2020 Photonics Online Meetup (#POM20) Program

Contents

1. Introduction

The meeting is geared to bring together a community of early career and established researchers from universities, industry, and government to amplify the role of optics and photonics in daily life.

POM was a free and entirely virtual online conference. Given the nature of the meet-up event, there was no perfect time. Therefore, all presentations were recorded, and were available for researchers to view off-line after the conference for a limited time.

The inaugural meet-up on January 13, 2020 had three themes, and submitted abstracts were chosen for either presentations or posters. The audience watched from their home location with many forming POM-hub sites. Over 1100 researchers watched the presentations in real-time from 37 countries (on 6 continents)! All posters are still available on Twitter (just search for #POM20).

Interested in organizing an online meeting?

The POM Organizers have drafted a “How to” guide that also includes some analysis of our event and posted it on arXiv.org and subsequently published in Nature Materials Reviews.

If you use any of our materials or ideas, consider citing: Reshef, O.; Aharonovich, I.; Armani, A. M.; Gigan, S.; Grange, R.; Kats, M. A.; Sapienza, R. How to Organize an Online Conference. Nature Reviews Materials 2020, doi: 10.1038/s41578-020-0194-0.

2. Mission

The idea of an online conference has been percolating within the twittersphere for some time to address several well-acknowledged issues with the conventional conference format; namely, the large carbon footprint of conference travel, the impact of travel on work/life balance, and the increasing rates of disruption and cost of international travel.

In parallel, the technical platforms designed for hosting a multi-location, open forum have significantly advanced, further motivating the development of alternative mechanisms for research dissemination. We decided to take a leadership role in implementing the concept.

Therefore, in addition to disseminating technical information to the photonics community, POM has a larger overarching mission. Briefly, the four goals are:

- improve accessibility of conference attendance
- reduce carbon footprint of conference travel
- reduce burden on family of conference travel
- reduce the cost of conference participation

3. Committee

The seven founders of the conference participated to the elaboration of the inaugural POM.

Conference Chairs:

- Prof. Andrea Armani, University of Southern California, Los Angeles, USA
- Dr. Orad Reshef, University of Ottawa, Ottawa, Canada

Conference Organizing Committee:

- Prof. Igor Aharonovich, University of Technology Sydney, Sydney, Australia
- Prof. Sylvain Gigan, Sorbonne Universite, Paris, France
- Prof. Rachel Grange, ETH Zurich, Zurich, Switzerland
- Prof. Mikhail Kats, University of Wisconsin-Madison, Madison, USA
- Prof. Riccardo Sapienza, Imperial College London, London, UK

Committee members:

- Prof. Roel Baets, Gent University, Belgium
- Dr. Kirsten Moselund, IBM Research, Zurich
- Dr. Dhruv Saxena, Imperial College, London, England

Additional support:

We would like to thank Mark Veksler (USC Iovine and Young Academy) for designing the POM logo, Dr. Toan Tran (University of Technology, Sydney) and Marc Reig Escalé (ETH Zurich, Switzerland) for the scientific renderings on the website, and Boris Braverman for editing the videos. We would like to thank the technical support (ITS) at the University of Southern California, notably Jairo Delgado and Nadia Barosy, for coordinating and supporting this event.

4. Topic areas

The three thematic topic areas of POM 2020 in January are described below.

Integrated Photonics
Chair: Prof. Rachel Grange, Department of Physics, ETH Zurich
Members: Prof. Roel Baets, Gent University, Belgium; Dr. Kirsten Moselund, IBM Research, Zurich

This topic will focus on integrated optics in general with an emphasis on hybrid systems combining different materials (Silicon, III-V, or metal-oxides) or fabrication technologies (thin films, nanowires, or membranes) to target applications in the telecommunication, quantum optics, or sensing.

Invited Speaker: "Topological photonics in active platforms", Prof. Mercedeh Khajavikhan, CREOL, University of Central Florida, USA

Nanoscale Quantum Optics
Chair: Prof. Riccardo Sapienza, Department of Physics, Imperial College London, London UK
Members: Prof. Igor Aharonovich, University of Technology Sydney

This session is dedicated to nanoscale quantum optics, the coherent interaction of nanophotonic systems and quantum objects, such as the generation of quantum states by nonlinear processes in nanostructured media, the manipulation and storage of quantum states of light at the nanoscale, and quantum effects driven by strongly confined optical fields.

Invited Speaker: Prof. Mete Atature, University of Cambridge, Cambridge UK, twitter: @MeteAtature

Optical Materials
Chair: Prof. Mikhail Kats, Department of Electrical and Computer Engineering, University of Wisconsin – Madison, Madison USA
Members: Dr. Dhruv Saxena, Imperial College, London, England

The topic will focus on emerging topics in optical materials, including two dimensional (2D) materials, perovskites, spin defects, III-V and II-IV compounds, and silicon/diamond nanostructures.

Invited Speaker: Prof. Nader Engheta, University of Pennsylvania, USA, twitter: @NaderEngheta

5. Oral presentation Program

All times EST on January 13, 2020.

Topic 1: Integrated optics
Session Chair: Rachel Grange, Department of Physics, ETH Zurich, Switzerland

2:00-2:05pm Opening Remarks
Andrea Armani, Conference Chair

2:05-2:35pm *Topological photonics in active platforms*, invited
Mercedeh Khajavikhan, CREOL, University of Central Florida, USA
Abstract:

2:35 – 2:53pm *Graphene-oxide-silicon micro-ring resonators with enhanced all-optical resonance-tuning*
Aneesh Dash, Ujwol Palanchoke, Marc Gely, Guillaume Jourdan, Sebastien Hentz, Shankar Kumar Selvaraja, Akshay Naik, IISc Bangalore, India
Abstract: All-optical cavity-tuning (manipulating optical signals with another optical signal) is useful for modulation, switching, signal routing for applications in on-chip signal processing and communication. Optical absorption in the cavity induces two primary effects: thermo-optic effect and free-carrier dispersion (FCD). In a pure silicon-on-insulator (SOI) optical cavity, these two effects, caused predominantly by two-photon

absorption (TPA), produce competing red-shift (towards longer wavelength) and blue-shift (towards shorter wavelength) of the resonance respectively. Hence the efficiency and dynamic range of all-optical tuning is limited. Improving the performance of all-optical tuning requires one of the effects to be dominant. In alternate material platforms like silicon nitride (SiN), TPA is absent and hence FCD is minimal. However, the thermo-optic effect due to linear absorption is inefficient. Thus, integration of other materials over these platforms is required for enhancing the all-optical tuning. Graphene-on-SiN devices have been shown to be more efficient in all-optical resonance-tuning than pure SiN devices due to enhanced TPA-induced thermo-optic effect in graphene. However, the TPA-induced FCD still competes with the thermo-optic effect and limits the dynamic range of tuning. In our work, we demonstrate suppression of TPA in graphene by introducing a 100 nm thick oxide spacer between a SOI waveguide and graphene. Therefore, the FCD gets suppressed., while the strong linear absorption in graphene produces thermo-optic red-shift for tuning the resonance. In this graphene-oxide-silicon waveguide-system, we demonstrate a resonance-tuning efficiency of 300 pm/mW (0.055 π /mW) with a large dynamic range of 1.2 nm (0.22π) from linear resonance to optical bistability. This work opens up ways to extract optimal performance of graphene-on-waveguide systems in all-optical cavity-tuning.

2:55 – 3:13pm *Microwave Plasmonics: 500 GHz plasmonic modulators enabling sub-THz microwave photonics*

Maurizio Burla[1], Claudia Hoessbacher[1], Wolfgang Heni[1], Christian Haffner[1], Yuriy Fedoryshyn[1], Dominik Werner[1], Tatsuhiko Watanabe[1], Yannick Salamin[1], Hermann Massler[2], Delwin L. Elder[3], Larry R. Dalton[3], Juerg Leuthold[1,] [1]ETH Zurich, Switzerland, [2]Fraunhofer IAF, Germany, [3]University of Washington, USA

Abstract: To convert electrical signals to the optical domain, broadband electro-optic intensity modulators are essential. The growing demand for terahertz applications demands modulators with frequency responses to the sub-terahertz range, high power handling, and high linearity, simultaneously. We have experimentally demonstrated plasmonic intensity modulators simultaneously meeting all requirements for analog applications, featuring— at the same time— a short length of tens of micrometers, record-high flat frequency response beyond 500 GHz, high power handling, and high linearity. To our knowledge, this also represents the fastest Mach-Zehnder modulator to date. Using the same kind of modulator, we also implemented a sub-terahertz radio-over-fiber analog optical link up to 325 GHz, with >100 GHz bandwidth. We believe these devices have the potential to grow as a new tool in the general field of microwave photonics, making the sub-terahertz range accessible to, e.g., medical imaging, wireless communications, antenna remoting, Internet of Things, sensing, and more.

3:15 – 3:33pm *Hexagonal Boron Nitride Nanophotonics*

Kim Sejeong, Igor Aharonovich, University of Technology Sydney, Australia

Abstract: Single-photon emitters (SPEs) are key resources for many quantum technologies including quantum computation and quantum communications. To date, the most investigated solid-state SPE systems are epitaxial quantum dots that operate primarily at cryogenic temperatures, and colour centres in solids. Despite years of research, the existing systems remain inadequate for practical applications, and the search is on for high-performance quantum emitters. In 2015, the SPE platform expanded to 2D materials. In 2016, hexagonal boron nitride (hBN) emerged as a compelling 2D host of SPEs. SPEs in hBN are promising because they are bright, with more than a million counts per second at room temperature, optically stable at ambient conditions, fully polarized and with a narrow zero photon line (ZPL). Furthermore, hBN is a wide bandgap material, which guarantees optical transparency in the visible and infrared spectral regions. These factors make this material an outstanding candidate for quantum nanophotonics with diverse promising applications. Here, we demonstrate the first photonic cavities that are entirely consisted of hBN, which is van der Waals crystal with stacked 2D atomic layers. High-Q photonic cavities made of 2D materials enable increased in light-matter interaction which is promising for many nanophotonics applications including quantum photonics, optomechanics and nonlinear optics.

3:35 – 3:50pm *Break*

Topic 2: Nanoscale Quantum optics
Chair: Riccardo Sapienza, Department of Physics, Imperial College London, London UK

3:50-4:20 *Quantum Optics with New Materials*
Mete Atature, University of Cambridge, Cambridge UK
Abstract:

4:20 – 4:38 *All-photonic quantum teleportation and entanglement swapping using on-demand solid-state quantum emitters*

Francesco Basso Basset[1], Michele B Rota[1], Christian Schimpf[2], Davide Tedeschi[1], Marcus Reindl[2], Daniel Huber[2], Katharina D Zeuner[3], Saimon F Covre da Silva[2], Huiying Huang[2], Val Zwiller[3], Klaus D JÃns[3], Armando Rastelli[2], Rinaldo Trotta[1]
[1] Sapienza University of Rome, Italy, [2] Johannes Kepler University Linz, Austria, [3] Royal Institute of Technology Stockholm, Sweden

Abstract: All-optical quantum teleportation and entanglement swapping are essential elements to the operation of a quantum network [1]. These quantum phenomena rely on the properties of entangled states of light that, in the prospect of real-life applications, should be encoded on photon pairs on demand [2]. Despite recent advances, however, the goal has proved elusive [3]. In this work, we show that entangled photon pairs generated on demand by a single GaAs quantum dot can successfully be used to perform multi-photon experiments without the need for spectral or temporal filtering. We present the first experimental demonstration of photonic entanglement swapping relying on a quantum emitter [4], as well as the implementation of a teleportation protocol with a fidelity violating the classical limit for any arbitrary input state [5]. In parallel, we develop a theoretical framework capable of quantitatively reproducing the experimental observations using the measured values of entanglement fidelity and photon indistinguishability. Moving from the discussion of our results, we conclude by envisioning the next steps for quantum dots towards implementing fundamental quantum protocols in practical quantum networks.

[1] S. Wehner, D. Elkouss, and R. Hanson, Science 362, eaam9288 (2018).
[2] D. Huber, et al., Phys. Rev. Lett. 121, 33902 (2018).
[3] J. Nilsson., et al., Nat. Phot. 7, 311 (2013).
[4] F. Basso Basset, M. Rota, C. Schimpf, D. Tedeschi, et al., Phys. Rev. Lett. 123, 160501 (2019).
[5] M. Reindl, et al., Sci. Adv. 4, eaau1255 (2018)

4:40 – 4:58 *A three-dimensional polymeric platform for photonic quantum technologies*

Maja Colautti[1]**,** Pietro Lombardi[1], Marco Trapuzzano[2], Francesco S. Piccioli[3], Sofia Pazzagli[1], Bruno Tiribilli[4], Sara Nocentini[1], Francesco S. Cataliotti[1], Diederik Wiersma[1], Costanza Toninelli[3]
[1] European Laboratory for Non-Linear Spectroscopy (LENS), Italy, [2] Universita degli Studi di Firenze, Italy, [3] National Institute of Optics (CNR-INO), Italy, [4] Institute for Complex Systems (CNR-ISC), Italy

Abstract: The efficient interaction of light with quantum emitters is crucial to most applications in nano and quantum technologies. Effective excitation and collection are key ingredients for the deployment of the generated single photons [1]. Furthermore, on-chip integration and miniaturization allows for minimized losses and tailored interaction, and is essential to scale-up to large devices. In the present contribution we demonstrate the deterministic integration in 3-dimensional polymeric structures of single quantum emitters

close to the lifetime limit [2]. This is achieved by 3D Laser Writing (3DLW) of commercial photoresists around self-assembled organic nanocrystals containing fluorescent molecules. Thanks also to the high 3D resolution of the two-photon absorption process, this solution offers a big advantage in terms of coupling efficiency of the emitted fluorescence to the photonic structure.
Anthracene nanocrystals doped with dibenzoterrylene (DBT:Ac NCX) fluorescent molecules show [3] unprecedented performances of single-photon emission and are naturally suitable both to deterministic positioning and to the integration in hybrid devices. We integrate DBT:Ac NCX via DLW on different substrates and at variable heights. In particular, close-to Fourier limited emission is observed from on-chip molecules at cryogenic temperatures and enhanced light extraction is achieved in a micro-dome solid immersion lens design. These results show how an all-organic platform can be realised, that offers unique solutions for photonic quantum technologies, combining on a chip the freedom of three-dimensional polymeric architectures with the optimal properties of single photon emission from fluorescent molecules.

[1] S. Checcucci, et al., Light: Science & Applications 6, e16245 (2017).
[2] M. Colautti et al., arXiv:1909.07334 (2019)
[3] S. Pazzagli, et al., ACS Nano 12, 4295-4303 (2018)

5:00 – 5:18 *Quantum optics with nanoscale waveguides and cold atoms*
Julien Laurat, Neil V. Corzo, Jeremy Raskop, Jeremy Berroir, Aveek Chandra, Tridib Ray, Alban Urvoy, Adrien Bouscal, Alexandra S. Sheremet, Baptiste Gouraud Laboratoire Kastler Brossel, Sorbonne University, CNRS, ENS-University PSL, France
Abstract: Considerable efforts have been recently devoted to combining ultracold atoms and nanophotonic devices to obtain not only better scalability and figures of merit than in free-space implementations, but also new paradigms for atom-photon interactions. Dielectric waveguides offer a promising platform for such integration because they enable tight transverse confinement of the propagating light, strong photon-atom coupling in single-pass configurations and potentially long-range atom-atom interactions mediated by the guided photons. In this context, I will report on recent experiments involving cold atoms trapped in the vicinity of a nanofiber. Specifically, we observed recently a single collective atomic excitation in this setting [1]. The stored collective entangled state can be efficiently read out with an external laser pulse, leading to on-demand emission of a single photon into the guided mode. We characterize the emitted single photon via the suppression of the two-photon component and confirm the single character of the atomic excitation, which can be retrieved with an efficiency of about 25%. These results demonstrate a capability that is essential for the emerging field of waveguide quantum electrodynamics.

[1] N.V. Corzo et al., Waveguide-coupled single collective excitation of atomic arrays, Nature 566, 359 (2019).

5:20 – 5:35pm *Break*

Topic 3: Optical Materials
Chair: Mikhail Kats, Department of Electrical and Computer Engineering, University of Wisconsin – Madison, Madison USA

5:35-6:05 *Optical Materials for Photonic Mathematics*
Nader Engheta
University of Pennsylvania, USA
Abstract: In my group, we are investigating how optical materials and photonic structures can be utilized to perform analog computation as waves travel through them. We are exploring metastructures that can perform mathematical operations, such as solving integral and differential equations, with waves. We are

studying several wave-based platforms for various mathematical functionalities. I will present the results of some of our ongoing work in this research area.

6:05 – 6:23 *Time refraction in an epsilon-near-zero material*

Jeremy Upham[1], M. Zahirul Alam[1], Yiyu Zhou[2], Mohammad Karimi[1], Orad Reshef [1], Cong Liu[3], Alan E. Willner[3], Robert W. Boyd[1, 2]
[1]University of Ottawa, Canada, [2]University of Rochester, USA, [3] University of Southern California, USA

Abstract: We report a large ($\Delta\lambda$ >70 nm), tunable wavelength conversion of an infrared probe beam through time refraction in indium tin oxide (ITO) in its epsilon-near-zero spectral region. Adjusting the timing between the pump and probe controls the direction and the magnitude of the wavelength shift. Just as Snell's law describes how the wavevector of a light wave changes at a spatial discontinuity of the refractive index while the frequency is conserved, when a light wave encounters a temporal change in the refractive index Δn(t), the frequency of the light changes proportionally while the wavevector is conserved. This "time refraction" can be expressed as an analogue of Snell's law, written as $n_1\omega_1 = n_2\omega_2$ [1]. Such changes have been observed but are generally limited by the magnitude of observable change of n witnessed by the light within the medium (typically on the order of 10^{-3}) [2,3]. Using a pump-probe measurement with 100 fs pulses near the ENZ spectral region of ITO (near 1240 nm), we experimentally demonstrate large adiabatic wavelength conversion in epsilon-near-zero (ENZ) materials due to low background refractive index (n_1) and the optically excited unity-order change in the refractive index ($\Delta\mathrm{n}$) [4]. Our experimental results show the probe red shift by up to 50 nm and a blue shift by up to 28 nm. These results match very well with our modelling based on the nonlinear Schrodinger equation.

[1] Mendonca, J. T., Theory of photon acceleration, CRC Press, (2000).
[2] Preble, S. F. et al., Nat. Photonics 1, 293 (2007).
[3] Upham, J. et al., Appl. Phys. Express 3, 062001 (2010).
[4] Alam, M. Z. et al., Science, aae0330 (2016).

6:25 – 6:43 *Inverse Design of Nanophotonic Structures with Interpretable Convolutional Neural Networks*

Christopher Yeung, Ju-Ming Tsai, Aaswath Raman
University of California, Los Angeles, USA

Abstract: Reaching the true potential of nanophotonic devices requires the arbitrary control of spectral and angular selectivity in the propagation, absorption, and emission of electromagnetic waves. To this end, previously investigated design methods for nanophotonic structures have encompassed both conventional inverse-optimization approaches as well as nascent machine-learning (ML) strategies. However, inverse-optimization processes are computationally-intensive, and image generation-based ML design techniques which can facilitate the generation of complex geometries require exhaustive investigation to produce stable results. Here, we demonstrate that stable and well-established deep learning architectures such as convolutional neural networks (CNN), which are traditionally used for "forward design", can also be utilized for "inverse design" by leveraging neural network interpretability and visualization methods. To illustrate this capability, we trained a CNN model with 10,000 images of selective mid-infrared thermal emitters and their corresponding absorption spectra. The trained CNN established the relationships between nanophotonic structures and their responses, then predicted the responses of new and unknown designs with over 95% accuracy. After training the CNN, we applied the Shapley Additive Explanations (SHAP) algorithm to the model to determine features that made positive or negative contributions towards specific spectral points, thereby informing which features to create or eliminate in order to meet a target spectrum. Using this strategy, we show that a starting electromagnetic metasurface design can be selectively manipulated to create or remove spectral peaks, thus demonstrating that inverse design can be achieved by exposing the valuable information that is hidden within a neural network.

6:45 – 7:03 *Grapes, Microwave Photonics, and the Shape of Water*

Aaron Slepkov[1], Hamza K Khattak[1, 2], Miao Hu[1]
[1]Trent University, Canada, [2]new position at McMaster University, Canada

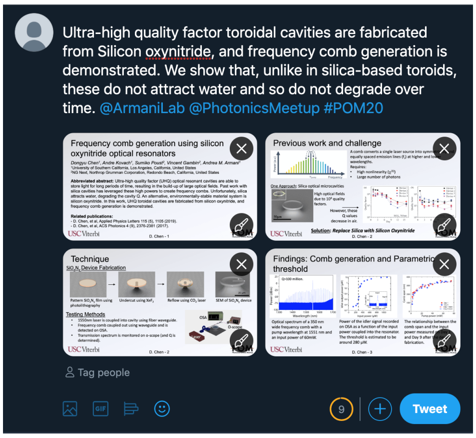
Abstract: The sparking of grapes in a household microwave oven has been a popular, if poorly-explained, online pop-sci phenomenon for decades, garnering millions of views on YouTube. Recently, we have used thermal imaging, high-speed videography, and FEM simulations to establish a new explanation for the phenomenon that is rooted in resonant optical scattering. With an extremely large index of refraction at GHz frequencies, balls of water can act as optical resonators, offering a wide range of morphology-dependent resonances (MDRs) as a function of size. Much like plasmonic dimers that hybridize to form hotspots near points of contact, pairs of cm-sized spheres of water (i.e. grapes) form “optical bonds” with microwave focussing sufficiently intense to ionize sodium and potassium species and form a “microwave plasma”. Furthermore, far from acting as an absolute detriment to the resonant phenomenon, the absorptive properties of water allow for the broadening of the range of sizes at which the resonances can be observed, without significantly diminishing the largely evanescent dimer hotspot. Ultimately, the scaling up of near-field optical resonances from nanophotonics at visible wavelengths to cm-sized objects at microwave wavelengths offers several experimental advantages; including the ability to image internal resonant mode structures that are largely unresolvable at the nanoscale. In this talk I will present the evidence that “grape plasma” is a result of morphology-dependent resonances, and will describe new opportunities for studying MDRs by controlling the shape of water.

7:05 – 7:20 *Closing Remarks*

Orad Reshef, Conference Chair

6. Posters Session

The Virtual Poster Session started during the morning of January 9, 2020, and it continued throughout the day. It was held entirely on twitter.



Ultra-high quality factor toroidal cavities are fabricated from Silicon oxynitride, and frequency comb generation is demonstrated. We show that, unlike in silica-based toroids, these do not attract water and so do not degrade over time. @ArmaniLab @PhotonicsMeetup #POM20

Example of a virtual poster hosted on twitter

Complete list of posters

Integrated Photonics

1. Microwave generation on an optical carrier in chains of nonlinear optical micro-resonator, Andrea Armaroli, GAP-Nonlinear, University of Geneva, Switzerland, andrea.armaroli@unige.ch

2. Spatial Mode Multiplexing with Integrated Optics, Boris Braverman, University of Ottawa, bbraverm@uottawa.ca
3. Quantum information processing on a silicon nitride integrated programmable waveguide circuit , Caterina Taballione, Laser Physics and Nonlinear Optics, University of Twente, The Netherlands, c.taballione@quix.nl
4. Electrically switchable whispering gallery mode lasing from ferroelectric liquid crystal microdroplets, Junaid Ahmad Sofi, University of Hyderabad, India, coolsofi14@gmail.com
5. Photonic network random lasers, Dhruv Saxena, Imperial College London, d.saxena@imperial.ac.uk
6. Integrated photonics for quantum communication, Davide Bacco, Technical University of Denmark, dabac@fotonik.dtu.dk
7. Dimensionality reduction for the design of high-performance subwavelength vertical grating couplers, Daniele Melati, National Research Council Canada, daniele.melati@nrc-cnrc.gc.ca
8. Integrated microring-resonators and waveguide Bragg cavities in lithium niobate-on-insulator, Fabian Kaufmann, ETH Zurich, fabiank@phys.ethz.ch
9. Dispersive-scan characterization of the nonlinear refractive index of fs-laser written Gorilla Glass waveguides, Franciele Renata Henrique, Sao Carlos Institute of Physics, University of Sao Paulo, francielerenata@usp.br
10. Miniaturized Volatile Organic Compound (VOC) Raman Spectroscopy Using Functionalized Silicon Nitride Slot Waveguides, Haolan Zhao, Photonics Research Group, INTEC, Ghent university, haolan.zhao@ugent.be
11. Reversible optical tuning on integrated optics by self-assembled azobenzene, Jinghan He, USC, jinghanh@usc.edu
12. Slow-light frequency combs and dissipative Kerr solitons in coupled-cavity waveguides, Juan Pablo, Vasco, Institute of Physics, EPFL, Switzerland, juan.vasco@epfl.ch
13. Scalable Two-Dimensional Quantum Integrated Photonics, Klaus Jöns, KTH Stockholm, klausj@kth.se
14. First In-Vitro Recordings from a Liquid Crystal Optrode, Leonardo Silvestri, UNSW Sydney, l.silvestri@unsw.edu.au
15. Confining light in a 3D band-gap cavity superlattice, Manashee Adhikary, COPS, MESA+ Insititute for Nanotechnology, University of Twente, m.adhikary@utwente.nl
16. Direct UV writing of integrated photonic devices with 213nm laser light, Paul Gow, Optoelectronics Research Centre, University of Southampton, p.gow@soton.ac.uk
17. Multimodal Fiber-Optic Quantum Sensing with Defect Centers in Diamond, Sean Blakley, Department of Physics and Astronomy, Texas A&M University, SMB784@tamu.edu
18. Exceptional Point impact on the behavior of Distributed Feedback Quantum Cascade Lasers, Mehran Shahmohammadi, ETH Zurich, smehran@phys.ethz.ch
19. Fast and high quality silicon photonics integrated circuit production services, Yunhong DING, SiPhotonIC ApS, Denmark, yunhong.ding@siphotonic.com

20. Planar Optical Antennas as Efficient Single-Photon Sources for Free-Space and Fiber-Based Operation in Quantum Optics and Metrology, Pietro Lombardi, CNR-INO, Università di Firenze, lombardi@lens.unifi.it

Nanoscale Quantum Optics

21. Loss of purity in two-photon helical states interacting with nanostructures, Alvaro Nodar, Centro de Fisica de Materiales CSIC-UPV/EHU, alvaro_nodar001@ehu.eus
22. Second-Harmonic Generation from a Quantum Emitter Coupled to a Metallic Nanoantenna, Antton Babaze, Materials Physics Center CSIC-UPV/EHU, anttonbabaze@dipc.org
23. Semiconducting molybdenum disulphide nano-sheet interaction with a photosynthetic bacteria, Sanhita Ray, University of Calcutta, daladysphinx@gmail.com
24. Reconfigurable Hybrid Quantum Circuits, Ali Elshaari, Royal Institute of Technology, elshaari@kth.se
25. Ultrafast coherent manipulation of the orbital angular momentum of a free-electron wave function via chiral plasmonic near fields, Giovanni Maria Vanacore, Ecole Polytechnique Federale de Lausanne, giovanni.vanacore@epfl.ch
26. Indistinguishability and collection efficiency of transition metal dichalcogenides single photon emitters embedded in silicon nitride photonic integrated circuits, Joaquin Guimbao, Instituto de Micro y Nanotecnologia, Madrid, Spain, j.guimbao@csic.es
27. Strong coupling beyond the light-line, Kishan Menghrajani, University of Exeter, km508@exeter.ac.uk
28. Acoustic diamond resonators with ultra-small mode volumes, Mikolaj Schmidt, Macquarie University, mikolaj.schmidt@mq.edu.au
29. Quantum model of a graphene flake interacting with an adatom: Weisskopf-Wigner emission , Miriam Kosik, Nicolaus Copernicus University, mkosik@doktorant.umk.pl
30. Accessing hidden spin of linear dipoles, Sergey Nechayev, University of Ottawa, snechaye@uottawa.ca

Optical Materials

31. Liquid-Phase Exfoliated Graphene Nonlinear Optical Properties , Aidan, Baker-Murray, University of Ottawa, amurray8@tcd.ie
32. Real time observation of magnetic field induced fluorescence engineering in SPIONs, Ashish Tiwari, Indian Institute of Technology Mandi, India, ashish_tiwari@students.iitmandi.ac.in
33. DWSG: Directional Waveguide Scatterer Gratings for Large-Angle, Broadband & Multifunctional Operations, Ashutosh Patri, Polytechnique Montreal, ashutoshpatri@gmail.com
34. Laser Engineering of Colour Centres in Diamond for Quantum Technologies, Ben Griffiths, University of Oxford, benjamin.griffiths@materials.ox.ac.uk
35. Femtosecond laser ablation in liquids nanoparticle production increase by simultaneous spatial and temporal focusing nonlinear effects reduction, Carlos Donate, University Jaume I, cdonate@uji.es
36. Perfect absorption via block copolymer designed metasurfaces, Cian Cummins, University of Bordeaux, cian.a.cummins@gmail.com
37. Silicon oxynitride microresonators for Kerr frequency combs, Dongyu Chen, University of Southern California, dongyuch@usc.edu

38. Second-harmonic diffraction and vortex beam from patterned MoS2 monolayer flakes, Franz Loechner, Institute of Applied Physics, Friedrich Schiller University Jena, Germany, franz.loechner@uni-jena.de
39. Asymmetric atomic medium as a low-frequency radiation generator., Piotr Gadysz, Institute of Physics, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Grudziadzka 5, 87-100 Torun, Poland, glad@doktorant.umk.pl
40. III-V semiconductor nanowires as building blocks for tunable metamaterials , Gregoire Saerens, ETH Zurich, gsaerens@phys.ethz.ch
41. Toward frequency selective surfaces using doping of zinc oxide with a focused ion beam, Hongyan Mei, University of Wisconsin-Madison, hmei6@wisc.edu
42. Broadband electro-optic modulators enabled via BaTiO3 meta-coatings, Artemios Karvounis, ETH Zurich, karvounis@phys.ethz.ch
43. Dynamic Organic Plasmonics from Conductive Polymer Nanoantennas, Magnus Jonsson, Linkping University, magnus.jonsson@liu.se
44. Nonlinear Effects and Dynamical Tuning of Plasmons and Excitons in Graphene Nanoantennas, Marvin, MÃ¼ller, Karlsruhe Institute of Technology (KIT), marvin.mueller@kit.edu
45. Exciting Pseudospin-Dependent Edge States in Plasmonic Metasurfaces, Matthew Proctor, Imperial College London, matthew.proctor12@imperial.ac.uk
46. Tri- & Tetra-Hyperbolic Iso-frequency Topologies Complete Classification of Bi-Anisotropic Materials, Maxim Durach, Georgia Southern University, mdurach@georgiasouthern.edu
47. Optimal Wave Fields for Micro-Manipulation in Complex Scattering Environments, Michael Horodynski, Vienna University of Technology (TU Wien), michael.horodynski@tuwien.ac.at
48. Effects of spatial confinement on the optical properties of phase-change materials, Ann-Katrin Michel, ETH Zurich, micheann@ethz.ch
49. Optimization and control of the nonlinear optical processes in AlGaAs dielectric nanoantennas, Michele Celebrano, Politecnico di Milano, michele.celebrano@polimi.it
50. Multiresonant High-Q Plasmonic Nonlinear Metasurfaces, Mikko Huttunen, Tampere University, mikko.huttunen@tuni.fi
51. Optical and Scintillation Properties of Pure and Doped Î²-Ga2O3 Crystals, Micha Makowski, Institute of Physics, Faculty of Physics, Astronomy and Informatics, Nicolaus Copernicus University, Poland, mimak@fizyka.umk.pl
52. Perturbation effect of ultrashort laser pulse in wake field generation in plasma based accelerators, Mohaddeseh Sadat Mousavi, SRBIAU, Tehran, Iran, mohaddeseh.s.mousavi@gmail.com
53. Hybrid Self Assembled Carbon Flakes, Muhammad Abdullah Tariq Butt, Max Planck Institute for the Science of Light, muhammad-abdullah.butt@mpl.mpg.de
54. Nano-patterning of atomically thin CVD grown MoS2 monolayers, Rajeshkumar Mupparapu, Institute of Applied Physics, Abbe Center of Photonics, Friedrich Schiller University Jena, Jena, Germany, rajeshkumar.mupparapu@uni-jena.de

55. General strategy for doping rare earth metals into Au-ZnO core-shell nano-spheres, Rene Zeto, USC, rwzeto@gmail.com
56. Enhanced optical nonlinearity of epsilon-near-zero materials realized using optical metamaterials, Sisira Suresh, University of Ottawa, s.sisiraa@gmail.com
57. Freeing the nitrogen vacancy with an efficient optical interface, Shazeaa Ishmael, Department of Materials, Univeristy of Oxford, shazeaa.ishmael@lincoln.ox.ac.uk
58. Conditions for enhancing chiral nanophotonics near achiral nanoparticles, T. V. Raziman, Eindhoven University of Technology, t.v.raziman@tue.nl
59. Strong light-matter coupling in van der Waals materials, Vinod Menon, City College & Grad Center - CUNY, vmenon@ccny.cuny.edu

7. Hubs

A POM-hub is a place where students and researchers interested in optics can gather to watch POM as a group, creating local communities. The #POM20 hubs are indicated on the map below.

Complete list of hubs:

Africa

Afrophotonics labs
University of Limpopo, Mankweng, South Africa

Asia

SING Lab
Zhejiang University, Zhejiang, China

IIT Bombay
Mumbai, India

IISER Pune Optics League
Indian Institute of Science Education and Research (IISER), Pune, India

IISER Kolkata SPIE student chapter
Indian Institute of Science Education and Research, Kolkata, India

IISc OSA Student Chapter
Dept of ECE, Indian Institute of Science, Bangalore, India

Advanced Materials Processing Lab (AMPL)
Punjab Engineering College, Chandigarh, India

CSU Jade
    Caraga State University, Butuan City, Philippines

Bilkent University UNAM
    Bilkent University, UNAM, Ankara, Turkey

Australia and Oceania

POM Sydney hub
    University of Technology Sydney, Sydney, Australia

RMIT Photonics Society
    RMIT University, Melbourne, Australia

Auckland Laser Lab
    The University of Auckland, Auckland, New Zealand

Physics @ University of Otago
    University of Otago, Dunedin, Otago New Zealand

Europe

Horodynski lab, Vienna University of Technology (TU Wien)
    Vienna, Austria

Ghent University SPIE, OSA, IEEE and SID Chapters
    Ghent University Ghent, Belgium

Joint between VTT – Technical Research of Finland and Aalto University
    Helsinki, Finland

Tampere University Photonics Club
    Tampere University Tampere, Finland

Laboratoire Kastler Brossel
    Laboratoire Kastler Brossel (Jussieu campus), Paris, France

Laboratoire Kastler Brossel
    Laboratoire Kastler Brossel (Lhomond campus), Paris, France

Abbe Center of Photonics, Abbe School of Photonics of the Friedrich Schiller University Jena, and SPIE and OSA student chapters
    Jena, Germany

Max Planck School of Photonics
    Max Planck School of Photonics, Jena, Germany

MPL OSA Student Chapter
    Max Planck Institute for the Science of Light, Erlangen, Germany

Uni-WUE Nano-Optics & Biophotonics
    University of Wurzburg, Wurzburg, Germany

Politecnico di Milano OSA Chapter & EPS Young Minds Milano
    Polytechnic University of Milan Milan, Italy

OSA Student Chapter in Pisa
    University of Pisa, Pisa, Italy

Advanced Photonics Lab at CNR Nanotec Lecce
    University Campus Ecotekene, Lecce, Italy

Universite du Luxembourg
    Luxembourg

Center for Nanophotonics, AMOLF
    Amsterdam, Netherlands

University of Warsaw OSA-SPIE-EPS-IEEE Student Chapter
    University of Warsaw, Warsaw, Poland

SPIE Student Chapter at Warsaw University of Technology
    Warsaw University of Technology, Warsaw, Poland

Nicolaus Copernicus University
    Torun, Poland

INL Braga
    International Iberian Nanotechnology Lab, Braga, Portugal

Condensed-Matter Physics Center (IFIMAC)
    Autonomous University of Madrid Madrid, Spain

Linkoping University
    Linkoping, Sweden

QNP @ KTH
KTH – Royal Institute of Technology, Stockholm, Sweden

ETH Zurich Optics Student Chapter Team
ETH Zurich Zürich, Switzerland

Centre for Photonics and Metamaterials
Imperial College London London, UK

Photon Science Institute
Manchester, UK

OSA/SPIE chapters of University of Exeter
EUOPS at University of Exeter, Exeter, UK

University of Cambridge
Cambridge, UK

University of St. Andrews, School of Physics and Astronomy
St. Andrews, UK

Optical Sciences
University of Glasgow, Glasgow, UK

Photonics Network in Oxford
University of Oxford, Oxford, UK

Bath OSA Student Chapter
University of Bath, Bath, UK

Nature Quantum and Optical Technologies community
Nature, London, UK

North America

University of Ottawa OSA Student Chapter
University of Ottawa, Ottawa, Ontario

McGill POM hub
McGill University, Montreal, Quebec

Simon Fraser University/Gates Group
Simon Fraser University, Burnaby, British Columbia

USC Optics Society
University of Southern California, Los Angeles, California

Optics Club of UC Davis
UC Davis, Davis, California

Photonics Society@ UCSB
UCSB, Santa Barbara, California

Stanford Optical Society
Stanford University, Stanford, California

Advanced Science Research Center (ASRC) of CUNY,
City University of New York (CUNY) New York, New York

UT Austin
Austin, Texas

SPIE
Bellingham, Washington

The Optical Society (OSA)
Washington DC

CREOL
University of Central Florida, Orlando, Florida

Florida Tech OSA/SPIE Student Chapter
Florida Institute of Technology, Melbourne, Florida

MIT Photonic Materials
MIT, Cambridge, Massachusetts

UW-Madison SPIE/OSA Student Chapter
University of Wisconsin-Madison, Madison, Wisconsin

OSA Student Chapter at the University of Michigan (OSUM)
University of Michigan, Ann Arbor, Michigan

CICESE student chapter
Ensenada Center for Scientific Research and Higher Education, Ensenada, Mexico

SPIE Student Chapter at Tecnologico de Monterrey
Tecnologico de Monterrey, Monterrey, Mexico

South America

Buenos Aires JOFA
National Scientific and Technical Research Council (CONICET), Buenos Aires, Argentina

OSA Student Chapter Recife
Universidad Federal de Pernambuco, Recife, Brazil

USACH Herrera Lab
Universidad de Santiago de Chile, Santiago, Chile

8. Media Coverage

[1] Photonics Media, Photonics Leaders Join together for global, online academic conference, Dec 2019.

[2] Ellie Bothwell, Universities urged to radically cut flights to help climate, Times Higher Education, Nov 2019.

[3] uOttawa Teaming up with Photonics Leaders to Launch Global, Online Academic Conference *(uOttawa press release — version française)*

[4] Virtual conferences get real *(Nature Reviews Materials 5, 167 (2020))*

[5] Photonics from afar *(Nature Photonics 14, 137 (2020))*

[6] Rethinking conferences *(Times Higher Education)*

[7] Rethinking conferences *(Nature Reviews Physics 2, 67 (2020))*

[8] One of the world’s first global, online academic conferences to be held January 13, 2020 *(Eurekalert)*

[9] A Different Kind of Conference *(Optics & Photonics News)*

[10] SPIE Cancels DCS In-Person Conference, COVID-19 Leads to Surge in Online Conferences *(Photonics.com)*

[11] 3 Questions with Andrea Armani *(Photonics.com)*

[12] History-Making Online Photonics Conference Draws Participants From Around The World *(USC press release)*

[13] An international conference – without flight emissions *(ETH Zurich press release)*

[14] Physicists to hold free global online-only conference *(Imperial College London press release)*

[15] Photonics leaders team up to launch global, online academic conference *(University of Wisconsin-Madison press release)*

[16] Le photonique online meetup: Une expérience réussie de conférence virtuelle en photonique *(photoniques.com)*

9. Additional resources

Our inspiration comes from several places. Below is a small sampling of the many discussions currently occurring around trying to develop alternative approaches to scientific meetings.

- Olivier Hamant, Timothy Saunders and Virgile Viasnoff, Seven steps to make travel to scientific conferences more sustainable, Nature Career Column, 2019.
- Jon Cartwright, Work travel doubles researchers’ carbon footprint, Physics World, 2019.
- Editorial, Scientists should explore alternatives to flying, Nature Nanotechnology, 2019.

- Joachim Ciers, Aleksandra Mandic, Laszlo Daniel Toth, and Giel Op ’t Veld, Carbon Footprint of Academic Air Travel: A Case Study in Switzerland, Sustainability, 11 (1) 2019.
- Caroline Levine et al, Reducing the Carbon Footprint of Academic Travel, Inside Higher Ed, 2019.
- Anna McKie, Scholars want sabbaticals and placements to fight climate change, Times Higher Education, Oct 2019.
- Richard Davies, How can internationalisation be compatible with carbon neutrality?, Times Higher Education, Oct 2019.
- Peter Kalmus, Fly less to convey urgency, Science, 365 (6460) 2019.