effective shielding from the thermal crosstalk. Subsequently, we obtained a better bit error rate performance for the modified design.

**C-KP.8 THU**

Gap solitons supported by mode hybridisation in Lithium Niobate nano-waveguides

W.R. Rowe*; 1, A.V. Gorbach*; 2 H. Fergestad*; 2 K. Gallo*, and D.V. Skryabin*; 1 Centre for Photonics and Photonic Materials, Department of Physics, University of Bath, Bath, United Kingdom; 2 Department of Applied Physics, KTH Royal Institute of Technology, Stockholm, Sweden

We investigate a system of one fundamental frequency and two hybridised second harmonic modes in Lithium Niobate nano-waveguides. We find three-component solitons exist with their spectrum in the gap of the hybridised second harmonic modes.

**C-KP.9 THU**

Towards optical circuits using tweezers position-control

S. Keep*, M. Dovzdien*; 1, B. Bathish*; 2, L. Tiekiewicz Abadi*; 1, V. Shavuye*; 2, L. Dyck*; and T. Carmon*; 1 Technion Institute of Technology, Haifa, Israel; 2 City University of New York, New York, USA; 3 Tel Aviv University, Tel Aviv, Israel

We experimentally demonstrate optical circuits composed of several spherical-resonators that their position is controlled with optical tweezers. The resonance structure and spectral distribution are measured and compared with the numerical and analytical Mie theory.

**C-KP.10 THU**

Modeling and Fabrication of an AntiReflection Microstructure on an AgClBr Fiber by Single-pulse Femtosecond Laser Ablation

M. Tarabrin*; 1,2; A. Bushunov*; 1, A. Teslenko*; 1, 2, V. Lazaren*; 1, T. Sukharova*, 1, J. Hinkel*; 1,2, I. Usenov*; 1,2, Doctoralo*, 1,2, V. Artyushenko*; 1,2, Bauman Moscow State Technical University, Moscow, Russia; 2 P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Novosibirsk, Russia; 3 Novosibirsk State University, Novosibirsk, Russia; 4 Art Photonics GmbH, Berlin, Germany; 3 Technical University of Applied Science Wildau, Wildau, Germany; 5 Technische Universität Berlin, Berlin, Germany

AgClBr fiber end face transmission of 92.8% at 10.6um and an average transmittance of 91.8% in the 7-14um range were achieved by single-pulse femtosecond laser ablation.

**C-KP.11 THU**

Thermal Self-stabilisation of a Microcavity on the Surface of an Optical Fibre with Active Core

D. Kadashkin*; 1, D. Krasanov*; 1, S. Khorev*; 1, D. Churkin*; 1, I. Vatnik*; 1, N. Kozyrev*; 1, Novosibirsk State University, Novosibirsk, Russia; 2 Czecet Photonics, Inc., Richmond, Canada

We propose a technique for thermal tuning and thermal self-stabilisation of cylindrical microresonators formed on the surface of optical fibres. The method is based on launching light into the fiber core with strong absorption.

**C-KP.12 THU**

Stimulated Brillouin Scattering on AlGaAs on Sapphire platform

H.K. Sahoo, Y. Zheng, C. Kim, M. Galli, K. Yvind, L.K. Oxenløwe, M. Pu, and H. Hu; Department of Photonics Engineering, Technical University of Denmark, Kongens Lyngby, Denmark

We propose and demonstrate on-chip stimulated Brillouin scattering (SBS) on the AlGaAs on sapphire platform, which can simultaneously control optical and acoustic waves. High Brillouin gain is achieved using longitudinal acoustic mode without suspended structures.

**C-KP.13 THU**

Position dependence of local density of states in 3D band gap of a finite photonic crystal

C.P. Marinov*; 1, A. Tsolapom*; 2, S.B. Hasan*; 1, T. Kuczyn*; 1, E.N. Economou*; 3, M. Kafesaki*; 1,2, C.M. Soukoulis*; 1,2, and W.L. Vos*; 1 Department of Materials Science and Technology, University of Crete, Heraklion, Greece; 2 Institute of Electronic Structure and Laser, Foundation for Research and Technology Hellas, Heraklion, Greece; 3 Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands; 4 Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames, Iowa, USA; 5 Department of Physics, University of Crete, Heraklion, Greece; 6 Current address: ASML Netherlands B.V., Veldhoven, Netherlands

We investigate the local density of states in 3D woodpile finite photonic crystals. We find exponential decay of the LDOS from the crystal's surface to the center and show large inhibitions for small crystals.

**C-KP.14 THU**

Study of dye local photo-bleaching obtained by UV lithography for photonic applications

A. Gasseng, K. Cherrier, A. Bard, J.-M. Benoit, C. Symonds, and J. Bellissa; Univ Lyon, Institut Lumière Matière, UMR5306, LON, Lyon, France

In this work, we have studied local photo-bleaching to modulate the refractive index of TDBC dye layers only over a limited wavelength range and spatial region for wavelength selective optical grating fabrication.

**C-KP.15 THU**

Thermally reconfigurable loss in a passive optical cavity

A. Dash, V. Mere, S.K. Selvaraja, and A.K. Naik; Indian Institute of Science, Bangalore, India

We demonstrate thermo-optic tuning of the quality factor from 3000 to 10000 and extinction ratio from = 0 dB to 25 dB in a passive silicon micro-ring resonator. This work opens several possibilities for reconfigurable photonic devices.

**C-KP.16 THU**

Nanostructured multilayer optical coatings for angular filtering of light

L. Grineviciute, C. Babayigit**; G. Dailaričius**; M.
Moscow, Russia
Physics Institute of the Russian Academy of Sciences,
holmium-doped fiber lasers operating in continuous We compared the ablation of ex-vivo tissues by
encesandTechnology, Vilnius, Lithuania
spatial filtering in the near-field domain.
In this study, we propose a possibility to create 2D photonic crystal based on nanostructured multilayer coating and demonstrate a conceptually novel mechanism of spatial filtering in the near-field domain.

**CK-P.17 THU**

**Generalized Lorenz-Mie theory of complex source vortex beams**

*J. Berlyks and S. Orlov; State research institute Center for Physical Sciences and Technology, Vilnius, Lithuania*

We present a generalized Lorenz-Mie theory of complex source vortex beams and employ it to investigate the interaction with nanoparticles and a cluster made out of them.

**CK-P.18 THU**

The contribution has been withdrawn.

**CK-P.19 THU**

**Design and control of NxN microphotonic switch array based on non-adiabatic theory**

*A. Sheveleva, C. Pinot, and P. Colman; Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR CNRS 6303, Université de Bourgogne Franche-Comté, Dijon, France*

Weak modulation of the propagation parameters is sufficient to control the flow of light within a densely packed array of waveguides. The modulation must obey strict selection rules that make this non-adiabatic technique robust.

**CK-P.20 THU**

**High performance optical interference filters fabrication using automatically optimized optical monitoring strategy**

*J. Zideluns, F. Lemarchand, A. Arhliger, H. Hagedorn, and J. Lumeau; Institut Fresnel, Marseille, France; Tübinger Leybold Optics, Alzenau, Germany*

The fabrication of high performance optical interference filters is demonstrated. We present a novel optical monitoring method based on optimized optical monitoring wavelength. Various filters are used to illustrate the method.

**CK-P.21 THU**

**Optical spatial differentiation with suspended subwavelength gratings**

*A. A. Darki, A. Partenopoulos, B. R. Jeppesen, J. V. Nygården, and A. Dantan; Department of Physics and Astronomy, Aarhus University, Aarhus, Denmark; Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Aarhus, Denmark; Department of Engineering, Aarhus University, Aarhus, Denmark*

We noninvasively characterize the profile of large-area subwavelength gratings directly patterned on suspended silicon nitride membranes and demonstrate high-quality first- and second-order spatial differentiation of the transverse profile of an optical beam using guided-mode resonance.

**CK-P.22 THU**

*The contribution has been withdrawn.*
Surface phonon polariton: the 4th heat carrier in SiN nanofilms
M. Nomura, Y. Wu, J. Ordonez-Minuada, R. Anufriev, and S. Voit; The University of Tokyo, Tokyo, Japan
We demonstrate that surface phonon polaritons can be the dominant thermal energy carriers in SiN nanofilms. Their contribution becomes larger in thinner films.

We present Valley Hall topological waveguides that support the transport of terahertz waves through sharp corners without any loss. Such interconnects are ideal for the realization of sixth-generation (6G) communication which rely heavily on terahertz on/off-chip wave management.

Wavelength-tunable few-cycle mid-infrared laser pulses from frequency domain optical parametric amplification
G. Dalla-Barba1,2, P. Lassonde1, G. Jarge1, E. Haddad3, A. Laramie3, A. Leblanc1, H. Ibrahim1, E. Cormier1,4, and F. Légère3; 1Institut National de la Recherche Scientifique, centre EMT, Varennes, Canada; 2Laboratoire Photonique Numérique et Nanosciences, UMR 5298, Talence, France; 3Laboratoire d’Optique Appliquée, UMR 7639, Palaiseau, France; 4Institut Universitaire de France, Paris, France
We report on a toolbox for both generation and characterization of 20 ± mid-infrared few-cycle pulses tunable from 5.6 μm to 13.5 μm with pulse durations ranging from 6.4 to 1.3 optical cycles.

Parametric Chirped-pulse Optimization of Optical Parametric Chirped-pulse Amplification
P. Fischer1, A. Muschet1, T. Lang2, R. Sahli3, and L. Veisz1; 1Department of Physics, Umeå University, Umeå, Sweden; 2Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
We experimentally demonstrate for any physical system. Worksnaturally on multiple qubits and any physical system.

Quantum optical coherence: From linear to nonlinear interferometers
K.-H. Luo1, M. Santandrea1, M. Stefczyk1, J. Sterling1, M. Massaro1, A. Ferreri1, P.R. Sharapov1, H. Herrmann1, and C. Silberhorn1; 1Integrated Quantum Optics Group, Institute for Photonic Quantum Systems, Eawag, Zurich, Switzerland
We report on results from linear, semi-nonlinear and nonlinear interferometric systems, elucidating the unique first-order classical and second-order quantum coherence properties between them.
Spectral soliton complex with asymmetric dispersion
J.P. Lourdesamy1, J. Widyadha1, A.F.J. Runge1, T.J. Alexander1, and C.M. de Sterke1,2; 1Institute of Photonics and Optical Science, School of Physics, The University of Sydney, Sydney, Australia; 2The University of Sydney Nano Institute, Sydney, Australia
We experimentally observe soliton complexes formed by two fundamental soliton centres at different frequencies, but with identical group velocities, from a dispersion-managed fibre laser. An asymmetric dispersion leads to spectral asymmetry and non-trivial phase ramps.

Design and Realization of a Three-Dimensional Dielectric Zero-Index Metamaterial based on Steiner Tree Networks
H. Ya, Q. Zhang, and M. Gie; University of Shanghai for Science and Technology, Shanghai, China
A 3D dielectric Zero-Index-Medium (ZIM) based on Steiner tree networks is proposed and demonstrated, which provides a 3D platform to study properties of Dirac-like cone and realization of ZIM with ultra-low loss at optical frequency.

Enhanced design strategy for Mesoscopic Self-Collimation
S.L. Flores Esparza, A. Monmayrant, O. Gauther-Lafaye, and D. Gaucher; C.N.R.S. LAAS, Toulouse, France
Mesoscopic photonic crystals combine reflectivity control and self-collimation. We show that periodic energy exchange between solitons leads to symmetric collimation.

Continuous-wave electron-light interaction in high-Q whispering gallery microresonators
J.-W. Henke1, A.S. Raju1, A. Feist1, J. Liu1, G. Aren1d1, G. Huang, E.J. Kapper1, R.N. Wang1, J. Pan1, O. Kfir1,3, A. Ropers1,3, and T.J. Kippenberg2; 4th Physical Institute - Solids and Nanostructures, University of Göttingen, 37077 Göttingen, Germany; 3Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), CH-1015 Lausanne, Switzerland; 1Max Planck Institute for Biophysical Chemistry, 37077 Göttingen, Germany
We observe CW-driven inelastic electron-photon scattering at a fiber-integrated high-Q Si3N4 microresonator. The interaction is enabled by the strong, resonantly enhanced coupling between the electrons and the confined optical whispering gallery mode.

Thz photon-assisted tunneling in hBN encapsulated graphene quantum dot
S. Messeliot1, E. Riccardi1, S. Massabeau1, M. Rosticher1, K. Watanabe2, T. Taniguchi3, J. Tigges1, S. Dhillon1, R. Ferreira1, S. Balibar1, T. Kontos1, and J. Mangeney3; 1Laboratoire de Physique, University of Grenoble-Alpes, Grenoble, France
Mesoscopic photonic crystals combine reflectivity control and self-collimation. We show that periodic energy exchange between solitons leads to symmetric collimation.

Condensation and spatial coherence of Exciton-Polaritons in a MoSe2 monolayer - microcavity
C. Anton-Solanas1,2, M. Waldherr3, M. Klaas1, H. Suchomel1, T.H. Harder1, H. Cal1, E. Sedov1,2, S. Klem1, A.V. Kavokin1,2, S. Tongay4, K. Watanabe5,6, T. Taniguchi7,8, S. Hofling1,9, and C. Schneider1,2; 1Universität Würzburg, Würzburg, Germany; 2Carl von Ossietzky University, Oldenburg, Germany; 3University of California, Merced, USA; 4Fachtwissenschaftliche Universität Hagenburg, China; 5Westlake Institute for Advanced Study, Hangezhou, China; 6Vladimir State University, Vladimir, Russia; 7St. Petersburg State University, St. Petersburg, Russia; 8Arizona State University, Tempe, USA; 9Research Center for Functional Materials, Tsukuba, Japan; 10International Center for Materials Nanoarchitectonics, Tsukuba, Japan; 11University of St. Andrews, St. Andrews, United Kingdom
Our experiments demonstrate the strong light-matter coupling and the bosonic condensation of exciton-polaritons in an atomically thin layer of MoSe2 coupled to a hybrid micro-cavity.

High Damage Threshold Ultrafast Laser Nanostructuring in Silica Glass
X. Chang, Y. Lei, H. Wang, G. Shayeganrad, C. Deng, and P. Kazansky; Optoelectronics Research Centre, University of Southampton, Southampton, United Kingdom
The damage threshold...
Saturation in optical parametric chirped-pulse amplification enhances system performance. However, various spectral components saturate differently. We numerically and experimentally demonstrate control of saturation for a broad spectral range and optimize overall gain and conversion efficiency.

leision is done by bending tech- nique, operating at an output power of >1W at a slope efficiency of 37%.

the first time that, in contrast to clas- sical Hong-Ou-Mandel experiment performed with a dissipation-free beamsplitter, bosons anti-coalesce while fermions 'coalesce' on a dissipative beamsplitter.
Symmetry protection against mode crossings for dissipative Kerr soliton generation in microresonator chains.


Institute of Physics, Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland,

Laboratoire Temps-Fréquence, Neuchâtel, Switzerland

The accessibility of solitons in driven-dissipative photonic dimers drastically varies for different superradome modes. We explain the origin of this phenomenon and show its crucial influence on any soliton lattice configuration including topological arrangements.

Embedded InP-on-Si 1D photonic crystal emitting in the topological mode.


IBM Research - Europe, Rüschlikon, Switzerland,

Hanbat National University, Daejeon, South Korea

We demonstrate for the first time an embedded one-dimensional topological photonic structure based on a III-V photonic crystal on silicon, which shows localized single mode emission from the topological state located in the bandgap center.

Single-Mode, Broadband, Near Infrared Light Emission from Metal-Oxide-Semiconductor Tunnel Junctions in Silicon Photonics.


Institute of Electromagnetic Fields, ETH Zurich, Zurich, Switzerland,

Physical Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, USA,

Photronics Laboratory, ETH Zurich, Zurich, Switzerland

We demonstrate electroluminescence from inelastic electron tunnelling directly coupled into a single-mode silicon waveguide. The near-infrared emission into a resonator with $Q_{\text{res}} = 47$ achieves narrowest emission observed to date for light emitting tunnel junctions.

Twist-Tailoring Hybrid Excitons In Van Der Waals Homobilayers.


Department of Physics, Regensburg University of Regensburg, Germany,

Department of Physics, Chalmers University of Technology, Gothenburg, Sweden

Institute of Condensed Matter Physics, Friedrich-Alexander University Erlangen-Nürnberg, Erlangen-Nürnberg, Germany

By probing internal 1s–2p transitions with phase-locked mid-infrared pulses, we trace how the twist angle precisely controls the binding energy and lifetime of hybrid excitons in transition metal dichalcogenide bilayers.

High-resolution microfabrication through a graded-index multimode optical fiber.

G. Konstantinou, D. Loterie, E. Kakavda, D. Psaltis, and C. Amer.

École Polytechnique Fédérale de Lausanne, Laboratory of Applied Photonics Devices, CH-1015, Lausanne, Switzerland,

Readily3D SA EPFL Innovation Park, Bâtiment C CH-1015, Lausanne, Switzerland,

École Polytechnique Fédérale de Lausanne, Laboratory of Optics, CH-1015, Lausanne, Switzerland

A fiber-based 3D printing system based on the Transmission Matrix method and wavefront shaping is used for the fabrication of smooth micro-structures by two-photon polymerization. The focused spot is scanned digitally and initiates photo-polymerization.
We introduce a numerical opto-thermo-mechanical model to analyze the photoacoustic signal generated by gold nanowires/spheres by photothermal characterization of chiral materials, ordered/disordered meta-atoms and devices. We illustrate the energy scaling rules of hollow-core fiber nonlinear compression for high energy Yb technologies. As a demonstration, 70 mJ/230 fs pulses were compressed down to 25 fs with 1.3 TW peak power.

Laser, FORTH, Heraklion, Greece; 2Department of Materials Science and Technology, University of Crete, Heraklion, Greece; 3Department of Materials, University of Manchester, Manchester, United Kingdom; 4National Graphene Institute, University of Manchester, Manchester, United Kingdom; 5Henry Royce Institute for Advanced Materials, University of Manchester, Manchester, United Kingdom; 6Science Program, Texas A&M University at Qatar, Doha, Qatar.

We demonstrate an ultrafast self-induced terahertz absorption modulator operating at 2.3 THz. A modulation of 50 dB is observed in the absorption when the THz field strength increases from 145 to 654 kV/cm.

R. Li Voti; L. Li; C. Spielmann; A. Koulouklidis; J.-M. Manceau; E. Lin; S. Dhillon; J. Freeman; L. Li; E. Linfield; S. Tzortzakis; and R. Colombelli.

Recently advances for the optothermal characterization of chiral materials, ordered/disordered nanowires/spheres by photothermal techniques are summarized. IR radiometry is introduced to measure the thermal property at a nanoscopic scale.

We introduce a numerical optothermal characterization at a Nanoscopic Scale.

JSL-4.4 FRI 9:30

Photothermal Characterization at a Nanoscopic Scale

• R. Li Voti; Dipartimento SBAI, Sapienza Università di Roma, Rome, Italy

Recent advances for the optothermal characterization of chiral materials, ordered/disordered nanowires/spheres by photothermal techniques are summarized. IR radiometry is introduced to measure the thermal property at a nanoscopic scale.

JSI-4.4 FRI 9:30

Photothermal Characterization at a Nanoscopic Scale

• R. Li Voti; Dipartimento SBAI, Sapienza Università di Roma, Rome, Italy

Recent advances for the optothermal characterization of chiral materials, ordered/disordered nanowires/spheres by photothermal techniques are summarized. IR radiometry is introduced to measure the thermal property at a nanoscopic scale.
of bright and dark localized states arising in doubly resonant dispersive optical parametric oscillators. We show that bright states undergo collapsed snaking, while dark ones experience homoclinic snaking.

Twente, Enschede, Netherlands; 3 Mathematics of Computational Science (MACS), MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands; 3 Center for Hybrid Quantum Systems (Hy-Q), Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark

We show the first experimental evidence of light transport within the band gap of a 3D photonic crystal that is functionalized with a superlattice of point defects that act as resonant cavities.

Supercontinuum Generation by Polychromatic Soliton Molecules
• S. Wilms1,2, O. Melcher1,2, S. Bose1, A. Yulin2, U. Morgner2,3, I. Babushkin1, and A. Demircan1,3,3
• Cluster of Excellence PhoenixD, Hannover, Germany
• Institute of Quantum Optics, Leibniz University Hannover, Hannover, Germany
• Hannover Centre for Optical Technologies, Hannover, Germany
• Department of Nanophotonics and Metamaterials, ITMO University, Saint Petersburg, Russia

We investigate the propagation dynamics of polychromatic soliton molecules regarding their ability to generate a bright coherent supercontinuum. An efficient scheme is presented and analogies to the quantum mechanical dissociation process are highlighted.

EF-8.5 FRI 9:30

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EF-7.5 FRI 9:30

High-purity free-electron momentum states prepared by three-dimensional optical phase modulation
• A. Feist1, S.V. Yalunin1, S. Schäfer1, and C. Ropers2,3
• 4th Physical Institute, University of Göttingen, Göttingen, Germany
• Max Planck Institute for Biophysical Chemistry, Göttingen, Germany
• Institute of Physics, University of Oldenburg, Oldenburg, Germany

We demonstrate a laser-based and femtosecond-switchable inelastic electron beam splitter. Coherent optical phase modulation of 200-keV electrons at a thin electron-transparent membrane prepares a high-purity three-dimensional momentum superposition state, characterized in energy and momentum space.

EG-7.5 FRI 9:30

Polarization-Resolved Second Harmonic Generation Imaging microscopy of 2D Materials
• S. Psilodimitrakopoulos1, L. Mouchliadis1, G.M. Maragkakis2,4, G. Kourmoulakis1,2, I. Denerisidou1,2, A. Lemonis1, G. Kioseoglou1,2, and E. Stratakis1,2
• Institute of Electronic Structure and Laser-Foundation for Research and Technology-Hellas, GR-711 10, Heraklion, Greece
• Institute of Physics, University of Crete, GR-700 13, Heraklion, Greece

All optical, large area polarization-resolved SHG imaging microscopy in 2D materials, reveals lattice imperfections, probes valley population imbalance and measures twist angle in stacked layers, in real-time, pixel-by-pixel and in the same substrate that those materials are produced.

EI-4.5 FRI 9:30

Femtosecond Laser Surface-structuring for Cell-repellent Functionalization of Medical Implants
• M. Muck1, B. Wolfsohner1, K. Selbert1, C. Maiert2, A.W. Hasel3, W. Baumgartner1, and J. Heitz4
• 1 Institute of Applied Physics, Johannes Kepler University Linz, Linz, Austria
• 2 Hofer GmbH & Co KG, Fürstenfeld, Austria
• 3 Institute of Chemical Technology of Inorganic Materials, Johannes Kepler University Linz, Linz, Austria
• 4 Institute of Biomedical Mechatronics, Johannes Kepler University Linz, Linz, Austria

Femtosecond laser-induced micro- and nanostructures at anodized Ti bone screws result in repulsion of osteoblasts. This shall enable removal of these implants when the bone is healed without destruction of the newly grown bone matrix.

CM-7.5 FRI 9:30
We present two filtering techniques based respectively on the match/mismatch of the laser and pillar optical modes to measure Brillouin scattering in 3D optronic resonators.
Rotating and Spiralising Optomechanical Cavity Solidot

- G. Baio, G. Robb, T. Ackemann, A. Yao, and G.-L. Oppo; Department of Physics, University of Strathclyde, Glasgow, Scotland, United Kingdom

Stable spatial solitons due to self-structuring in a cloud of cold atoms in a cavity can rotate or spiral under the action of laser light with optical angular momentum, leading to controllable atomic transport.

F louro dynamics in photonic crystal optical nonresonator

- G. Madiot, K. Pelka, A. Xuereb, and R. Braive; Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France; Department of Physics, University of Malta, Malta, Malta; Université de Paris, Paris, France

We explore the interaction between a mechanical resonator and a modulated thermo-optic cavity, using an integrated photonic crystal nanomembrane. These results open perspectives in the realization of logical gates using multimode optomechanical devices.
The fraction of protein content in an exosome is sensed in a label free manner by means of a coated microresonator as a technique for early stage cancer diagnosis and fundamental cancer studies.

**CF-9.2 FRI 11:15**

**Single-Mode Laser Diode Pumped Yb:CaF$_2$ Dual-Comb Oscillator**

D. Koenen, B. Willenberg, J. Pupeikis, S. Camenzind, C.K. Phillips, and U. Keller; Department of Physics, Institute of Quantum Electronics, ETH Zurich, Zurich, Switzerland

We demonstrate a free-running, polarization-multiplexed Yb:CaF$_2$ dual-comb laser with 100-fs pulses at 161-MHz repetition-rate and 115-mW average power per comb pumped by a single-mode laser diode. The tunable repetition-rate difference was set to 1.15-kHz.

**CM-8.3 FRI 11:30**

**Time-Resolved Digital Holography System with High Phase Precision for Detail Observation in Laser Ablation Dynamics**

S. Kawano, M. Tanimizu, H. Sakurai, K. Konishi, T. Ideguchi, J. Yumoto, and M. Kawata-Gonokami; The University of Tokyo, Tokyo, Japan

To observe slight thermodynamical changes in materials in laser ablation, we constructed a coaxial time-resolved digital holography optical system with a novel interferometer, which realizes high spatial resolution and high optical-phase-delay precision.

**CD-10.2 FRI 11:15**

**Low-Threshold Fully-Stabilized Mid-Infrared Frequency Comb Generation**

M. Roiz$^1$, J.-Y. Lai$^2$, J. Karhu$^1$, and M. Vänskä$^3$; 1University of Helsinki, Helsinki, Finland; 2HC Photonics Corp., Hsinchu, Taiwan; 3Aalto University, Espoo, Finland; 4Tampere University, Tampere, Finland

We demonstrate a method for mid-infrared frequency comb generation featuring extremely low threshold (30 pJ) and high conversion efficiency (63.5%). The method is based on continuous wave seeded optical parametric generation in nonlinear waveguides.

**CL-4.2 FRI 11:15**

**Towards Broadband Mid-Infrared Fully Integrated Protein Sensor employing a Quantum Cascade Laser and Quantum Cascade Detector**

A. Dabrowska$^1$, M. David$^2$, A. Schweighofer$^3$, B. Hinkov$^4$, A. Harres$^2$, G. Strasser$^1$, and B. Lendl$^1$; 1Institute of Chemical Technologies and Analytics, Technische Universität Wien, Vienna, Austria; 2Institute of Solid State Electronics & Center for Micro- and Nanostuctures, Technische Universität Wien, Vienna, Austria

We present a combination of quantum cascade laser and quantum cascade detectors for broadband mid-IR spectroscopy sensing of bovine milk proteins in aqueous solution.
under continuous femtosecond laser irradiation. Over >400 hours, a stable octave-spanning supercontinuum plus second-harmonic generation allows for direct self-referencing of a frequency comb.

**CJ-8.2 FRI 11:15**

Towards CEP-stable single-cycle pulses with microweavel-level energy at 8 MHz repetition rate

*F. Tan*, J. Lamprecht, D. Schade, J. Jiang, M.E. Fernandez, and P.S.I. Russell

A 20 cm long Kr-filled single-ring hollow core PCF, pumped by 36 fs pulses from a low-noise Yb fiber laser at 8 MHz, produces 7.3 fs pulses with microweavel-level energy.

**EE-5.2 FR 11:15**

Dispersion Management of Mid-Infrared Filamentation in Dense Gases

*O. Kosareva, N. Panov, D. Shipilo, and I. Nikolaeva*

Faculty of Physics, M.V. Lomonosov Moscow State University, MOSCOW, Russia; 2. N. Lebedev Physical Institute of the Russian Academy of Sciences, MOSCOW, Russia

In 3D+1 optical simulations, we propose an experiment, where a mixture of gases (nitrogen and water vapor) is used for the continuous transition from X- to O-shaped angle-wavelength spectrum of a femtosecond infrared filament.

**CJ-8.3 FRI 11:30**

High-yield, wafer-scale fabrication of ultraw-los, dispersion-engineered silicon nitride photonic circuits

*I. Liu, G. Huang, R.N. Wang, J. He, A. Raja, J. Riemensberger, G. Li, I. Ruprecht, N. Engelsen, and T. Kippenberg*

Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, Switzerland

For widespread applications of nonlinear photonic integrated circuits, ultrawave optical loss and high fabrication throughput are required. Here, we present a CMOS fabrication technique for photonic micromirrors with mean quality scaling of the output average power of fiber laser systems.

**CK-8.2 FRI 11:15**

Supermode-based second harmonic generation in a nonlinear interferometer

*J. Barral, V. D'Auria, F. Douste, T. Luong, S. Taccetti, A.P. Rambo, S. Tuschi, J.A. Levenson, N. Belabas, and K. Bencekheli*

1. Centre de Nanosciences et de Nanotechnologies C2N, Palaiseau, France; 2. University Côte d'Azur, CNRS, Institut de Physique de Nice (INPHYNI), Nice, France; 3. Research Center on Advanced Materials and Technologies, Alexandru Ioan Cuza University of Iasi, Iasi, Romania

We experimentally demonstrate a supermode-based SHG through a specifically-designed integrated LiNbO3 nonlinear interferometer made of linear and nonlinear directional couplers with a fully-fibered pump paving the way for the demonstration of on-chip supermode-based entanglement.

**EE-5.3 FRI 11:30**

High-Energy Pulse Compression in the Mid-Wave Infrared

*T. Nagy, L. von Grafenstein, D. Urberschaefer, and U. Griebner*

Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin, Germany

We compress 45mJ, 2.4ps pulses of a 1kHz holmium laser emitting at 2.05µm wavelength to 96% duration in a stretched hollow-core fiber. The pulses comprise >20mJ energy at >20W average power, setting a new milestone.

**EE-5.2 FRI 11:15**

Programmable Huygens' metasurfaces for active optical phase control

*A. Letts, A. Hefler, S. Wahl, M. Wuttig, T. Taubner, A. Titil, and H. Aluga*

1. Institute of Bioengineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland; 2. Institute of Physics (IA), RWTH Aachen University, Aachen, Germany

We present tunable metasurfaces with incorporated phase change materials for optical phase control in transmission mode. The versatility of these metasurfaces is demonstrated by optically programs light spatial phase distributions with single meta-unit precision and retrieving high-resolution phase-encoded images.

**CJ-8.3 FRI 11:30**

THz electro luminescence from non-polar ZnO quantum cascade structures


1. TU Wien, Institute of Solid State Electronics, Vienna, Austria; 2. ETH Zürich, Institute for Disruptive Photonic Electronics, Zurich, Switzerland; 3. CNRS CRHSA and Université Cote d’Azur, Valbonne, France; 4. Universidad Complutense de Madrid, Departamento de Química Inorgánica, Madrid, Spain; 5. Universidad Politécnica de Madrid, ISOM, Madrid, Spain

Non-polar m-ZnO is a new material in THz-intersubband optoelectronics for overcoming previous LO-phonon-energy-based limitations as nonlinearities for future all-optical operation of larger reservoir computers.

**CC-7.3 FRI 11:30**

Demonstration of a Resonantly Amplified Terahertz Quantum Cascade Detector

*P. Mieletti, J. Faist, T. Okuara, M. Beck, and G. Scalari*

ETH Zurich, Zürich, Switzerland

The photon-driven nature of the transport in terahertz cascade laser can be exploited to detect light. Fast tunable detectors are demonstrated with responsivities higher than 17 V/W and working temperature up to 100 K.

**JSIV-3.3 FRI 11:30**

Random lasers are studied in networks where mutual coupling is demonstrated by detecting unique spectral signatures from compound cavities. Proposed experiments and simulations provide the basis for future networks that can be enhanced by the noise injection during the training stage.

**CC-7.2 FRI 11:15**

Implementation of Analogue Neural Networks

*J.A. Consoli*, N. Caselli, and G. Scalari*

1. Department of Electrical Engineering, University of Seville, Seville, Spain; 2. Department of Engineering and Architecture, University of Perugia, Perugia, Italy

Mutually coupled random lasers in complex photonic networks

*J.A. Consoli*, N. Caselli, and G. Scalari

1. Department of Electrical Engineering, University of Seville, Seville, Spain; 2. Department of Engineering and Architecture, University of Perugia, Perugia, Italy
We exploit the intrinsic Intensity modulation of a single-cavity dual-color dual-comb for simultaneous time-of-flight and dual-comb distance measurements enabling us to overcome ambiguity limits.

Prominence of orbital angular momentum mode sorting of optical vortices by using polarization gratings

K. Yanagie, K. Iitsuaka, M. Sakamoto, H. Oto, K. Oka, Y. Toda, and R. Morita; 2 Hokkaido University, Sapporo, Japan; 3 Nagaoka University of Technology, Nagaoka, Japan

The detection accuracy in orbital angular momentum (OAM) decomposition of optical vortices was remarkably improved by use of beam duplication technique based on polarization gratings, together with our newly developed sideloop reduction filter.

Towards fully passive deep UV Dual-Comb Spectroscopy

T. Hofer1, K. Fritzsch, N. Picqué, and O. Pronin; 1 Helmut Schmidt University, Hamburg, Germany; 2 Max-Planck-Institute of Quantum Optics, Munich, Germany

Passive high power dual frequency comb thin-disk oscillator operating at 1030 nm wavelength was extended in green preserving its performance. This holds promise towards performing first Dual-Comb Spectroscopy in UV and deep UV regions.

High-Power Fiber-Pumped Continuous-Wave Difference-Frequency-Generation at 2.26 μm

H. Sukeerth1, C.K. Suddappali2, and M. Ebrahim-Zadeh1,2; 1 ICFo-Institut de Ciencies Fotòniques, the Barcelona Institute of Science and Technology, Castelldefels, Spain; 2 Instituto Catalana de Recerca and Estudis Avançats (ICREA), Barcelona, Spain

We report high-power single-pass continuous-wave difference-frequency-mixing of Yb and Tm-fiber lasers in MgO:PLN, generating ~4 W of output power at 2262 nm, with excellent power stability of 0.5%rms over 1.5 hours, in high beam quality.

Polarization-entangled quantum holography

H. Deffner1, B. Ndagano, A. Lyons, and D. Faccio; School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom

By exploiting polarization entanglement between photons, we demonstrate a quantum holography approach that circumvents the need for first-order coherence that is vital to classical holography, with potential for biological imaging and high-dimensional quantum states characterization.
Q-Switched Rod-Type Multicore Fibre Laser Delivering 3.1 mJ Pulses
C. Aleshire1, A. Steinkopf2, M. Karol1,2, A. Kloeffel1,2, C. Jauregui1, S. Kuhn3, J. Nold3, N. Haarlammert3, T. Schreiber3, and J. Limpert1,2,3, 1Institute of Applied Physics, Friedrich-Schiller-University Jena, Jena, Germany, 2Helmholtz-Institute Jena, Jena, Germany, 3Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany
A custom rod-type multicore Yb-doped fibre is used in Q-switched operation, achieving 3.1 mJ pulse energy. The fibre design, laser performance, and prospects for further power scaling in multistage MCF amplifiers will be discussed.

Gender Efficiency Photon Pair Generation
H. Mohammadi1,2, S. May1, A. Anger1,2,3, M. Sorel2,3, and M. Kae1,2,3, 1Institute of Photonics, Leibniz University Hannover, Hannover, Germany, 2Hannover Centre for Optical Technologies, Leibniz University Hannover, Hannover, Germany, 3Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering – Innovation Across Disciplines), Leibniz University Hannover, Hannover, Germany
We demonstrate the generation of correlated photon pairs in AlGaAs-on-insulator waveguides through spontaneous four-wave mixing at telecom wavelengths with a generation efficiency of 0.986 e-103 pairs/(W-s2), one of the highest achieved in integrated structures.

Role of dispersion and compression ratio on the temporal contrast of SPM-broadened post-compressed pulses
E. Escoto1, A.-L. Vötti1, S. Aliaisaukas1, H. Zummermann1, M. Seidel1, K. Dudde1, B. Manscckwets1, J. Hart1, and C.M. Heyl1,2,3, 1Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany, 2Department of Physics, Lund University, Lund, Sweden, 3Helmholtz-Institute Jena, Jena, Germany, 4GH Helmholzszentrums für Schwerionenforschung GmbH, Darmstadt, Germany
We explore the effects of dispersion and compression ratio on pulse post-compression. We show by numerical simulations, supported by experimental data, that ultrashort pulses with high temporal contrast can be produced at high compression ratios.

Overcoming operational performance and diffusion issues in thermo-germanium quantum wells
D. Stark1,2, L. Mirza2, L. Persichetti1, M. Montanari2, S. Markmann1, M. Beck1, T. Grange3, S. Birner4,5, V. Virgilio6, C. Ciano7, M. Ortolan8,9, C. Corley10, G. Capellini1,2, L. Di Gaspare1, M. De Seta1,2, D.J. Paoli1, J. Faitz1, and G. Scalfari1, 1Institute for Quantum Electronics, Department of Physics, ETH Zürich, Zürich, Switzerland, 2James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom, 3Dipartimento di Scienze, Universita Roma Tre, Roma, Italy, 4nextnano GmbH, München, Germany, 5Dipartimento di Fisica “E. Fermi,” Universita di Pisa, Pisa, Italy, 6Sapienza Universita di Rome, Department of Physics, Rome, Italy, 7IHF - Leibniz-Institut für innovative Mikroelektronik, Frankfurt (Oder), Germany
We report the observation of intersubband electroluminescence from n-type GaSb/GaAs quantum cascade structures at THz frequencies. This is an important step towards an integrated THz quantum cascade laser on silicon.

CJ-8.4 FRI 11:45
AlGaAs-on-insulator Waveguides for Highly Efficient Photon Pair Generation
M. Billet1,2, N. Poulvellarie1,2, C. Op de Beeck1,2, L. Reus1,2,3, V. Léger1,2, C. Corent1, F. Rainier1,3, I. Sagne1,3, K. Pantzas1, G. Beaudoin1, G. Roelkens1,2, F. Leo2, and B. Kaykens1,2, 1Photonics Research Group, Ghent University-IMEG, Ghent, Belgium, 2Center for Nano and Biophotonics (NB-Photonics), Ghent, Belgium, 3OPERA-Photonique, Université libre de Bruxelles, Bruxelles, Belgium
We present highly efficient conversion schemes for broadband SH-pumped OCPAs. Utilizing the Yb-pump in a cascaded-SFG, 69% conversion efficiencies to 300nm were obtained without degradation. The tunable UV pulses are compressed in glass to 75fs.

EH-5.4 FRI 11:45
Overcoming operational performance and diffusion issues in thermo-germanium quantum wells
D. Stark1,2, L. Mirza2, L. Persichetti1, M. Montanari2, S. Markmann1, M. Beck1, T. Grange3, S. Birner4,5, V. Virgilio6, C. Ciano7, M. Ortolan8,9, C. Corley10, G. Capellini1,2, L. Di Gaspare1, M. De Seta1,2, D.J. Paoli1, J. Faitz1, and G. Scalfari1, 1Institute for Quantum Electronics, Department of Physics, ETH Zürich, Zürich, Switzerland, 2James Watt School of Engineering, University of Glasgow, Glasgow, United Kingdom, 3Dipartimento di Scienze, Universita Roma Tre, Roma, Italy, 4nextnano GmbH, München, Germany, 5Dipartimento di Fisica “E. Fermi,” Universita di Pisa, Pisa, Italy, 6Sapienza Universita di Rome, Department of Physics, Rome, Italy, 7IHF - Leibniz-Institut für innovative Mikroelektronik, Frankfurt (Oder), Germany
We report the observation of intersubband electroluminescence from n-type GaSb/GaAs quantum cascade structures at THz frequencies. This is an important step towards an integrated THz quantum cascade laser on silicon.

CJ-8.4 FRI 12:00
Efficient tunable UV pulse generation from a green pumped fs-OPCA
T. Lang1, S. Aliaisaukas1, M. Kazemi1, A. Tajalli1, J. Hart1, Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany
We present highly efficient conversion schemes for broadband SH-pumped OCPAs. Utilizing the Yb-pump in a cascaded-SFG, 69% conversion efficiencies to 300nm were obtained without degradation. The tunable UV pulses are compressed in glass to 75fs.
We exploit silica defects photoluminescence for directly visualizing the self-imaging arising from the interference of LP01 and LP11 modes of a bimodal optical fiber. This provides a length-independent method to determine the fiber cut-off.

In this paper, a photonic computing architecture for Cholesky decomposition implementation is proposed. By exploiting the bandwidth and lossless light propagation, the proposed architecture provides a significant improvement in time efficiency as compared to GPUs.

We demonstrate a new dual Q-switched laser based on a Nd:YAG crystal pumped by a Q-switched laser. We can clean and determine the sample composition using multimode smart endoscopic system monitored by LIBS spectroscopy.

We experimentally implement phase-shifting holography in a nonlinear interferometer. This allows fast and convenient holographic phase and transmission sensing of samples with spectral separation of illumination and detection.

Infrared Metasurface Detectors

We present a far-field computational microscopy technique, using speckle-based structured illumination stimulated Raman scattering microscopy. We exploit silica defects photoluminescence for directly visualizing the self-imaging arising from the interference of LP01 and LP11 modes of a bimodal optical fiber. This provides a length-independent method to determine the fiber cut-off.

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High-Power Cladding Light Stripper with Vapor Deposition of Polyethersulfone

*B. Şimşek, O. Aktaş, A. Karatutlu, A. Başaran, E. Yapar Yıldırım, Y. Midilli, and B. Ortaç, National Nanotechnology Research Center, Ankara, Turkey

Vapor deposition of high index engineered polymer over fiber cladding was presented. Performance of device was tested with 171.3 W launched cladding light and it was reduced by 17.72 dB at the output.

A high-repetition rate attosecond pulse source for coincidence spectroscopy was presented. State Electronics, TU Wien, Vienna, Austria; Center for Quantum Electronics, ETH Zurich, Zurich, Switzerland

We show that the emission spectra of quantum cascade random lasers can be controlled by optically exciting electron-hole pairs. State of the art machine learning allows us to generate desired spectra almost instantaneously.

Extreme localisation of light in driven-dissipative photonic lattices

O. Jamadi1, B. Real1, K. Sawicki2, N. Pernet2, I. Sagnes3, A. Lemaître4, L. Le Gratiet5, and B. Ortaç1

1Université de Lille, CNRS, UMR 8523 – PhLAM – Physique des Lasers, Atomes et Molécules, Lille, France; 2Institut of Experimental Physics, Faculty of Physics, University of Warsaw, Warsaw, Poland; 3Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France

We demonstrate a new way to engineer localised modes in photonic lattices, based on the driven dissipative nature of our polariton resonators and the chiral symmetry of the honeycomb lattice.

Field-resolved interference among dark waves

L. Vamos1, I. Tsybulnev1, L. Malden1, C. Hensel2, U. Eli3, M. Enders1, and J. Biegert1,2

1GFo – Institut de Ciencies Fotòniques, Castelldefels, Barcelona, Spain; 2ICREA, Castelldefels, Barcelona, Spain

Frequency-time analysis of field-resolved measurements provides a direct insight and deeper understanding of the temporal decay process of individual lines in a complex absorption spectrum.

Temperature-tunable Surface Lattice Resonances in Plasmonic Metasurfaces

T. Stol1, J. Kalavou3, V. Vanyukov1, H. Rekola1, J. Resn1, T.K. Hakola1, and M.J. Huttunen1

1Tampere University, Tampere, Finland; 2University of Eastern Finland, Joensuu, Finland

We demonstrate post-fabrication tuning of the spectral properties of plasmonic surface lattice resonances by controlling the ambient temperature. Our method opens interesting pathways towards actively tunable metamaterial devices.

Systematic search for single mode QCL at 4.7THz and post-process frequency tuning

T. Olaria, M. Beck, G. Scalari, and J. Faist; Institute for Quantum Electronics, ETH Zurich, Zurich, Switzerland

A systematic search of THz QCL operating at 4.745 THz is performed by tracking the measured against the designed frequency, and frequency tuned post-process by changing the local geometry and therefore the effective refractive index.

Field-resolved multipath echoes

V. Kapitany1, A. Turpin2, J. Radford3

1Université de Lille, CNRS, UMR 8523 – PhLAM – Physique des Lasers, Atomes et Molécules, Lille, France; 2Institut of Experimental Physics, Faculty of Physics, University of Warsaw, Warsaw, Poland; 3Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Palaiseau, France

Inferring spatial scenes from their time-resolved multipath echoes

C. Lemaître1, A. Lemaître2, and J. Biegert1

1GFo – Institut de Ciencies Fotòniques, Castelldefels, Barcelona, Spain; 2ICREA, Castelldefels, Barcelona, Spain

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T. Olaria, M. Beck, G. Scalari, and J. Faist; Institute for Quantum Electronics, ETH Zurich, Zurich, Switzerland

A systematic search of THz QCL operating at 4.745 THz is performed by tracking the measured against the designed frequency, and frequency tuned post-process by changing the local geometry and therefore the effective refractive index.
We present experimental results of self-starting harmonic combs in THz Quantum Cascade Lasers with a single, sub-kHz linewidth beatnote. The coherence between optical modes is verified and our theoretical model explains the experiments.

We design and train a convolutional neural network to reconstruct the complex dispersement of a target from a self-mixing interferometer signal. The network's prediction is robust against noise, alignment configurations and even across experimental setups.

We report the generation of water window soft X-ray high-order harmonic generation through pulse self-compression in an antiresonant hollow-core fiber.
the visible spectrum with a conversion efficiency of 2.4 × 10⁻⁸ at a pump intensity as low as 0.5 GW/cm².

CD-11.3 FRI 15:15
Opto-thermally controlled beam steering in nonlinear all-dielectric metasurfaces
• D. Rocco1,2, M. Gandolfi1,2, A. Tognazzi1,2, O. Pushkina1,2, K. Frizuk2, G. Zograf1, S. Makarov1, C. Gigi2, G. Leo1, M. Petrov1, and C. De Angelis1,2
1 University of Brescia, Brescia, Italy;
2 National Institute of Optics CNR – INO, Brescia, Italy

Constraint-free wavelength conversion in nonlinear all-dielectric metasurfaces
• A. Karatula1, I. Seker1, M. Karakoz3, G. Gökçik4, and B. Ortaç5
1 Bilkent University UNAM – Institute of Materials Science and Nanotechnology, Ankara, Turkey;
2 Aylse Built-in Appliances, Organized Industrial Zone, Amasya, Turkey;
3 Cobham University, Department of Mechatronics Engineering, Siras, Turkey;
4 Institute of Experimental Epistemology and Cognition Research, Life and Brain Center, University of Bonn Medical Center, Bonn, Germany

Numerical simulations using the finite element method support the Si NWs size-dependent fluorescence enhancement factors with a signal amplification factor from 2 to 7 demonstrating the optimum position of the fluorophore within the hot spot.

CL-5.4 FRI 15:15
Au-Capped Si Nanowiskers for Size-Dependent Improved Fluorescence of Fluorophores
• A. Karatula1, I. Seker1, M. Karakoz3, G. Gökçik4, and B. Ortaç5
1 Bilkent University UNAM – Institute of Materials Science and Nanotechnology, Ankara, Turkey;
2 Aylse Built-in Appliances, Organized Industrial Zone, Amasya, Turkey;
3 Cobham University, Department of Mechatronics Engineering, Siras, Turkey;
4 Institute of Experimental Epistemology and Cognition Research, Life and Brain Center, University of Bonn Medical Center, Bonn, Germany

We demonstrate dielectric metasurfaces with phase profiles that respond to changes in two input control light beams, resulting in a steerable focal line. We further show their application of particle routing in continuous-flow microchannels.

CL-5.5 FRI 15:30
Metalas-based Particle Routing in Continuous-Flow Microchannels
• S. Yin, F. He, N.G. Green, and X. Fang
School of Electronics and Computer Science, University of Southampton, Southampton, United Kingdom

We demonstrate dielectric metasurfaces stacked to generate a high-NA focal spot.

EH-6.4 FRI 15:15
All-dielectric Metasurfaces Enabling Imaging-based Real-time Biosensing
• Y. Jahani1, E.R. Arvelo2, F. Yesikley2, K. Kothele3, C. Giancarruso3, M. De Palma3, Y. Kivshar3, and H. Alrug1
1 Institute of Bioengineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland;
2 Department of Biomedical Engineering, University of Wisconsin–Madison, Madison, USA;
3 Nonlinear Physics Center, Australian National University, Canberra, Australia;

We present an in-flow label-free biosensor supporting high-quality-factor resonances based on bound-states-in-the-continuum and novel data-processing. The biosensor is integrated with an imaging platform offering solutions to eliminate sophisticated and bulky spectroscopy requirements for point-of-care applications.

CL-9.4 FRI 15:30
Free-running and imposed-wavelength cavities for high power continuous-wave fiber laser
• A. Motard1,2, C. Luous1, T. Robin3, B. Cadier1, N. Dalloz1, A. Hildreben-Dholland4, and I. Maneck-Hönninger2
1 French-German Research Institute of Saint-Louis, F-64800 Saint-Louis, France;
2 Université Bordeaux, CNRS CEA, CELIA UMR5107, F-33405 Talence, France;
3XBLUE PHOTONICS, F-22300 Lannion, France

We demonstrate a monolithic high efficiency (45%) single-oscillator Tm3+, Ho3+ codoped fiber laser providing an output power of up to 195 W at 2.09 μm in continuous regime with an excellent beam quality (M2 < 1.1).

CK-9.5 FRI 15:30
Rabi Splitting using Gold Bipyramids and Monolayer MoS2
• J. Lawless1, C. Hrelescu2, C. Elliott3, L. Peters4, N. McEvoy5, and L. Bradley1
1 School of Physics and AMBER, Trinity College Dublin, Dublin, Ireland;
2 School of Chemistry and AMBER, Trinity College Dublin, Dublin, Ireland;
3 IIP, Tyndall National Institute, Cork, Ireland

Bipyramids were investigated as a nanoresonator to achieve strong coupling with monolayer MoS2. It was shown that larger bipyramids could couple more strongly, even without increasing the number of coupled excitons, contrasting to other nanostructures.
comb, we show it can fully compensate the cavity dispersion.

**CC-8.4 FRI 15:15**

**Synthesized Terahertz Frequency Combs**

D. Theiner1,2, B. Limbacher1,2, K. Unterrainer1,2, and J. Darmo1,1 Photonics Institute, TU Wien, Vienna, Austria; 2Center for Micro- and Nanostructures, TU Wien, Vienna, Austria

A synthesized tunable terahertz frequency comb (FC) source with center frequencies up to 3.6 THz exhibiting linewidths below 10 MHz is presented that is based on commercially available fiber integrated optical components.

**CC-8.5 FRI 15:30**

**THz Quantum Cascade Laser Frequency Comb based on a Y-coupled Planarized Waveguide**

U. Senica, T. Olariu, P. Micheletti, M. Beck, J. Faist, and G. Scalari; ETH Zurich, Zurich, Switzerland

We present a Y-coupled planarized THz Quantum Cascade Laser, operating as a frequency comb with a THz emission spanning over 500 GHz. Broadband phase locking is indicated by far-field interference patterns throughout the whole operating range of the laser.

We present localized Brillouin measurements inside a CS2-filled liquid-core optical fiber. Local temperature and pressure changes can be discriminated using Brillouin Optical Correlation Domain Analysis with a resolution of 4 cm.

We present pulse self-compression and soft X-ray HHG in a single gas-filled hollow-core fiber resulting in a flux $>10^6$ Photons/s/eV at 300 eV. The source is driven by a thulium-doped fiber-laser at 98 kHz repetition rate.

We present pulseself-compression and soft X-ray HHG in a single gas-filled hollow-core fiber resulting in a flux $>10^6$ Photons/s/eV at 300 eV. The source is driven by a thulium-doped fiber-laser at 98 kHz repetition rate.

**JSIV-4.3 FRI 15:15**

**Intelligent imaging sensor out of two-photon polymerized microcavities with self-sensing boosting**

A. Soetelmans1,2, E. Tchernevskaya1, V. Saetchnikov1,2, and A. Ostendorf1,2; 1Ruhr University Bochum, Bochum, Germany; 2Belarusian State University, Minsk, Belarus

We report on realization of the microcavitated based imaging sensor with self-sensing boosting fabricated with two-photon polymerization and supplemented by machine learning for highly accurate predictions of the variations in the ambient environment.

**JSIV-4.4 FRI 15:30**

**100 laser beam array phase-locked in a neural network loop**

A. Boja1,2, M. Shpakovych1,2, G. Maulion1,2, C. Vozzi1,2, E. Tcherniavskaia1, and K. Krzempek1; 1Institute for Photonics and Nanotechnologies, National Research Council, Milano, Italy; 2Department of Isotopic and Molecular Technologies, Cluj-Napoca, Romania; 3Politecnico di Milano, Department of Aerospace Science and Technology, Milano, Italy

We demonstrate the spatial separation of a considerable portion of the XUV from the fundamental IR driving beam in high-order harmonic generation by an integrated system of microchannels realized through Femtosecond Laser Micromachining.
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<th>ROOM 1</th>
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<tr>
<td><strong>CD-12: Raman Amplification and Nonlinear Media</strong>&lt;br&gt;Chair: Tal Ellenbogen, Tel Aviv University, Tel Aviv, Israel</td>
<td><strong>CJ-10: Fiber Optical Techniques and Applications</strong>&lt;br&gt;Chair: William Wadsworth, University of Bath, Bath, United Kingdom</td>
<td><strong>EH-6.6 FRI</strong>&lt;br&gt;15:45</td>
<td><strong>CJ-9.6 FRI</strong>&lt;br&gt;15:45</td>
<td><strong>CK-9.6 FRI</strong>&lt;br&gt;15:45</td>
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<tr>
<td><strong>CD-12.1 FRI</strong> (Keynote)</td>
<td><strong>CJ-10.1 FRI</strong>&lt;br&gt;Soliton detuning of 68.5 THz corresponding to a wavelength shift from 1560 nm to 2400 nm in a highly nonlinear suspended core tellurite fiber&lt;br&gt;<strong>T. Karpate</strong>&lt;br&gt;<strong>G. Stepienski</strong>&lt;br&gt;<strong>D. Pysz</strong>&lt;br&gt;<strong>R. Buczynski</strong>&lt;br&gt;<strong>M. Klimeczak</strong>&lt;br&gt;<strong>Faculty of Physics, University of Warsaw, Pasteura 7, 02-093, Warsaw, Poland</strong>&lt;br&gt;<strong>Institute of Applied Physics, University of Bern, Sidlerstrasse 5, 3012, Bern, Switzerland</strong>&lt;br&gt;<strong>Institute of Physical Chemistry, Polish Academy of Sciences, Kasprzaka 4/2, 01-224, Warsaw, Poland</strong>&lt;br&gt;We investigate soliton self-frequency shift in suspended core tellurite fibers. Owing to high nonlinearity, detuning exceeding 68 THz is observed upon injecting 90 fs, 1560 nm laser pulses in 5 cm long fiber sample.</td>
<td><strong>Simple CW-UV generator by SHG technique with double-clad Pr-doped water- proofed fluoro-aluminate glass laser</strong>&lt;br&gt;<strong>Y. Fujimoto</strong>&lt;br&gt;<strong>M. Nakahara</strong>&lt;br&gt;<strong>S. Binun</strong>&lt;br&gt;<strong>S. Kurosawa</strong>&lt;br&gt;<strong>I. Iwata</strong>&lt;br&gt;<strong>S. Nakashima</strong>&lt;br&gt;<strong>Chair in Hybrid Nanosystems</strong>&lt;br&gt;<strong>Materials Research, Tohoku University, Sendai 980-8577, Japan</strong>&lt;br&gt;<strong>University Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, 91120, Palaiseau, France</strong>&lt;br&gt;<strong>Department of Nanophotonics and Metamaterials, University of Southern California, Los Angeles, USA</strong>&lt;br&gt;<strong>Advanced Institute for Materials Research, Tohoku University, Sendai 980-8577, Japan</strong></td>
<td><strong>Semi-Dirac transport and localization in polaritonic graphene</strong>&lt;br&gt;<strong>B. Real</strong>&lt;br&gt;<strong>O. Jamadi</strong>&lt;br&gt;<strong>M. Milicevic</strong>&lt;br&gt;<strong>P. St-Jean</strong>&lt;br&gt;<strong>T. Ozawa</strong>&lt;br&gt;<strong>Montambaux</strong>&lt;br&gt;<strong>Sagnes</strong>&lt;br&gt;<strong>L. Le Gratiet</strong>&lt;br&gt;<strong>G. Harouet</strong>&lt;br&gt;<strong>Ravesz</strong>&lt;br&gt;<strong>Block</strong>&lt;br&gt;<strong>Amo</strong></td>
<td><strong>Adaptive optics of temporal focusing microscopy by utilizing structured illumination</strong>&lt;br&gt;<strong>E. Ishikawa</strong>&lt;br&gt;<strong>K. Itoke</strong>&lt;br&gt;<strong>A. Inazawa</strong>&lt;br&gt;<strong>K. Kannari</strong>&lt;br&gt;<strong>M. Midorikawa</strong>&lt;br&gt;<strong>Riken Center for Advanced Photonics, 2-1 Hirosawa, Wako, Saitama, Japan</strong>&lt;br&gt;<strong>Department of Electronics and Electrical Engineering, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Japan</strong>&lt;br&gt;<strong>Department of Advanced Imaging, Graduate School of Biostudies, Kyoto University, Kyoto, Japan</strong>&lt;br&gt;<strong>We present adaptive optics of wide-field temporal focusing microscopy by utilizing structured illumination, which works well even if strong out-of-focus fluorescence exists or a sample is thick.</strong></td>
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**Room 6**

**CC-8.6 FRI 15:45**

**Terahertz Near-field Nanoscopy Based on Self-mixing Interferometry with Quantum Cascade Resonators**

E.A.A. Pogna\(^1\), K. Reichel\(^1\), C. Silvestri\(^2\), S. Biazzo\(^1\), L. Viti\(^1\), A. di Gaspare\(^1\), L.L. Columbus\(^2\), M. Brambilla\(^1\), G. Scamarcio\(^2\), and M.S. Vitiello\(^1\); "NEST, CNR-Istituto Nanoscienze and Scuola Normale Superiore, Pisa, Italy; 2 Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Turin, Italy; 3 Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom; 4 Dipartimento Interateneo di Fisica, Università degli Studi di Bari, Bari, Italy.

We discuss the performances of innovative THz near-field nanoscopy systems based on self-mixing interferometry with THz quantum cascade resonators endowed with different degrees of spatial and temporal coherence.

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**Room 7**

**JSIV-4.5 FRI 15:45**

**Deep Reinforcement Learning Control of White-Light Continuum Generation**

C.M. Valensise\(^1\), F. Vernuccio\(^1\), A. Giuseppe\(^1\), G. Cerullo\(^1\), and D. Pollt\(^1\); IFN-CNR, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy; DIAG, University of Rome “La Sapienza”, Rome, Italy.

An actor-critic Deep Reinforcement-Learning architecture is used to generate long-term-stable white-light continuum without a-priori knowledge of the system acting on the crystal position and on the power and numerical aperture of the driving beam.

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**Room 8**

**CH-12.6 FRI 15:45**

**Towards Multimode-fiber-based Two-photon Endoscopy**

M.C. Velsen\(^1\), L.V. Amintonova\(^2\), and P.W.H. Pinkse\(^1\); 1 MESA+ Institute for Nanotechnology, University of Twente, Enschede, Netherlands; 2 Advanced Research Center for Nanolithography (ARCNL), Amsterdam, Netherlands.

We demonstrate a method towards two-photon endoscopy based on time-domain wavefront shaping through a multimode fiber. This allows grid scanning of an ultrashort pulse over the output facet of the fiber with a perturbation-insensitive input.

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**Room 9**

**CG-7.6 FRI 15:45**

**Continuously tunable high photon flux high harmonic source at 50-70 eV**

A. Kirsche\(^1\), R. Klas\(^1\), M. Gebhardt\(^1\), L. Eisenbach\(^1\), W. Eschen\(^1\), J. Baldt\(^1\), H. Stark\(^1\), J. Rothhardt\(^1\), and J. Limpert\(^1\); 1 Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-University, Jena, Germany; 2 Heilmoltz-Institute, Jena, Germany; 3 Fraunhofer Institute for Applied Optics and Precision Engineering, Jena, Germany.

A fast and fully tunable table-top extreme ultraviolet high harmonic source with record-high photon flux at energies of 50-70 eV based on blueshift in a capillary is presented.
### ROOM 1

**CJ-10.2 FRI 17:15**

**Importance of Topological Charge Preservation in Vectorial Modulational Instability in Chiral Three-Core PCF**

- P. Roth\(^1\), M.H. Frosz\(^1\), P.S.J. Russell\(^1\), and G.K.L. Wong\(^2\)
- \(^1\)Max Planck Institute for the Science of Light, Erlangen, Germany
- \(^2\)Department of Physics, Friedrich-Alexander-Universität, Erlangen, Germany

The presence of polarisation modulational instability gain in circularly birefringent chiral PCF is critically dependent on preserving the total topological charge of the fields. Experiments on a PCF with a threefold symmetric core confirm this.

### ROOM 2

**CJ-10.3 FRI 17:00**

**Frenet-Serret analysis of helical Bloch modes in N-fold rotationally symmetric rings of coupled spiralling optical waveguides**

- Y. Chen\(^1\) and P. Russell\(^2\)
- \(^1\)Max Planck Institute for the Science of Light, Erlangen, Germany
- \(^2\)Department of Physics, University of Erlangen-Nuremberg, Erlangen, Germany

Frenet-Serret theory is generalised to the case of a chiral ring of N coupled birefringent cores. The dispersion and polarisation of the helical Bloch modes are derived, for the first time properly including torsion effects.

### ROOM 3

**CK-10.3 FRI 17:00**

**Experimental demonstration of a bat microresonator fabricated at the 125-micron-diameter optical fiber having an eigenmode which amplitude is uniform along the more than 100 microns of the fiber length with 7% accuracy.**

- Y. Yang, M. Crespo-Ballesteros, and M. Sumetsky
- Aston Institute of Photonic Technologies, Birmingham, United Kingdom

We experimentally demonstrate an optical microresonator fabricated at the 125-micron-diameter optical fiber having an eigenmode which amplitude is uniform along the more than 100 microns of the fiber length with 7% accuracy.

### ROOM 4

**CH-13.3 FRI 17:00**

**Contrast enhancement in volumetric two-photon microscopy using multiple orders of Bessel beam**

- H. He\(^1\), Y.-X. Ren\(^1\), R.K.Y. Chau\(^2\), W.L. So\(^3\), H.K. Fok\(^4\), C.S.W. Lai\(^5,6\), K.K. Tsiu\(^1,7\), and K.K.Y. Wong\(^2,8\)
- \(^1\)Department of Electrical and Electronic Engineering, The University of Hong Kong, Pokfulam Road, Hong Kong, China
- \(^2\)School of Biomedical Science, The University of Hong Kong, Pokfulam Road, Hong Kong, China
- \(^3\)Advanced Biomedical Instrumentation Centre, Hong Kong Science Park, Shatin, New Territories, Hong Kong, China

We demonstrate a contrast-enhanced volumetric two-photon microscopy by cancelling the side lobes of the fundamental 0th-order Bessel beam using the 3rd-order Bessel beam based on the well-matched ring patterns.

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**CD-12.2 FRI 17:15**

**Spectrum Synthesizer Based on Two-Stage Transient Stimulated Raman Chirped-Pulse Amplification in KGW crystal**

- A. Petruľová, P. Mackonis, A. Rodin, and V. Girdauskas
- Solid State Laser laboratory, Center for Physical Science and Technology, Vilnius, Lithuania

A spectrum synthesizer based on two-stage transient Stimulated Raman Chirped-Pulse Amplification in KGD(WO4)\(_2\) crystals provides a tailored bandwidth ~38nm of amplified supercontinuum pulses with a positive chirp sufficient for transform-limited pulsedwidth of ~50fs after compression.

**CJ-10.4 FRI 17:15**

**Ultrafast gyroscopic measurements in passive Mach-Zehnder interferometer via time-stretch technique**

- I. Kudelín\(^1\), S. Sugavanam\(^2\), and M. Chernysheva\(^3\)
- \(^1\)Aston Institute of Photonic Technologies, Birmingham, United Kingdom
- \(^2\)IIT Mandi, Kamand, India
- \(^3\)Max Planck Institute of Photonic Technology, Jena, Germany

We demonstrate a phase-based method to detect rotation in a passive all-fibre Mach-Zehnder interferometer via the Dispersive Fourier Transformation. The resolution of the angular velocity measurements is 5.78 µrad/s at acquisition rate of 15 MHz.

**CK-10.4 FRI 17:15**

**Resonant Mode Tuning of Ge2Sb2Te5 Coated Silica Microresonators**

- E. Huseyinoglu\(^1\), E. Özkür\(^2\), M. Chernysheva\(^3\), and M. Sumetsky\(^1\)
- \(^1\)Institute of Materials Science and Nanotechnology, National Nanotechnology Research Center, Bilken University, Ankara, Turkey
- \(^2\)National Graphene Institute, University of Manchester, Manchester, United Kingdom
- \(^3\)E. L. Ginzton Laboratory, Stanford University, California, USA

The large scale utilization of the optical microresonators was hindered by obstacles originated from fabrication errors. By using chalcogenide coating, a method to tune resonant modes permanently was demonstrated to correct deviations from designed parameters.
We experimentally explore the leaky mode dynamics in evanescently coupled arrays of optical single-mode waveguides with variable spacing and show how judiciously designed tapered arrays may give rise to directed emissions within the lattice plane.

Electroabsorption Modulated Laser Based on Identical Epitaxial Layer and Transmission Line Technology

An electroabsorption modulated DFB laser has been fabricated based on an identical epitaxial layer design, HSQ planarization, and transmission line technology. It operates at a wavelength of 1572 nm with 18 GHz bandwidth.

Traveling-Wave Electroabsorption Modulated Laser Based on Identical Epitaxial Layer Scheme and HSQ Planarization

We present a novel approach to remove the spurious non-resonant background from broadband coherent anti-Stokes Raman scattering spectra in real time based on deep learning, without requiring the measurement of reference spectra.

Sample-efficient dataset generation for Deep Learning based inverse design of photonic nanostructures

We find that unsupervised clustering techniques can be exploited for creating training datasets to reduce the burden of model training. This has implications for broadening applicability of Deep-learning to complicated structures requiring lengthy computations.

Nanoscale energy deposition in glass by double ultrashort Gauss-Bessel pulses

We demonstrate transient metallization and lightwave-driven current control with 300-pJ pulses at 80 MHz repetition rate. We will demonstrate a new process for lightwave-driven current control with 300-pJ pulses at 80 MHz repetition rate.
CD-12.3 FRI
Interacting Ring-Airy Beams in Nonlinear Media
• C.W. Robson and M. Ornigotti; Tampere University, Tampere, Finland
  The interactions between overlapping ring-Airy beams in a local Kerr medium are numerically investigated, predicting controllable regions of low intensity during propagation. This may prove useful for optical tweezing applications in nonlinear media.

CD-12.4 FRI
Second Harmonic Generation in Spliced Pooled Fibers
• W.A. Gemechu1,2, U. Minoni1, D. Modotto1, A. Tonello1, and V. Couder2; 1 Dipartimento di Ingegneria dell’Informazione, Università di Brescia, via Branze 38, 25123 Brescia, Italy; 2 ETH Zurich, Switzerland  We present a new method for the direct laser synthesis of nanosecond-scale optical waveforms with freely-tunable repetition rate and relatively high energy by digitally-controlled cavity dumping of a hybrid fiber laser with two active media.

10:00 – 11:00
CH-P: CH Poster Session

CH-P.1 FRI
Antiresonant Hollow Core Fiber-assisted Photothermal Spectroscopy of Nitric Oxide at 5.26 μm
• K. Krzempek1, P. Kocić1, F. Jaworski1, G. Dudač1, and W. Belardi2; 1 Laser & Fiber Electronics Group, Faculty of Electronics, Wroclaw University of Science and Technology, Wroclaw, Poland; 2 ETH Zurich, Switzerland  We report on a systematic study of the coupling between nanoresonators, aimed at proposing and assessing an analytic non-Hermitian tight-binding Hamiltonian formalism for advanced nanophotonics meta-systems.

CH-P.2 FRI
Investigation of In-Gap Field Enhancement at Terahertz Frequencies for a Metasurface Enhanced Sensor
• H. Tugay1, Y. Altun1, Y. Demirhat1, L. Ozyuzer4, and C. Sabah1; 1 department of physics, metu, ankara, Turkey; 2 1stech, izmir, Turkey; 3 northern cyprus campus, metu, nicosia, Turkey  This work is motivated by the non-linear gap enhancement effect we designed and analyzed a metasurface sensor structure that utilizes the phase transition in a VO2 thin film layer.

CH-P.3 FRI
Raman Gas Analyzer of Carbon Isotopologues with 50 ppm Level Sensitivity
• L. Chudchenko1, E. Popov1, K. Grigorenko1, V. Kurikova2, L. Konopleko8, P. Loiko2, and V. Vitkin1; 1 TNO University, St. Petersburg, Russia; 2 Centre de Recherche sur les Ions, les Matériaux et la Photonique (CIMAP), Caen, France  We describe the results on calibration of a Raman gas analyzer in terms of gas volume fraction measurements, as well as determine the limit of detection for two methane isotopologues - 12CH4 and 13CH4.

CH-P.4 FRI
Feedback cooling of a trampoline in a high-finesse cavity from room temperature
• A. Manetta, I.M. Haghhi, D. Haj, J. van der Heijden, U.B. Hoff, and U.L. Andersen; Center for Macroscopic Quantum States bigQ, Department of Physics, Technical University of Denmark, Lyngby, Denmark  We achieved feedback cooling of a SiN tethered membrane (trampoline) in a high finesse optical cavity down to an average phonon occupation number of 4000 starting from room temperature using coherent light at telecom wavelength.

CH-P.5 FRI
Analysis of engineered aluminum-based plasmonic devices decorated with graphene/2D nanomaterials for enhanced biosensing applications in the near-infrared region
• S. Shukla and P. Arora; Birla Institute of Technology and Science, Pilani, Pilani, India  The work utilizes the modified Attenuated Total Reflection configuration, to detect minute refractive index changes using surface plasmons. Highly-sensitive Aluminum-based plasmonic devices decorated with Graphene/2D nanomaterials are engineered to demonstrate biosensing in the near-infrared region.
Magnetophotonic on-chip device for all-optical reading of magnetic memory
F.E. Demirer, S. Reniers, L. Lavrijsten, B. Koopmans, and J. van der Toi; Eindhoven University of Technology, eindhoven, Netherlands
The device implements magnetic racetrack-memory as its cladding. Uses magnet-optic effect to determine the magnetization direction, therefore read the magnetic bits. Built in IMOS platform, it modulates mode intensity at 20 GHz.

Gigahertz Mid-Infrared Interband Cascade Detectors: Photo-Response Saturation by a Femtosecond Oscillator
L.M. Krüger, J. Hillbrand, J. Heidrich, M. Beiser, K. Koel, C.B. Phillips, R. Schwarz, G. Strasser, and U. Keller; 1Department of Physics, Institute for Quantum Electronics, ETH Zurich, Zürich, Switzerland; 2Institute of Solid State Electronics, TU Wien, Vienna, Austria; 3Nanoplas NanoSystems and Technologies GmbH, Gerbrunn, Germany; 4Center for Micro- and Nanomaterials, TU Wien, Vienna, Austria. We measured the bias-dependent photo-response and saturation behaviour of an interband cascade laser with a femtosecond OPO. The dynamic response shows a double-exponential decay, where a reverse bias increases the saturation power and 3-dB-bandwidth.

Stacked neural networks for predicting scattering spectra of core–(multi-)shell particles
L. Kuhna, T. Reapan, and C. Rockstulla, 1Institute of Theoretical Solid State Physics, Karlruhe Institute of Technology, Karlsruhe, Germany; 2Institute of Nanotechnology, Karlsruhe Institute of Technology, Karlsruhe, Germany.
We present stacked neural network approaches to predict scattering spectra from core-shell particles (with multiple shells), where we stack multiple independently trained ANNs, each corresponding to a shell (or the core) of the particle.

Photonic components in polymers made by femtosecond pulses
D. Perevoznikov, S. Bose, S. Burger, A. Demircan, and U. Morgen; 1Institute of Quantum Optics, Leibniz Universität Hannover, Hannover, Germany; 2Cluster of Excellence PhoenixD (Photonics, Optics, and Engineering - Innovation Across Disciplines), Hannover, Germany; 3Zuse Institute Berlin, Berlin, Germany; 4Laser Zentrum Hannover e.V., Hannover, Germany. We report on a new waveguide writing concepts in PMMA. We found and investigate the optimal writing parameters to create single-mode waveguides with minimal propagation losses as well as demonstrate 2D and 3D Y-splitters.

Polarization controlled orientation of LiNO3 nanocrystals induced in Li2O – Nb2O5 – SiO2 – B2O3 glasses by femtosecond laser irradiation
E. Muzi, M. Cavillon, M. Lancry, F. Brisset, B. Sapaluy, D. PhoeniX, and B. Poumellec; 1Institut de Chimie Moléculaire et des Matériaux d’Orsay (ICMMO), Université Paris-Saclay, Orsay, France; 2IRCER-Université de Limoges, Limoges, France.
We introduce an original approach for processing CASR congested spectra, based on multivariate curve resolution with non-negative least squares. We add a hyper-spectral segmentation and regularization constraint and introduce the use of convolutional neural networks.

Liquid immersion enables 3D printable diffractive optical elements
By immersing a diffractive optical element in a near-index-matched solution we demonstrate a method to controllably scale up the dimensions of the DOE. This enables a low-cost fabrication method without compromising optical performance.

Wideley Electrically Tunable QCLs for Rapid Detection of Volatile Organic Molecules
R. Brechbieler, P. Scheidegger, H. Looser, A. Kupferenschmid, L. Emmenegger, and R. Tziozin; Laboratory for Air Pollution / Environmental Technology, Empa, CH-8600 Dübendorf, Switzerland.
We report on fast and high-resolution mid-infrared mid-IR imaging of marine coatings, demonstrating its applicability for measuring wet film thickness, and for non-destructive inspection of particles and defects.

Non-Destructive Testing and Imaging of Marine Coatings using High-Resolution Mid-Infrared Optical Coherence Tomography
C. Petersen, C. Markou, N. Israelevich, P. Rodgrigo, G. Woyessa, P. Tidemand-Lichtenberg, C. Pedersen, and O. Bang; 1DTU Fotonik, Technical University of Denmark, 2800 Kgs Lyngby, Denmark; 2DTU Fotonik, Technical University of Denmark, 4000 Roskilde, Denmark; 3Norbelis, 2830 Virum, Denmark; 4NKT Photonics, 3460 Birkedal, Denmark.
We report on fast and high-resolution mid-infrared OCT imaging of marine coatings, demonstrating its applicability for measuring wet film thickness, and for non-destructive inspection of particles and defects.
Highly flexible deep learning based speckle correlation extraction

Y. Wang1, Z. Lin1, Y. Li2, C. Hu3, H. Yang2, and M. Gu4;
1Centre for Artificial-Intelligence Nanophotonics, School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China; 2School of Optical-Electrical and Computer Engineering, University of Shanghai for Science and Technology, Shanghai, China
We show that the trained convolutional neural network (COECNN) is able to extract scalable speckle correlation and make high-quality sparsity object predictions through an entirely different set of diffusers.

An Optical Fiber-based SPR Sensor for Colorectal Cancer Diagnosis

R. Xavier, J. Alpino, C. Moreira, and R. Cruz; IFPB Instituto Federal de Educação, Ciência e Tecnologia da Paraíba, João Pessoa, Brazil
An optical fiber-based surface plasmon resonance sensor for colorectal cancer (CRC) diagnosis is presented here.

Fiber-coupled balanced-detection interferometric quantum properties on top of the classical stimulation, rendering it practical in applications of quantum illumination and sensing.

InAs/AlAsSb-Based Quantum Cascade Detector at 2.7 μm

M. Giparakis1, H. Knörgl3, M. Beiser1,2, W. Schrenk1, B. Schwarz1, M. Beiser1,2, and A.M. Andrews3; 1Institute of Solid State Electronics E362, TU Munich, Germany; 2Institute of Solid State Electronics E362, TU München, Germany; 3Institute of Semiconductor Electronics, Vienna University of Technology, Vienna, Austria
We investigated the magneto-optical effect in the Terahertz Gallium Garnet WGM resonator possessing the record quality factor Q=1.45×10^8 for such material. We have observed an eigenfrequency modulation and polarisation declination induced by a harmonic magnetic field.

Multi-channel laser Doppler anemometer for airborne integration as real-time optical wind vector sensor

O. Kleibisch1, P. Muhnek2, R.-A. Lorberer3, N. Miller4, and M. Damm4; German Aerospace Center, Institute of Technical Physics, Stuttgart, Germany
A rack-mounted laser Doppler anemometer (LDA) for integration into an research aircraft is presented. The LDA is tested as a potential optical air data sensor for measuring true air speed and local airflow angles.
EG-P.8 FRI
High-Harmonic Spectroscopy through Matter Talbot-Lau Interferometry
A. García-Castellana, C. Hernández-García, and L. Plaja; Grupo de Investigación en Aplicaciones del Láser y Fotónica, Universidad de Salamanca, Salamanca, Spain
We demonstrate an ultrafast matter-Talbot effect in the nonlinear response of a low-dimensional solid to an intense laser. Our results show that it leaves a unique spectroscopic trace, opening the way for high-harmonic Talbot-Lau spectroscopy.

EG-P.9 FRI
Large Third-Order Nonlinear Optical Effect Induced by Plasmonic Metasurface with Sub-nm Gaps
T. Takeuchi and K. Yakabu; Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan
We computationally investigated third-order nonlinear optical effects induced by plasmonic metasurfaces with sub-nm gaps. It has been clarified that the nonlinear effects are strongly enhanced by quantum tunneling and/or overbarrier currents through the sub-nm gaps.

EG-P.10 FRI
Interaction of photonics wheel with cluster of nanoparticles
B. Kerks and S. Orlov; State research institute Center for Physical Sciences and Technology, Vilnius, Lithuania
We present an investigation of novel type optical beam with transversely oriented angular momentum to its propagation direction interaction with nanoparticles and clusters. The focus is on angular momentum, torques and forces during the interaction.

EG-P.11 FRI
Thermal effect in plasmon assisted photocalysis: a parametric study
J. W. Un and Y. Sivan; School of Electrical and Computer Engineering, Ben-Gurion University of the Negev, Beer Sheva, Israel
We show that the temperature rise in plasmon-assisted photocatalysis is weakly-dependent on the illumination wavelength, pulse duration, particle size, and density, but strongly-sensitive to the beam size and the host thermal conductivity.

EG-P.12 FRI
Plasmon mediated interactions between fluorescent emitters in weak and strong coupling regime
C. Chevrier1, C. Pérez1, R. Bouchet2, R. Cerrai2, Y. De Wilde1, and J.-M. Benoît1; 2A. Gasseng2, C. Symonds2, B. Jellessa2, and V. Krachmalnicoff2; 1Institut Langevin, ESPCI Paris, Université PSL, CNRS, Paris, France; 2Institut Lumière Matière, Université Claude Bernard Lyon 1, CNRS, Villeurbanne, France
We investigate the plasmon mediated interaction between two different ensembles of fluorescent emitters, the first weakly coupled to a surface plasmon and the second strongly coupled to a surface plasmon.
Deep Learning based Inverse Design of Integrated Silicon Nanophotonic Gratings

We demonstrated deep learning based inverse design of integrated silicon nanophotonic grating. Predicted geometries by the inverse design algorithm resulted in mean-square-error of the order of 10-4 while comparison of simulated and predicted transmission response.

Deep Neural Networks with Time-Domain Synthetic Photonic Lattices


Using liquid crystals as tuneable waveplates in femtosecond Bessel beams create in dielectrics over-dense nanoplasmas with diameter below 200 nm, which open high aspect ratio nanochannels. The main mechanism is collisionless resonance absorption.

Study of femtosecond laser post-processing regimes for dispersion tailoring of fiber Bragg gratings

T.O. Inogure, R.G. Kramer, T.A. Gobez, C. Matzdorf1, D. Richter1, S. Nolte1,2, Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University, Albert-Einstein-Straße 15, 07745, Jena, Germany; Fraunhofer Institute for Applied Optics and Precision Engineering IOF, Albert-Einstein-Straße 7, 07745, Jena, Germany

We demonstrate with experiments and simulations that femtosecond Bessel beams create in dielectrics over-dense nanoplasmas with diameter below 200 nm, which open high aspect ratio nanochannels. The main mechanism is collisionless resonance absorption.

Conical Beams for Directing Chemical Etching along Deeply-Focussed Femtosecond Laser Modification Tracks

E. Alimohammadan, E. Ertorer, and P.R. Herman1; Department of Mechanical and Industrial Engineering, University of Toronto, 5 King’s College Rd., M5S6G8, Toronto, Canada; Department of Electrical and Computer Engineering, University of Toronto, 10 King’s College Rd., M5S 3G4, Toronto, Canada

We demonstrate the use of liquid crystals as switchable retardation elements embedded in femtosecond laser direct written waveguides, allowing a switch e.g. from anti-diagonal to diagonal output polarization.

Creation of high-contrast structures in superpositions of higher order Bessel beams for laser processing of glasses

Illeva2, E. Kozlovskis1, S. Orlov1, P. Gatosov1,3, and O. Ulkinas1,2, Center for Physical Sciences and Technology, Coherent Optics laboratory, Vilnius, Lithuania; 2 Workshop of Photonics, Vilnius, Lithuania; 3 Faculty of Electronics, Vilnius Gediminas Technical University, Vilnius, Lithuania

We report on generation of complex transverse intensity distribution beams, by superimposing several Bessel beams of higher order and different spatial frequencies, using geometrical phase elements and applications of such beams for glass processing.

An optical convolutional neural network is demonstrated in which linear operations are implemented by lenses and spatial light modulators (SLMs), while an optical non-linearity is realized by a cesium vapor cell as a saturable absorber.

Prediction of the morphological features of laser-based patterned surfaces through the use of machine learning approaches

M. C. Veli1,2, G. Tabiabi1, A. Mimidis1,2, E. Skoulas1,2, A. Alberucci1,2, S. Orlov1, P. Gatosov1,3, and O. Ulkinas1,2, Center for Physical Sciences and Technology, Coherent Optics laboratory, Vilnius, Lithuania; 2 Workshop of Photonics, Vilnius, Lithuania; 3 Faculty of Electronics, Vilnius Gediminas Technical University, Vilnius, Lithuania

Using liquid crystals as tuneable waveplates in femtosecond Bessel beams create in dielectrics over-dense nanoplasmas with diameter below 200 nm, which open high aspect ratio nanochannels. The main mechanism is collisionless resonance absorption.

Using liquid crystals as tuneable waveplates in femtosecond Bessel beams create in dielectrics over-dense nanoplasmas with diameter below 200 nm, which open high aspect ratio nanochannels. The main mechanism is collisionless resonance absorption.
Time-resolved imaging and simulations of SiO2 films dynamic fracture due to laser-induced confined micro-explosion at Si/SiO2 interface.

Large Area Surface Ablation and Micropatterning of Transparent Dielectrics with Femtosecond UV Laser Pulses.

We present a parametric investigation on solids complemented with theoretical calculations.

Large Area Surface Ablation and Micropatterning of Transparent Dielectrics with Femtosecond UV Laser Pulses.

Volumetric 3D printing of conductive ceramics.

Femtosecond laser-generated shockwaves in transparent media: Experiments and Simulation.

Femtosecond laser-generated shockwaves in transparent media: Experiments and Simulation.


We report on the laser writing of nonlinear optical patterns in x-ray gratings and sub-micron hole patterns with different beam shapes.

Ultrafast laser micromachining of x-ray gratings and sub-micron hole patterns with different beam shapes.

Hologram Recording Using Ultrashort Laser Pulses.

Fabrication of Microfluidic Macromolecule Separator by Femtosecond Direct Laser Writing.

Hologram Recording Using Ultrashort Laser Pulses.

Fabrication of Microfluidic Macromolecule Separator by Femtosecond Direct Laser Writing.

Laser Processing for Surface Protection of Marble through Hydrophobicity Enhancement.

Laser Processing for Surface Protection of Marble through Hydrophobicity Enhancement.

Laser Processing for Surface Protection of Marble through Hydrophobicity Enhancement.

Ultrafast laser micromachining of x-ray gratings and sub-micron hole patterns with different beam shapes.

Laser Processing for Surface Protection of Marble through Hydrophobicity Enhancement.

Large Area Surface Ablation and Micropatterning of Transparent Dielectrics with Femtosecond UV Laser Pulses.

Femtosecond laser-generated shockwaves in transparent media: Experiments and Simulation.

Femtosecond laser-generated shockwaves in transparent media: Experiments and Simulation.

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Femtosecond laser-generated shockwaves in transparent media: Experiments and Simulation.
We consider optoelectronic elements based on the space-domain Pancharatnam–Berry phase for the generation of an optical needle with imperfect input beams and misalignments is investigated.

**CM-P.25 FRI**

Periodic Surface Structures Induced by 2-μm Femtosecond Pulses on ITO

B. Bánhegyi, L. Peter, Z. Pípa, and P. Dombi

1 Wigner Research Centre for Physics, Budapest, Hungary; 2 ELI–ALPS Research Institute, ELI–HU Nonprofit Kft, Szeged, Hungary

We analyze periodic surface structures produced by 2-μm femtosecond laser pulses on indium-tin-oxide thin-film with SEM and element analysis. The generated double-periodic morphologies are discussed in the frame of finite-difference and finite-element simulations.

**CM-P.26 FRI**

Tomographic Volumetric Additive Manufacturing in Scattering Resins

J. Madrid-Wolf, A. Boniface, M. Jonin, P. Delrot, D. Loterie, and C. Moiser

1 Laboratory of Applied Photonics Devices, School of Engineering, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland; 2 Readily3D, Lausanne, Switzerland

Tomographic Additive Manufacturing produces three-dimensional objects by projecting light patterns onto cell-laden hydrogels. We improve print resolution and reduce the effects of scattering by incorporating a refractive-index matching agent.

**CM-P.27 FRI**

Direct laser writing of 3D microstructures for photocatalytic applications

I. Syngelakis, E. Boukourakis, G. Kenanakis, A. Klim, and M. Farsari

1 Institute of Electronic Structure and Laser (IESL), Foundation for Research and Technology-Hellas (FORTH), Heraklion, Greece; 2 Department of Materials Science and Technology, University of Crete, Heraklion, Greece

The present work investigates the potential increase of the active surface area of TiO$_2$ nanorods, synthesized on 3D microstructures, in order to efficiently enhance their photocatalytic performance.

**CM-P.28 FRI**

Selective Laser Etching of Crystalline Sapphire for 3D Structure Fabrication

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1 Laser Research Center, Faculty of Physics, Vilnius University, Vilnius, Lithuania

Selective laser etching is perspective technology in high quality 3D structures formation in glasses and crystals. However, SLE of crystals is not widely studied. Here we present SLE optimisation for crystalline sapphire processing.

**CM-P.29 FRI**

Direct Correlation of Local Fluence to Ablation Morphology Created by a Single Femtosecond Laser Pulse

H. Sakurai, K. Konishi, H. Shimizu, J. Yumoto, and M. Kawata-Gonokami

1 The University of Tokyo, Tokyo, Japan

We develop a method to directly correlate the two-dimensional ablated crater profile to the incident beam profile. We use this method to qualitatively explore previously unexplored intra-crater features in the femtosecond ablation of sapphire.

**CM-P.30 FRI**

Bio inspired Surface engineering via Ultrafast Laser Patterning for textiles made of polymers

E. K. Kossi, C. Mauchair, and X. Sedou

1 Lyon Jean Monnet University, UMR 5516 CNRS, Laboratory Hubert Curien, Saint Etienne, France

In this work, we investigate the optimal laser parameters to reproduce liquid repellent properties on PET and PA66 fluoralkyl-free polymers for textile industry. The first tests of DLIP texture on the impact of silicon are presented.

**CM-P.31 FRI**

Triphenylamine-based aldehydes as photoinitiators for multiphoton polymerization

D. Ladika, G. Noirebent, F. Dumar, D. Gignes, A. Mourska, M. Farsari, and D. Gray

1 Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas, HERAKLIO, CRETE, Greece; 2 Department of Materials Science and Technology, University of Crete, HERAKLIO, CRETE, Greece

Presentation of three triphenylamine-based aldehydes which can be used as photoinitiators for Multiphoton Lithography. Besides their efficient formulations, they show good quality 3D prints with high aspect ratios and feature sizes in the sub-micrometer regime.

**CM-P.32 FRI**

Pyrolyzed microstructures made by two-photon polymerization: comparative study


1 Lomonosov Moscow State University, Moscow, Russia; 2 Moscow Institute of Physics and Technology (National Research University), Moscow, Russia

Two-photon polymerization is a powerful technology to make 3D microstructures. Post-processing pyrolysis enhances both microstructures’ resolution and chemical composition. We have analyzed shrinkage, elemental composition, survival rate and adhesion of microstructures made of three photoresists.

**CM-P.33 FRI**

Femtosecond Laser micromachining of Various Materials for Industrial Engraving Applications

D. Pallarés-Aldeiturría and X. Sedou

1 Hubert Curien Laboratory, University of Lyon, Jean Monnet University, UMR 5516 CNRS, F-42000, Saint Etienne, France

A new optimization protocol for industrial femtosecond laser engraving has been developed. It has been applied to Polyether ether ketone (PEEK), sapphire and silicon carbide (SiC), producing remarkable results in all cases.

**CM-P.34 FRI**

The contribution has been withdrawn.

**CM-P.35 FRI**

Femtosecond laser texturing of surfaces: applications in industrial scale production

D. Ceresi, G. Kontenis, A. Zemaitis, R. Vargalis, G. Merkinkastaitė, and G. Nemickas

1 Femtika Ltd, Vilnius, Lithuania; 2 Laser Research Center, Vilnius University, Vilnius, Lithuania; 3 Department of Chemistry, Vilnius University, Vilnius, Lithuania

Femtosecond laser-induced surface functionalities in high speed and the capabilities of their applications in the industry.

**CM-P.36 FRI**

Laser scribing of Sb$_2$Se$_3$ thin-film solar cells

F. Giovannardi, F. Khoezyeh, F. Bissoli, S. Rampino, E. Giloli, G. Trevisti, M. Mazzez, and S. Selleri

1 University of Parma, Department of Engineering and Architecture, Parma, Italy; 2 IMEM–CNRS, Institute of Materials for Electronics and Magnetism, Parma, Italy

A preliminary test of laser scribing in Sb$_2$Se$_3$ solar cell manufacturing has been performed. SEM image and EDAX analysis confirm the removal of the TCO layer without damaging the underlying absorber.
Babou, Florent.......... EB-1.3 MON (p33),

Babayigit, Ceren......... CK-P.3 THU (p144),

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Balys, Robert..........,
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