

OSA Latin America Optics & Photonics Conference

12–15 November 2018

Pontificia Universidad Católica del Perú, Lima, Peru

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Multidisciplinary Applications of Photonics

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General Information

Conference Venue: Pontificia Universidad Católica del Perú, Lima, Peru

Address: Av. Universitaria 1801, Lima, Lima Province Lima 32



Accessibility

The closest airport to Pontificia Universidad Católica del Perú, Lima, Peru is Jorge Chávez International Airport (LIM / SPIM). It is located in the Constitutional Province of Callao, next to the port and 10 km from Lima. To get to the university, passengers may rent a car, hire a licensed taxi, or take a city bus. The Lima public transportation system includes the city buses (combi/colectivos and micros) and taxis.

Transportation

Combi or Colectivo

In Lima, there are two types of buses: the "combi" or "colectivo" (collective minivans) and the "micro" (short for "microbus" and larger than the combis). Both the combis and micros are fast and inexpensive ways to travel around the city.

When finding transportation to the Pontificia Universidad Católica del Perú (PUCP), look for the micro or combi that says Universitaria, which is the name of the street on which the main entrance to the PUCP campus is situated. Another option is to take combis or micros that go to Plaza San Miguel, a large mall next to the PUCP campus.

Users of most buslines usually wait no longer than fifteen minutes. Most trips, including those to distant areas, take less than 40 minutes. Buses are available 24 hours a day but their frequency decreases after 24:00. There are more than 180 lines in the city of Lima and several routes provide connection to the greater metropolitan area. The normal fare is 1.20 soles (\$0.40 USD), but you might be charged less if the distance is not very far. You will always need exact change to pay a micro, combi or colectivo. There are NO automatic ticket machines that issue tickets, but each combi is equipped with staff that, in addition to yelling out the various stops along the route, will also be responsible for collecting your fare.

Taxis

Street taxis in Peru do not use a meter. You will need to negotiate your price before getting into the vehicle. Depending on the distance, a street taxi costs between 5 and 10 soles. You are not required to tip taxi drivers, nor do they expect a tip. It is recommended that you use a radio taxi (a taxi that you call for in advance) rather than flagging down a taxi on the street. Radio taxis are generally safer than street taxis, especially at

night. Radio taxis have a set price that is non-negotiable, and although they are more expensive than street taxis, they are more dependable. Ensure that you have the exact change necessary to pay the driver and that you are ready to pay upon arrival.

Registration

Hours:

| | |
|-------------|------------------------|
| 08:00–17:00 | Monday, 12 November |
| 07:30–17:30 | Tuesday, 13 November |
| 07:30–17:30 | Wednesday, 14 November |
| 07:30–17:30 | Thursday, 15 November |

Speaker Preparation

All oral presenters should check in at the corresponding session room at least thirty minutes prior to their scheduled talk to upload and check their presentation. **No shows of the oral presentation will be reported to Conference management and these papers will not be published.**

Poster Preparation

There are two Poster Sessions scheduled during LAOP 2018. Poster presenters should make note of which session they have been scheduled to present. Authors should prepare their poster before their designated poster session starts. The poster must not exceed the boundaries of the display board and A0 size is recommended. Authors are required to be standing by their poster for the duration of their allocated session to answer questions and further discuss their work with attendees. **No shows will be reported to Conference management and these papers will not be published.**

Poster Session Presentation Times

| | |
|-------------|-----------------------|
| 16:30–18:00 | Tuesday, 13 November |
| 16:30–18:00 | Thursday, 15 November |

Exhibition

The LAOP Exhibition is open to all attendees.

Location: To be Announced

Hours:

| | |
|-------------|------------------------|
| 11:00–18:00 | Tuesday, 13 November |
| 11:00–17:00 | Wednesday, 14 November |
| 11:00–18:00 | Thursday, 15 November |

Coffee Breaks

| | |
|-------------|------------------------|
| 11:00–11:30 | Tuesday, 13 November |
| 16:30–18:00 | Tuesday, 13 November |
| 11:00–11:30 | Wednesday, 14 November |
| 16:30–17:00 | Wednesday, 14 November |
| 11:00–11:30 | Thursday, 15 November |
| 16:30–18:00 | Thursday, 15 November |

About OSA Publishing's Digital Library

Registrants and current subscribers can access all of the congress papers, posters and postdeadline papers on OSA Publishing's Digital Library. The OSA Publishing's Digital Library is a cutting-edge repository that contains OSA Publishing's content, including 16 flagship, partnered and co-published peer-reviewed journals and 1 magazine. With more than 240,000 articles including papers from over 450 conferences, OSA Publishing's Digital Library is the largest peer-reviewed collection of optics and photonics.

Early Online Access to the Technical Digest and Postdeadline Papers

Full Technical Attendees have both early and free continuous access to the digest papers through OSA Publishing's Digital Library. To access the papers go to osa.org/LAOP and select the "Access digest papers" essential link on the right hand navigation. As access is limited to Full Technical Congress Attendees only, you will be asked to validate your credentials by entering the same login email address and password provided during the Congress registration process.

If you need assistance with your login information, please use the "forgot password" utility or "Contact Help" link.

Update Sheet and Postdeadline Papers

All technical program changes will be communicated in the onsite Congress Program Update Sheet. All attendees receive this information with registration materials, and we encourage you to review it carefully to stay informed to changes in the program. Postdeadline papers will also be announced on the update sheet. This program contains the latest information up to 12 October.

Conference Highlights

Plenary Presentations

Auditorio de Derecho

LAOP 2018 will feature nine plenary presentations over the course of three days. Plenary session dates and times are listed below. Plenary presenter talk titles and biographies as well as exact presentation times are listed on the next page.

Plenary Sessions

| | |
|-------------|------------------------|
| 08:20–11:00 | Tuesday, 13 November |
| 08:30–11:00 | Wednesday, 14 November |
| 08:30–11:00 | Thursday, 15 November |

OSA Student and Early Career Professionals Lunch

Tuesday, 13 November
13:00–14:30
Room N-101

Presented by Arti Agrawal, University of Technology Sydney, Australia, Amol Choudhary, University of Sydney, Australia, and Michelle Sander, Boston University, USA

Join us for an interactive lunch and learn program focused on professional development and engagement to promote excellence in optics and photonics research. This program will engage students and early career professionals with the key leaders in the field who will share their professional development journey and provide useful tips to those who attend. Lunch will be provided.

Programs are open to OSA Members. There is limited space and we ask that you RSVP to Curtis Burrill at cburrill@osa.org to attend.

OSA Senior Member Workshop: Enhancing Diversity in Optics Leadership, Enhancing Careers

Wednesday, 14 November
14:30–15:30

Location to be Announced

Facilitated by Arti Agrawal, University of Technology Sydney, Australia

This workshop aims to encourage participants, especially women and people from underrepresented groups to apply for the senior member designation. The OSA senior membership designation recognizes experience and professional accomplishments within the field. It is useful for career progression and recognition by peers. Individuals can self apply or be nominated. Proportion of senior members who are female, and/or from regions (Asia, South America, Africa) and/or ethnic minority is low.

Participants will:

- Learn about application/nomination process
- Assessment of applications
- Have the option to informally discuss their application/nomination
- Learn more about the benefits of being a senior member

Conference Banquet

Wednesday, 14 November
20:30 – 22:30

Location to be Announced

The LAOP Conference Banquet will be held on Wednesday, 14 November from 20:30–22:30. The Banquet is included in the registration fee for all registrants. The ticket is provided within the badge. Additional tickets for the banquet can be purchased at the registration desk.

Optional Tours

Several optional tours have been arranged for LAOP participants through ACTours, a local agency in Peru. Tours must be scheduled in advance and reservations should have been received by 11 October. Costs vary and are separate from LAOP registration fees. If you have registered for a tour and need more information, you may email Rocío Reátegui at reategui@actours.com.pe. Tour descriptions are located on www.osa.org/laop.

Plenary Speakers



Polarization and Complementarity – What's the Connection?

Tuesday, 13 November
08:30–09:20

Joseph Eberly
Univ. of Rochester, USA

Biography: Joseph H. Eberly earned his PhD in Physics at Stanford University in 1962, and in 1979 joined the Institute of Optics faculty. A member of the UR physics faculty since 1967, he is the Andrew Carnegie Professor of Physics and Professor of Optics. A fellow of OSA and APS, Professor Eberly is the recipient of the Townes Award and the Smoluchowski Medal, has been selected for a Senior Humboldt Award and elected a Foreign Member of the Academy of Sciences of Poland. In 1995, with funding from the National Science Foundation, he founded the Rochester Theory Center (RTC), a research group focused on optical and quantum optical science with faculty from several UR departments. He served as president of The Optical Society in 2007 and was an instrumental co-chair of OSA's Centennial Advisory Committee which was charged with planning OSA's 100th Anniversary in 2016.



Photonic Point-of-Care Nanobiosensor Platforms for Universal Health Diagnostics

Tuesday, 13 November
09:20–10:10

Laura Lechuga
Catalan Institute of Nanoscience and Nanotechnology, Spain

Biography: Prof. Laura M. Lechuga is Full Professor of the Spanish National Research Council (CSIC) and Head of the Nanobiosensors and Bioanalytical Applications Group at the Catalan Institute of Nanoscience and Nanotechnology (ICN2) in Barcelona, Spain. The principal focus of her research is the technological development of nanophotonic biosensors, their integration in lab-on-a-chip platforms and their application for real diagnostics. She has published more than 250 papers, has 8 families of patents and has delivered more than 300 invited talks at national and international conferences. She has co-founded two spin-off companies and has received several awards and distinctions.



Current and Future NASA Space Telescopes

Tuesday, 13 November
10:10–11:00

Joseph Howard
NASA Goddard Space Flight Center, USA

Biography: Joe Howard originally joined OSA as a student member in 1997, while he was pursuing graduate work in optical design at the Institute of Optics, University of Rochester, NY. After earning his Ph.D. in 1999, he started to work for NASA as a post-doc, and was hired full time in 2001. His primary job at NASA has been supporting the design and development of the James Webb Space Telescope, the successor to the Hubble Space Telescope. He also manages the Optical Design Lab at Goddard Space Flight Center, so he supports many proposal and design efforts for future NASA missions. Joe lives with his wife and two children in Washington, DC.



Deep Learning Optics

Wednesday, 14 November
08:30–09:20

Aydogan Ozcan
Univ. of California Los Angeles, USA

Biography: Dr. Ozcan is the Chancellor's Professor at UCLA and an HHMI Professor with the Howard Hughes Medical Institute, leading the Bio- and Nano-Photonics Laboratory at UCLA and is also the Associate Director of the California NanoSystems Institute. Dr. Ozcan holds 38 issued patents and >20 pending patent applications and is also the author of one book and the co-author of >500 peer-reviewed publications in major scientific journals and conferences. Dr. Ozcan is the founder and a member of the Board of Directors of Lucendi Inc. and Holomic/Cellmic LLC, which was named a Technology Pioneer by The World Economic Forum in 2015. Dr. Ozcan is a Fellow of the International Photonics Society (SPIE), The Optical Society (OSA), the American Institute for Medical and Biological Engineering (AIMBE), the Institute of Electrical and Electronics Engineers (IEEE), the Royal Society of Chemistry (RSC), and the Guggenheim Foundation, and has received major awards including the Presidential Early Career Award for Scientists and Engineers, International Commission for Optics Prize, Biophotonics Technology Innovator Award, Rahmi M. Koc Science Medal, International Photonics Society Early Career Achievement Award, Army Young Investigator Award, NSF CAREER Award, NIH Director's New Innovator Award, Navy Young Investigator Award, IEEE Photonics Society Young Investigator Award and Distinguished Lecturer Award, National Geographic Emerging Explorer Award, National Academy of Engineering The Grainger Foundation Frontiers of Engineering Award and MIT's TR35 Award for his seminal contributions to computational imaging, sensing and diagnostics.



Next Generation Photonics Based on 2D Materials

Wednesday, 14 November
09:20–10:10

Michal Lipson
Columbia University, USA

Biography: Professor Michal Lipson joined the Electrical Engineering faculty at Columbia University in July 2015. She completed her B.S., M.S., and Ph.D. degrees in Physics at the Technion in 1998 followed by a Postdoctoral position at MIT in the Materials Science Department till 2001. In 2001 she joined the School of Electrical and Computer Engineering at Cornell University. She was named Cornell Given Foundation Professor of Engineering in 2013. Lipson was one of the main pioneers in the field of silicon photonics and is the inventor of several of the critical building blocks in the field including the GHz silicon modulator. She holds over 20 patents and is the author of over 200 technical papers. Professor Lipson's honors and awards include the MacArthur Fellow, Blavatnik Award, IBM Faculty Award, R. W. Wood Prize, and the NSF Early Career Award. She is a fellow of OSA and IEEE. Since 2014, she has been named top 1% most cited by Thomson Reuter Award.



Advances in Semiconductor Core Fibers

Wednesday, 14 November
11:30–12:15

Ursula Gibson
Norges Teknisk Naturvitenskapelige Univ., Norway

Biography: Ursula Gibson received a Ph.D. in physics from Cornell University in 1982. During her doctoral work she held a Bell Laboratories Graduate Research Program for Women grant, and spent two summers working at Bell Labs. After Cornell, she joined the faculty of the University of Arizona Optical Sciences Center, and was promoted to associate professor before moving to the Thayer School of Engineering at Dartmouth College in 1990. She currently holds a professorship in the Physics department at the Norwegian University of Science and Technology (NTNU), where she has been since 2010. She is also an adjunct professor in the Department of Applied Physics at the KTH Royal Institute of Technology and the Chemistry Department of Dartmouth College.

Her research on optical materials has been wide ranging, including polymers, protein crystals and semiconductors, with an emphasis on limited dimension structures such as thin films and waveguides. She holds three patents and has authored 7 book contributions and over 100 refereed journal articles with 2300 citations. Prof. Gibson's present research is focused on semiconductor-core optical fibers and MBE-grown films for mid-infrared applications.



Advances in Optics Research at Corning

Thursday, 15 November
08:30–09:20

Aleksandra Boskovic
Corning Research & Development Corporation, USA

Biography: Dr. Aleksandra Boskovic is the Research Director for Optics, Surfaces and Integration Technologies at Corning Research & Development Corporation. In her role, Dr. Boskovic is responsible for oversight of research programs aimed at several business groups within Corning, such as the Telecommunications Business Group, Specialty Materials, Display Technologies and the Emerging Innovations Group. During her early career, she made several contributions to the Optical Communications Systems effort in Corning both as an individual contributor and as a team leader. Dr. Boskovic holds a Ph.D. in physics from Imperial College, UK.



Title to be Announced

Thursday, 15 November
09:20–10:10

Alexander Gaeta
Columbia Univ., USA

Biography: Alex Gaeta received his Ph.D. in 1991 in Optics from the University of Rochester. From 1992 to 2015 he was on the faculty at the School of Applied and Engineering Physics at Cornell University. In July of 2015, he joined the faculty at the Department of Applied Physics and Applied Mathematics at Columbia University where he is the David M. Rickey Professor of Applied Physics. He has published more than 200 papers in areas of integrated nonlinear optics, all-optical signal processing, nanophotonics, ultrafast nonlinear optics, and quantum effects in nonlinear optics. He co-founded PicoLuz, Inc. and is the founding Editor-in-Chief of Optica. He is a Fellow of The Optical Society and of the American Physical Society.



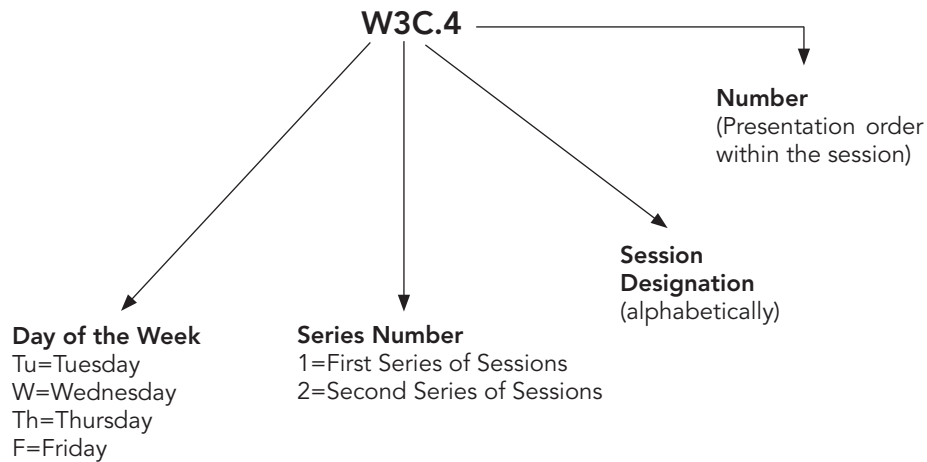
Optical Metrology: Measuring from Micrometers to Nanometers

Thursday, 15 November
10:10–11:00

Fernando Mendoza-Santoyo
*Centro de Investigaciones en Optica,
Mexico*

Biography: Fernando Mendoza Santoyo graduated as a Physicist in Mexico and obtained his MSc and PhD degrees in England, where he started his career as a researcher and lecturer. In 1983 he joined Centro de Investigaciones en Optica, A.C., (CIO), León, México, and became its General Director for ten years (2002-2012). He now holds a full time Professorship and leads the Optical Metrology Division. He was a Visiting Professor at the University of Texas in San Antonio and ITO-Stuttgart University, conducting research in Electron Holography and Optical Non Destructive techniques applied to novel nano materials and a wide variety of bio materials. He has organized and Chaired several international Conferences, was an ICO Vice President and President of the Mexican Academy for Optics, and created the very first OTT in Optics and Photonics in Mexico. He has received several international awards and is currently in the Board of Editors Optics and Lasers in Engineering (Elsevier), and a Topical Editor for Applied Optics. He is an SPIE Fellow and a member of its Board of Directors.

Explanation of Session Codes



The first letter of the code designates the day of the week (Tu= Tuesday, W = Wednesday, Th =Thursday, F= Friday). The second element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). The third element continues alphabetically through a series of parallel sessions. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded W3C.4 indicates that this paper is being presented on Wednesday (W) in the third series of sessions (3), and is the third parallel session (C) in that series and the fourth paper (4) presented in that session.

Invited papers are noted with **Invited**

Plenary papers are noted with **Plenary**

Agenda of Sessions — Monday, 12 November

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|-------------|--|
| 14:00–18:00 | Pre-Conference Short Courses (<i>local universities</i>) |
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Agenda of Sessions — Tuesday, 13 November

| | Room 1 | Room 2 | Room 3 | Room 4 | Room 5 |
|-------------|---|--|---|--|---|
| 08:20–11:00 | Tu1A • Plenary Session I, Auditorio de Derecho | | | | |
| 11:00–11:30 | Coffee Break | | | | |
| 11:30–13:00 | Tu2A • Multidisciplinary Applications of Photonics I | Tu2B • THz, Microwave and Millimeter-Waves Photonics (ends at 12:45) | Tu2C • Nanobiophotonics | Tu2D • Matter-field Interactions | Tu2E • High-Capacity Optical Transmission |
| 13:00–14:30 | Lunch On Your Own | | | | |
| 14:30–16:30 | Tu3A • Non-conventional Imaging | Tu3B • Laser Science and Technology I | Tu3C • Cancer Diagnosis and Treatment | Tu3D • Vector Beams and Structured Light | Tu3E • Atom and Light Interactions and Laser Spectroscopy |
| 16:30–18:00 | Tu4A • Poster Session 1 and Coffee Break | | | | |
| 18:00–19:30 | Tu5A • Multidisciplinary Applications of Photonics II | Tu5B • Sensing Technologies I | Tu5C • Biophotonics and Biomedical Applications | Tu5D • Quantum and Classical Light | Tu5E • Optical Modulation and Coding (ends at 19:15) |

Agenda of Sessions — Wednesday, 14 November

| | Room 1 | Room 2 | Room 3 | Room 4 | Room 5 |
|-------------|--|---|---|--|--|
| 08:30–11:00 | W1A • Plenary Session II, Auditorio de Derecho | | | | |
| 11:00–11:30 | Coffee Break | | | | |
| 11:30–13:00 | W2A • Complex Photonics | W2B • Physical Optics (ends at 12:45) | W2C • Imaging Processing and Vision I | W2D • Laser Science and Technology II | W2E • Spatiotemporal Nonlinear Optics Dynamics |
| 13:00–14:30 | Lunch On Your Own | | | | |
| 14:30–16:30 | W3A • Harnessing Quantum Features | W3B • Sensing Technologies II | OSA Senior Member Workshop: Enhancing Diversity in Optics Leadership, Enhancing Careers (ends at 15:30) | W3D • Optical Access | W3E • Optomechanics and Integrated Nonlinear Optics |
| | | | W3C • Case Study of an Optoelectronics Medical Equipment Manufacture in Brazil (ends at 16:00) | | |
| 16:30–17:00 | Coffee Break | | | | |
| 17:00–18:30 | W4A • Quantum Systems Interacting with Environments | W4B • Holography | W4C • Imaging Processing and Vision II | W4D • Novel Platforms | W4E • Novel Materials and Nonlinear Optics (ends at 18:00) |

Agenda of Sessions — Thursday, 15 November

| | Room 1 | Room 2 | Room 3 | Room 4 | Room 5 |
|-------------|---|--|--|---|---|
| 08:30–11:00 | Th1A • Plenary Session III, Auditorio de Derecho | | | | |
| 11:00–11:30 | Coffee Break | | | | |
| 11:30–13:00 | Th2A • Light Control | Th2B • Systems Design (ends at 12:15) | Th2C • Nanophotonics and Metamaterials I | Th2D • Multidisciplinary Applications of Photonics III | Th2E Frequency Conversion and Soliton Physics |
| 13:00–14:30 | Lunch On Your Own | | | | |
| 14:30–16:30 | Th3A • Silicon Photonics | Th3B • Optical Fibers | Th3C • Nanophotonics and Metamaterials II | Th3D • Postdeadline Paper Session I | Th3E • Optics and Photonics in Low-dimensional Materials and Novel Materials |
| 16:30–18:00 | Th4A • Poster Session II and Coffee Break | | | | |
| 18:00–19:30 | Th5A • Plasmonics | Th5B • 3D Optical Reconstruction (ends at 19:15) | Th5C • Color | Th5D • Postdeadline Paper Session II | Th5E • Magneto-optical Effects in Novel Materials |
| 19:30–20:00 | Closing Remarks | | | | |

Auditorio de Derecho

08:30–11:00

Tu1A • Plenary Session I

Presider: Hugo Enrique Hernández; Figueiroa Universidade Estadual de Campinas, Brazil

Tu1A.1 • 08:30 **Plenary**

Polarization and Complementarity - What's the Connection?, Joseph H. Eberly¹; ¹Univ. of Rochester, USA. Abstract not available.

Tu1A.2 • 09:20 **Plenary**

Photonic Point-of-care Nanobiosensor Platforms for Universal Health Diagnostics, Laura M. Lechuga¹; ¹Catalan Inst of Nanoscience and Nanotech, Spain. We present the point-of-care integration of extremely sensitive nanophotonic biosensors for the direct, label-free and multiplexed detection of biomarkers or pollutants directly in human or environmental samples. Advantages as miniaturization, relevant sensitivities, robustness, reliability, and mass production can be offered by our ultimate technology.

Tu1A.3 • 10:10 **Plenary**

Current and Future NASA Space Telescopes, Joseph M. Howard¹; ¹NASA Goddard Space Flight Center, USA. NASA's current space telescopes are summarized, along with the status of the James Webb Space Telescope (JWST). Future telescopes, including the Wide Field Infra-Red Survey Telescope (WFIRST) and concepts for the 2020 Decadal Survey in Astrophysics, are also discussed.

11:00–11:30 Coffee Break

Room 1

11:30–13:00

Tu2A • Multidisciplinary Applications of Photonics I

Presider: Agnese Callegari; Bilkent Univ., Turkey

Tu2A.1 • 11:30 **Invited**

Fundamental Detection Limit of Integrated Photonic Sensors, Nicolas Le Thomas¹; ¹Ghent Univ., INTEC, Belgium. The quest for improving the sensitivity of optical sensors goes hand in hand with confining light in smaller volumes to increase light-matter interaction. I will show that this quest has reached a fundamental detection limit.

Tu2A.2 • 12:00 **Invited**

Observation of the Symmetry Breaking of the Fermi Pasta Ulam Recurrence in Nonlinear Optical Fibers, Corentin Naveau¹, Florent Bessin¹, Alexandre Kudlinski¹, Matteo Conforti¹, Pascal Szriftgiser¹, Stefano Trillo², Arnaud Mussot¹; ¹Univ Lille 1 Laboratoire PhLAM, France; ²Univ. di Ferrara, Italy. We provide the first longitudinal characterization in phase and amplitude of the Fermi Pasta Ulam recurrence in optical fibers by means of a heterodyne optical time domain reflectometer. This original setup allows to report the symmetry breaking of the process due to an initial condition change.

Tu2A.3 • 12:30

Luminescence of Sputtered Tb³⁺ Doped ITO Thin Films and its Impact on the Host's Optical and Electrical Properties, Paul D. Llontop¹, Carlos Torres¹, Jan Amaru P. Tofflinger¹, rolf Grieseler¹, Jorge A. Guerra Torres¹; ¹PUCP, Peru. The effect of terbium doping on the light emission, optical and electrical properties of sputtered ITO films was investigated for different annealing temperatures. Films maintained a high optical transmittance and a medium resistivity.

Tu2A.4 • 12:45

Flame Emission Characterization from Combustion of Different Biomass Species, Fernando A. Castillo¹, Luis Arias¹, Jose Cifuentes¹, Milton Marín¹, Carlos Toro¹, Hugo Garces²; ¹Universidad de Concepción, Chile; ²Universidad Católica de la Santísima Concepción, Chile. Visible spectral emissions emitted by different biomass species in a combustion process were measured and analyzed. By applying spectral techniques, it is possible to characterize and to monitor the combustion process, identifying different species.

Room 2

11:30–12:45

Tu2B • THz, Microwave and Millimeter-Waves Photonics

Presider: Stavros Iezekiel; Univ. of Cyprus, Cyprus

Tu2B.1 • 11:30 **Invited**

Broadband Room-Temperature Terahertz Spectrometry through Plasmonic Photomixing, Mona Jarrah¹; ¹Univ. of California Los Angeles, USA. We introduce a broadband terahertz spectrometry scheme that uses plasmonic photomixing for frequency down-conversion from terahertz to radio frequencies and offers quantum-level sensitivities at room temperature for the first time.

Tu2B.2 • 12:00

Narrowband Microwave Chaos Generation using Optoelectronic Oscillators, Yanne K. Chembo¹; ¹GeorgiaTech-CNRS, USA. In this communication, we discuss an architecture of optoelectronic oscillator that permits to generate a narrowband chaotic signal for microwave engineering applications. A time-delayed model permits to understand the complex dynamics of this oscillator.

Tu2B.3 • 12:15

Centralized Optical True Time Delay Beamforming at 60GHz with Multicore Fiber Distribution, Alvaro Morales¹, Simon Rommel¹, Idelfonso Tafur Monroy¹; ¹Inst. for Photonic Integration, Eindhoven Univ. of Technology, Netherlands. We experimentally demonstrate a hybrid millimeter wave/photonic system with beamforming capabilities at 60GHz. The true time delay configuration is remotely set in the optical domain and it is maintained by using a 7-core fiber with sub-picosecond accuracy.

Tu2B.4 • 12:30

High-Speed Wireless Access in Forested Rural Areas Using Analog Radio-over-Fiber Technology, Dimitrios Konstantinou¹, Alvaro Morales¹, Imane Aghmani², Simon Rommel¹, Thiago R. Raddo¹, Ulf Johansson³, Idelfonso Tafur Monroy¹; ¹Inst. for Photonic Integration, Eindhoven Univ. of Technology, Netherlands; ²ENSIL Engineer School, Univ. of Limoges, France; ³Centre for Wireless Technology, Eindhoven Univ. of Technology, Netherlands. A low complexity Ka-band hybrid photonic-wireless link based on a commercial SFP+ module is demonstrated, offering an economical and efficient solution for access provisioning to rural areas. A rain forest environment is emulated and low BER is achieved.

Room 3

11:30–13:00

Tu2C • Nanobiophotonics

Presider: Anderson Dourado Sisnando, Brazil

Tu2C.1 • 11:30 **Invited**

Nanoparticles Based Plasmonic Biosensor, Isabel C. Carvalho¹, Larissa M. Soares², Natalia S. Costa², Regina H. Peralta³, Jose M. Peralta², Regina C. Allil², Marcelo M. Werneck², Greice K. Costa⁴; ¹Pontificia Univ Católica Rio de Janeiro, Brazil; ²UFRJ, Brazil; ³UFF Niteroi, Brazil; ⁴Department of Physics, UFRRJ, Brazil. We demonstrated an LSPR nanobiosensor in a colloidal solution of Au nanoparticles, for the binding between monoclonal antibody anti-*T. solium* and vesicular fluid from *T. solium* antigen. The sensor response had a limit detection of 0.06 µg/mL, for antigen concentrations between 0.1 to 2.0 µg/mL, with potential for Neurocysticercosis diagnosis.

Tu2C.2 • 12:00 **Invited**

Label-free SERS and LSPR Gold Nanoaptasensors of Mycotoxins in Solution: Solvent Assessment, Lesly K. Lagos¹, Lorena Veliz¹, Yulán Hernandez¹, Betty Galarreta¹; ¹Departamento de Ciencias - Sección Química, Pontificia Universidad Católica del Perú, Peru. Liquid-phase gold nanoaptasensors were developed for mycotoxin determination down to ppb level. We present selected results of accessible detection of OTA and AFB1 toxins and the solvent effect in the LSPR and SERS bioassay.

Tu2C.3 • 12:30 **Invited**

Mapping and Quantification of Gold Nanoparticles in Tissue Simulating Phantoms using Spatial Frequency Domain Imaging, Adamo Monte¹, Ana C. M. Mendes¹, Arnaldo F. Reis¹, Andrea Antunes¹; ¹Universidade Federal de Uberlândia, Brazil. Silicone-based phantoms were used to mimic the scattering and absorption properties of tissues and determine the accuracy of spatial frequency domain imaging to localize and quantify the nanoparticles with a 3D perspective.

13:00–14:30 Lunch On Your Own

08:30–11:00

Tu1A • Plenary Session I

Presider: Hugo Enrique Hernández; Figueroa Universidade Estadual de Campinas, Brazil

Tu1A.1 • 08:30 **Plenary**

Polarization and Complementarity - What's the Connection?, Joseph H. Eberly¹; ¹Univ. of Rochester, USA. Abstract not available.

Tu1A.2 • 09:20 **Plenary**

Photonic Point-of-care Nanobiosensor Platforms for Universal Health Diagnostics, Laura M. Lechuga¹; ¹Catalan Inst of Nanoscience and Nanotech, Spain. We present the point-of-care integration of extremely sensitive nanophotonic biosensors for the direct, label-free and multiplexed detection of biomarkers or pollutants directly in human or environmental samples. Advantages as miniaturization, relevant sensitivities, robustness, reliability, and mass production can be offered by our ultimate technology.

Tu1A.3 • 10:10 **Plenary**

Current and Future NASA Space Telescopes, Joseph M. Howard¹; ¹NASA Goddard Space Flight Center, USA. NASA's current space telescopes are summarized, along with the status of the James Webb Space Telescope (JWST). Future telescopes, including the Wide Field Infra-Red Survey Telescope (WFIRST) and concepts for the 2020 Decadal Survey in Astrophysics, are also discussed.

11:00–11:30 Coffee Break

Room 4

11:30–13:00

Tu2D • Matter-field Interactions

Presider: Luis Sanchez-Soto; Universidad Complutense, Spain

Tu2D.1 • 11:30 **Invited**

Two-Level System State Estimation with Discrete and Continuous Pointers, Karen M. Fonseca Romero¹, Daniel A. Saavedra Martinez¹, Alvaro J. Martinez Cifuentes¹; ¹Universidad Nacional de Colombia, Colombia. The simultaneous interaction of a two-level system with two measuring apparatuses, coupled to different spin components, allows the estimation of the system state for almost all values of the coupling constants. The cases of two-level and continuous degrees of freedom apparatuses are considered.

Tu2D.2 • 12:00

Control of the Frequency Correlations of Entangled Photons to Produce a Pure Heralded Single Photon Source, John F. Suárez Pérez¹, Alejandra Valencia¹, Mayerlin Nunez Portela¹; ¹Universidad de los Andes, Colombia. A heralded single photon source is implemented from a spontaneous down conversion process. Frequency correlations between photon pairs are controlled by spectral filters. Heralded efficiency and purity of single photons are measured under different conditions.

Tu2D.3 • 12:15 **Invited**

Observing Photon-number Superpositions from Artificial Atoms, Juan Loredó¹, Carlos Anton¹, Bogdan Reznichenko¹, Paul Hilaire¹, Abdelmounaim Harouri¹, Clement Millet¹, Helene Ollivier¹, Niccolò Somaschi¹, Lorenzo De Santis¹, Aristide Lemaitre¹, Isabelle Sagnes¹, Loïc Lanco¹, Alexia Auffeves¹, Olivier Krebs¹, Pascale Senellart¹; ¹CNRS, France. We report on the coherent generation of photon Fock-state superpositions from solid-state artificial atoms: non-classical states in a highly-pure quantum superposition of zero, one, and two photons resembling Schrödinger-cat states, and allowing phase super-resolving interferometry.

Tu2D.4 • 12:45

Quantum Holography with Twin Photons of Large Spatial Dimensionality, Fabrice Devaux^{1,2}, Alexis Mosset², Florent Bassignot³, Eric Lantz^{1,2}; ¹Physics, Université de Bourgogne Franche-Comte, France; ²Optics, FEMTO-ST, France; ³FEMTO Engineering, France. We report results of quantum holography where spatial information stored in phase hologram is retrieved by measuring spatial coincidences between two images formed by spatially entangled twin photons of high-dimensionality transmitted by the hologram

Room 5

11:30–13:00

Tu2E • High-Capacity Optical Transmission

Presider: Darli Mello; Unicamp, Brazil

Tu2E.1 • 11:30 **Invited**

SoC-FPGA Based Emulation of CMA Equalizer for Time Variant Optical Communication Channel, Neil G. Gonzalez¹, David Márquez-Viloria², Cristian Alzate-Anzola²; ¹National Univ. of Colombia, Colombia; ²Instituto Tecnológico Metropolitano, Colombia. This work presents a SoC-FPGA based emulation approach for time-variant optical communication channels. ARM ran a QPSK transmitter and FPGA serves as receiver performing a real-time CMA blind equalization. Parallelization directives were applied using Vivado HLS.

Tu2E.2 • 12:00 **Invited**

Breaking the Transmission Barriers in Ultra-broadband High-capacity Optical Fiber Transmission Systems, Lidia Galdino¹, Daniel Semrau¹, Polina Bayvel¹; ¹Univ. College London, UK. The limitations and practicalities in the design of ultra-high-capacity optical transmission systems with bandwidth beyond C+L EDFA are described, together with a deep theoretical understanding of each noise source contribution limiting the overall data throughput.

Tu2E.3 • 12:30

Performance Comparison of SDN Equalization Methods for High-capacity Inter-datacentre Links, Eduardo C. Magalhães¹, Philip Perry¹, Liam Barry¹; ¹Dublin City Univ., Ireland. Optical power and OSNR can vary due optical network reconfigurations and hence equalization methods are desired. This paper aims at comparing different methods using inter datacentre links with an SDN simulation framework.

Tu2E.4 • 12:45

Flattened Optical Frequency Combs Generated by Algorithm-assisted Parallel Electro-optical Phase Modulators, Leonid A. Huancachoque Mamani¹, Aldário C. Bordonalli²; ¹Communication Department, Univ. of Campinas, Brazil. Abstract: A simple scheme is proposed for the generation of multiple equally spaced and equalized optical subcarriers using two electro-optical phase modulators in a parallel configuration. An algorithm based on theoretical analysis was developed to allow for flat generated combs.

13:00–14:30 Lunch On Your Own

Room 1

14:30–16:30

Tu3A • Non-conventional Imaging*Presider: Jorge Garcia-Sucerquia; Universidad Nacional de Colombia, Colombia***Tu3A.1 • 14:30** **Invited**

Multidimensional Integral Imaging and Recognition in Degraded Environments, Bahram Javid¹, Adam Markman¹, Xin Shen¹, Satoru Komatsu¹, Myungjin Cho², Manuel Martinez Corral³, Artur Carnicer⁴, Adrian Stern⁵, Hong Hua⁶, Genaro Saavedra³, José Martínez Sotoca⁷, Pedro Latorre-Carmona⁷, Filiberto Pla⁷, Jung Yong Son⁸, Yi-Hsin Lin⁹, Yi-Pai Huang⁹; ¹Univ. of Connecticut, USA; ²Hankyong National Univ., Korea; ³Univ. of Valencia, Spain; ⁴Univ. of Barcelona, Spain; ⁵Ben Gurion Univ., Israel; ⁶Univ. of Arizona, USA; ⁷Univ. of James I, Spain; ⁸Konyang Univ., Korea; ⁹National Chiao Tung Univ., Taiwan. We present an overview of our work on multidimensional integral imaging systems. Integral-imaging-based multidimensional optical sensing and imaging will be described for 3-D visualization, seeing through obscurations, material inspection, augmented reality, biomedical applications, and object recognition from microscales to long-range imaging.

Tu3A.2 • 15:00 **Invited**

A Sneak Peek into Opaque Materials with Light, Sylvain Gigan¹; ¹Laboratoire Kastler-Brossel, France. Opaque materials, where light is multiply scattered, remain a major challenge for optics. I will discuss how wavefront shaping - the ability to control the incident light - has deeply changed this view and holds tremendous prospects for biological imaging, as well as for sensing and for fundamental investigations.

Tu3A.3 • 15:30 **Invited**

Adaptive Wave-front Control in Linear and Nonlinear Complex Media, Rafael Piestun¹; ¹Univ. of Colorado at Boulder, USA. Wave-front shaping enables control of light propagation through complex media for focusing and imaging. We discuss fast spatial light modulation, control of nonlinear interactions in multimode fibers, and resolution improvements using photoacoustic feedback.

Tu3A.4 • 16:00

A Critical Microscopic Engine in an Optical Tweezers, Giovanni Volpe¹; ¹Goteborgs Universitet, Sweden. An optically trapped absorbing microsphere in a sub-critical mixture rotates around the optical trap thanks to diffusio-phoretic propulsion, which can be controlled by adjusting the optical power, the temperature, and the criticality of the mixture.

Room 2

14:30–16:30

Tu3B • Laser Science and Technology I*Presider: Laura Sinclair; National Inst of Standards & Technology, USA***Tu3B.1 • 14:30** **Invited**

New Frontiers in Optical Parametric Oscillators, Majid Ebrahim-Zadeh^{1,2}; ¹ICFO -Institut de Ciències Fotoniques, Spain; ²Instituto Catalana de Recerca i Estudis Avancats (ICREA), Spain. The latest advances in wavelength conversion sources and optical parametric oscillators based on a new generation of nonlinear materials covering spectral regions into the deep-infrared and their novel applications in spectroscopy and imaging are described.

Tu3B.2 • 15:00 **Invited**

X-ray Generation with MIR OPOs, Tenio Popmintchev¹; ¹Univ. of California San Diego, USA. Abstract not available.

Tu3B.3 • 15:30 **Invited**

The Dilemma: A Beam or Not a Beam, the Story Behind Nondiffracting Beams, Sabino Chavez-Cerda¹; ¹Inst Nat Astrofísica Óptica Electrónica, Mexico. Nondiffracting beams have exotic properties that might contradict the common sense physics. We will show that they arise from the fact of being a type structured wave fields placing the questions: are they really beams?

Tu3B.4 • 16:00 **Invited**

Ultra-High Efficiency and Low Threshold in Random Lasers, Niklaus U. Wetter¹, Ernesto Jiménez-Villar¹; ¹Instituto de Pesquisas Energéticas e Nucleares, CNEN IPEN, Brazil. Random lasers hold the potential for cheap and coherent light sources, however, improvements in terms of efficiency and laser threshold are required. In this paper, we show two new strategies to increase efficiency and decrease the laser threshold.

Room 3

14:30–16:30

Tu3C • Cancer Diagnosis and Treatment*Presider: Denise Zezell; IPEN - CNEN-SP, Brazil***Tu3C.1 • 14:30** **Invited**

Autofluorescence Lifetime Endoscopy for Early Detection of Oral Dysplasia and Cancer, Javier A. Jo¹, Rodrigo Cuenca¹, Elvis Duran¹, Shuna Cheng¹, Bilal Malik¹, Kristen Maitland¹, John Wright¹, Lisa Cheng¹, Beena Ahmed¹; ¹Texas A&M Univ., USA. Endogenous FLIM images are being acquired in vivo from patients undergoing tissue biopsy of oral lesions. Preliminary results from 84 lesions imaged in vivo strongly suggest the potential of endogenous FLIM for detecting oral pre-cancer/cancer from benign conditions.

Tu3C.2 • 15:00 **Invited**

Photodynamic Therapy - Designing Optical Systems for Customized Application, Cristina Kurachi¹, Lilian T. Moriyama¹, Natalia M. Inada¹, Vanderlei S. Bagnato¹; ¹Univ. of São Paulo, Brazil. The development of anatomical devices is required to improve the PDT efficiency. Here we present PDT devices developed by our group for the treatment of cancer, pre-cancer and infected lesions.

Tu3C.3 • 15:30

Diagnosis of Advanced Skin Cancer Using Infrared Spectral Histopathology, Cássio Lima², Luciana Correa¹, Hugh J. Byrne², Denise M. Zezell³; ¹Faculdade de Odontologia, Univ. of Sao Paulo, Brazil; ²FOCAS Research Inst., Dublin Inst. of Technology, Ireland; ³IPEN-CNEN/SP, Univ. of Sao Paulo, Brazil. In this study, we investigated the feasibility of Infrared Spectral Histopathology to diagnose invasive squamous cell carcinoma using hematoxylin and eosin stained tissue placed on conventional glass slides, as used in the pathologist workflow.

Tu3C.4 • 15:45

Raman Spectroscopy of Wild Type and Mutants p53, Karen Hernandez Vidales¹, Edgar Guevara¹, Vanesa Olivares Illana¹, Francisco Javier Gonzalez¹; ¹Universidad Autónoma de San Luis Potosí, Mexico. Wild type p53 and three types of mutants were characterized by Raman spectroscopy. Principal components analysis allows to distinguish among the specimens and through partial least square regression the limit of detection was estimated.

Tu3C.5 • 16:00

Raman Spectroscopy Study of a Topical Penetration of a New Generation Skin-Cancer Antineoplastic Drug, Maria Natalia Calienni¹, Jorge Anibal Montanari¹, Maria Eugenia Tuttolomondo³, Gisela Gomez¹, Silvia del Valle Alonso¹, Fernando C. Alvira^{1,2}; ¹Laboratorio de Biomembranas, Universidad Nacional de Quilmes, Argentina; ²Laboratorio de Instrumentación, Automatización y Control, Universidad Nacional de Quilmes, Argentina; ³Cátedra de Físicoquímica I, INQUINOA, Argentina. We present a photonic technique to detect the distribution of ultra-deformable liposomes and Vismodegib in the different layers of stratum corneum. Our primary results showed agreement between the proposed technique and HPLC data.

Room 4

14:30–16:30

Tu3D • Vector Beams and Structured Light

Presider: Enrique Galvez; Colgate Univ., USA

Tu3D.1 • 14:30 **Invited**

Vectorial Light Fields, Generation, Correlations and Interactions with Atoms, Sonja Franke-Arnold¹, Neal Radwell¹, Adam Selyem¹, Francesco Castellucci¹, Ryan Hawley¹; ¹Univ. of Glasgow, UK. We use a variety of techniques to imprint structure in the amplitude, phase and polarization of a light beam, yielding non-classical correlations between the polarization and spatial degree of freedom. I will report on applications in polarimetry and strong focusing, and experiments that transfer structure to atomic vapors.

Tu3D.2 • 15:00

Mobius Polarization of Non-Collinear Poincare Superpositions, Enrique J. Galvez¹, Ishir J. Dutta¹, Saiyang Zhang¹; ¹Colgate Univ., USA. Polarization patterns in 3 dimensions present unique views of vector light patterns containing optical singularities. We investigated the Mobius twists of the electric field that appear in non-separable superpositions of vortex modes and polarization.

Tu3D.3 • 15:15 **Invited**

Polarization Controlled Nonlinear Wave Mixing with Structured Light, Wagner T. Buono¹, Jordy Santiago², Leonardo J. Pereira¹, Daniel S. Tasca¹, Kaled Dechoum¹, Antonio Z. Khoury¹; ¹Universidade Federal Fluminense, Brazil; ²Departamento Ciencias, Sección Física, Pontificia Universidad Católica del Perú, Peru. We perform nonlinear wave mixing with entangled optical structures and investigate the cross talk between different degrees of freedom. Path-polarization controlled mixing of orbital angular momentum (OAM) allows optical switching between different OAM operations.

Tu3D.4 • 15:45

Optical Singularities in a Light Field Propagating Obliquely Through a Stress-Engineered Optic, Ashan Ariyawansa¹, Kevin Liang¹, Thomas Brown¹; ¹The Inst. of Optics, Univ. of Rochester, USA. We numerically model and experimentally verify lemon, star, and monster polarization singularities appearing and annihilating in the light field when polarized light is obliquely propagating through a birefringent element known as a stress-engineered optic.

Tu3D.5 • 16:00 **Invited**

Long-distance Fiber-optic Propagation of Deterministically-shaped Single Photons, Alfred B. U'Ren¹, Daniel Cruz-Delgado¹, Juan Carlos Alvarado-Zacarias², Hector Cruz-Ramirez¹, Enrique Antonio-Lopez², Sergio Leon-Saval³, Rodrigo Amezcua Correa²; ¹Instituto de Ciencias Nucleares, Mexico; ²CREOL, USA; ³Univ. of Sydney, Australia. We demonstrate control over the structure of light at the single-photon level integrating in a single setup i) fiber-based photon pair generation, ii) deterministic/broadband single-photon spatial conversion, and iii) single-photon structure-retaining transmission over 400m of few-mode fiber.

Room 5

14:30–16:30

Tu3E • Atom and Light Interactions and Laser Spectroscopy

Presider: To be Announced

Tu3E.1 • 14:30 **Invited**

Title to be Announced, Carmen S. Menoni¹; ¹Colorado State Univ., USA. Abstract not available.

Tu3E.2 • 15:00 **Invited**

Towards Attosecond Pump-Probe Coincidence Spectroscopy with High Acquisition Rates, Federico J. Furch¹, Tobias Witting¹, Felix Schell¹, Mikhail Osolodkov¹, Claus Schulz¹, Marc Vrakking¹; ¹Max Born Inst., Germany. Coincidence detection of electrons and ions is an ideal technique to study complex attosecond molecular dynamics. We report on the progress of an attosecond pump-probe beamline driven by a high power 100 kHz parametric amplifier.

Tu3E.3 • 15:30 **Invited**

Quantum Enhanced Sensing with Squeezed Light, Alberto M. Marino¹; ¹Univ. of Oklahoma, USA. We study the use of quantum states of light generated with an atomic system to enhance the sensitivity of plasmonic sensors. We show a quantum-based sensitivity enhancement of 56% with transmission-based measurements and analyze the use of phase-based measurements for further enhancements.

Tu3E.4 • 16:00

Two-photon-excited Rb Decay Transients as Probes of Material Porosity, Horacio Failache¹, Lucia Amy¹, Santiago Villalba¹, Arturo Lezama¹; ¹Universidad de la Republica, Uruguay. We studied fluorescence decay following sudden interruption of two-photon excitation of Rb atoms inside interstitial cavities of porous glass. Since the transients are limited by collisions with pore walls, information about confinement dimensions is obtained.

Room 1

Tu3A • Non-conventional Imaging—Continued

Tu3A.5 • 16:15

Towards a Robotic Micromanipulation Platform Enhanced by IR-LASER-Pulse-based Optofluidic Actuation, Emir Vela¹, Johan Quispe², Stephane Regnier²; ¹Universidad Peruana Cayetano Heredia, Peru; ²Sorbonne Université, France. Manipulation of micro-components is a challenge at microscale because of their small size. Thus, we discuss the generation and use of thermocapillary convection flows through IR-LASER pulses as a technique for versatile manipulation of micro-objects.

Room 2

Tu3B • Laser Science and Technology I—Continued

Room 3

Tu3C • Cancer Diagnosis and Treatment—Continued

Tu3C.6 • 16:15

Digital Holographic Microscopy and Tomography in Necrosis Detection in Three Types of Cancer Cells, Andrei V. Belashov², Anna A. Zhikhoreva^{1,2}, Natalia A. Avdonkina³, Irina A. Baldueva³, Anna B. Danilova³, Mark L. Gelfond³, Irina Semenova², Tatiana L. Nekhaeva³, Daria A. Rogova^{4,2}, Oleg Vasyutinski²; ¹ITMO Univ., Russian Federation; ²Ioffe Inst., Russian Federation; ³N.N. Petrov National Medical Research Center of Oncology, Russian Federation; ⁴Peter the Great St. Petersburg Polytechnic Univ., Russian Federation. Changes in optical and morphological parameters in three types of cancer cells from neoplastic material taken from patients and subjected to photodynamic treatment were monitored using digital holographic microscopy and tomography.

Location to be Determined

16:30–18:00

Tu4A • Poster Session I

Tu4A.1

Multi-region Calibration of LC SLM for All Optical Dynamic Modulation/Multiplexation, Ana M. Cardenas¹, Maria Isabel Alvarez -Castaño¹, Sebastian Alarcon-Ortega¹, Nelson Correa²; ¹Universidad de Antioquia, Colombia; ²(2) Instituto Tecnológico Metropolitano, Colombia. Multi-region calibration of a LC-SLM using Michelson interferometer is presented, visioning its future deployment as optical dynamic modulator or multiplexer. We found that up to 16 sectors could be implemented, without major difficulties or signal processing.

Tu4A.2

Prospects of Spin Gyroscopes Based on Nitrogen-Vacancy Centers in Diamond, Andrey Jarmola^{1,2}; ¹Physics, Univ. of California at Berkeley, USA; ²US Army Research Laboratory, USA. We are developing a solid-state gyroscope based on ensembles of nitrogen-vacancy centers in diamond. Rotation of the nitrogen-vacancy symmetry axis will induce Berry phase shifts in the electronic ground state ¹⁴N hyperfine sublevels and can be measured with a Ramsey technique.

Tu4A.3

Theoretical and Experimental Study of Polarization Modulation Instability in All-Normal Dispersion Photonic Crystal Fibers, Antonio Diez¹, Abraham Loredó-Trejo¹, Yanelis López-Diéguez¹, Lorena Velazquez¹, Miguel V. Andrés¹; ¹Universitat de Valencia, Spain. Experimental observation of polarization modulation instability in all-normal dispersion photonic crystal fibers is reported. Stokes and anti-Stokes sidebands with spectral shift of 40 nm were observed when the fiber was pumped at 1064 nm. Experimental results are bared by a vectorial four-wave mixing model.

Tu4A.4

Below Threshold Harmonics Beams Characterization Using the Knife-Edge Technique, Armando Valter F. Zuffi¹, Andreia Almeida¹, Nilson Dias Vieira¹, Ricardo Samad¹; ¹IPEN - CNEN/SP, Brazil. Using the knife-edge method we have measured gas generated BTH beams sizes in the VUV region and calculated their divergences, geometrically characterizing this light source.

Tu4A.5

Innovative Methodology in Digital Image Analysis to Erythrocyte Morphology Identification, Bibiana D. Riquelme^{1,2}, Carolina Londero^{1,2}, Manuel Mancilla Canales^{1,2}, Ana Korol^{1,2}; ¹Fac. Cs. Bioquímicas y Farmacéuticas, UNR, Argentina; ²Instituto de Física Rosario (CONICET-UNR), Argentina. An innovative methodology to identification of erythrocyte morphologies was developed using shape descriptors and noise elimination by Wavelet Transform for digital images analysis from conventional microscopy. This method is useful for automatizing erythrocyte morphology recognition.

Tu4A.6

Analysis of the Dependence of the Numerical Aperture on Cone Angle in a Tapered Step-index Optical Fiber, Brayan Patiño¹, Jorge Garcia-Sucerquia¹, Juan F. Botero-Cadavid¹; ¹Universidad Nacional de Colombia, Colombia. This work aims to present a ray tracing analysis to determine the numerical aperture of step-index fibers with conical tips. A multi-mode fiber optics is modeled and a ray tracing study is performed in order to obtain an equation for the numerical aperture in terms of the cone angle.

Tu4A.7

Recirculating Loop for Experimental Transmission of DDO-OFDM Signals, Caio M. Santos¹, Reginaldo Nunes², Jair L. Silva¹, Marcelo E. Segatto¹, Maria J. Pontes¹; ¹UFES, Brazil; ²UFES, Brazil. We discuss the use of an optical recirculating loop for the experimental transmission of DDO-OFDM signals. Although the bitrate is modest, transmission distances as long as 900 km were obtained using direct detection.

Tu4A.8

Application of Optical Methods to Diagnose Nutritional Stress on Tabasco Pepper (*Capsicum frutescens*) Crops, Frank Montenegro¹, Aldemar Reyes¹, Carlos A. Galindez-Jamioy¹, Efrain Solarte¹; ¹Universidad del valle, Colombia. The diffuse reflectance and SPAD index of Tabasco Pepper (*Capsicum frutescens* L.) leaves were measured, in an experimental design of a crop in conditions of nutritional stress for Nitrogen. Strong correlations were found between measures.

Tu4A.9

Design and Construction of a Broadband Spectrum Femtosecond Laser, Catalina Ramirez-Guerra¹, Jesús Garduño-Mejía¹, Martha Rosete-Aguilar¹; ¹Universidad Nacional Autónoma de México, México. A femtosecond oscillator was designed and constructed to compensate astigmatism and second order dispersion inside the cavity. Pulse time width around 14 femtoseconds was measured using Two-Photon Absorption (TPA) interferometric autocorrelation.

Tu4A.10

Patrimonial, Forensic and Biosensing Applications of a Homemade Multispectral Scanner, Cesar Costa Vera¹, Andres Vega¹, Jose L. Paz¹, Andrea Montero², Miguel A. Mendez²; ¹Departamento de Física, Esc. Politécnica Nacional, Ecuador; ²Instituto de Simulación Computacional, Universidad San Francisco de Quito, Ecuador. A homemade multispectral scanner has been used to evaluate the decay and fading of ink entries on paper and to quantitatively evaluate biosensor readings. The reflected light from 10 different LEDs is read by a compact optical spectrometer.

Tu4A.11

Determination of Non-linear Optical Properties of TiO₂ Nanoparticles Functionalized with an Azo-triphenylmethane Dye using the Z-scan Technique, Corinna J. Enriquez Sánchez¹, Kevin M. Esparza Ramírez¹, Samuel M. Afanador Delgado¹, Virginia Maraño-Ruiz¹, Roger Chiu¹, Jesús Castañeda¹, Hector Pérez¹, Rita Patakfalvi¹, Yara Ramirez Quiros²; ¹Universidad de Guadalajara, Mexico; ²Universidad Autónoma Metropolitana unidad Azcapotzalco, Mexico. Z-scan technique offers simplicity to determine nonlinear optical properties. We propose its use in nanoparticles of TiO₂ functionalized with an azo-triphenylmethane dye obtaining $n_2=3.37 \times 10^{-3}$ and $\beta=1.28 \times 10^5$ which allows us to propose them for solar cells.

Tu4A.12

Linear Unmixing of Optic Signals by Extended Blind End-member and Abundance Extraction, Daniel U. Campos-Delgado¹, Omar Gutierrez-Navarro², Javier A. Jo³; ¹Facultad de Ciencias, Universidad Autónoma de San Luis Potosí, Mexico; ²Universidad Autónoma de Aguascalientes, Mexico; ³Biomedical Engineering Department, Texas A&M Univ., USA. We introduce a new methodology for linear unmixing of optic signals, which is denoted as extended blind end-member and abundance extraction. To validate the proposal, we study m-FLIM datasets to classify fresh postmortem human coronary atherosclerotic plaques.

Tu4A.13

Non-linear Effects in Strong-coupled Two-core Optical Fibers, Denisse A. Trujillo Lopez¹, Daniel Ceballos-Herrera¹, Ramon Gutierrez-Castrejon¹; ¹Instituto de Ingeniería, Universidad Nacional Autónoma de México, México. We present a numerical analysis of non-linear effects on the inter-core crosstalk of 40 WDM channels in two-core fibers. We show how the power penalties among WDM channels are modified during the inter-core coupling process.

Tu4A.14

Experimental Non-paraxial Self-images, Emiro S. Arrieta Jimenez^{1,2}; ¹Surcolombian Univ., Colombia; ²Cesar, Popular Univ. of Cesar, Colombia. An experimental report of the Talbot effect at non-paraxial regime for a one dimensional amplitude grating of period of 2µm is presented. Quasi and self-images were obtained with a confocal microscope, and these self-images are contrasted with those obtained by the scalar theory of diffraction in representation of plane waves.

Tu4A.15

Nonlinear Absorption and Diffraction Patterns in Au Nanorods, Emma V. García Ramirez¹, Jorge Alejandro Reyes Esqueda², Maximino Luis Arroyo Carrasco¹, José Juan Méndez¹; ¹Universidad Autónoma de Puebla, Mexico; ²IF, UNAM, Mexico. Colloidal gold nanorods were analyzed by Z-scan technique in the resonant regime. Results were obtained for CW and pulse light. Diffraction patterns and nonlocal behavior are analyzed too

Tu4A.16

Ultra-short Polarization Beam Splitter to Operate in Two Communication Bands based on a Gold-filled Dual-core Photonic Crystal Fiber, Cristian Jimenez-Durango¹, Erick E. Reyes Vera^{1,2}, Nelson Gomez-Cardona^{1,3}; ¹Instituto Tecnológico Metropolitano, Colombia; ²Department of Electrical and Electronic Engineering, Universidad Nacional de Colombia, Colombia; ³Escuela de Física, Universidad Nacional de Colombia, Colombia. A high performance and ultra-compact polarization beam splitter based on a gold-filled DC-PCF is reported in this paper. Numerical results show that this device can operate into the O and C bands simultaneously.

Tu4A.17

Thermal Diffusivity Measurement in Thin Metallic Filaments by the Laser Beam Deflection Technique with a Digital Camera and Lock-in Imaging Processing, Ernesto Marin¹, Angel Cifuentes¹, Eduardo Vargas¹, Salvador Alvarado¹, Antonio Calderon¹, Humberto Cabrera², Osvaldo Delgado³; ¹CICATA-Legaria, Instituto Politécnico Nacional, Mexico; ²The Abdus Salam International Centre for Theoretical Physics (ICTP), Italy; ³Universidad Politécnica Metropolitana de Hidalgo, Mexico. The thermal diffusivity of thin metallic filaments is measured by the photothermal beam deflection method using a digital camera and lock-in imaging processing methodologies in the multibeam and the shadowgraph experimental configurations.

Tu4A.18

Using Morphological Binary Images Operations for Automate Rotation Fill-in Estimation in Ultrasound Elastography Medical Imaging, Esteban Donoso¹, Belfor A. Galaz¹; ¹Universidad de Santiago de Chile, Chile. We present an automate estimation method of rotation fill-in signature based on morphological binary image operations of elastographic images. The method is tested by Finite-Element simulations and then validated by in-vitro experiments.

Tu4A.19

Analysis of Holographic Wavefront Sensing Performance for Extended Sources, Michele Lacerenza², Esteban Vera¹; ¹Universidad Católica de Valparaíso, Chile; ²Politecnico di Milano, Italy. We present a sensitivity analysis of holographic wavefront sensing to extended sources due to spot elongation. Overall, the holographic wavefront sensor (HWFS) tolerates spot elongations at the expense of less sensitivity of the main Zernike mode and the appearance of a moderate amount of crosstalk.

Tu4A.20

Two-Photon Induced Fluorescence of ICT Dimethylamino-substituted-halogenated Heterocyclic Chalcones, Estefanía S. Sucre¹, Ricardo Fernandez-Teran², Marco Filoseta¹, Neudo Urdaneta¹, Florencio E. Hernández³, Lorenzo Echevarria¹; ¹Universidad Simon Bolívar, Venezuela, Bolivarian Republic of; ²Chemistry, Univ. of Zurich, Switzerland; ³Chemistry, Univ. of Central Florida, USA. Chalcone analogues evidenced a strong ICT process without contribution of the halogen substituent. TPA in acetone solutions was measured using TPIF, It was evidenced that protonation of the alkylamino substituent inhibits the ICT.

Tu4A.21

TiO₂ Thin Films Obtained by Pulsed Laser Deposition Under Different Excitation Regimes, Luis Ponce¹, Yonic Peñaloza Mendoza¹, Fernando C. Alvira^{2,3}; ¹Laboratorio de Tecnología Laser, CICATA, Mexico; ²Laboratorio de Biomembranas, Universidad Nacional de Quilmes, Argentina; ³Laboratorio de Instrumentación, Automatización y Control, Universidad Nacional de Quilmes, Argentina. TiO₂ nanolayers were grown by PLD in high vacuum under monopulse and multipulse excitation. Results show that it is possible to deposit black titania films by PLD and also to modulate the final crystalline phase.

Tu4A.22

Development of High-order H(curl;Ω)-conforming Approximation Spaces for Photonic Waveguide Analysis, Francisco Orlandini¹, Luciano P. de Oliveira¹, Hugo E. Hernandez-Figueroa¹, Philippe Devloo²; ¹FEEC, Universidade Estadual de Campinas, Brazil; ²FEC, Universidade Estadual de Campinas, Brazil. In the context of photonic waveguides, a high-order Finite Element Method (FEM) scheme using H(curl;Ω) and H1(Ω)-conforming elements for modal analysis is presented, and the conditions for high order convergence are discussed.

Tu4A.23

Optical Fiber Vibration Sensor, Francisco M. Smolka¹; ¹OptoLink, Brazil. A vibration sensor with a fused fiber biconical taper, as displacement monitor for the movement of an inertial mass; sensing results of vibration amplitudes < 0.2mm, accelerations down to 0.02g and SNR >20dB are presented.

Tu4A.24

Conditions for Optical Parametric Oscillation Under Structured Light Pump, Gabriel B. Alves¹, Rafael F. Barros¹, Daniel S. Tasca¹, Carlos E. Souza¹, Antonio Z. Khoury¹; ¹Universidade Federal Fluminense, Brazil. We investigate the down-conversion of the signal and idler transverse modes when pumped with a high-order paraxial mode in an optical parametric oscillator. We extract some constraints from the coupling constant describing the nonlinear interaction, which are verified experimentally.

Tu3E.5 • 16:15

Laser Induced Breakdown Spectroscopy on Liquids Assisted by Acoustic Levitation Sampling: Towards on-line Monitoring Applications, Victor U. Contreras Loera¹, Aaron Diaz², Sebastian Tan², Horacio Martinez¹; ¹Universidad Nacional Autonoma de México, Mexico; ²Centro Universitario de Ciencias Exactas e Ingenierías, Universidad de Guadalajara, Mexico; ³Universidad Politécnica del Estado de Morelos, Mexico. LIBS assisted by acoustic levitation for chemical analysis of liquid samples is presented. We describe instrumentation successfully implemented towards the development of a methodology that fulfill the requirements for online water quality monitoring.

Location to be Determined

Tu4A • Poster Session I—Continued

Tu4A.25

Phase-step Retrieval for Phase-shifting Algorithms by Ellipse Fitting, Gastón Ayubí¹; ¹Universidad de la Republica, Uruguay. In this work we present a method to extract the phase-step between consecutive interferograms. We present experimental results showing the performance of the method.

Tu4A.26

Semi Quantitative Elemental Analysis of Volcanic Ashes from Populations Surrounding the Tungurahua Volcano of the Eruptive Period 2008-2010, Using the LIBS Spectroscopy (Laser-Induced Breakdown Spectroscopy), Geovanna E. Vasquez¹; ¹EPN, Ecuador. LIBS was applied in 18 volcanic ash samples, suitable preparation methods are proposed for the ashes. For the quantitative analysis (CF-LIBS) is used. A comparison of the CF-LIBS data with EDS and ICP-AES was made

Tu4A.27

Experimental Evaluation of a Coherent DPSK-BPSK Long-Reach PON, German V. Arevalo¹, Cristian A. Salcedo¹, Evelyn Lagos¹; ¹Carrera de Ingeniería en Telecomunicaciones, Universidad Politécnica Salesiana, Quito, Ecuador. This article presents a DPSK-BPSK coherent LR-PON employed for sending data at 10Gb/s using homodyne and heterodyne reception. Receiver sensitivities of -21dBm, for homodyne, and -20dBm, for heterodyne, were achieved for a BER of 10⁻³

Tu4A.28

LIBS Use in Study of Homogenization and Plasma Characterization in Medicine Tablets, Thalena C. Zanetti¹, Tiago Catelani², Edenir R. Pereira-Filho², Jader Cabral¹; ¹Universidade Federal de Uberlândia, Brazil; ²Universidade Federal de São Carlos, Brazil. We have checked the tablets homogeneity throughout the correlation statistic method and have identified the APIs. Also, we present a physical characterization of the LIBS plasma generated by the temperature and electronic density calculation.

Tu4A.29

Evaluation of Nitrogen Fertilization in Sugarcane Leaves Using Laser-Induced Breakdown Spectroscopy (LIBS) Coupled with Principal Component Analysis (PCA), Gustavo Nicolodelli^{2,3}, Renan A. Romano³, Giorgio S. Senesi³, Jader Cabral¹, Alex Watanabe³, Sarah Tellif, Ricardo de O. Bordonal⁵, João L. Carvalho⁵, Bruno S. Marangoni², Débora M. Milori³; ¹Universidade Federal de Uberlândia, Brazil; ²Universidade Federal do Mato Grosso do Sul, Brazil; ³Embrapa Instrumentação, Brazil; ⁴Instituto de Nanotecnologia, Italy; ⁵Centro Brasileiro de Tecnologia do Etanol, Brazil. Laser-Induced Breakdown Spectroscopy coupled with Principal Component Analysis has proved to be a potential tool for qualitative analysis of Nitrogen (N) in sugarcane leaves, thus discriminating samples without N fertilization and after N fertilization.

Tu4A • Poster Session I—Continued

Tu4A.30

Impact of PMD Changes to Optical Link Performance in a Harsh Environment, Jan Bohata¹, Stanislav Zvánovec¹; ¹Czech Technical Univ. in Prague, Czechia. Optical networks are commonly deployed in harsh environments. Based on measurement we provide new statistics of optical link performance in high-variant temperature environment with the impact of polarization mode dispersion to the system reliability.

Tu4A.31

Synthesis and Characterization of Magnetic Nanoparticle Colloids Generated in Liquid Media by UPLA¹, Jessica Santillan¹, David Muñeton Arboleda¹, Marcela B. Fernandez van Raap², Daniel C. Schinca^{1,3}, Lucia B. Scaffardi^{1,3}; ¹Centro de Investigaciones Ópticas (CIOp), Argentina; ²Física, Instituto de Física La Plata (IFLP), Argentina; ³Departamento de Ciencias Básicas, Facultad de Ingeniería, UNLP, Argentina. Optical and magnetic characterization of NPs colloids synthesized by Ultrashort Pulsed Laser Ablation¹ (UPLA) of a solid Fe or Ni target immersed in water are studied. Absorption spectra in the UV-region are measured; shape, size distribution and superparamagnetic state of the nanoparticles are proved.

Tu4A.32

Low-cost Monitoring System to Control and Measure Temperature in a Microwave Process Using Double Grating Filter Technique based on FBG, Manuel Jaramillo Gaviria¹, Jorge Galvis¹, Pedro Torres¹; ¹Univ Nacional de Colombia Medellin, Colombia. We propose a low-cost monitoring system based on the double FBG filter technique to measure and control the temperature in industrial processes with microwave ovens.

Tu4A.33

Selective Etching on a FBG Tip for the Development of a Robust Refractometric and Temperature Probe, Didinzo Valderrama Arboleda¹, Jorge Galvis¹, Pedro Torres¹; ¹Univ Nacional de Colombia Medellin, Colombia. In this work, we developed a low cost refractometric and temperature probe based on selective etching on a FBG tip. Due to its robustness these probes are promising for the development of biosensors.

Tu4A.34

Determination of the Complex Refractive Index, Optical Bandgap and Urbach Energy of CH₃NH₃PbI₃ and FA_{1-y}Cs_yPb(I_{1-x}Br_x)₃ Perovskite Thin Films, Alvaro Tejada^{1,2}, Steffen Braunger², Lukas Kegelmann², Steve Albrecht², Jan Amaru P. Tofflinger¹, Lars Korte², Jorge A. Guerra Torres¹; ¹PUCP, Peru; ²Inst. für Silizium-Photovoltaik, Helmholtz Zentrum Berlin, Germany. The complex refractive indices of CH₃NH₃PbI₃ and FA_{1-y}Cs_yPb(I_{1-x}Br_x)₃ perovskite thin films are reported. These are determined point-by-point using a combination of ellipsometry and transmittance. Bandgaps and Urbach energies are calculated using a band fluctuations model.

Tu4A.35

Speckle Reduction in Digital Holography by Phase Modulation Using a Digital Micromirror Device, Jorge A. Herrera Ramirez¹, John Restrepo-Agudelo¹, Nelson Correa¹, Diego Hincapié¹; ¹Instituto Tecnológico Metropolitano, Colombia. Using a DMD for phase modulation of the object illumination in digital holography, we generate different speckle patterns on the object reconstruction. The superposition on an intensity basis of multiple reconstructions reduces the speckle successfully.

Tu4A.36

Modeling Temperature Response of a Fiber Specklegram Sensor by Using Finite Element Method, Jorge A. Herrera Ramirez^{2,1}, Luis C. Gutierrez², Luis F. Castaño², Jorge A. Gómez², Jairo C. Quijano², Luiz C. Da Silva Nunez³, Francisco J. Vélez⁴, Victor H. Aristizabal⁴; ¹Instituto Tecnológico Metropolitano, Colombia; ²Politécnico Colombiano Jaime Isaza Cadavid, Colombia; ³Mechanical Engineering, Universidad Federal Fluminense, Brazil; ⁴Universidad Cooperativa de Colombia, Colombia. By using a finite element method (FEM), several combinations of dopants concentrations in the cladding and core of a silica glass fiber are tested in order to change the sensing temperature characteristics of a fiber sensor

Tu4A.37

FTIR Spectroscopy in Qualitative Analysis in the Blood to Study the Spectral Difference of Diabetic Blood Samples, Eman A. Nemer¹, Malaz a. Fadolalseed¹; ¹Al Neelien Univ., Sudan. In the qualitative analysis of glucose using FTIR spectroscopy in pure, bound glucose and blood (whole and serum) and comparing it with convention way. Glucose showed figure print in the regions 1388, 1072 and 1037 cm⁻¹.

Tu4A.38

Laser Ablation Technique Using for Metallic Nanoparticles Production in Colloids and their Applications in Photochemical Process, Johan Sebastian Duque Buitrago¹, Henry Riascos¹, Yenny P. Avila¹; ¹Universidad Tecnológica de Pereira, Colombia. In this work laser ablation technique is used for the nanoparticles (NPs) production in liquid media, we studied the effect of the wavelength laser in the nanoparticles quality for antibacterial applications. We analyzed the antibacterial effect in colonies of *Escherichia Coli* and *Staphylococcus Aureus*.

Tu4A • Poster Session I—Continued

Tu4A.39

Fluorescence Spectra and Lifetimes of Alkyl Derivatives of Fluorescein in the Presence of Liposomes, Dina M. Beltukova¹, Vladlen R. Abbasov¹, Viktor P. Belik¹, Yuriy Antonenko², Elena A. Kotova², Galina A. Korshunova², Irina Semenova¹, Oleg Vasyutinskiy¹; ¹*Ioffe Inst., Russian Federation*; ²*Belozersky Inst. of Physico-Chemical Biology, Lomonosov Moscow State Univ., Russian Federation*. We present an experimental analysis of major fluorescence characteristics of the two alkyl derivatives of fluorescein in a buffer solution and in the presence of the two types of unilamellar liposomes.

Tu4A.40

Quadratic Interpolation of the Transmission Matrix for the Light Propagation Control in Turbid Media, José O. García¹, Samuel M. Afanador Delgado¹, R. Chiu¹; ¹*Departamento de Ciencias Exactas y Tecnologías, Centro Universitario de los Lagos, Universidad de Guadalajara, Mexico*. In present work, we implement the quadratic interpolation technique to transmission matrix obtained with iterative algorithm proposed by Vellekoop. We managed reducing the process time for a greater segment number.

Tu4A.41

Study of InN Thin Film for Pulse Oximeter Application, Marina Sparvoli¹, Mario Gazziro¹, Ronaldo Mansano², José Chubaci², Fábio Jorge², Roberto Onmori²; ¹*UFABC, Brazil*; ²*Universidade de São Paulo, Brazil*. The objective of this study is the development of pulse oximeter sensor based in InN thin film deposited by RF magnetron sputtering. A Software was produced in Labview. Its function is to reproduce the results from pulse oximeter.

Tu4A.42

Study of Red Blood Cell Interaction by Side Scattering and Forward Scattering Biospeckle, Martín A. Toderi^{1,3}, Bibiana D. Riquelme^{1,3}, Gustavo Galizzi^{2,3}; ¹*Fac. Cs. Bioquímicas y Farmacéuticas, UNR, Argentina*; ²*Fac. Cs. Exactas, Ingeniería y Agrimensura (UNR), Argentina*; ³*Instituto de Física Rosario (CONICET-UNR), Argentina*. We investigated the erythrocyte interaction by means of biospeckle laser analysis. The Discrete Wavelet Transform was used to decompose the sample activity in order to better identify the cells behavior. The Correlation Coefficient was calculated.

Tu4A.43

Could NO-releasing Chitosan Nanoparticles Improve Photodynamic Therapy on Cutaneous Leishmaniasis?, Fernanda V. Cabral¹, Milena Pelegrino², Amedea Seabra², Marthá S. Ribeiro¹; ¹*IPEN USP, Brazil*; ²*UFABC, Brazil*. Photodynamic inactivation (PDI) and NO-releasing chitosan nanoparticles (CSNPs) were associated to treat cutaneous leishmaniasis in mice to verify synergism between therapies. Parasite burden, lesion size and hyperalgesia were analyzed. CSNPs were not able to improve PDI.

Tu4A.44

Luminescence Properties and Up-conversion Emission of Er³⁺/Yb³⁺/Tm³⁺ Triply Doped Zinc-Tellurite Glasses, Gaston Lozano Calderón^{1,3}, Otavio de Brito Silva^{1,3}, Máximo Siu Li¹, Victor A. García Rivera², Euclides Marega Junior^{1,3}; ¹*Instituto de Física de São Carlos - Universidade de São Paulo, Brazil*; ²*Universidad Nacional Mayor de San Marcos, Peru*; ³*Departamento de Física e Ciência dos Materiais, Centro de Pesquisas de Óptica e Fotônica, Brazil*. Green to yellow light emission via up-conversion in Er³⁺-Yb³⁺-Tm³⁺ have been reported for tellurite-zinc glasses by modifying the concentration of the rare earth ions and adjusting the laser excitation power at 972 nm.

Tu4A.45

Photobiomodulation Can Delay Tumor Progression in Breast Cancer Bearing-mice, Camila Ramos Silva¹, Saulo d. Pereira¹, Carolina G. Contatori¹, Marthá S. Ribeiro¹; ¹*IPEN, Brazil*. Cancer is a worldwide health problem and new therapeutic strategies are necessary. Photobiomodulation is a noninvasive and cost-effective therapy, but its use in cancer cells is still controversial. In this study, we explore the effects of PBM on breast tumor bearing-mice

Tu4A.46

Molecular Characterization of Human and Bovine Hydroxyapatite from Dental Enamel and Dentin Submitted to Gamma Radiation, Claudia B. Zamataro¹; ¹*Center for Lasers and Applications, Brazil*. The important alteration of hydroxyapatite in the buccal cavity depends on the biochemical alteration of the whole environment, when the hydroxyapatite is analyzed isolated there is minimal molecular change of the crystal.

Room 1

18:00–19:30

Tu5A • Multidisciplinary Applications of Photonics II

Presider: Emir Vela; *Universidad Peruana Cayetano Heredia, Peru*

Tu5A.1 • 18:00 **Invited**

Making Sense in Surgery Using Near-Infrared Optical Imaging, Sylvain Gioux¹; *Universite de Strasbourg, France*. There is a pressing clinical need to provide image guidance during surgery. In this presentation, we will review our efforts to provide real-time & wide-field image-guidance during surgery using NIR diffuse optical imaging.

Tu5A.2 • 18:30 **Invited**

Exploring Cellular and Tissue Mechanics with Optical Manipulation, Microfluidics and Spectroscopy, David McGloin¹; *Univ. of Technology, Sydney, Australia*. Using optical techniques in complex biological structures often suffers from issues associated with scattering. Here we examine how multimodel approaches may offer better outcomes and examine new uses for optical tweezers in multi-cellular structures.

Tu5A.3 • 19:00

Growth and Characterization of Organic LEDs with Europium Complex as Emitting and Electron Transporting Layer, Reynaldo G. Reyes¹, H. Brito², M. Cremona³; *1Universidad Nacional de Ingeniería, Peru; 2Universidade de Sao Paulo, Brazil; 3Pontificia Universidade de Rio de Janeiro, Brazil*. The growth and the characterization of red emitting double-layer organic LED using vacuum deposited [Eu(TTA)₃(TPPO)₂] europium complex as emitting and electron transporting layer is described. The observed electroluminescence is characteristic of the Eu³⁺ emission.

Tu5A.4 • 19:15

Fluorescence by Confocal Scanning Microscopy in Ba (Ti_{0.97}Er_{0.03}) O₃ Thin Films, José L. Clabel¹, Sukarno Olavo Ferreira², Euclides Marega Junior¹; *1IFSC, Brazil; 2FISICA, UNIVERSIDADE FEDERAL DE VICOSA, Brazil*. We demonstrate the application of the Confocal Fluorescence Microscopy (CFM) technique to the upconversion luminescence of Ba (Ti_{0.97}Er_{0.03}) O₃-BTE3 thin films on glass substrate.

Room 2

18:00–19:30

Tu5B • Sensing Technologies I

Presider: Cicero Martelli; *CPGEI, UTFPR - Federal Univ. of Technology - Paraná, Brazil*

Tu5B.1 • 18:00 **Invited**

Multi-Resonant Optical Fiber Gratings for Hundred-fold Improvements in Sensing Limits of Detection, Jacques Albert¹, Tingting Gang²; *1Carleton Univ., Canada; 2School of Physics, Northwest Univ., China*. The cladding of single-mode optical fibers supports hundreds of propagating modes providing for different sensing modalities. Simultaneous use of many grating-induced resonances in a given measurement leads to a corresponding improvement in detection limits.

Tu5B.2 • 18:30

Refractometer Based on Si₃N₄-coated Tapered Optical Fiber, Deborah Martinez-Camacho¹, Rene Dominguez-Cruz¹, Daniel May-Arrijo², Oscar baldovino-pantaleon¹; *1Electronics Department, Universidad Autonoma de Tamaulipas, Mexico; 2Unidad Aguascalientes, Centro de Investigación en Óptica, Mexico*. Si₃N₄-thin film deposited on the tapered fiber to fabricate high-refractive-index sensor, that shows sensitivity up to 291 nm/RIU in the range of 1.3388-1.3983 by measuring mixtures of glycerol and deionized water.

Tu5B.3 • 18:45

Design Tolerances of Devices Based on Tapered Depressed-Cladding Fibers, Sergio Celaschi², Gilliard N. Malheiros-Silveira³, Nicolas Grégoire⁴, Steeve Morency⁴, Younès Messaddeq⁴, Claudio Floridia¹, Joao B. Rosolem¹; *1CPqD - Research and Development Center in Telecommunications, Brazil; 2Centro de Tecnologia da Informação (CTI) Renato Archer, Brazil; 3São Paulo State Univ. (UNESP), Brazil; 4Université Laval, Canada*. We investigated important aspects of design tolerances of devices based on biconical tapered fibers. Special focus is given to spectral filters defined by tapering two distinct depressed-cladding fibers.

Tu5B.4 • 19:00

Multi-analyte Refractive Index Sensor Based on Hybrid Long Range Plasmon Modes in H-shaped Optical Fiber, Nelson Gomez-Cardona^{3,2}, Erick Reyes-Vera^{1,3}, Pedro Torres²; *1Departamento de Ingeniería Eléctrica y Electrónica, Universidad Nacional de Colombia, Sede Bogotá, Colombia; 2Escuela de Física, Universidad Nacional de Colombia, Sede Medellín, Colombia; 3Departamento de Electrónica y Telecomunicaciones, Instituto Tecnológico Metropolitano, Colombia*. We propose a novel design for a multianalyte refractive index sensor based on hybrid long-range plasmon in H-shaped microstructured optical fiber. Good sensitivity, as high as 4.2x10³ nm/RIU, can be achieved with the proposed structure.

Tu5B.5 • 19:15

Polymer Comparison on Temperature Sensors Based on Fiber-Optic Fabry-Perot Interferometer, Sigifredo Marrujo¹, Sofia Flores-Hernández¹, Miguel Torres-Cisneros¹, Daniel López-Cortés³, David Monzón², Daniel May-Arrijo³, Iván Hernández-Romano¹; *1Guanajuato Univ., Mexico; 2Centro de Investigaciones en Óptica, Mexico; 3Centro de Investigaciones en Óptica, Mexico*. We compare the behavior of three temperature sensors based on fiber optic Fabry-Perot interferometers (FPI). The length of the cavities were 30 ± 2 μm and they were filled with polydimethylsiloxane, poly(methyl methacrylate), and the optical adhesive NOA61. The sensitivities for each sensor were 2.20 nm/°C, 0.42 nm/°C, and 0.57 nm/°C, respectively.

Room 3

18:00–19:30

Tu5C • Biophotonics and Biomedical Applications

Presider: To be Announced

Tu5C.1 • 18:00 **Invited**

Towards In-Vivo Characterization and Deep Imaging of the Cornea and Beyond, Kristina Irsch^{1,2}; *1Institut de la Vision, Sorbonne Univ., France; 2The Wilmer Eye Inst., The Johns Hopkins Univ. School of Medicine, USA*. This talk reviews the ongoing work towards in-vivo characterization and deep imaging of the human eye, primarily for the purpose of quantifying corneal transparency, for which to date no objective clinical tool exists.

Tu5C.2 • 18:30

Evaluation of Optical Access to the Brain in the Near Infrared Range with a Transparent Cranial Implant, Mildred Socorro Cano Velazquez¹, Nami Davoodzadeh², David Halaney², Carrie Jonak³, Devin K. Binder³, Guillermo Aguilar², Juan Hernandez-Cordero¹; *1Instituto de Investigaciones en Materiales, Universidad Nacional Autonoma de Mexic, Mexico; 2Department of Mechanical Engineering, Univ. of California, Riverside, USA; 3Division of Biomedical Sciences, Univ. of California, Riverside, USA*. We report on the improvements in optical access provided by a transparent cranial implant for brain studies in the Near Infrared range. Comparison between the cranial implant and murine native skull by ex-vivo transmittance measurements and Laser Speckle Imaging are presented.

Tu5C.3 • 18:45

Photodynamic Therapy with Amber LED and Methyl Aminolevulinic Acid Gold Nanosensitizer in THP-1 Macrophages, Karina O. Gonçalves^{1,2}, Lilia C. Courrol¹, Daniel P. Vieira²; *1Unifesp, Brazil; 2Centro de Biotecnologia, Instituto De Pesquisas Energéticas e Nucleares - Ipen, Brazil*. Gold nanoparticles synthesized with aminolevulinic acid were tested in macrophage cell culture to evaluate their toxicity and photodynamic therapy performance with LED irradiation. The goal was to improve drug delivery for atherosclerosis treatment since protoporphyrin IX, a subproduct of aminolevulinic acid, accumulates preferably in macrophages.

Tu5C.4 • 19:00 **Invited**

Photoacoustic and Raman Methods for Physicochemical Analysis in Restorative Dentistry, Mauro L. Baesso¹, Adriana L. Ubal dini¹, Bruna M. Oliveira¹, Renata Paschetto¹, Francielle Sato¹, Antonio C. Bento¹; *1UEM, Brazil*. Photoacoustic and Raman methods were used for physicochemical analysis in restorative dentistry. The interaction of restorative adhesive system with dentin is investigative, especially the study of mineral formation and the characteristic of resin-dentin interfaces.

Room 4

18:00–19:30

Tu5D • Quantum and Classical Light

Presider: *Silvia Ledesma; Universidad de Buenos Aires, Argentina*

Tu5D.1 • 18:00 **Invited**

Optical Polarization Coherence Sharing, Xiao-Feng Qian¹; ¹Univ. of Rochester, USA. Abstract not available.

Tu5D.2 • 18:30

Experimental Bell Violations with Entangled and Non-Entangled Optical Fields, Junior R. Gonzales Ureta¹, Piero L. Sanchez¹, Victor Avalos¹, Francisco De Zela¹; ¹Pontifical Catholic Univ., Peru. We report Bell violations with classical light prepared in entangled and nonentangled polarization-path states. This shows that Bell violations do not necessarily falsify local-realism, but exhibit the shortcomings of Bell-type correlations.

Tu5D.3 • 18:45 **Invited**

Generating, Manipulating and Detecting Quantum States of Light at the Nanoscale, Val Zwillner¹; ¹Royal Inst. of Technology, Sweden. We develop quantum devices based on nanostructures to generate quantum states of light with semiconductor quantum dots, single photon detectors based on superconducting nanowires and on-chip circuits based on waveguides to filter and route light.

Tu5D.4 • 19:15

Experimental Tests of the Relationship between Visibility, Distinguishability and the Degree of Polarization, Piero L. Sanchez¹, Junior R. Gonzales Ureta¹, Victor Avalos¹, Fabio Aucahualla¹, Elmer Suarez¹, Francisco De Zela¹; ¹Pontificia Universidad Catolica del Peru, Peru. We present experimental tests of a recently reported generalization of the polarization coherence theorem.

Room 5

18:00–19:15

Tu5E • Optical Modulation and Coding

Presider: *Lidia Galdino; Univ. College London, UK*

Tu5E.1 • 18:00 **Invited**

Modulation and Coding for Spatial Division Multiplexing Systems, Tobias A. Eriksson¹, Georg Rademacher¹, Ruben Luis¹, Benjamin J. Puttnam¹; ¹National Inst of Information & Comm Tech, Japan. We present modulation formats designed for the SDM channels with hard-decision FEC. We also review how soft-decision FEC with code word interleaving over spatial modes enabled record bitrate-distance products in few mode fiber transmission.

Tu5E.2 • 18:30

On the Impact of Probabilistic Shaping on the Cycle Slip Occurrence, Fabio A. Barbosa^{1,2}, Darli Mello¹, Jacklyn D. Reis²; ¹Univ. of Campinas, Brazil; ²Idea! Electronic Systems, Brazil. We investigate the impact of probabilistic shaping (PS) on the cycle slip (CS) probability of phase recovery using the blind phase search (BPS) algorithm. The results show a strong dependence of CS on PS.

Tu5E.3 • 18:45

Geometric Constellation Shaping with Demodulation Based-on Clustering to Mitigate Phase-Noise in Radio-over-Fiber Systems, Eduardo A. Fernandez^{1,2}, Ana M. Cardenas¹, Jhon J. Granada Torres¹, Neil G. Gonzalez¹; ¹Facultad de Ingenieria, Universidad Nacional, Colombia; ²Ingenieria Electrónica, Universidad Pedagógica y Tecnológica de Colombia, Colombia. Geometric constellation shaping based on rings rely on clustering demodulation were evaluated experimentally in Radio-over-Fiber scenario under phase noise issues. We achieve an improvement in OSNR of 2.9 dB using FCM Gustafson-Kessel based-demodulation for 16-QAM.

Tu5E.4 • 19:00

Adaptive Phase-Offset Compensation on Fragmented Constellation Diagrams in Radio-over-Fiber Systems, Eduardo A. Fernandez^{3,2}, Ana M. Cardenas³, Neil G. Gonzalez¹, Giovanni Serafino⁴, Antonella Bogoni^{4,5}, Francesco Fresi⁴; ¹Facultad de Ingenieria, Universidad Nacional, Colombia; ²Escuela de Ingenieria Electrónica, Universidad Pedagógica y Tecnológica de Colombia, Colombia; ³Facultad de Ingenieria, Universidad de Antioquia, Colombia; ⁴Photonics, CNIT – National Laboratory of Photonic Networks, Italy; ⁵Photonics, Scuola Superiore Sant'Anna – TeCIP Inst., Italy. A phase-offset compensation by dual-stage ring fragmentation and clustering of 16-QAM and APSK constellation is demonstrated experimentally in RoF scenario. OSNR improvements of 3.3 dB and 1.4 dB for 16-QAM and 12+4 PSK, respectively, are obtained.

08:30–11:00

W1A • Plenary Session II

W1A.1 • 08:30 **Plenary**

Deep Learning Optics, Aydogan Ozcan, *University of California Los Angeles, USA*. We will discuss applications of the state-of-art deep learning methods on optical microscopy and microscopic image reconstruction, which enable image enhancement and new transformations among different modalities of imaging, driven entirely by image data.

W1A.2 • 09:20 **Plenary**

Next Generation Photonics Based on 2D Materials, Michal Lipson¹; ¹*Columbia Univ., USA*. Two dimensional materials such as monolayer transition metal dichalcogenides (TMD) are expected to have large changes in their optical sheet conductivity by controlling their carrier densities. We demonstrate a platform for waveguide-integrated phase modulators in the near-infrared regime based on Tungsten disulphide (WS₂) gating.

W1A.3 • 10:10 **Plenary**

Advances in Semiconductor-Core Fibers, Ursula J. Gibson¹; ¹*Norges Teknisk Naturvitenskapelige Univ., Norway*. Optical fibers excel in signal transmission, while semiconductor-core fibers are finding uses in non-linear optics and optoelectronics; as solar cells, optical sources, detectors and switches. Laser processing of these materials is opening up intriguing possibilities.

11:00–11:30 Coffee Break

Room 1

11:30–13:00

W2A • Complex Photonics

Presider: Maxime Jacquot; Univ. Bourgogne Franche-Comté, France

W2A.1 • 11:30 **Invited**

Toward a Thinking Microscope: Deep Learning in Optical Microscopy and Image Reconstruction, Aydogan Ozcan¹; ¹*Univ. of California Los Angeles, USA*. In this presentation, I will provide an overview of some of our recent work on the use of deep neural networks in advancing computational microscopy and sensing systems, also covering their biomedical applications.

W2A.2 • 12:00 **Invited**

Reinforcement Learning in a Large Scale Photonic Network, Daniel Brunner¹, Maxime Jacquot², Ingo Fischer³, Laurent Larget²; ¹*CNRS - FEMTO-ST, France*; ²*FEMTO-ST, Univ. Burgundy Franche-Comte, France*; ³*IFISC (UIB-CSIC), Spain*. I will present fully-implemented large scale recurrent photonic neural networks. We photonically created parallel connections for 2025 nonlinear oscillators and efficiently converging photonic reinforcement learning. The system is applied to a chaotic signal prediction benchmark.

W2A.3 • 12:30

Estimating Band Diagrams of Photonic Crystals with Multilayer Feed-forward Neural Network, Adriano d. Ferreira^{1,2}, Gilliard N. Malheiros-Silveira^{1,3}, Hugo E. Hernández-Figueroa¹; ¹*Department of Communications, Universidade Estadual de Campinas, Brazil*; ²*São Paulo Federal Inst. of Education, Science and Technology, Brazil*; ³*São Paulo State Univ., Brazil*. We designed a Multilayer Perceptron (MLP) feed-forward Artificial Neural Network for estimating band diagrams of tri-dimensional photonic crystals. We show a simple and fast-training MLP model able to build accurate band diagrams through speedy computations.

W2A.4 • 12:45

Active Matter Alters the Growth Dynamics of Coffee Rings, Agnese Callegari¹, Tugba Andac¹, Pascal Weigmann¹, Sabareesh K. Velu^{1,2}, Ergac Pince¹, Giorgio Volpe³, Giovanni Volpe^{4,1}; ¹*Bilkent Univ., Turkey*; ²*Univ. of Information Science and Technology "St. Paul the Apostle", Macedonia (the former Yugoslav Republic of)*; ³*Chemistry Department, Univ. College London, UK*; ⁴*Institutionen för Fysik, Göteborgs Universitet, Sweden*. We show that bacterial mobility starts playing a major role in determining the growth dynamics of the edge of drying droplets, as the droplet evaporation rate slows down.

Room 2

11:30–12:45

W2B • Physical Optics

Presider: To be Announced

W2B.1 • 11:30 **Invited**

Geometric Phases in Optics, Miguel A. Alonso^{1,2}; ¹*Univ. of Rochester, USA*; ²*Aix Marseille Univ., Institut Fresnel, CNRS, Centrale Marseille, France*. Several aspects of geometric phases in optics are discussed, including the transmission of phase through birefringent elements and their applications in interferometry, polarimetry and imaging, geometric phases for nonparaxial light and for structured light beams.

W2B.2 • 12:00

Sequential Wavefront Sensing Using a Scanning Aperture, Brian Vohnsen¹, Alessandra Carmichael Martins¹; ¹*Univ. College Dublin, Ireland*. Sequential sensing of optical aberrations allow for a large dynamical range and tunability. We show results with sensing and reconstruction using a scanning aperture on a digital micromirror device and apply it to ophthalmology.

W2B.3 • 12:15

Design of a Linear in Wavenumber Spectrometer, Sebastian Ruiz Lopera¹, René Retrepo¹; ¹*Applied Optics Group, Universidad EAFIT, Colombia*. We describe the optical design of a linear in wavenumber spectrometer that combines a grating and a prism. OpticStudio software was used to validate the performance of the design. High linearity in k-space was achieved.

W2B.4 • 12:30

Monoscopic Multifocus In Polarization Images For Biological Samples Segmentation, Camilo Cano Barrera¹, René Restrepo¹; ¹*EAFIT, Colombia*. We present an implementation based on polarization images acquisition for different focus planes in a microscope, allowing the volumetric segmentation of structured biological samples like onion cellular walls.

Room 3

11:30–13:00

W2C • Imaging Processing and Vision I

Presider: To be Announced

W2C.1 • 11:30 **Invited**

Computational Intelligence Algorithms for Digital Image Processing and Optical Metrology, Francisco Javier Cuevas de la Rosa¹; ¹*Centro de Investigaciones en Optica AC, Mexico*. In this talk, it is presented a brief description of the main algorithms that can be applied in digital image processing and optical metrology problems. Some results are presented in digital image processing for the recovery of fringe patterns obtained from interferometric experiments and structured light projection.

W2C.2 • 12:00 **Invited**

Optical Correction of the Effects of Cataracts, Augusto Arias¹, Enrique Fernandez¹, Pablo Artal¹; ¹*Laboratorio de Optica - U. de Murcia, Spain*. Wavefront shaping technique was applied to compensate the effects of cataracts. Its performance was experimentally evaluated through objective and subjective methods.

W2C.3 • 12:30

Implementation of a Digital In-Line Holographic Microscope for the Study of Plant Tissues, Marcela Duarte Espinosa^{2,1}; ¹*Universidad Nacional de Colombia, Colombia*; ²*Universidad El Bosque, Colombia*. This paper digital in-line holographic microscopy (DIHM) as a "no marker" technique to study the morphology and size of plant tissues through the amplitude reconstruction of the recorded complex optical fields.

W2C.4 • 12:45

Global Blind Deconvolution of Fluorescence Lifetime Imaging Microscopy, Ricardo Salinas-Martinez¹, Daniel U. Campos-Delgado¹, Javier A. Jo²; ¹*Facultad de Ciencias, Universidad Autonoma de San Luis Potosi, Mexico*; ²*Biomedical Engineering Department, Texas A&M Univ., USA*. A global blind deconvolution estimation of fluorescence lifetime imaging microscopy measurements is proposed by using a multi-exponential model, constrained optimization, and alternating least squares. A comprehensive validation is presented in two stages: fluorescence dyes and oral tissue samples.

13:00–14:30 Lunch On Your Own

08:30–11:00

W1A • Plenary Session II

W1A.1 • 08:30 **Plenary**

Deep Learning Optics, Aydogan Ozcan, *University of California Los Angeles, USA*. We will discuss applications of the state-of-art deep learning methods on optical microscopy and microscopic image reconstruction, which enable image enhancement and new transformations among different modalities of imaging, driven entirely by image data.

W1A.2 • 09:20 **Plenary**

Next Generation Photonics Based on 2D Materials, Michal Lipson¹; ¹*Columbia Univ., USA*. Two dimensional materials such as monolayer transition metal dichalcogenides (TMD) are expected to have large changes in their optical sheet conductivity by controlling their carrier densities. We demonstrate a platform for waveguide-integrated phase modulators in the near-infrared regime based on Tungsten disulphide (WS₂) gating.

W1A.3 • 10:10 **Plenary**

Advances in Semiconductor-Core Fibers, Ursula J. Gibson¹; ¹*Norges Teknisk Naturvitenskapelige Univ., Norway*. Optical fibers excel in signal transmission, while semiconductor-core fibers are finding uses in non-linear optics and optoelectronics; as solar cells, optical sources, detectors and switches. Laser processing of these materials is opening up intriguing possibilities.

11:00–11:30 Coffee Break

Room 4

11:30–13:00

W2D • Laser Science and Technology II

Presider: Majid Ebrahim-Zadeh; ICFO -Institut de Ciencies Fotoniques, Spain

W2D.1 • 11:30 **Invited**

Compact Fiber Frequency Combs for Precision Measurement Outside the Metrology Lab, Laura C. Sinclair¹, Jean-Daniel Deschênes^{2,3}, William C. Swann¹, Isaac Khader¹, Hugo Bergeron², Esther Baumann¹, Sarah Stevenson¹, Paritosh Manurkar¹, Ian Coddington¹, Nathan R. Newbury¹; ¹*National Inst of Standards & Technology, USA*; ²*Universite Laval, Canada*; ³*Octosig Consulting, Canada*. We discuss the development of compact fiber frequency combs which can enable precision measurements outside of the metrology lab. To illustrate their impact, we present recent results using these combs for optical two-way time-frequency transfer.

W2D.2 • 12:00

Ultrashort Pulse Generation Performance in Short and Ultralong EDFL Cavities Using CVD Monolayer Graphene, Juan D. Zapata¹, David Steinberg², Thoroh A. De Souza², Lúcia A. Saito²; ¹*Electronic Engineering, Universidad de Antioquia, Colombia*; ²*MackGraphe – Graphene and Nanomaterials Research Center, –Mackenzie Presbyterian Univ., Brazil*. We investigated ultrashort pulses generation in short and ultralong EDFL cavities using CVD monolayer graphene onto D shaped optical fiber as polarizer and saturable. The pulses duration performance was between 168 fs and 3.4 ps.

W2D.3 • 12:15 **Invited**

Recent Technological Advances in Ultrafast Lasers, Catalin Neacsu¹; ¹*Amplitude Laser Group, USA*. We report on various laser technologies and applications: industrial-grade XUV light sources driven by high repetition-rate Yb lasers with highest flux to date, high repetition rate PW laser systems, high energy lasers for gamma sources.

W2D.4 • 12:45

>11-W 2.05- μ m Holmium Fiber Laser Pumped by 1.13- μ m Ytterbium Fiber Laser, Alexander V. Kir'yanov¹, Yuri O. Barmenkov¹; ¹*Centro de Investigaciones en Optica AC, Mexico*. We report recent progress towards effective 2- μ m lasing employing an all-fiber Holmium fiber laser, pumped by a 1.13- μ m Ytterbium fiber laser: ~11.1-W CW narrow-line ~2.05- μ m output power is accessed at ~35-W 1.13- μ m pump power.

Room 5

11:30–13:00

W2E • Spatiotemporal Nonlinear Optics Dynamics

Presider: Moritz Merklein; Univ. of Sydney, Australia

W2E.1 • 11:30 **Invited**

Ultrafast Dynamics of Nonlinear Refraction, David J. Hagan¹; ¹*Univ. of Central Florida, CREOL, USA*. We introduce the nonlinear beam deflection technique that allows unambiguous separation of slow and fast nonlinearities. This highly sensitive method allowed characterization of a wide range of materials, including solvents, gases, semiconductors and transparent conducting oxides.

W2E.2 • 12:00 **Invited**

High Repetition Rate Ultrafast Soliton Fiber Lasers, Michelle Y. Sander¹; ¹*Boston Univ., USA*. Pathways for the generation of high repetition rate soliton lasers and design challenges are discussed. Applications and different cavity configurations for ultrafast GHz fiber lasers and their nonlinear dynamics are presented.

W2E.3 • 12:30

Supercontinuum Generation by Cascaded Intermodal Raman and FWM Processes in Step-index Few-mode Fibers, Thibaut Sylvestre¹; ¹*CNRS FEMTO-ST, France*. This work shows that step-index few-mode fibers can be combined with a simple microchip picosecond laser to give a multi-octave spanning supercontinuum output by cascaded Raman scattering and intermodal four-wave mixing.

W2E.4 • 12:45

Rogue Waves in Photorefractive SBN Crystals, Rodrigo A. Vicencio¹, Ignacio A. Salinas¹, Carla Hermann-Avigliano¹, Danilo A. Rivas¹, Bastian Real¹, Cristian Mejia-Cortes², Ana Mancic³, Aleksandra Maluckov⁴; ¹*Universidad de Chile, Chile*; ²*Universidad del Atlantico, Colombia*; ³*Universidad of Nis, Serbia*; ⁴*Vinca Inst. of Nuclear Sciences, Serbia*. We report on the excitation of large-amplitude waves, with very low probability, in photorefractive SBN crystals. We excite the system with a narrow gaussian beam and observe different dynamical regimes tailored by the crystal nonlinearity.

13:00–14:30 Lunch On Your Own

Room 1

14:30–16:30

W3A • Harnessing Quantum Features

Presider: Ruben Fonseca, Universidad de la Costa CUC, Colombia

W3A.1 • 14:30 **Invited**

Optical Resolution at the Quantum Limit, Zdenek Hradil¹, Jaroslav Rehacek¹, Bohumil Stoklasa¹, Martin Paur¹, Andrei Krzic¹, Jai Grover¹, Luis Sanchez-Soto^{2,3}; ¹Department of Optics, Palacky Univ., Czechia; ²Departamento de Optica, Facultad de Fisica, Universidad Complutense, Spain; ³Max-Planck-Institut für die Physik des Lichts, Germany; ⁴ESA—Advanced Concepts and Studies Office, European Space Research Technology Centre (ESTEC), Netherlands. We establish the multiparameter quantum Cramer-Rao bound (qCRB) for quantum inspired imaging of two incoherent point sources. Analysis of the ultimate bounds may pave the way for future practical applications in optical metrology.

W3A.2 • 15:00

Decoding Vortex Beams with Shear Interferometry, Enrique J. Galvez¹, Behzad J. Khajavi¹, Junior R. Gonzales Ureta^{1,2}; ¹Colgate Univ., USA; ²Physics, Pontifical Catholic Univ. of Peru, Peru. Optical vortices can be used to encode information in optical beams. We present a method to decode the superposition of two vortex beams: determining the topological charges and their relative amplitude and phase.

W3A.3 • 15:15 **Invited**

Metrological Power of Extremal Majorana Constellations, Luis Sanchez-Soto¹; ¹Universidad Complutense, Spain. Abstract not available.

W3A.4 • 15:45

Coupling Different Degrees of Freedom of Light to Study Open Quantum Systems, Daniel Furrego¹, Jiri Svazilik¹, Mayerlin Nunez Portela¹, Alejandra Valencia¹; ¹Universidad de los Andes (Colombia), Colombia. Coupling light spatial variables and its polarization, we report an all-optical experiment in which we implement a dephasing channel and generate Markovian and non-Markovian dynamics by environment engineering via spatial interference of light.

W3A.5 • 16:00 **Invited**

Solar-Pumped Laser with Intra-Cavity Photovoltaic Cell for Energy Conversion, Sascha Wallentowitz¹; ¹Instituto de Fisica, Pontificia Universidad Catolica de Chile, Chile. It is shown how the efficiency limit of a photovoltaic cell can be overcome by placing it within the cavity of a solar-pumped co-doped Nd:YAG laser. The power conversion efficiency, among other aspects, is discussed.

Room 2

14:30–16:30

W3B • Sensing Technologies II

Presider: Juan Hernandez-Cordero; Univ Nacional Autonoma de Mexico, Mexico

W3B.1 • 14:30 **Invited**

Optical Frequency-Domain Reflectometry for Monitoring Carbon Fiber Reinforced Polymer Structures, Marcelo A. Soto^{1,2}, Pingyu Zhu²; ¹Electronic Engineering, Universidad Técnica Federico Santa María, Chile; ²Mechanical and Electric Engineering, Guangzhou Univ., China. Optical frequency-domain reflectometry offers relevant sensing features, such as distributed, high spatial resolution and dynamic capabilities, for monitoring machining processes. The benefits of this technology for monitoring carbon fiber composite structures are here reviewed.

W3B.2 • 15:00

Surface-core Fibers: Plasmonics and Sensing, Jonas H. Osório², Antti Matikainen¹, Hanne Ludvigsen¹, Cristiano M. Cordeiro²; ¹Aalto Univ., Finland; ²UNICAMP, Brazil. We investigated surface-core fibers as a platform for refractive index sensing using surface plasmon resonance. The high sensitivity (1380 nm/RIU), the increased robustness and easy preparation makes surface-core fibers a promising platform for sensing.

W3B.3 • 15:15

Nanostructures for Highly Sensitive Surface Plasmon Resonance Sensors and Confinement of IR Energy in Two-dimensional Materials, Suresh C. Sharma², Kunal Tiwari¹, Hussein Akafzade², Nader Hozhabri²; ¹Univ. of Texas at Arlington, USA; ²Physics, Univ. of Texas at Arlington, USA; ³Nanotechnology Research Center, Shimadzu Inst., Univ. of Texas at Arlington, USA. We discuss nanostructures for highly-sensitive surface plasmon sensors, novel pump-probe fixed-detector SPR spectrometer to study SPR-semiconductor QDs' interactions, and present preliminary results on the compression of IR energy in 2D materials.

W3B.4 • 15:30

Fiber Optic Temperature Sensors with Polymer-based Fluorescent Materials, Sandra S. Escobar^{1,2}, Juan Hernandez-Cordero¹; ¹UNAM, Mexico; ²Materiales complejos, Instituto de Investigaciones en Materiales, Mexico. Optical fiber sensors based on the fluorescence emission of rare-earth active ions mixed with polydimethylsiloxane (PDMS) are demonstrated. The sensors use off-the shelf materials and are easy to fabricate, showing good performance and excellent linearity.

W3B.5 • 15:45

Geotechnical Inclinomater Based on FBG, Maria J. Nieto callejas¹, Alvaro J. Castro-Caicedo¹, Pedro Torres¹; ¹Universidad Nacional de Colombia, Colombia. This paper presents a geotechnical inclinometer with FBG sensors attached to the inner wall of their pipeline casing. The analysis of results indicates the feasibility of the system.

W3B.6 • 16:00

Refractive Index Measurement using Diffraction in Photonic Crystal Fibers, Marcelo L. da Silva¹, Cicerio Martelli¹, John Canning²; ¹CPGEE, UTFPR - Federal Univ. of Technology - Paraná, Brazil; ²School of Electrical & Data Engineering, Univ. of Technology, Australia. Refractive index measurements within photonic crystal fibres is demonstrated using short wavelength diffraction resulting from controlled bend loss induced light leakage.

W3B.7 • 16:15

All-fiber Coaxial Mach-Zehnder Digital Sensor, Sergio Celaschi², Gilliard N. Malheiros-Silveira³, Claudio Florida¹, Joao B. Rosolem¹; ¹CPqD - Research and Development Center in Telecommunications, Brazil; ²Centro de Tecnologia da Informação (CTI) Renato Archer, Brazil; ³São Paulo State Univ. (UNESP), Brazil. We proposed a novel digital optical sensor designed from a tapered depressed-cladding fiber. The dynamic range is estimated 20 dB as its linear response for stresses up to 8 % of the elastic limit of the material.

Room 3

14:30–15:30

OSA Senior Member Workshop: Enhancing Diversity in Optics Leadership, Enhancing Careers

Facilitated by: Arti Agrawal, University of Technology Sydney, Australia

This workshop aims to encourage participants, especially women and people from underrepresented groups to apply for the senior member designation. The OSA senior membership designation recognizes experience and professional accomplishments within the field. It is useful for career progression and recognition by peers. Individuals can self apply or be nominated. Proportion of senior members who are female, and/or from regions (Asia, South America, Africa) and/or ethnic minority is low.

Participants will:

- Learn about application/nomination process
- Assessment of applications
- Have the option to informally discuss their application/nomination
- Learn more about the benefits of being a senior member

15:30–16:00

Case Study of an Optoelectronics Medical Equipment Manufacture in Brazil

W3C • 15:30 **Invited**

Case Study of an Optoelectronics Medical Equipment Manufacturer in Brazil, Jarbas Castro¹; ¹USP, Brazil. In my presentation I will discuss a case of one of my companies, Opto Eletronica SA. The company, started in 1986, became in 2014, a 40 USD\$ million business, with approximately 400 employees, a manufacturing large line of high tech equipment for ophthalmology, including lasers, fundus cameras, microscopes, etc. The business model will be discussed.

16:30–17:00 Coffee Break

Room 4

14:30–16:00

W3D • Optical Access

Presider: Neil Gonzalez; National Univ. of Colombia, Colombia

W3D.1 • 14:30 **Invited**

mm-Wave and THz Analog Radio-over-Fiber for 5G, Wireless Communications and Sensing, Simon Rommel¹, Alvaro Morales¹, Dimitrios Konstantinou¹, Thiago R. Raddo¹, Idelfonso Tafur Monroy¹; ¹*Inst. for Photonic Integration, Eindhoven Univ. of Technology, Netherlands*. Analog radio-over-fiber transmission and millimeter-wave and terahertz signal generation through photonic heterodyning are a valuable and versatile solution for many applications. This talk will discuss recent advances, focusing 5G networks, wireless communications and sensing applications.

W3D.2 • 15:00 **Invited**

Optical Technologies for the 5G Mobile Networks, Patryk J. Urban^{1,2}, Tomasz Nasitowski¹, Tadeusz Tenderenda¹, Grzegorz Żegliński², Ewa Weinert-Rączka²; ¹*InPhoTech, Poland*; ²*Westpomeranian University of Technology, Poland*. Optical networks must evolve to meet future communication requirements. This includes support for high-bandwidth demanding next generation mobile networks. Such needs can be addressed by multi-core fibers (MCF) and MCF-related technologies as fan-in/out components and splicing techniques.

W3D.3 • 15:30

Increasing VLC Nonlinearity Tolerance by CE-OFDM, Klaas M. van der Zwaag¹, José L. Neves¹, Helder R. Rocha¹, Marcelo E. Segatto¹, Jair L. Silva¹; ¹*Federal Univ. of Espirito Santo, Brazil*. We experimentally demonstrate constant-envelope OFDM transmission in visible light communication (VLC) systems to increase the tolerance to nonlinearities. An EVM gain of 3% (5.5dB) was achieved in a 2.5 m link, when compared to conventional OFDM.

W3D.4 • 15:45

A New All-Optical OFDM Architecture for NG-PON2, Pablo R. Marciano¹, Diogo V. Coelho², Jair L. Silva¹, Maria J. Pontes¹, Marcelo E. Segatto¹; ¹*Federal Univ. of Espirito Santo, Brazil*; ²*Electrical Engineering, Federal Univ. of Juiz de Fora, Brazil*. A new all-optical orthogonal frequency division multiplexing architecture based on a Mach-Zehnder interferometer is proposed. Our results show a throughput of 1.28 Tbps over 100 km of single mode fiber which is suitable for long reach NG-PON2 applications.

Room 5

14:30–16:30

W3E • Optomechanics and Integrated Nonlinear Optics

Presider: David Hagan; Univ. of Central Florida, CREOL, USA

W3E.1 • 14:30 **Invited**

From Parameter Extraction, Variability Models to Yield Prediction, Yufei Xing¹, Jiaying Dong¹, Umar Khan¹, Yinghao Ye¹, Domenico Spina¹, Tom Dhaene¹, Wim Bogaerts¹; ¹*Ghent Univ., Belgium*. We will discuss methods and workflow of variability analysis and yield prediction for integrated photonic circuits, describing the process from wafer-scale parameter extraction over spatial variability modelling to layout-aware yield prediction of photonic circuits.

W3E.2 • 15:00 **Invited**

Towards Fabless Optomechanics: Enhancing Light and Sound Interaction in a CMOS-Compliable Platform, Gustavo S. Wiederhecker¹, Newton C. Frateschi¹, Thiago Alegre¹, Paulo Dainese¹; ¹*Univ. of Campinas, Brazil*. In this talk I will review our recent efforts in enabling strong interaction between light and mechanical modes using a mixed foundry and in-house fabrication approach.

W3E.3 • 15:30 **Invited**

On-chip Brillouin-based Light Storage, Moritz Merklein¹; ¹*Univ. of Sydney, Australia*. We demonstrate a chip-integrated light storage scheme based on coherently transferring optical data pulses to acoustic waves. This technique enables simultaneous storage of multiple optical wavelengths, large fractional delays, and non-reciprocal operation.

W3E.4 • 16:00 **Invited**

Pushing Performances of Nonlinear Optics in Silicon Nitride Waveguides, Camille-Sophie Bres¹, Davide Grassani¹; ¹*Ecole Polytechnique Federale de Lausanne, Switzerland*. Silicon nitride waveguides offer excellent linear and nonlinear properties that can be exploited from the visible to the middle infrared. Here we will cover recent efforts on pushing performances of 3rd and 2nd order nonlinear wave mixing in such waveguides.

16:30–17:00 Coffee Break

17:00–18:30

W4A • Quantum Systems Interacting with Environments

Presider: Alejandra Valencia; Universidad de los Andes (Colombia), Colombia

W4A.1 • 17:00 **Invited**

Quantum Experiments with Massive, Mechanical Oscillators, Simon Gröblacher¹; ¹TU Delft, Netherlands. Mechanical oscillators coupled to light have attracted significant attention over the past years for their potential in testing quantum physics and in quantum information processing. Here, we would like to discuss the latest results.

W4A.2 • 17:30

From Rabi Oscillations to Adiabatic Passage in Multi-level Quantum Systems with a Train of Weak Pulses, Vladimir S. Malinovsky¹, Svetlana A. Malinovskaya², Bo Y. Chang³, Ignacio R. Sola⁴, Barry M. Garraway⁵; ¹US Army Research Laboratory, USA; ²Physics, Stevens Inst. Of Technology, USA; ³Chemistry, Seoul National Univ., Korea; ⁴Departamento de Química Física, Universidad Complutense, Spain; ⁵Physics, Univ. of Sussex, UK. We demonstrate an efficient population transfer in multi-level quantum systems without partial overlap of pump and Stokes sub-pulses of the weak pulse trains. The transfer mechanism and the robustness of the proposed scheme is discussed.

W4A.3 • 17:45 **Invited**

Entropy in the Atom-Field Interaction: Mixed Initial States, Jorge A. Anaya-Contreras², Hector Moya-Cessa¹, Arturo Zúñiga-Segundo²; ¹Optica, Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico; ²Física, Instituto Politécnico Nacional, Mexico. We show that the Araki-Lieb inequality may be used to calculate the atomic and field entropies even though atom or field may be initially described by mixed states.

W4A.4 • 18:15

Observation of the humidity induced oscillatory behavior of the Purcell factor in a single PEG nanofiber, Belkis Gokbulut¹, Mehmet Naci Inci¹; ¹Bogazici Univ., Turkey. Humidity induced oscillatory behavior of the Purcell factor of the Boradiazaindacene (BODIPY) dye molecules, doped in a PEG nanofiber, is investigated for the first time, using a time resolved fluorescence lifetime imaging technique.

17:00–18:30

W4B • Holography

Presider: To be Announced

W4B.1 • 17:00 **Invited**

In Line Microfluidic Holographic Tomography: a Biological Imaging Strategy for Single Cell Analysis, Pietro Ferraro^{3,2}, Pasquale Memmolo^{3,2}, Lisa Miccio^{3,2}, Francesco Merola^{3,2}, Martina Mugnano^{3,2}, Melania Paturzo^{3,2}, Massimiliano Villone^{1,2}, Pier Luca Maffettone^{1,2}; ¹Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale—DICMaPI, Univ. of Naples Federico II, Italy; ²NEAPoLIS Numerical and Experimental Advanced Program on Liquids and Interface Systems, Italy; ³Inst. of Applied Sciences & Intelligent Systems, CNR-ISASI, Italy. A novel strategy for imaging single cells while they flow along microfluidic chips is shown. Thanks to digital holography modality, it is possible to obtain full phase-contrast tomograms. Results on various biological cells are reported.

W4B.2 • 17:30 **Invited**

Digital Holographic Interferometry in the Biomedical Field Toward Non-Destructive Characterization of Specimens, Maria d. Hernandez Montes¹; ¹Centro de Investigaciones en Optica AC, Mexico. Digital Holographic Interferometry is attractive to detect in real time changes in the surface of specimens. The displacements characterization is based on distinctive unwrapped phase. These phase maps can utilize to investigate alterations, among others.

W4B.3 • 18:00

Computational and Photorefractive Holographic Techniques Applied in Generation and Analysis of Non-diffracting Beams, Marcos R. Gesualdi¹; ¹Universidade Federal do ABC, Brazil. This work presents the generation and analysis of non-diffracting beams via holographic techniques. The realization of non-diffracting beams was made in a computational holography CGH algorithms. The optical generation were obtained via spatial light modulators systems (Lcos and photorefractive materials); and, their analysis by digital holography.

W4B.4 • 18:15

Enlarging Computer-Vision Sensing-Capabilities Using Pseudo-Periodic Patterns, Patrick Sandoz¹, Maxime Jacquot¹, Valérian Guélp¹, July Galeano², Emilie Gaiiffe³, Miguel Asmad Vergara^{1,4}, Cédric Clévy¹, Guillaume J. Laurent¹; ¹FEMTO-ST Inst., Université Bourgogne Franche-Comté, CNRS, France; ²Instituto Tecnológico Metropolitano, ITM, Medellín, Instituto Tecnológico Metropolitano, ITM, Medellín, Colombia; ³Univ. Hospital of Besançon, Fédération Hospitalo-Universitaire INCREASE, Univ. Bourgogne Franche-Comté, INSERM, EFS BFC, UMR1098, France; ⁴Departamento de Ciencias, Pontificia Universidad Católica del Perú, Apartado 1761, Lima, Peru. Using pseudo-periodic patterns on the observed target releases usual computer-vision constraints by allowing sub-pixel resolutions together with supra field-of-observation absolute measurement ranges. The allowed range of working distances is also tremendously extended using digital holography.

17:00–18:30

W4C • Imaging Processing and Vision II

Presider: To be Announced

W4C.1 • 17:00 **Invited**

Diffractive Optics Applied to Vision, Alejandro Mira-Agudelo¹; ¹Universidad de Antioquia, Colombia. Concepts of diffractive optical elements are presented, with examples of that kind of components applied to vision, starting with the diffractive version of lenses and following with multifocal or extended depth of focus diffractive elements.

W4C.2 • 17:30 **Invited**

The Impact of Scattering on Vision and the Importance of Measuring It, Alexandros Pennos^{1,2}, Harilaos S. Giniis³, Pau Santos², Dimitrios Christaras¹, Pablo Artal¹; ¹Universidad de Murcia, Laboratorio de Óptica, Spain; ²Visionmetrics S.L., Spain; ³Athens Eye Hospital, Greece. A very common descriptor of the human visual function, is the Visual Acuity (VA). Unfortunately, it falls short to precisely detect effects of another very common reason of visual deterioration, the effects of -Intraocular- Scattering.

W4C.3 • 18:00

Complex Wavefront Reconstruction by Binary Amplitude Modulation, Eduardo Peters¹, Jaime A. Anguita¹, Gustavo Funes¹; ¹Faculty of Engineering and Applied Sciences, Universidad de los Andes, Chile. We propose a phase reconstruction technique based on binary amplitude modulation onto the object and intensity patterns recorded at a single plane. This method is suitable for characterization of optical vortices carrying OAM.

W4C.4 • 18:15

Adaptive Filtering of Interference Fringes by Polar Transformation and Empirical Mode Decomposition, Hernando Altamar-Mercado¹, Alberto Patiño-Vanegas¹, Andres G. Marrugo¹; ¹Universidad Tecnológica de Bolívar, Colombia. We designed an adaptive filter based on empirical mode decomposition for the removal of fringes in an interference microscopy image. Promising results show the possibility for extended depth-of-field imaging.

Room 4

17:00–18:30

W4D • Novel Platforms

Presider: Miguel Levy; Michigan Technological Univ., USA

W4D.1 • 17:00 **Invited**

Silicon Nanophotonics - Dispersion and Optical Forces, Vilson R. Almeida^{1,2}, Janderson R. Rodrigues¹; ¹Instituto Tecnológico de Aeronáutica, Brazil; ²Instituto Científico e Tecnológico da Universidade Brasil, Brazil. We rigorously analyze the effects of dispersion forces (Casimir and van der Waals forces) on a nano-optomechanical device based on a silicon waveguide and silicon dioxide substrate, surrounded by air and driven by optical forces.

W4D.2 • 17:30

Plasma-etched GaAs Optomechanical Microdisks Fabricated with an Electro-lithographic Soft Mask, Rodrigo da Silva Benevides¹, Michaël Ménard², Gustavo S. Wiederhecker¹, Thiago Alegre¹; ¹Unicamp, Brazil; ²Univ. of Quebec, Canada. A method to fabricate GaAs optomechanical single and coupled microdisks using only a soft electro-lithographic mask and inductive coupled plasma etching is presented. Optical quality factors of $Q_{opt} \sim 1.2 \times 10^5$ are achieved.

W4D.3 • 17:45

Stable Propagation of Orbital Angular Momentum Modes in Pedestal Waveguides, José A. Borda Hernandez¹, marco i. alayo², Daniel O. Carvalho³, Hugo E. Hernandez-Figueroa¹; ¹Univ. of Campinas, Brazil; ²Univ. of São Paulo, Brazil; ³Univ Est Paulista Julio Mesquita Filho, Brazil. We use numerical simulations to show that, even under common perturbations such as waveguide bends, pedestal waveguides are suited for stable propagation of modes carrying orbital angular momentum (OAM) in integrated devices.

W4D.4 • 18:00

Overcoming Optical Spring Effect with Thermo-opto-mechanical Coupling in GaAs Microdisks, Rodrigo da Silva Benevides¹, Natalia C. Carvalho¹, Michaël Ménard², Newton C. Frateschi¹, Gustavo S. Wiederhecker¹, Thiago Alegre¹; ¹Unicamp, Brazil; ²Univ. of Quebec, Canada. We demonstrate a composite coupling between optical fields, acoustic modes and thermal expansion in gallium arsenide microdisks. A relationship between optical detuning and mechanical frequency diverse from traditional optomechanical theory is also observed.

W4D.5 • 18:15

Propagation and Spectroscopic Analysis of Femtosecond Laser Written Waveguides in Er/Yb LiNbO₃ Crystals, Demian Biasetti¹, Eugenio Cantelar³, Gustavo Torchia^{1,2}; ¹Centro de Investigaciones Ópticas, Argentina; ²Ciencia y Tecnología, Universidad Nacional de Quilmes, Argentina; ³Física de Materiales, Universidad Autónoma de Madrid, Spain. Waveguides fabricated by Ultrafast Laser Inscription (ULI) in z-cut LiNbO₃ crystal doped with Er/Yb are presented and explored. TE and TM propagation modes are supported at 1.55 μ m. Luminescence features of Er/Yb ions are essentially preserved in the waveguide core and surroundings of laser-matter region.

Room 5

17:00–18:00

W4E • Novel Materials and Nonlinear Optics

Presider: To be Announced

W4E.1 • 17:00 **Invited**

Gas, Glass and Light: The Making of Hollow Core Fiber Science and Technology, Fetah Benabid¹; ¹GPPMM Group, XLIM Research Institute, France. We review the key scientific and technological results in the development of hollow-core photonic-crystal-fiber and photonic-microcell. We stress their enabling powers in gas-laser based applications and their potential as a future alternative for long-haul telecommunications.

W4E.2 • 17:30

Impact of Nonlinearity of Dielectric Layers on the Fabry-Perot Transmission Resonances of Spatially Dispersive Metal-Dielectric Stack, Denis Iakushev¹, Servando Lopez-Aguayo¹; ¹Tecnológico de Monterrey, Mexico. We study light transmission through dielectric-metal array where dielectric is the dominant nonlinear medium with the Kerr nonlinearity. It is shown that spatial dispersion of the metal layers diminishes the nonlinear effect of the dielectric.

W4E.3 • 17:45

Nonlinear Absorption and Optical Limiting Effect in Redox Exfoliated Layered Transition Metal Dichalcogenides, Melissa Maldonado², Manoel L. da Silva Neto³, Pilar G. Vianna⁴, Henrique B. Ribeiro⁴, Lucas M. Martinho¹, Gleice G. Germano¹, Isabel C. Carvalho¹, Leonardo d. Menezes², Cid B. de Araújo², Cristiano José de Matos⁴, Ali M. Jawaid⁵, Allyson J. Ritter⁶, Richard A. Vaia⁵, Anderson S. L. Gomes²; ¹Pontifícia Univ Católica Rio de Janeiro, Brazil; ²Departamento de Física, Universidade Federal de Pernambuco, Brazil; ³Graduate Program in Materials Science, Universidade Federal de Pernambuco, Brazil; ⁴MackGraphe-Graphene and Nanomaterials Research Center, Mackenzie Presbyterian Univ., Brazil; ⁵Materials and Manufacturing Directorate, Air Force Research Laboratory, Wright-Patterson AFB, USA. Nonlinear absorption and optical limiting effects were studied in exfoliated MoS₂, WS₂, NbS₂, and ZrTe₂. The optical limiting results indicate good performance regarding fluence threshold using nanosecond pulses in the 500 nm-610 nm spectral region.

08:30–11:00

Th1A • Plenary Session III

Presider: To be Announced

Th1A.1 • 08:30 **Plenary**

Advances in Optics Research at Corning, Aleksandra Boskovic¹; ¹Corning Research & Development Corp, USA. Corning is an industrial research lab focused on materials and optics research. I'll present an overview of our Research lab and highlight some of our most recent advances ranging from optical communications to optical coatings for consumer electronics and more.

Th1A.2 • 09:20 **Plenary**

Title to be Announced, Alexander L. Gaeta¹; ¹Columbia Univ., USA. Abstract not available.

Th1A.3 • 10:10 **Plenary**

Optical Metrology: Measuring from Micrometers to Nanometers, Fernando Mendoza-Santoyo¹; ¹Centro de Investigaciones en Optica AC, Mexico. Optical metrology methods and techniques based in interferometry concepts will be discussed as applied to the study of nanomaterial and biological samples. Current optical methodologies are used to analyze data from interferometrical setups using light and electrons.

11:00–11:30 Coffee Break

Room 1

11:30–13:00

Th2A • Light Control

Presider: Gustavo Torchia; Centro de Investigaciones Opticas, Argentina

Th2A.1 • 11:30 **Invited**

The Elimination of the Magnetizing Element in Integrated Magneto-Optic Isolators, Miguel Levy¹; ¹Michigan Technological Univ., USA. The fabrication and operation of on-chip-integrated high performing optical isolators magnetized via micron-thick magnets and of magnet-less isolators is presented. This report discusses the integration of liquid-phase-epitaxy-grown iron garnet films into non-lattice-matched non-compatible platforms.

Th2A.2 • 12:00

Ultrathin All-dielectric Metasurface for Infrared Waves Focusing, Tulio Freitas Simões de Castro¹, Rafael Andrade Vieira¹, Vitaly F. Rodriguez Esquerre¹; ¹DEE UFBA, Brazil. This paper presents an all-dielectric metalens designed to focus the electric field in infrared frequency without ohmic losses, which is common on plasmonic metamaterials, due to the absence of metal parts.

Th2A.3 • 12:15 **Invited**

Tunable, Reconfigurable and Active Silicon Photonic Devices Employing Photonic Molecules, Guilherme F. de Rezende^{2,1}, Mario Souza², Luis Barea³, Andre Moras², Paulo Jarschel², Ghunter Roelgens¹, Newton C. Frateschi²; ¹Photonics Research Group, INTEC, Ghent Univ.-imec 9052, Belgium; ²Gleb Wataghin Physics Inst., Univ. of Campinas, 13083-859, Brazil; ³Electrical Engineering Department, Federal Univ. of São Carlos, Brazil. We report our recent progress on silicon-based photonic molecules. Continuously tunable mode-, athermal sensors; resonant optical amplification, and hybrid III-V on Si lasers are presented.

Th2A.4 • 12:45

On-Chip Nanoscopy, Øystein I. Helle¹, David A. Coucheron¹, Cristina I. Øie¹, Jean-Claude Tinguely¹, Balpreet S. Ahluwalia¹; ¹UIT The Arctic Univ. of Norway, Norway. Multi-modality nanoscopy is reported using a photonic chip. Chip-based nanoscopy enables large field-of-view super-resolution imaging by decoupling of collection and excitation light paths.

Room 2

11:30–12:15

Th2B • Systems Design

Presider: To be Announced

Th2B.1 • 11:30 **Invited**

Improved Single Molecule Localization Using a Dual Objective System, Abhishek Kumar^{1,2}, James M. Marr³, Mark McLean³, Jeremiah Woodcock³, Anthony Mautino¹, Jeffrey Gilman³, Stephan Stranick³, Veronia Szalai², J. Alexander Liddle²; ¹UMD College Park, USA; ²Center for Nanoscale Science and Technology, National Inst. of Standards and Technology, USA; ³Materials Measurements Laboratory, National Inst. of Standards and Technology, USA. Single molecule localization microscopy allows imaging structures well below the diffraction limit. Here, we report a flexible dual objective optical microscope design for improved localization.

Th2B.2 • 12:00

Analysis of Spectral Vegetation Indices in Chrysanthemum Production Flowers, Carlos A. Sanchez Rios¹, Andres M. Cardona², Jorge A. Herrera Ramirez¹; ¹Instituto Tecnológico Metropolitano, Colombia; ²Antioquia, Universidad Católica de Oriente, Colombia. The acquisition and analysis of spectral reflectance information obtained from chrysanthemum flowers is presented. This analysis is performed to determine the discriminant spectral regions for different biological variables through using vegetation indices and multivariate analysis.

Room 3

11:30–13:00

Th2C • Nanophotonics and Metamaterials I

Presider: Marina Leite; Univ. of Maryland at College Park, USA

Th2C.1 • 11:30 **Invited**

Enhanced Tunability of Metasurfaces with Graphene, Humeyra Caglayan¹; ¹Tampere Univ. of Technology, Finland. Graphene-gold metasurfaces to enhance light-graphene interaction in the MIR region will be presented and additionally, I will demonstrate a new class of electrically controlled active metadevices working in microwave frequencies. The results show that electrical gating of graphene allows actively tuning the resonance wavelength.

Th2C.2 • 12:00

Electromagnetic Behavior of the Relativistic Fermi Gas, Daniel M. Reis¹, Ernesto Reyes-Gomez², Luiz Oliveira³, Carlos A. de Carvalho^{4,5}; ¹Centro Brasileiro de Pesquisas Físicas, Brazil; ²Universidade de Antioquia - UdeA, Colombia; ³Universidade Estadual de Campinas - Unicamp, Brazil; ⁴Diretoria Geral de Desenvolvimento Nuclear e Tecnológico da Marinha - DGDNTM, Brazil; ⁵Universidade Federal do Rio de Janeiro - UFRJ, Brazil. We obtain the electromagnetic modes of propagation in a Relativistic Fermi Gas and show that there is a region in the graph of the dispersion relation where both the electric permittivity and magnetic permeability are simultaneously negative, a behavior known to occur in artificial metamaterials.

Th2C.3 • 12:15

Nonreciprocal and Control THz Components Based on Planar Graphene Structures, Victor Dmitriev¹, Wagner Castro¹, Samara Matos¹, Francisco Nobre¹, Tiago Oliveira¹, Gabriel Barros¹, Geraldo Melo¹; ¹Federal Univ. of Para, Belem, Para, Brazil. Different types of circulators, switches and nonreciprocal power dividers are discussed. The components consist of a magnetized planar graphene structure and waveguides connected to it. They have small dimensions, large bandwidths and good electrical parameters.

Th2C.4 • 12:30 **Invited**

Strongly Nonreciprocal Platforms: Unidirectional Excitation of Surfaces Plasmons and Nonreciprocity-Induced Optical Torque, Francesco Monticone¹; ¹Cornell Univ., USA. In this talk, we review our recent efforts on strongly nonreciprocal plasmonic systems, which can be designed to support truly unidirectional surface modes. We discuss their topological properties, elliptic/hyperbolic dispersion, and the possibility of inducing strong optical forces/torques.

13:00–14:30 Lunch On Your Own

08:30–11:00

Th1A • Plenary Session III

Presider: To be Announced

Th1A.1 • 08:30 **Plenary**

Advances in Optics Research at Corning, Aleksandra Boskovic¹; ¹Corning Research & Development Corp, USA. Corning is an industrial research lab focused on materials and optics research. I'll present an overview of our Research lab and highlight some of our most recent advances ranging from optical communications to optical coatings for consumer electronics and more.

Th1A.2 • 09:20 **Plenary**

Title to be Announced, Alexander L. Gaeta¹; ¹Columbia Univ., USA. Abstract not available.

Th1A.3 • 10:10 **Plenary**

Optical Metrology: Measuring from Micrometers to Nanometers, Fernando Mendoza-Santoyo¹; ¹Centro de Investigaciones en Optica AC, Mexico. Optical metrology methods and techniques based in interferometry concepts will be discussed as applied to the study of nanomaterial and biological samples. Current optical methodologies are used to analyze data from interferometrical setups using light and electrons.

11:00–11:30 Coffee Break

Room 4

11:30–13:00

Th2D • Multidisciplinary Applications of Photonics III

Presider: Niklaus Wetter; *Centro de Lasers e Aplicações - IPEN/SP, Brazil*

Th2D.1 • 11:30 **Invited**

Micromachining with Ultrashort Laser Pulses, Wagner de Rossi¹; ¹IPEN, Brazil. It will be shown how to deal with different process parameters in practical applications of micro-machining ultra-short laser pulse. Several case studies conducted at CLA-IPEN will be presented.

Th2D.2 • 12:00 **Invited**

Abnormalities Detection in Biomedical Images Combining Image Processing and Machine Learning Techniques, Leticia Rittner¹; ¹UNICAMP, Brazil. Image processing techniques are used together with machine learning algorithms to detect abnormalities. Examples of abnormalities detected are brain white matter lesions and interstitial lung diseases, such as honeycomb or ground-glass opacity.

Th2D.3 • 12:30 **Invited**

Kubelka-Munk Modeling of Diffuse Reflectance Measurements on Monocotyledonous Plant Leaves, Efrain Solarte¹; ¹Universidad del Valle, Colombia. A Kubelka-Munk model has been done to estimate chlorophyll content in sugar cane leaves. Spectral diffuse reflectance and transmittance was measured using an integrating spheres setup. Spectral results, calculated K-M coefficients and optical constants are presented.

Room 5

11:30–13:00

Th2E • Frequency Conversion and Soliton Physics

Presider: David Hagan; *Univ. of Central Florida, CREOL, USA*

Th2E.1 • 11:30 **Invited**

Quantum State Generation and Frequency Conversion Using Nanophotonics, Kartik Srinivasan¹; ¹National Inst of Standards & Technology, USA. I will discuss experiments in which quantum states of light generated by single quantum dots in microcavities and Kerr nonlinear microresonators are frequency-converted on a nanophotonic chip. Tunable Hong-Ou-Mandel interference enabled by using frequency conversion to erase spectral distinguishability is demonstrated.

Th2E.2 • 12:00

Optical Solitons in Nonlocal Media Generated with the Numerical Variational Method, Servando Lopez-Aguayo¹, Erick Duque¹; ¹Tecnologico de Monterrey, Mexico. We report an optimized solitons solutions for media with arbitrary degree of nonlocality using a variational method. We show the existence of three regions as a function of the nonlocal characteristic length of the media.

Th2E.3 • 12:15

Mobility of Discrete Soliton in Nonlinear Lieb Photonic Lattices, Bastian Real¹, Rodrigo A. Vicencio¹; ¹Universidad de Chile, Chile. We study the mobility of localized solutions in a nonlinear Lieb photonic lattice. We numerically observe a perfect transport across the system with negligible radiation, where two highly compact solutions move for low power.

Th2E.4 • 12:30

Hermite-Gaussian Solitons Supported by Optical Lattices, Servando Lopez-Aguayo¹, David Trejo-Garcia¹, Diana Gonzalez-Hernandez¹, Daniel Lopez-Aguayo¹; ¹Tecnologico de Monterrey, Mexico. We study a family of analytic solitons solutions generated by Hermite-Gaussian beams that are supported in optical lattices described also by Hermite-Gaussian functions in combination with a harmonic potential.

Th2E.5 • 12:45

Stable Turing Patterns Using Silicon Nitride Ring Cavity, Shahryar Sabouri¹, Mircea t. Catuneanu¹, kambiz jamshidi¹, Rabia F. Riaz¹; ¹Faculty of Electrical and Computer Engineering, Technische Universität Dresden, Germany. We present the transient formation of different stable Turing patterns in silicon nitride ring cavities targeting telecommunication applications. The optical spectrum of three kinds of formed Turing patterns, namely soft, hard and firm are studied.

13:00–14:30 Lunch On Your Own

Room 1

14:30–16:30

Th3A • Silicon Photonics

Presider: Vilson Almeida; Instituto Tecnológico de Aeronáutica, Brazil

Th3A.1 • 14:30 **Invited**

Design, Characterization and Optimization of Silicon Photonic Waveguides and Devices, Azizur B. Rahman¹, Weifeng Jiang²; ¹City, Univ. of London, UK; ²College of Electronic and Optical Engineering, Nanjing Univ. of Posts and Telecommunications, China. Design and optimization of silicon strip and slot waveguides and power, mode, and polarization splitters, spot-size converters and biosensors are presented by using numerically efficient and rigorous full-vectorial finite-element based approaches.

Th3A.2 • 15:00

Fabrication Error Analysis of Photonic Crystals Optical Logic Gates, Pedro Paulo Matos Barreto¹, Vitaly F. Rodriguez Esquerre¹; ¹DEE UFBA, Brazil. In this work we analyze in detail the influence of the parameters of a universal logic gate based on photonic crystals. We have verified a high tolerance against manufacturing and error of the order of 10% for the cylinder radius and lattice constant.

Th3A.3 • 15:15

Modeling of Parametric Amplification in Ultra-Low Loss Spiral Waveguides, Daniel F. Londono¹, Andres Gil-Molina², Ana M. Cardenas³, Hugo L. Fragnito^{1,2}; ¹Mackgrape, Brazil; ²Unicamp, Brazil; ³Ingeniería Electrónica y Telecomunicaciones, Universidad de Antioquia, Colombia. We analyze spiral nano-waveguides providing parametric gain in meter long lengths with millimetric footprint, considering robustness against fluctuations of core dimensions and curvature dependence of the dispersion parameters. We discuss an example design on $\text{Si}_3\text{N}_4/\text{SiO}_2$.

Th3A.4 • 15:30 **Invited**

Exploiting Surface Phonon Polaritons for Nanophotonics, Arti Agrawal¹; ¹Univ. of Technology Sydney, Australia. Coupling between Surface Phonon Polaritons (SPP) in SiC and Surface Plasmon Polariton (SPP) modes in Graphene is proposed to obtain sub-wavelength confinement and localization in the IR regime. Simulation and experimental results will be presented.

Room 2

14:30–16:30

Th3B • Optical Fibers

Presider: To be Announced

Th3B.1 • 14:30 **Invited**

Supercontinuum Generation in Graded Index Multimode Fibers, Rodrigo Amezcua Correa¹; ¹Univ. of Central Florida, CREOL, USA. Abstract not available.

Th3B.2 • 15:00 **Invited**

Kerr Effect in Long Period Gratings with a Pump and Probe Technique, Emmanuel Rivera-Pérez¹, Antonio Carrascosa¹, Antonio Diez², José L. Cruz², Miguel V. Andrés¹; ¹Universidad de Valencia, Spain. Kerr effect in long period gratings is investigated with a pump and probe technique. UV-written and acoustic in-fiber gratings are studied. The nonlinear refractive index coefficient can be measured using short lengths of optical fiber.

Th3B.3 • 15:30

Recovery of Highly-dispersive Modes Using a Wavelength-resolved Modified S^2 Imaging Method, Erick Lamilla¹, Ivan Aritz-Garde², Maicon Faria^{3,1}, Julian Pita⁴, Paulo Jarschel¹, Paulo Dainese¹; ¹Inst. of Physics Gleb Wataghin, Univ. of Campinas, Brazil; ²State Univ. of Sao Paulo (UNESP), Brazil; ³CENAPAD, National Center for High Performance Computing in Sao Paulo (CENAPAD-SP), Brazil; ⁴School of Electrical and Computer Engineering, Univ. of Campinas, Brazil. We present a modified wavelength-resolved S^2 method that allows recovery of highly-dispersive modes. We employed this method using a variable window spectrogram to characterize a hollow core photonic crystal fiber where several surface-modes are recovered.

Th3B.4 • 15:45

All-fiber Graphene Electro-optical Modulator with PMMA Superstrate Layer, Maria Cecilia S. Araújo¹, Matheus Bonando¹, Lúcia A. Saito¹; ¹Mackenzie Presbyterian Univ., Brazil. We present a method to optimize a graphene electro-optical modulator built onto a side-polished fiber with the polymer superstrate layer. The thickness control of PMMA cladding can improve its modulation depth with reduced dielectric thickness.

Room 3

14:30–16:30

Th3C • Nanophotonics and Metamaterials II

Presider: Christiano De Matos; Mackenzie Univ., Brazil

Th3C.1 • 14:30 **Invited**

Generation and Detection of Surface Acoustic Waves Using Single Plasmonic Nanoresonators, Rodrigo Berte^{4,5}, Fabricio Della Picca^{1,2}, Martin Poblet^{1,2}, Yi Li^{3,3}, Emiliano Cortés^{3,5}, Richard V Craster⁶, Stefan A. Maier^{3,5}, Andrea V. Bragas^{1,2}; ¹Departamento de Física, Universidad de Buenos Aires, Argentina; ²CONICET-UBA, IFIBA, Argentina; ³Fakultät für Physik, Ludwig-Maximilians-Universität München, 80799 München, Germany, Germany; ⁴CAPES Foundation, Ministry of Education of Brazil, Brazil; ⁵Department of Physics, Blackett Laboratory Imperial College London, UK; ⁶Department of Mathematics, Imperial College, UK. We show that coherent phonons generated in isolated metallic nanoantennas are transmitted through the substrate as surface acoustic waves (SAWs) which are detected by other nanoantennas positioned at distances up to 3µm away from the source.

Th3C.2 • 15:00

A Tool for Modeling, Design and Applications of MetaSurfaces, Luigi La Spada¹, Anna Maria Vegni²; ¹School of Computing, Electronics and Mathematics, Coventry Univ., UK; ²Department of Engineering, Univ. of Roma Tre, Italy. We present a new approach to model, design and realize MetaSurface structures for sensing and telecommunications. The method turns out to be versatile and has great potential to be used for practical electromagnetic applications.

Th3C.3 • 15:15 **Invited**

Hot Carrier Effects in Novel Ultrathin Metal Films, Lisa J. Krayel¹, Jeremy N. Munday¹; ¹Univ. of Maryland at College Park, USA. Here we discuss our latest work using novel materials to achieve ultrahigh absorption and hot carrier generation in films that are 100 times thinner than the illumination wavelength.

Th3C.4 • 15:45

Visible/Infrared Narrow-band Resonant Absorber, Igor Leonardo Gomes de Souza¹, Icaro Almeida Sampaio¹, Vitaly F. Rodriguez Esquerre¹; ¹DEE UFBA, Brazil. In this work we propose a narrowband planar absorber using gold and silica. The designed structure is a metal-dielectric-metal-resonator with a large substrate to prevent transmission. We evaluated the absorption behavior with the angle of incidence for both modes of polarization, the thicknesses of the metal, and the dielectric

Room 4

14:30–16:30

Th3D • Postdeadline Paper Session I

For a complete list of Postdeadline abstracts and times, please check the Program Update Sheet.

Room 5

14:30–16:30

Th3E • Optics and Photonics in Low-Dimensional Materials and Novel Materials

Presider: Hugo Fragnito; *Universidade Presbiteriana Mackenzie, Brazil*

Th3E.1 • 14:30 **Invited**

Nonlinear Optics with Low-dimensional Materials, Zhipei Sun¹; ¹*Aalto Univ., Finland*. I will discuss our recent results on nonlinear optics with one-dimensional and two-dimensional materials. These results show advantages of utilizing low-dimensional nanomaterials for photonic and optoelectronic applications, e.g., quantum emitters, wavelength converters, and ultrafast lasers.

Th3E.2 • 15:00 **Invited**

Femtosecond Pulse Generation by the Use of 2D Materials in Fiber Lasers, Thoroh A. De Souza¹, David Steinberg¹; ¹*Universidade Presbiteriana Mackenzie, Brazil*. We present a review of ultrashort pulse generation in EDFL using several 2D-materials as saturable absorber onto D-shaped optical fibers. Pulses as short as 150 fs were obtained, confirming their effectiveness for mode-locking applications.

Th3E.3 • 15:30

Third Harmonic Generation in Mechanically Exfoliated Franckeite, David Steinberg¹, Alexandre Samuel Oré¹, Juan D. Zapata², Thoroh A. De Souza¹, Christiano José de Matos¹; ¹*Universidade Presbiteriana Mackenzie, Brazil*; ²*Faculty of Engineering, Universidad del Antioquia UdeA, Colombia*. We report on the optical third harmonic generation in mechanically exfoliated franckeite, a natural Van der Waals heterostructure. Results show a nonlinear signal that is anisotropic and 1300-1500 times stronger than that of monolayer graphene.

Th3E.4 • 15:45

A Low-energy High-bandwidth Interconnects Based on Opto-plasmonic Capacitors, Pouya Dianat^{1,2}, Kiana Montazeri¹, Zhihuan Wang¹, Bahram Nabet^{1,2}; ¹*Drexel Univ., USA*; ²*Nanogress Solar LLC, USA*. A plasmonic structure is introduced with a capacitance that is three orders of magnitude smaller than that of typical copper line. Furthermore, it can encode optical signal into binary states, making it suitable for on-chip optically enabled computation.

Room 1

Th3A • Silicon Photonics—Continued

Th3A.5 • 16:00

A Simple Tunable TE-pass CMOS Compatible Polarizer, Renan Santos^{1,3}, Maria Aparecida G. Martinez¹, Maria Thereza M. Rocco Giraldo²; ¹Electrical Engineering, Photonics Lab, CEFET/RJ, Brazil; ²Electrical Engineering Department (SE/3), Military Inst. of Engineering, Brazil; ³National Inst. of Industrial Property, Brazil. In this work, we analyze a CMOS-compatible TE-pass tunable polarizer based on graphene's selective loss. Simulations show that the slab waveguide structure proposed attains a 6 dB/cm difference in losses between TM₀ and TE₀ modes, over a 600 nm band.

Th3A.6 • 16:15

Comparison Between Lateral and Interleaved Junctions for High-speed O-band Silicon Mach-Zehnder Modulator, Yesica R. Rumaldo Bustamante¹, Giovanni B. Farias¹, Diogo d. Motta², Alexandre P. Freitas², Lucas H. Gabrielli², Hugo E. Hernandez-Figueroa²; ¹CPqD, Brazil; ²Feec, Unicamp, Brazil. In this work, we present a design for a high-bandwidth (>40GHz) O-band Silicon Mach-Zehnder modulator using a lateral junction and compare it with an interleaved junction in terms of efficiency, loss and bandwidth

Room 2

Th3B • Optical Fibers—Continued

Th3B.5 • 16:00

Annealing of Gold Films on TFBGs, Violeta A. Marquez-Cruz¹, Jacques Albert¹; ¹Electronics, Carleton Univ., Canada. Tilted fiber Bragg gratings have been used to investigate structure changes on electroless plated gold thin films before and after annealing. Changes in intensity and refractive index sensitivity can be useful to model the permittivity as a function of morphology.

Th3B.6 • 16:15

The Light Polarization Changes at the Fiber Optic Thermal Disturbance Sensor Output, Martin Kyselák¹, Filip Dvorak¹, Cestmir Vlcek¹; ¹Univ. of Defence, Czechia. When subjected to heat treatment on a sensory optical fiber with equally excited polarizing planes, the birefringence causes time shift, which results in a change in the instantaneous states of light polarization due to temperature.

Room 3

Th3C • Nanophotonics and Metamaterials II—Continued

Th3C.5 • 16:00 **Invited**

Light Induced "Mock Gravity" at the Nanoscale, Juan J. Saenz¹; ¹Donostia International Physics Center, Spain. We analyze the optical forces between two identical molecules or nanoparticles in a quasi-monochromatic isotropic random light field. A gravity-like inverse-square-distance interaction law is predicted whenever the light frequency is tuned at an absorption resonance.

Room 4

Th3D • Postdeadline Paper Session I—Continued

Room 5

Th3E • Optics and Photonics in Low-Dimensional Materials and Novel Materials—Continued

Th3E.5 • 16:00 **Invited**

Emerging Materials for Photonics, Marina S. Leite¹; ¹*Univ. of Maryland at College Park, USA*. We propose the alloying of Ag, Au, Cu, and Al to overcome the limitation imposed by their pre-defined permittivity. We further investigate the implementation of earth-abundant metals for dynamic and transient photonics.

16:30–18:00

Th4A • Poster Session II

Th4A.1

Non-Bragg Gaps for Second Harmonic Generation in Metamaterial Photonic Superlattices, Faustino Reyes Gómez¹, Nelson Porras Montenegro², Jorge R. Mejía-Salazar¹, ¹Instituto Nacional de Telecomunicaciones, Brazil; ²Física, Universidad del Valle, Colombia. Defect modes in the zero-n and the plasmon-polariton non-Bragg gaps of a one-dimensional nonlinear metamaterial photonic superlattice were used here to produce second harmonic waves. Results are interesting for potential applications in filtering and frequency upconversion.

Th4A.2

Single-mode Bragg Reflectors in Tapered 4-Modes Fiber, Luis Herrera-Piada², Martina Delgado-Pinar¹, Jose L. Cruz¹, Antonio Diez¹, Miguel V. Andrés¹, ¹Universitat de Valencia, Spain; ²Electronics, Univ. of Guanajuato, Mexico. In this paper we report on the fabrication of fiber Bragg gratings in tapered 4-modes fibers whose diameter have been reduced to achieve single mode operation. The gratings present a single reflection band, and the device has low insertion loss and reduced coupling to cladding modes when the fiber is symmetrically illuminated.

Th4A.3

Ring Laser For Sensing Angular Deflection, Julian Moises Estudillo Ayala¹, ¹Universidad de Guanajuato, Mexico. An angular deflection laser sensor in ring configuration is presented, based on a wavelength selective filter, which was manufactured by splicing a segment of thin core fiber between two segments of single-mode fiber SMF-28. A spectral was obtained at different angles of deflection in steps of 17.86 μ rad.

Th4A.4

Soliton in a 2 Two-level Atom Media, Julio C. Garcia-Melgarejo¹, Karla J. Sanchez-Perez², Daniel May-Arrijo³, Miguel Torres-Cisneros⁴, Julian D. Sanchez de la Llave², Jose Javier Sánchez-Mondragón², ¹Universidad Autonoma de Coahuila, Mexico; ²Instituto Nacional de Astrofísica, Óptica y Electrónica, Mexico; ³Centro de Investigaciones en Óptica, Mexico; ⁴Universidad de Guanajuato, Mexico. Resonant solitons in TLA media has quite a distinguished, well-known and studied physics. Recent work in CQED has allowed us to recognize new promising possibilities in 2 TLA media that would allow current physics problems.

Th4A.5

The Spin-polarization Coherence Matrix in a Cross Cavity Model, Julio C. Garcia-Melgarejo¹, Nestor Lozano-Crisostomo¹, Julian D. Sanchez de la Llave², Jesus Escobedo-Alatorre³, Adalberto Alejo-Molina³, Jose Javier Sánchez-Mondragón², ¹Universidad Autonoma de Coahuila, Mexico; ²INAOE, Mexico; ³UAEM, Mexico. Pursuing the work developed by J. H. Eberly and coworkers [1], for free fields that related entanglement and the spin-polarization coherence Matrix. We explore for a fully solvable QED model, the Cross-Cavity Jaynes-Cummings Model.

Th4A.6

New MILP Formulation for Energy Efficient QoTware Elastic Optical Networks, Karcus D. Assis¹, Igor M. Queiroz², ¹UFBA, Brazil. This paper presents a new formulation whose objective is to minimize the power consumed by SLICE networks. Amplified spontaneous emission noise is considered on calculation. Simulations proved the model efficiency when reaching 500W of economy

Th4A.7

Synthesis and Characterization of SnO₂/Graphene Transparent Conducting Films, Kevin M. Esparza Ramirez¹, Virginia Marañon-Ruiz¹, Corinna Enriquez¹, Hector Pérez¹, Jesús Castañeda¹, Rubén Rodríguez¹, Rita Patakfalvi¹, Roger Chiu¹, Alejandro Pérez¹, ¹Universidad de Guadalajara, Mexico. Advancing technology requires low-cost transparent conducting films. Using a technique derived from spray pyrolysis, we developed an SnO₂/Graphene material with optical transparency of 79-84% and sheet resistances of 40-91 Ω /sq, proper candidate for photovoltaic applications.

Th4A.8

Multiple-Input All-Optical OR Gate by Cascaded Logic Gates Based on Quantum-Dot Semiconductor Optical Amplifier, Kosuke Komatsu¹, Gou Hosoya¹, Hiroyuki Yashima¹, ¹Tokyo Univ. of science, Japan. We realize a multiple-input all-optical OR gate by cascading logic gates based on quantum-dot semiconductor optical amplifier (QD-SOA). We demonstrate that it can be implemented by three QD-SOAs.

Th4A.9

A Particle Swarm Optimization Approach to Log-Gabor Filtering in Fourier Transform Profilometry, Jesus Pineda¹, Jhacson Meza¹, Andres G. Marrugo¹, Raul Vargas¹, Lenny A. Romero¹, ¹Universidad Tecnológica de Bolívar, Colombia. In this work, we propose a Particle Swarm Optimization approach to Log-Gabor filtering in Fourier Transform Profilometry. Encouraging experimental results show the advantage of the proposed method.

Th4A.10

First Molecular Electronic Hyperpolarizability of Two Oxazoles Dyes in Solution, Luis Abegao¹, Ruben Fonseca², Francisco Santos³, Sandrine Pignuel⁴, José Rodrigues⁵, Cleber R. Mendonca⁶, Kenji Kamada⁷, Leonardo De Boni⁸, ¹Yale Univ, USA; ²Departamento de Ciências Naturales y Exactas, Universidad de la Costa, Colombia; ³Departamento de Física, Universidade Federal de Sergipe, Brazil; ⁴Institut Curie/CNRS, France; ⁵Universidade de São Paulo, Instituto de Física de São Carlos, Brazil; ⁶National Inst. of Advanced Industrial Science and Technology, Japan. Two π -conjugated oxazoles compounds were characterized by the hyper-Rayleigh scattering technique in order to determine the value of the first molecular hyperpolarizability (β_{HRS}). Quantum-chemical calculations using time-dependent density functional theory level were performed to calculate the static and dynamic β_{HRS} theoretical values.

Th4A.11

Optical Cloning of Spatially Partially-Coherent Images, Luis E. de Araujo¹, Shamaila Manzoor¹, Ulises Apolinario¹, ¹Univ. of Campinas, Brazil. We demonstrate the transfer of partially-coherent images from a strong coupling beam to a weak probe beam via electromagnetically induced absorption in Rb vapor. We show cloning of spatially incoherent images beyond the usual diffraction.

Th4A.12

Liquid Concentration Measurements with Fiber Optic Sensor, Nilton Cardenas¹, Mauro Lomer², Rafael Vilchez¹, Guillermo Baldwin¹, ¹Pontificia Universidad Católica del Perú, Peru; ²Universidad de Cantabria, Spain. We present liquid concentration measurements based on light losses in fiber optic curvatures. Lateral polishing of the transition region of its u-shaped curved fiber increases sensor sensitivity.

Th4A.13

Analytical Expression of Z-scan Curves in Reflective and Absorptive Nonlocal Thin Media, Maximino L. Arroyo Carrasco¹, Roman Torres¹, Marcela M. Méndez Otero¹, Emma V. Garcia Ramirez¹, Edmundo Reynoso Lara¹, Marcelo D. Iturbe Castillo², ¹Benemérita Univ Autonoma de Puebla, Mexico; ²OPTICA, INAOE, Mexico. An analytical z-scan curve expression of a refractive and absorptive nonlocal thin medium is obtained. The sample transmittance is represented as the product of a purely refractive transmittance multiplied by a purely absorptive one.

Th4A.14

Nonlocal Refractive and Absorptive Z-scan Formula for Thick Nonlinear Media, Roman Torres¹, Maximino L. Arroyo Carrasco¹, Marcela M. Méndez Otero¹, Emma V. Garcia Ramirez¹, Marcelo D. Iturbe Castillo², ¹Benemérita Univ Autonoma de Puebla, Mexico; ²OPTICA, INAOE, Mexico. We obtain a general expression for z-scan curves in nonlocal thick media that exhibits simultaneously nonlinear refraction and absorption by considering the sample as a stack of thin slices without coupling of nonlinearities between them.

Th4A.15

Photothermal Mid-Infrared Phase Imaging with Sub-diffraction Limited Spatial Resolution, Panagis Samolis¹, Michelle Y. Sander¹, ¹Boston Univ., USA. Photothermal mid-infrared phase imaging of melamine beads with 1 μ m diameter embedded in a liquid crystal is demonstrated at sub-diffraction limited spatial resolution.

Th4A.16

Estimation of Dielectric Constant and Thickness of Copper Thin Films Using Surface Plasmon Resonance, Nicolás Manrique¹, Henry Riascos¹, ¹universidad tecnologica de pereira, Colombia. This work shows a procedure in which the surface Plasmon resonance phenomena based on attenuated total reflection method was used to determine the dielectric constant and an approximate thickness of two thin copper (Cu) films.

Th4A.17

Fiber-optic Sensor Based on MMI Effect for pH-sensing, Using PVA-thin Films Doped with Bromophenol Blue, Hank A Gallegos-Dominguez¹, Oscar Baldovino-Pantaleon¹, ¹Universidad Autonoma de Tamaulipas, Mexico. Fiber optic pH sensor based on the multimodal interference effect, coated with a PVA-thin-film doped with bromophenol blue, shows increased RI-sensitivity as high as 20x10⁻³ and 9x10⁻³ nm/RIU in the pH range of 2.0 – 5.0.

Th4A.18

Bragg-Induced Power Oscillations in PT-Symmetric Periodic Photonic Structures, Paulo A. Brandão¹, Solange B. Cavalcanti¹, ¹Universidade Federal de Alagoas, Brazil. We study optical Rabi-like oscillations between a pair of resonant Bragg modes in a linear PT-symmetric periodic photonic structure by analytically solving the paraxial wave equation.

Th4A.19

Optimizing Optical Forces on Trapped Rayleigh Particles with an Array of Airy beams, Rafael A. Suarez¹, Marcos R. Gesualdi¹, ¹Universidade Federal do ABC, Brazil. A symmetrical array of Airy beams accelerating against each other is enhanced by changing each beam's initial launch angle. Trap stiffness is enhanced for Rayleigh particles from force profiles with increasing beams in the array.

Th4A.20

LIBS Applied to Femtosecond Laser Ablation of Ridge Optical Waveguides on Thin Films of PLZT, Roberto Peyton^{1,2}, Valentin Guarepi¹, Gustavo Torchia^{1,2}, ¹Centro de Investigaciones Ópticas (CIOp), Argentina; ²Universidad Nacional de Quilmes, Departamento de Ciencia y Tecnología, Argentina. In this work we present the fabrication of ridge optical waveguides performed onto thin films of PLZT by femtosecond laser ablation, we use laser-induced breakdown spectroscopy in order to study the quality of micro-machining process.

Th4A.21

Analysis of Extra-cavity Pulses by Thermo-cavitation in Natural Dyes, Samuel M. Afanador Delgado², José O. García², Virginia Marañon-Ruiz¹, Ricardo Sevilla-Escoboza², R. Chiu², ¹División de estudios de la Biodiversidad e Innovación Tecnológica, Universidad de Guadalajara, Mexico; ²Departamento de Ciencias Exactas y Tecnologías, Universidad de Guadalajara, Mexico. In this work we present the analysis in amplitude and frequency of extra-cavity pulses generation by thermo-cavitation induced by a CW low power laser focused into a liquid solution of hibiscus Sabdariffa dissolved in ethanol.

Th4A.22

Holographic Metasurfaces applied to generation of Non-diffracting Beams, Santiago C. Fernandez¹, Marcos R. Gesualdi¹, ¹UFABC, Brazil. In this work, we present the holographic metasurface consisting in a grade of unit cells where each of them alters the phase of the incoming wave, so that as a whole, the metasurface behaves as a spatial wave modulator for generating non-diffracting beams through holograms in the microwave and optical regime.

Th4A.23

Fiber Sensitivity Characterization near the Turning Point of the Acousto-Optic Interaction, Saúl A. Rosales-Mendoza¹, Martina Delgado-Pinar¹, Antonio Diaz¹, Miguel V. Andrés¹, ¹Física Aplicada - ICMUV, Universidad de Valencia, Spain. In-fiber acoustic gratings exhibit a turning point in which the sensitivity of the coupling resonances to environment changes is extremely high. The frequency of the acoustic wave enables easy matching of the turning point.

Th4A.24

Azopolymers Films as Actuators to Generate Organized Hybrid Materials, Rebeca Falcione^{2,1}, María Capeluto^{2,1}, Nora Pellegrini¹, María Virginia Roldan³, Silvia Goyanes⁴, Silvia A. Ledesma^{2,1}, ¹CONICET, Argentina; ²Laboratorio de Procesado de Imágenes, Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina; ³Lab. Materiales Cerámicos, IFIR-CONICET-UNR, S2000EKF, Rosario, Santa Fe, Argentina, Argentina; ⁴Laboratorio de Polímeros y Materiales Compuestos, Departamento de Física, IFIBA, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina. We study a hybrid material produced by mixing an azopolymer and metallic nanoparticles (NPs). We observed an increase of the recording efficiency when incorporating NPs with high plasmonic absorption.

Th4A • Poster Session II—Continued

Th4A.25

Optical Demonstration of a Programmable Multi-channel Polarization Beamsplitter, Dudbil Pabon^{1,2}, Sebastian Bordaquovich¹, Claudio Lemmi^{1,2}, Lorena Rebón³, Silvia A. Ledesma^{1,2}, ¹Laboratorio de Procesado de Imágenes, Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina; ²CONICET, Argentina; ³Instituto de Física de La Plata - UNLP - CONICET, Argentina. We present a method that allows us to obtain different polarizations in different directions of the space acting as a multi-channel beamsplitter using a spatial light modulator (SLM) with different gray levels.

Th4A.26

Determination of Any Pure Spatial Qudit from 4d - 3 Projective Measurements, Quimey Pears Stefano^{1,2}, Lorena Rebón³, Silvia A. Ledesma^{1,2}, Claudio Lemmi^{1,2}, ¹Laboratorio de Procesado de Imágenes, Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina; ²CONICET, Argentina; ³Departamento de Física, Instituto de Física de La Plata - UNLP - CONICET, Argentina. We present a quantum tomography method that allows to characterize any pure qudit of arbitrary dimension d, with only 4d - 3 projective measurements. We verified the feasibility of the method with numerical simulations that include the effect of Poissonian detection noise.

Th4A.27

Nonparaxial Electromagnetic Bragg Scattering in Periodic Media with PT Symmetry, Solange B. Cavalcanti¹, Paulo A. Brandão¹, José Henrique Nascimento², ¹Universidade Federal de Alagoas, Brazil. Resonant Bragg modes evolution through a PT-symmetric photonic lattice is investigated. Non-paraxial wave solutions lead to nonreciprocal and unidirectional energy exchange between the pair in all regimes defined by the symmetry breaking point.

Th4A.28

A Simple Method for Characterizing the Dispersion of Epsilon-Near Zero Materials, Vinicius T. Alvarenga¹, Christiano José de Matos², ¹MackGraphe, Mackenzie Presbyterian Univ., Brazil. We determine the dielectric function spectrum of a material in the 0-1 range, by analyzing the reflectance spectrum as a function of incidence angle. Results obtained for silicon carbide closely match data from the literature.

Th4A.29

Eclipse Intensity Scan Technique, Vinicius Ferreira¹, Ricardo Correia¹, ¹Univ Federal do Rio Grande do Sul, Brazil. We present an eclipsed setup to improve the sensitivity and signal noise ratio of the I-scan technique. We demonstrate here that EI-scan is able to characterize nonlinear optical properties with good sensibility of inhomogeneous samples.

Th4A.30

Scatter Search Applied to the Taper Optimization, Luana da França Vieira¹, Vitaly F. Rodriguez Esquerre¹, Anderson Dourado Sisanodo², Cosme Eustaquio Rubio Mercedes³, ¹DEE UFBA, Brazil; ²UFRB, Brazil; ³UEMS, Brazil. We report the implementation of an algorithm based on the Scatter Search (SS) together with the Finite Element Method (FEM) for the optimization of waveguide couplers between a continuous waveguide (CWG) and a periodically segmented waveguide (PSW).

Th4A.31

Sensors Based on Metamaterial Cladded Waveguides, Juarez Caetano da Silva¹, Vitaly F. Rodriguez Esquerre¹, ¹DEE UFBA, Brazil; ²UFBA, Brazil. We propose and analyze a sensor based on cladded metamaterial waveguides for monitoring gas or liquid specimens. These structures are made of metal and dielectric thin layers claddings, surrounding the hollow core of the sensor. The sensor sensitivity to the optical response of the samples in the core was obtained to every architecture simulated.

Th4A.32

Analysis of Fibonacci Hypercrystal Metamaterials, Miriele Carvalho Paim¹, Joaquim Junior Isidoro de Lima², Vitaly F. Rodriguez Esquerre¹, ¹DEE UFBA, Brazil; ²UNIVASF, Brazil. In this article the properties of a photonic hypercrystal has been analyzed. The structure consists of pairs of metal-dielectric layers separated by air following a Fibonacci sequence. We have demonstrated asymmetric optical properties that enable the behavior as band mirrors, filters or absorbers for visible and infrared radiation.

Th4A.33

Effect of the High Intensity Laser Nd:YAG in Patients with Vascular Malformations Submitted to Photocoagulation at Brazilian School of Dentistry, Wilber E. Bernaola Paredes^{1,2}, ¹Stomatology, Hospital A. C. Camargo Cancer Center, Brazil; ²Oral Diagnosis and Stomatology, School of Dentistry, Univ. of São Paulo, Brazil. The aim of this study was to assess the effectiveness of Nd: YAG laser photocoagulation in the treatment of vascular malformations in the oral and perioral area in Clinical attendance of Oral Medicine at Brazilian center.

Th4A.34

Characterization of UV-induced Absorption and Scattering Losses in Photosensitive Fibers, Xavier Roselló-Mechó¹, Martina Delgado-Pinar¹, José L. Cruz¹, Antonio Diez¹, Miguel V. Andrés¹, ¹Universitat de València, Spain. We present a technique to measure the absorption coefficient increment induced during the UV-inscription of gratings in photosensitive fibers. Our technique also allows discriminating between the absorption and scattering contributions to the overall losses.

Th4A.35

Development of a Wide Range Hyperspectral Imager for Evidence Examination, Xuejun Zhao^{1,2}, Nengbin Cai^{1,2}, Shan He^{1,2}, Xiaochun Huang^{3,2}, Wenbin Liu^{1,2}, Huaimiao Hua^{3,2}, Jiyun Zhang^{3,2}, ¹Shanghai Research Inst. of Criminal Science and Technology, China; ²Shanghai Key Laboratory of Crime Scene Evidence, China; ³Shanghai Inst. of Forensic Science, Public Security Bureau, China. By adjusting the attitude, frame rate and moving speed of two hyperspectral imager, the matching method of line-of-sight field of the two equipments was studied, and the wide range imaging from 400 nm to 1700 nm was realized.

Th4A.36

Modelling of Structural and Material Parameters of Optical Planar Waveguide to Control Birefringence, Yaman Parasher¹, Akshay Kaushik², Gurjit Kaur², Prabhot Singh², ¹Electronics and Communication, Gautam Buddha Univ., India; ²Electronics and Communication, Sanskar College of Engineering and Technology, India; ³Electronics and Communication, Delhi Technological Univ., India; ⁴Salesforce.com EMEA Ltd, San Francisco, CA, USA, USA. Birefringence is observed when layers in the optical planar waveguide exhibits stresses at elevated temperature. To design birefringence free waveguide structure, we carefully modelled the structural, material parameters with the help of a thermal stress formula.

Th4A.37

Features of Narrow-band ASE Noise Pulsing, Yuri O. Barmenkov¹, Pablo Muniz-Cánovas¹, Alexander V. Kir'yanov¹, Jose L. Cruz², Miguel V. Andrés³, ¹Centro de Investigaciones en Optica AC, Mexico; ²Universidad de Valencia, Spain. The results of an experimental study of noise features of polarized and unpolarized amplified spontaneous emission (ASE) with narrow optical bandwidth, registered from standard low-doped erbium fiber pumped at 976 nm, are presented.

Th4A.38

Picosecond Non-Radiative Relaxation in Indole Studied by Interferometric Pump-Probe Method, Alexey Glazov¹, Alexander Sukharev¹, Irina Semenova¹, Oleg Vasyutinski¹, ¹Ioffe Inst., Russian Federation. A new interferometric pump-probe method based on the detection of local refractive index is proposed and used for studying non-radiative lifetime of high-lying vibronic energy states in indole dissolved in propylene glycol and two-photon excited by femtosecond laser pulses at 400 nm. The lifetime of the excited states and found to be below 40 ps.

Th4A.39

New Optical Approach to Simultaneous Determination of Deformability and Adhesion Energy of Human Erythrocytes, Bibiana D. Riquelme^{1,2}, Carolina Londero^{1,2}, ¹Fac. Cs. Bioquímicas y Farmacéuticas. UNR, Argentina; ²Instituto de Física Rosario (CONICET-UNR), Argentina. We present an optical microfluidic device that allows the simultaneous determination of deformability and energy adhesion parameters of erythrocytes applying the new optical technologies for acquisition and image analysis using an inverted optical microscope.

Th4A.40

Photonics Techniques Applied to the Characterization of Polyamidoamine (PAMAM) Dendrimers to be Employed as Drug Delivery System (DDS), David Ybarra¹, Daniela Igartúa¹, Maria Eugenia Tuttolomondo³, Silvia del Valle Alonso¹, Fernando C. Alvira^{1,2}, ¹Laboratorio de Biomembranas, Universidad Nacional de Quilmes, Argentina; ²Laboratorio de Instrumentación, Automatización y Control, Universidad Nacional de Quilmes, Argentina; ³Cátedra de Fisicoquímica I, INQUINOA, Argentina. We have characterized PAMAM dendrimers by Raman and UV-VIS spectroscopy. Those experiments showed the spectroscopic behavior of dendrimer chemical groups at different pH. This will help to a better understanding of drug-dendrimer interactions.

Th4A.41

Linear and Non-linear Viscoelasticity of Red Blood Cells Using a New Optical Erythrocyte Rheometer, Bibiana D. Riquelme^{1,2}, Horacio Castellini³, Brenda Albea¹, ¹Fac. Cs. Bioquímicas y Farmacéuticas. UNR, Argentina; ²Instituto de Física Rosario (CONICET-UNR), Argentina; ³Fac. Cs. Exactas, Ingeniería y Agrimensura (UNR), Argentina. Linear and non-linear viscoelasticity of red blood cells was characterized using a new Optical Erythrocyte Rheometer based on laser diffractometry technique. Optical and mechanical models were developed to obtain representative parameters for clinical application.

Th4A.42

FTIR spectroscopy: an optical method to study wound healing process, Pedro A. Castro², Cassio Lima², Telma T. Zorn¹, Denise M. Zzell^{1,2}, ¹ICB, Univ. of Sao Paulo, Brazil; ²PEN-CNEN/SP, Univ. of Sao Paulo, Brazil. In this study, we investigated the ability of Fourier transform infrared spectroscopy to discriminate healthy tissue and thermal injury, aiming the development of an optical method to evaluate the wound healing process.

Th4A.43

Coupling Length of a Non-symmetric Directional Coupler Implemented in a Microstructured Optical Fiber, Sergei Khotiaintsev¹, María del Carmen Lopez-Bautista¹, Alexander Martynuk¹, ¹Telecommunications, National Autonomus Univ. of Mexico, Mexico. We analyzed the effect of some geometrical parameters on the coupling length of a special non-symmetric optical directional coupler employed as a low-refractive-index sensor. Our results can help to choose the realistic length of the coupler.

Th4A.44

Growth and Post-processing Effects of Graphene through Hyperspectral X-ray Absorption Spectroscopy: Theory, Experiment and Data, Wudmir Y. Rojas¹, Allen Winter¹, Daniel Fischer², Edward Principe³, Chuong Hynh⁴, Sarbajit Banerjee⁵, David Prendergast⁶, Apurva Mehta⁷, James Grote⁸, Eva Campo⁹, ¹Bangor Univ., UK; ²National Inst. of Standards and Technology, USA; ³Synchrotron Research Inc., USA; ⁴Carl Zeiss Microscopy, LLC, One Corporation Way, USA; ⁵Department of Chemistry, Texas A&M Univ., USA; ⁶Molecular Foundry., Lawrence Berkeley National Laboratory, USA; ⁷Stanford Synchrotron Radiation Laboratory, Stanford Univ., USA; ⁸Materials and Manufacturing Directorate, Air Force Research Laboratory, USA. We analyze strain and corrugation derived upon growth and transferred mechanisms to foreign substrates of graphene at wafer scale by a combination of first-principles simulations and measurements of angle-resolved hyperspectral x-ray absorption spectroscopy.

Room 1**18:00–19:30****Th5A • Plasmonics***Presider: Vitaly Rodriguez Esquerre; DEE UFBA, Brazil***Th5A.1 • 18:00** **Invited**

Advances in Efficient Plasmonic Circuits, Amr S. Helmy¹; ¹Univ. of Toronto, Canada. In this work, we elucidate a systematic approach that enables long range hybrid plasmonic modes in highly asymmetric structure. We utilize these modes to demonstrate record performance for various hybrid plasmonic devices including detectors, waveguides and cavities.

Th5A.2 • 18:30

Localized Ground and Excited States in a Photonic Graphene Ribbon, Rodrigo A. Vicencio¹, Camilo Cantillano¹, Seababrat Mukherjee², Luis Morales-Inostroza¹, Bastian Real¹, Gabriel Caceres-Aravena¹, Carla Hermann-Avigliano¹, Robert R. Thomson²; ¹Universidad de Chile, Chile; ²Heriot-Watt Univ., UK. We report on the excitation of Flat Band states in photonic graphene ribbons. We experimentally observe two different zero dispersion states, for a fundamental as well as a higher-order mode excitation.

Th5A.3 • 18:45 **Invited**

Novel Numerically-efficient Spectral Method for Analyzing Photonic Devices, Salah S. Obayya¹, Ahmed Heikal¹; ¹Zewail City of Science and Technology, Egypt. An accurate and numerically efficient Chebyshev multi-domain pseudo-spectral method (MDPSPM) for modal analysis for photonic devices is proposed. The method is mesh-free where Chebyshev polynomials are used to expand the field components in the internal domains rational Chebyshev basis functions to efficiently handle semi-infinite computational external domains. Thus eliminates the use of PML-like absorbing boundary conditions. In this talk our recent work in developing spectral method for analyzing various photonic devices will be presented.

Th5A.4 • 19:15

A Discontinuous Galerkin Method for Optical and Plasmonic Waveguide Analysis, Leandro Andrade Couto Fonseca¹, Hugo E. Hernandez-Figueroa¹; ¹DECOM/FEEC, Univ. of Campinas, Brazil. We present a novel spurious-free method for the analysis of intricate optical waveguides. The Maxwell's equation are discretized with an Interior Penalty Discontinuous Galerkin Method combined with a standard FEM. We present results for optical waveguides, including a leaky plasmonic one.

Room 2**18:00–19:15****Th5B • 3D Optical Reconstruction***Presider: To be Announced***Th5B.1 • 18:00** **Invited**

Testing Free Forms with Optical Deflectometry, J. Rufino Diaz-Urbe¹, Oliver Huerta-Carranza¹, Martin I. Rodriguez-Rodriguez², Maximino Avendaño-Alejo¹; ¹Universidad Nacional Autonoma de Mexico, Mexico. A method for testing free forms based on optical deflectometry methods are presented. Preliminary results for progressive addition ophthalmic lenses and some kind of correcting plate, will be shown. The expected accuracy of the method is around few micrometers.

Th5B.2 • 18:30

A Novel Calibration Method for Fringe Projection Profilometry Considering Projector Lens Distortion, Jaime e. Meneses¹, Andres Gonzalez¹; ¹GOTS, Universidad Industrial de Santander, Colombia. A deformed fringe pattern was placed in the projector in order to compensate geometric distortion of projector lens. A lineal phase-height relationship was obtained and results show a reduction of 35% of residual errors.

Th5B.3 • 18:45

An Experimental Study on Deformation Analysis of an Indented Pipe via Fringe Projection Profilometry and Digital Image Correlation, Nelson Forero¹, Andres G. Marrugo¹, Raul Vargas¹, Jesus Pineda¹, Jairo Useche¹, Lenny A. Romero¹; ¹Universidad Tecnológica de Bolivar, Colombia. We studied the surface displacement of a steel pipe during indentation via Fringe Projection Profilometry and 2D-Digital Image Correlation. Experimental results show that a 3D strain approximation is possible for comparison with numerical simulation.

Th5B.4 • 19:00

Type-II Superlattice Digital Focal Plane Arrays for Earth Remote Sensing Instruments, Sarath Gunapala¹; ¹Jet Propulsion Laboratory, USA. We will discuss a development of digital infrared sensor using type-II superlattices. Our goal is to elevate the operating temperature of the sensor to reduce the size, weight, and power of the remote sensing instruments.

Room 3**18:00–19:30****Th5C • Color***Presider: To be Announced***Th5C.1 • 18:00** **Invited**

Understanding the Optics of the Human Retina: Its Role in Vision and in Retinal Imaging, Brian Vohnsen¹; ¹Univ. College Dublin, Ireland. The optics of the retina is crucial for vision and diagnostics. Yet, the exact relationship between light and structure remains poorly understood. I report on studies that provide added insight into the mechanisms at play.

Th5C.2 • 18:30

Color Multifractal Analysis of City Lights from Outer Space, Ivan Moreno¹; ¹Universidad Autonoma de Zacatecas, Mexico. Photographs of the lights seen from outer space at night are analyzed. We perform a multifractal analysis in RGB color channels of lights spatial distribution of the largest cities and most populous cities in the World.

Th5C.3 • 18:45 **Invited**

Watching Photoreceptors at Work: Two-Photon Ophthalmoscopy in the Living Eye, Christina Schwarz^{1,2}, Robin Sharma^{1,3}, Sarah Walters⁴, David R. Williams^{1,4}, Jennifer Hunter^{1,4}; ¹Center for Visual Science, Univ. of Rochester, USA; ²Inst. for Ophthalmic Research, Univ. of Tuebingen, Germany; ³Facebook Reality Labs, USA; ⁴The Inst. of Optics, Univ. of Rochester, USA. In vivo two-photon ophthalmoscopy shows potential to noninvasively assess retinal function and to objectively interrogate the visual cycle on the single-cell level. Recent advances support the utility and applicability to the human eye.

Th5C.4 • 19:15

Digital Holography in Monitoring and Analysis of Smooth Elongated Disturbances, Irina Semenova¹, Andrei V. Belashov¹, Yaroslav Beltukov¹; ¹Ioffe Inst., Russian Federation. The procedure is presented aimed for holographic recording and reconstruction of long traveling phase disturbances with smooth low-amplitude phase variations. Experimental validation is performed on monitoring of bulk nonlinear strain waves in a solid waveguide.

Room 4

18:00–19:30

Th5D • Postdeadline Paper Session II

For a complete list of Postdeadline abstracts and times, please check the Program Update Sheet.

Room 5

18:00–19:30

Th5E • Magneto-optical Effects in Novel Materials

President: Miguel Levy; Michigan Technological Univ., USA

Th5E.1 • 18:00 **Invited**

Optical Nonreciprocal Devices Fabricated with Directly Bonded Magneto-Optical Garnet, Tetsuya Mizumoto¹, Yuya Shoji¹; ¹Tokyo Inst. of Technology, Japan. Optical isolator and circulator are fabricated by directly bonding a single-crystalline magneto-optical garnet on silicon waveguides. An isolation of ≥ 30 dB has been obtained in fabricated devices.

Th5E.2 • 18:30 **Invited**

Magnetic Interference in Artificial Magnetic Lattices and Applications in Optical and Spin-wave Devices, Mitsuteru Inoue¹; ¹Toyohashi Univ. of Technology, Japan. Fundamental properties of magnetic interference in artificial magnetic lattices, mainly in magnetic garnet films and alloy thin films, are discussed, followed by demonstrations of their applications in optical and spin-wave devices.

Th5E.3 • 19:00 **Invited**

Monolithically-Integrated TE-mode 1D Silicon-on-Insulator Isolators Using Seedlayer-Free Garnet, Bethanie J.H. Stadler¹, Karthik Srinivasan¹, Prabesh Dulal¹, Cui Zhang², David Hutchings²; ¹Univ. of Minnesota Twin Cities, USA; ²Univ. of Glasgow, UK. Our SOI isolators are zero-power devices with 2 components: nonreciprocal mode converter (waveguide equivalent of Faraday Rotator) and half reciprocal phase shifter. With seedlayer-free garnets and quasi phase matching, they can achieve >30 dB isolation.

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