

Optica Imaging Congress and Optica Sensing Congress Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 08 July. For updated and complete information with special events, reference the online schedule or mobile app.

Monday, 15 July

08:00 -- 10:00

Room: Ariane 2

AM1A • Process Analytical Technology I

Presider: Christoph Wagner; Badger Meter Austria GmbH, Austria

AM1A.1 • 08:00 (Invited)

High-Speed Chemical Imaging via Compressive Raman Microspectroscopy, Hilton B. de Aguiar¹; ¹*Laboratoire Kastler Brossel, France*. I will introduce the concept of compressive Raman imaging: by exploiting the sparsity and redundancy in Raman data sets, one can considerably simplify and speed up the spectral image acquisition, reaching speeds compatible with video-rate imaging by detecting just a handful of photons. I will discuss the different ways of performing compressive Raman, in particular focusing on challenges for bio-imaging, and also show more recent results applied to long-time imaging of electrochemical systems.

AM1A.2 • 08:30 (Invited)

Time-Gated Raman for Bioprocess Analysis, Katherine A. Bakeev¹, Jacopo Zini¹, Amutha Daniel¹, Mari Tenhunen¹; ¹*Timegate Instruments Ltd., USA*. Raman spectroscopy for process monitoring can be limited due to interference of sample-induced fluorescence overwhelming the Raman signal. Using a Timegated[®] Raman spectrometer overcomes fluorescence and we show the successful monitoring of biopharmaceutical product production.

AM1A.3 • 09:00 (Invited)

Applied Raman Spectroscopy in Process Analytics, Martin Kraft¹; ¹*Competence Center CHASE GmbH, Austria*. Raman spectroscopy has evolved into an indispensable tool for contact-free, non-destructive process analytics. Using evolving, often customized instrumentation, pertinent applications range from pharmaceutical PAT past semiconductor cleanroom environments to in-situ polymer analytics e.g. in photovoltaic modules.

AM1A.4 • 09:30 (Invited)

In-Line Spectroscopic Monitoring of Dynamic Industrial Processes, Markus Brandstetter¹, Robert Zimmerleiter¹; ¹*Research Center Non Destructive Testing, Austria*. Industrial production processes can be highly dynamic and the material parameter of interest is often affected by various internal and external factors. In this contribution, successful application examples for infrared spectroscopic process monitoring are presented.

08:00 -- 10:00

Room: Caravelle 2

CM1B • Imaging Through Scattering Media

Presider: Abbie Watnik; US Naval Research Laboratory, USA

CM1B.1 • 08:00 (Invited)

Solving High-Order Inverse Scattering Problems for in Vivo Imaging Deep Within Scattering Media, Wonshik Choi^{2,1}; ¹*IBS Center for Molecular Spectroscopy and Dynamics,*

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Korea (the Republic of); ²Korea Univ., Korea (the Republic of). We report a method for tracing multiple scattering trajectories from an experimentally recorded reflection matrix and converting multiple scattering to signal. Using the proposed method, we demonstrated in vivo through-skull imaging of a mature mouse.

CM1B.2 • 08:30

Photon Transport Through the Adult Human Head, Vytautas Gradauskas¹, Jack Radford¹, Kevin J. Mitchell¹, Samuel Nerenberg¹, Ilya Starshynov¹, Daniele Faccio¹; ¹*Univ. of Glasgow, UK.* Transmitting photons through an adult human head could enable noninvasive imaging deep inside the brain. We present numerical simulations and experimental measurements of photons transmitted diametrically through an adult human head.

CM1B.3 • 08:45

Scatterguiding: Energy Transport With Diffusive Waveguides, Kevin J. Mitchell¹, Vytautas Gradauskas¹, Jack Radford¹, Ilya Starshynov¹, Samuel Nerenberg¹, Ewan M. Wright², Daniele Faccio^{1,2}; ¹*Univ. of Glasgow, UK;* ²*Univ. of Arizona, USA.* We demonstrate the diffusion equation, describing the propagation of photon density modes in strongly scattering materials, can accommodate the existence of guided modes to enhance sensing inside scattering media like fog, snow and human tissue.

CM1B.4 • 09:00

Enhanced Performance in Computational Diffuse Optical Tomography: the Impact of Multiple Illumination Points, Mingwei He¹, Sujit K. Sahoo², Cuong Dang¹; ¹*Nanyang Technological Univ., Singapore;* ²*Indian Institute of Technology Goa, India.* Imaging through highly diffusive media is challenging due to extensive light dispersion. Unlike costly time-of-flight methods, our approach utilizes a CMOS camera to gather information from multiple illumination points, achieving low-cost and highly accurate imaging.

CM1B.5 • 09:15

Noninvasive Phase Imaging Through Dynamically Scattering Media With Temporal Averaging, Naoki Matsuda¹, Jun Tanida², Makoto Naruse¹, Ryoichi Horisaki¹; ¹*The Univ. of Tokyo, Japan;* ²*Osaka Univ., Japan.* We propose and demonstrate a method for noninvasive imaging of complex amplitude objects hidden behind dynamically scattering media. This method integrates a temporal averaging process and phase retrieval with a variable coded aperture.

CM1B.6 • 09:30

Pupil Engineering Enhanced Speckle Granularity Probe, Qihang Zhang¹, Haoyu Yue¹, Liangcai Cao¹, George Barbastathis²; ¹*Tsinghua Univ., China;* ²*Massachusetts Inst. of Technology, USA.* We utilized the pupil engineering method to enhance contrast of the sidelobe region in speckle correlations. Thus, required data collection for the speckle granularity probe is suppressed down to single frame.

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08:00 -- 10:00

Room: Argos

IM1G • Spectroscopy and Multi-Spectral Sensing

Presider: Meredith Kupinski; Univ of Arizona, Coll of Opt Sciences, USA

IM1G.1 • 08:00

Spectroscopic Imaging From UV to Thermal IR, Gianluca Valentini^{1,2}, Matteo Corti¹, Fabrizio Preda³, Antonio Perri³, Marta Ghirardello³, Dario Polli^{1,3}, Ondrej Ballada⁴, Cestmir Barta⁴, Lukas Chorust⁴, Benedetto Ardini¹, Alessia Candeo¹, Daniela Comelli¹, Giulio Cerullo^{1,2}, Cristian Manzoni²; ¹*Politecnico di Milano, Italy*; ²*IFN, CNR, Italy*; ³*NIREOS S.R.L., Italy*; ⁴*BBT - Materials Processing s.r, Czechia*. A class of hyperspectral imaging systems operating on an extremely wide spectral range has been developed based on a new compact and reliable interferometer. The systems are portable and feature high throughput and low noise.

IM1G.2 • 08:15 (Invited)

Infrared Spectroscopic Imaging for Clinical Digital Histopathology, Rohit Bhargava¹; ¹*Univ of Illinois at Urbana-Champaign, USA*. Histopathology underpins almost all diagnostic tests and research in solid tissues. Here we describe infrared imaging technology to address the challenge of recording high fidelity data to scan large tissue samples in reasonable times.

IM1G.3 • 08:45

Design of Narrowband mid-Infrared Metamaterial Perfect Absorbers (MPAs) Based on Nanoscale Cross-Shaped Resonators, Sarra Chabbar¹, Guillaume Beaudin¹, Hugo Therrien¹, Jean-François Bryche¹, Paul G. Charette¹; ¹*3IT Université de Sherbrooke, Canada*. Metamaterial perfect absorbers (MPAs) are subwavelength structures offering powerful light/matter interaction characteristics. This technology could pave the way for cost-effective and compact hyperspectral MID-IR filters, making the "spectral fingerprint region" more accessible for atmospheric sensing.

IM1G.4 • 09:00

Development of a Hyperspectral System for Real-Time High Throughput Bioprocess Monitoring, Pdraig Mc Girr^{1,2}, Breandan Hill², Robert Pollard^{2,1}; ¹*Queen's Univ. of Belfast, UK*; ²*Causeway Sensors, UK*. Integrating nanophotonic sensors into the bioprocessing industry requires capturing spectral information on multiplexed assays. Using hyperspectral imaging, the spatial performance of these sensors can be characterized to determine their suitability for multiplexed biological measurements.

IM1G.5 • 09:15

Computational Inspection of VCSEL Oxidation Exploiting a Spectrally-Shaped Illuminator, Antoine Rouxel¹, Antoine Monmayrant¹, Stéphane Calvez¹, Guilhem Almuneau¹; ¹*LAAS-CNRS, France*. We introduce a co-design approach for VCSEL fabrication monitoring using sinusoidal illumination, well-suited for multi-layer inspection tasks. This methodology not only broadens the range of monitoring tasks but also aims to enhance precision in optoelectronic manufacturing.

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IM1G.6 • 09:30

Wide-Field Microplastic Identification Based on Spectrum and Deep Learning, Jingyan Chen¹, Yuxing Li¹, Jianqing Huang¹, Edmund Y. Lam¹; ¹*The Univ. of Hong Kong, Hong Kong*. We present a wide-field dispersion system to capture spectral images with low cost and real-time imaging capability. The system demonstrates a high level of accuracy in identifying microplastic materials.

IM1G.7 • 09:45

Imaging Snapshot Spectrometers Enabled With 2-Photon Polymerization Based Additive Manufacturing, Tomasz Tkaczyk¹, Jiawei Lu¹, Haimu Cao¹; ¹*Rice Univ., USA*. Two field integral imaging spectrometers enabled with 2-Photon Polymerization 3D printing components are presented. High precision of fabricated (1) waveguide arrays and (2) multi-faceted mirror array simplifies system's calibration, improve image quality and compact implementations.

08:00 -- 10:00

Room: Guillaumet 1

LM1E • Reacting Flow Diagnostics

Presider: Naibo Jiang; Spectral Energies, LLC, USA

LM1E.1 • 08:00 (Invited)

Laser Diagnostics Study of Flame Morphology Transition in a Dual-Stage Radial-Swirl Combustor, Shengming Yin¹, Linye Li¹, Mingming Gu¹, Liangliang Xu¹, Fei Qi¹; ¹*Shanghai Jiao Tong Univ., China*. We investigate flame morphology transition in a dual-swirl combustor. Spatial-temporally resolved velocity field, preheat zone, and temperature field of the flame were obtained by PIV, CH₂O PLIF, and FRS respectively using a burst mode laser.

LM1E.2 • 08:30

Measurements of Temperature Downstream of the Stratified Swirl Burner by a Single-Ended TDLAS Sensor, Luo Liezhao^{1,2}, Li Ting^{1,2}, Runzhou Zhao^{1,2}, Lijun Xu^{3,1}; ¹*School of Energy and Power Engineering, Beihang Univ., China*; ²*Collaborative Innovation Center for Advanced Aero-Engine, Beihang Univ., China*; ³*School of Instrumentation and Optoelectronic Engineering, Beihang Univ., China*. A single-ended TDLAS sensor with spatial resolution of 5 mm is developed. This sensor is utilized to perform temperature measurements downstream of a stratified swirl burner, achieving a measurement rate of 2 kHz.

LM1E.3 • 08:45

KHz Rate Multi-Focus fs/ps-CARS Spectroscopy for gas Flow Diagnostics, Michael Scherman¹, Clément Pivard¹, Rosa Santagata¹, Brigitte Attal-Tretout¹; ¹*Office Natl d'Etudes Rech Aerospatiales, France*. We report up to 8-point simultaneous CARS spectroscopy in a Ar/air gas flow, as well as 2-point thermometry in a CH₄/air flame, performed in single shot at 1 kHz using a birefringent-based multifocus arrangement

LM1E.4 • 09:00

High-Speed Thermographic Imaging in a Prechamber Assisted Engine Using Flame-Generated Sulfur Dioxide PLIF, Priybrat Sharma¹, Gaetano Magnotti¹; ¹*KAUST, Saudi Arabia*.

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We introduce a novel single-color excitation two-color planar laser-induced fluorescence thermographic imaging approach using flame-generated sulfur dioxide. The technique is implemented to visualize turbulent reacting jet ignition in an internal combustion engine.

LM1E.5 • 09:15

Dual-Phosphor Thermometry to Probe Flame Particle Interactions in a Model Packed bed, Mohammadhassan Khodsiani², Frank Beyrau², Benoit Fond¹; ¹*Department of Aerodynamics, ONERA - the French Aerospace Lab, France;* ²*Inst. of Fluid Dynamics and Thermodynamics, Otto von Guericke Univ. Magdeburg, Germany.* The flame-particle interaction in a model packed bed are probed at the pore scale using 2D lifetime imaging of thermographic phosphor coatings. A dual-phosphor approach reveals detailed temperature distributions at two temperature levels.

LM1E.6 • 09:30 (Invited)

Decoding Complex Physics of Rotating Detonation Engines: Insights From Advanced Laser Diagnostics, Venkat Athmanathan¹; ¹*Purdue Univ., USA.* Abstract not available.

08:00 -- 10:00

Room: Spot

LM1F • Chemical Sensing

Presider: Ning Liu; Princeton Univ., USA

LM1F.1 • 08:00 (Invited)

High-Performance Cavity-Enhanced Photoacoustic Sensing, Jacopo Pelini^{3,1}, Mario Siciliani de Cumis^{4,1}, Zhen Wang⁵, Stefano Dello Russo^{4,1}, Iacopo Galli^{1,2}, Inaki Lopez Garcia⁶, Maria Concetta Canino⁷, Alberto Roncaglia⁷, Pablo Cancio Pastor^{1,2}, Naota Akikusa⁸, Wei Ren⁵, Paolo De Natale^{1,2}, Simone Borri^{1,2}; ¹*Istituto Nazionale di Ottica, CNR-INO, Italy;* ²*LENS - European Laboratory for Nonlinear Spectroscopy, Italy;* ³*Università degli Studi di Napoli, Italy;* ⁴*ASI, Italy;* ⁵*The Chinese Univ. of Hong Kong, China;* ⁶*CNR-IMM, Italy;* ⁷*CNR-IMM, Italy;* ⁸*Hamamatsu Photonics, Japan.* We present our most recent results on trace-gas detection with an intracavity cantilever-enhanced photoacoustic sensor. A full performance analysis is performed using a standard cantilever, and preliminary results exploiting alternative configurations are discussed.

LM1F.2 • 08:30 (Invited)

Increased Spatial Coverage in Optical Diagnostics Using Glass Wedges, Daniel R. Richardson¹; ¹*Sandia National Laboratories Albuquerque, USA.* Glass wedges are used increase the dimensionality of various optical measurements. Light refracted through the wedges can be focused to closely spaced points, lines or planes as shown in the applications herein.

LM1F.3 • 09:00

Fast Rotating Blade Temperature Imaging Using a Submicrosecond Thermographic Phosphor, Georgios Kasapis¹, François Nicolas^{1,2}, Jérôme Delva¹, Linda Dalipi², Benoit Fond¹; ¹*ONERA - the French Aerospace Lab, France;* ²*Inst. of Fluid Dynamics and Thermodynamics, Otto von Guericke Univ. Magdeburg, Germany.* Blur-free temperature imaging of a fast rotating propeller blade is performed using an interframe camera in dual frame mode and a

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thermographic phosphor (CaS:Eu²⁺) paint with a temperature-sensitive lifetime in the sub-microsecond range.

LM1F.4 • 09:15

Characterization of Common Plastic Microspheres Through Holographic Mueller Matrix Imaging, Maria J. Lopera Acosta^{1,2}, Yunfeng Nie², Maciej Trusiak³, Carlos Trujillo¹, Heidi Ottevaere²; ¹Universidad EAFIT, Colombia; ²Vrije Universiteit Brussel, Belgium; ³Warsaw Univ. of Technology, Poland. This study presents the measurement of Mueller matrices from a polarimetric in-line holographic setup to characterize microspheres of common plastics. Results demonstrate distinctive polarimetric signatures, offering a deterministic tool for automated microplastic detection and insightful parameters for further analysis.

LM1F.5 • 09:30

ML-Enhanced Laser-Based Analyzer for Selective C1-C5 Alkanes Detection, Mohamed Sy¹, Ali Elkhazraji¹, Mohammed S. Khan¹, Pan Luo², Ibrahim Atwah², Aamir Farooq¹; ¹KAUST, Saudi Arabia; ²EXPEC ARC, Aramco, Saudi Arabia. A laser sensor is developed for selective and simultaneous measurement of C1-C5 alkanes in natural gas samples. Utilizing a DFB-ICL near 3.3 μm and employing CNNs, it distinguishes overlapping absorbance spectra of C1-C5 alkanes and isomer species

LM1F.6 • 09:45

Supercontinuum Light Simultaneously Sensing NO₂ and Particulate Matter (PM), Gaoxuan Wang^{1,2}, Qian Gou³, Weidong Chen¹; ¹Universite du Littoral, France; ²Ningbo research Inst., Zhejiang Univ., China; ³School of Chemistry and Chemical Engineering, Chongqing Univ., China. A novel instrument based on broadband cavity enhanced absorption spectroscopy has been developed using a supercontinuum broadband light source, which showcases its ability in simultaneous measurements of NO₂ concentration and the extinction of particulate matter.

08:00 -- 10:00

Room: Diamant

QM1D • Quantum Sensing with Solid-State Spins I

Presider: Jennifer Choy; Univ. of Wisconsin-Madison, USA

QM1D.1 • 08:00 (Invited)

Quantum Sensors in Diamond: From Bulk to Surface, Konstantin Herb¹, Christian Degen¹; ¹ETH Zurich, Switzerland. Quantum sensing with NV centers provides a new angle for investigating magnetism at the atomic scale. In this talk, we discuss our progress in diamond sensor engineering and applications to nanoscale NMR spectroscopy and chemical surface analysis.

QM1D.2 • 08:30 (Invited)

NV Sensing Simplified, Dmitry Budker¹; ¹Helmholtz-Institut Mainz, Germany. We will discuss some recent results on NV-diamond-based magnetic and rotation sensing with an emphasis on simplified experimental modalities, for instance, those that do not require application of microwave and/or bias dc fields.

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QM1D.3 • 09:00

Towards Quantum Resolution Limit of Magnetic Field Imaging With Nitrogen-Vacancy Centers, Nicolas J. Dëshler¹, Ayan Majumder², Kasturi Saha², Saikat Guha¹; ¹*Univ. of Arizona, USA*; ²*Electrical Engineering, Indian Inst. of Technology Bombay, India*. Nitrogen-vacancy centers are an emerging platform for optically interrogating spatially-varying magnetic fields. We calculate the quantum Fisher information matrix pertaining to the positions and local magnetic fields of two nitrogen-vacancy centers under the ODMR protocol.

QM1D.4 • 09:15 (Top-Scored)

Ultra-low AC Susceptibility Measurement With Quantum Diamond Microscope, Shishir Dasika¹, Kasturi Saha¹; ¹*Indian Inst. of Technology, Bombay, India*. Conventional AC susceptometers are limited to measuring AC susceptibilities of the order of nJT⁻¹. In this study, we showcase the application of a diamond quantum magnetometer and dynamical control sequences to assess susceptibilities in Permalloy micro-disks at magnitudes as low as a few fJT⁻¹.

QM1D.5 • 09:30 (Invited)

Quantum Imaging With NV-Diamond, Kasturi Saha¹; ¹*Indian Inst. of Technology, Bombay, India*. Abstract not available.

08:00 -- 10:00

Room: Guillaumet 2

SM1H • Optical Biological and Chemical Sensors I

Presider: Erik Emmons; DEVCOM Chemical Biological Center, USA

SM1H.1 • 08:00

Heat Management and Quantum Efficiency Enhancement of Phototransistors Made From Two-Dimensional Materials, Raonaql Islam¹, Ishraq Md Anjum¹, Curtis R. Menyuk¹, Ergun Simsek¹; ¹*UMBC, USA*. By placing a periodic array of metal nanoparticle-silicon nanowire composite structures underneath a monolayer of MoS₂, we achieve the design of a phototransistor with improved thermal management, higher quantum efficiency, and lower phase noise.

SM1H.2 • 08:15

4D Optical Microresonator for Precise Detection of Persistent Organic Pollutants in Water, Anton Saetchnikov¹, Andreas Ostendorf¹; ¹*Ruhr Univ. Bochum, Germany*. This paper introduces a high performance method for detection of persistent water contaminants utilizing whispering gallery mode technique. An array of self-sensing 4D microcavities, fabricated via two-photon polymerization, enables sensitive detection down to 1 ppb.

SM1H.3 • 08:30

Towards Controlling Single-Molecule Enzymes on Optoplasmonic WGM Sensor, Koji Masuda¹, Matthew C. Houghton¹, Frank Vollmer¹; ¹*Univ. of Exeter, UK*. The optoplasmonic single-molecule sensor goes beyond sensing to potentially controlling single-molecule enzyme

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activities. We present methods for direct control of single-molecule enzyme activities on an optoplasmonic WGM sensor and their applications.

SM1H.4 • 08:45

Whispering-Gallery Mode Biosensor Based on Polystyrene Microspheres Doped With Carbon Dots, Evgeniia Soloveva¹, Kamilla Kurassova¹, Kirill Bogdanov¹, Irina Arefina¹, Daler Dadadzhyanov¹, Anton Starovoytov¹, Nikita Toropov²; ¹*International Research and Educational Center for Physics of Nanostructures, ITMO Univ., Russian Federation*; ²*Optoelectronics Research Center, Univ. of Southampton, UK*. Whispering gallery mode biosensors were obtained by impregnating polystyrene microspheres in carbon dots solution. Lasing was obtained in microspheres. Protein molecules were detected via frequency shifts of lasing lines.

SM1H.5 • 09:00

Colorimetric Sensing With Reconfigurable Chiral Plasmonic Metamolecules, Jacky Loo¹, Roman Calpe², Xuan-Hung Pham¹, Kha Nguyen¹, Yike Huang¹, Susanna Hällsten¹, Kalle Mikkola¹, Anni Lindfors¹, Alina-Sofia Heikkilä¹, Tommi Hakala², Tim Liedl³, Anton Kuzyk¹; ¹*Aalto Yliopisto, Finland*; ²*Univ. of Eastern Finland, Finland*; ³*Ludwig-Maximilians-Univ., Germany*. Chiral Plasmonic Metamolecules with pronounced optical activities enable colorimetric readout of chiroptical responses. We developed the reconfigurable metamolecules that has a high dissymmetry factor as nanoswitches for molecular biosensing, where addition of target analytes brought a drastic color change readily detected with the naked eye.

SM1H.6 • 09:15 (Invited)

Plasmonic Nanocavities as a Versatile Tool for Biomolecular Sensing, Oluwafemi S. Ojambati¹; ¹*Universiteit Twente, Netherlands*. I will show experimental results of using single and coupled plasmonic nanocavities for molecular sensing of proteins, DNA, and small nanoparticles. Our results demonstrate label-free sensing with various spectroscopic techniques.

SM1H.7 • 09:45

Enhancing Phase Sensitivity by Approaching the Critical Coupling of Resonant Metasurface Sensor, Lotfi Berquiga^{2,1}, Théo Girerd^{3,1}, Fabien Mandorlo^{3,1}, Cécile Jamois^{2,1}, Taha Benyattou^{2,1}, Xavier Letartre^{2,1}, Lydie Ferrier^{3,1}; ¹*Instituts des Nanotechnologies de Lyon, France*; ²*CNRS, France*; ³*INSA Lyon, France*. Very high sensitive photonic sensor with phase interrogation is achieved by approaching the critical coupling by tuning the geometry of the nanostructured Tamm plasmon photonic crystal. Theoretical and experimental proofs are presented.

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10:30 -- 12:00

Room: Ariane 2

AM2A • Process Analytical Technologies II

Presider: Jacques Cochard; TEMATYS, France

AM2A.1 • 10:30 (Invited)

Industrial Photonic Terahertz Radar, Shiva Mohammadzadeh¹, Maris Bauer¹, Andreas Keil^{1,2}, Fabian Friederich¹; ¹*Materials Characterization and Testing, Fraunhofer ITWM, Germany*; ²*Becker Photonik GmbH, Germany*. We present nondestructive material characterization, thickness measurement, and volumetric inspection of glass-fiber reinforced plastic composites and Li-ion battery electrode coatings used in aviation and automotive industries, using a photonic terahertz frequency-modulated continuous-wave radar.

AM2A.2 • 11:00

Fiber-Optic Solutions for Multispectral Process-Control in-Line in 0.3-16 μ m Range, Viacheslav Artyushenko², Alexander Novikov^{2,1}, Tatiana Sakharova², Alexey Bocharnikov², Andrey Bogomolov^{2,3}; ¹*TU Berlin, Germany*; ²*art photonics GmbH, Germany*; ³*Samara State Technical Univ., Russian Federation*. Presentation of unique multispectral fiber system using 4 key spectral methods in broad 0.3-16 μ m range to enable remote control of media composition changes with robust single and combi-fiber probes to enhance process efficiency *in-line*.

AM2A.3 • 11:15

In-Line Spatially Offset Raman Spectroscopy (SORS) for Monitoring Pharmaceutical Isolation Processes, Mais Al-attili¹, Carla Ferreira¹, Chris Price^{1,2}, Karen Faulds³, Yi-Chieh Chen¹; ¹*Chemical and process engineering, Univ. of Strathclyde, UK*; ²*ESPRC Centre for Continuous Manufacturing and Advanced Crystallisation, Univ. of Strathclyde, UK*; ³*Pure and applied chemistry, Univ. of Strathclyde, UK*. This study reports the use of SORS for in-line monitoring of a challenging model system on drying and finds improved performance from the offset configurations with the potential of capturing sample non-uniformity during the drying process.

AM2A.4 • 11:30 (Invited)

Single-Shot THz Spectroscopy, Uli Schmidhammer¹; ¹*Teratonics S.A.S., France*. A disruptive approach of THz Time Domain Spectroscopy enables Non-Destructive Evaluation and 3D imaging for automated inspection and inline production control, to reveal internal defects and to measure dimensions in modern materials and manufacturing processes.

10:30 -- 12:00

Room: Argos

AM2F • Disease Detection and Diagnostics

Presider: Tatevik Chalyan; Vrije Universiteit Brussel, Belgium

AM2F.1 • 10:30 (Invited)

Photonic Biosensors for Point-of-Care Diagnostics, Maria Soler¹; ¹*ICN2 Catalan Inst. of Nanoscience, Spain*. Photonic biosensors hold a unique potential to become the next-

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generation diagnostic tools, offering a versatile technology for rapid and sensitive clinical analysis in a label-free format and integrated in point-of-care devices.

AM2F.2 • 11:00 (Tutorial)

Disease/Pathogen Detection, Heidi Ottevaere¹; ¹*Vrije Universiteit Brussel, Belgium*. Abstract not available.

10:30 -- 12:00

Room: Caravelle 2

CM2B • Event Based Sensing / Neuromorphic Sensing

Presider: Chris Metzler; Univ. of Maryland at College Park, USA

CM2B.1 • 10:30

Intelligent Quantum Sensing With Computational Neuromorphic Imaging, Chutian Wang¹, Edmund Y. Lam¹; ¹*The Univ. of Hong Kong, Hong Kong*. This work presents a solution that leverages the synergy of diamond quantum sensing and computational neuromorphic imaging, which brings high precision and a significant computation time reduction. It gives impetus to the advancement of more intelligent quantum sensing and computing capacity.

CM2B.2 • 10:45

Surpassing the Wavefront Sensor Dynamic Range With Neuromorphic Temporal Diversity Measurements, Chutian Wang¹, Shuo Zhu¹, Pei Zhang¹, Edmund Y. Lam¹; ¹*The Univ. of Hong Kong, Hong Kong*. We demonstrate the utilization of the computational neuromorphic imaging paradigm to acquire temporal diversity measurements, which proves advantageous in overcoming the dynamic range limitations of Shack-Hartmann wavefront sensors for ultra-fast large-gradient turbulence diagnosis.

CM2B.3 • 11:00 (Top-Scored)

Spectrum Synthesis With Computational Neuromorphic Imaging, Rongzhou Chen¹, Shuo Zhu¹, Chutian Wang¹, Edmund Y. Lam¹; ¹*The Univ. of Hong Kong, Hong Kong*. We propose a method for spectrum synthesis via computational neuromorphic imaging (CNI), employing stochastic variational inference to extract spectral profiles from dynamic light-sample interactions. It provides new insights into biological analysis and CNI applications.

CM2B.4 • 11:15

Event-Driven LiDAR With Dynamic Neuromorphic Processing, Matthias Aquilina¹, Alex V. Sola², Paul Kirkland², Ashley Lyons¹; ¹*Univ. of Glasgow, UK*; ²*Univ. of Strathclyde, UK*. We present a novel spiking neural network approach to building 3D LiDAR images from temporal information alone. Our method uses the "spike" events from individually detected photons without the need to construct temporal histograms.

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10:30 -- 12:00

Room: Guillaumet 1

LM2D • IR Sensing

Presider: Aamir Farooq; King Abdullah Univ of Sci & Technology, Saudi Arabia

LM2D.1 • 10:30 (Invited)

Infrared Laser Spectroscopy for Reactive Flow Sensing, Xing Chao¹, Zihao Song¹, Ning Zhu¹, Weitian Wang¹; ¹*Tsinghua U., China*. Infrared laser spectroscopy enables fast, *in-situ*, and quantitative gas sensing. We report our recent advancements in investigation of molecular vibrational energy transfers, high-resolution spectroscopy methods, and efficient spectral signal processing technologies, targeting reactive flow sensing.

LM2D.2 • 11:00

Improved Performance of a Mid-Infrared Cross-Dispersed Comb Spectrometer Using a Fast Framerate InSb Array, Diana M. Bailey¹, Adam J. Fleisher¹; ¹*National Inst of Standards & Technology, USA*. A fast full-frame-rate InSb array was combined with field-of-view ILS mapping to achieve a 20-fold increase in spectral acquisition rate and improved precision for N₂O isotopic analysis.

LM2D.3 • 11:15

Integrated Mid-Infrared System for Concurrent Open-Path Gas Sensing and Optical Communication, Ali Elkhazraji¹, Mohammed Sait², Aamir Farooq¹; ¹*KAUST, Saudi Arabia*; ²*Aramco, Saudi Arabia*. This paper demonstrates the first simultaneous open-path optical communication and gas concentration (H₂S) sensing using a single 8- μ m quantum cascade laser. The dynamics between communication and sensing using the same optical path are investigated.

10:30 -- 12:00

Room: Spot

LM2E • Environmental Sensing

Presider: Brett Bathel; NASA Langley Research Center, USA

LM2E.1 • 10:30

Environmental Dual-Comb Sensing of Nitrogen Dioxide, Alexander Eber¹, Lukas Fürst¹, Florian Lindorfer¹, Florian Siegrist¹, Adrian Kirchner¹, Benedikt Tschofenig², Robert di Vora¹, Armin Speletz¹, Mithun Pal¹, Birgitta Bernhardt¹; ¹*Graz Univ. of Technology, Austria*; ²*Air Pollution Control, Office of the Styrian Government, Austria*. Nitrogen dioxide is of major importance to our climate. We achieve a 5 ppb sensitivity with one-minute averaging times and a spatial resolution of 90 m with a mobile dual frequency comb and reflector setup.

LM2E.2 • 10:45

QEPAS Sensor for in-Situ Measurement of CO₂ and its Isotopic Fingerprint, Marta Ruiz Llata¹, Yuliy M. Sanoyan¹, Lucia Hidalgo-Arteaga¹; ¹*Universidad Carlos III de Madrid, Spain*. We present the design and first results of a Photoacoustic Spectroscopy sensor to measure in-situ CO₂ concentration and the $\delta^{13}\text{C}$ isotopic fingerprint. The sensor main components are a Quartz

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Enhanced Photoacoustic (QEPAS) gas cell excited with a Mid Infrared Quantum Cascade Laser (QCL).

LM2E.3 • 11:00 (Invited)

Laser Remote Microscopy for Insect Diversity Assessment, Mikkel Brydegaard^{1,2}; ¹*Lunds Universitet, Sweden*; ²*Norsk Elektro Optikk, Norway*. Recent insect decline prompts rapid online monitoring solutions with specificity for thousands of coexisting species. I demonstrate how microscopic and nanoscopic features of insects can aid differentiation of species and be retrieved with spectral lidar.

LM2E.4 • 11:30 (Invited)

Lidar and Parametric Sources Co-Design for Water Vapour and Isotopes Sensing by Differential Absorption Spectrometry, Jean-Baptiste Dherbecourt¹, Jonas Hamperl¹, Jean-Michel Melkonian¹, Antoine Godard^{1,3}, Cyrille Flamant², Myriam Raybaut¹; ¹*DPHY, ONERA, Université Paris Saclay, France*; ²*Laboratoire Atmosphères Milieux et Observations Spatiales (LATMOS), France*; ³*DSG, ONERA, Université Paris Saclay, France*. We present our latest lidar and parametric source developments to remotely measure stable water isotopologues (H₂¹⁶O, HD¹⁶O) in the lower troposphere, which is of high interest to investigate the water cycle for meteorology and climatology

10:30 -- 12:00

Room: Diamant

QM2C • Quantum Sensing with Solid-State Spins II

Presider: Konstantin Herb; ETH Zürich, Switzerland

QM2C.1 • 10:30

Testbed for Automatized Machine Learning Optimization of Nitrogen Vacancy Center Based Magnetometry, Ruben Pellicer-Guridi^{1,2}, Asier Mongelos¹, Jason Francis¹, Angel S. Cifuentes¹, Gabriel Molina-Terriza^{1,3}; ¹*Centro Física de Materiales, Spain*; ²*Donostia International Physics Center, Spain*; ³*IKERBASQUE, Basque Foundation for Science, Spain*. We present a versatile, robust and inexpensive setup for Nitrogen Vacancy center based sensing that enables automatized generation of large datasets to train machine learning algorithms towards fieldable advanced quantum magnetic field sensors.

QM2C.2 • 10:45

Continuous Real-Time Magnetometry and Feedback Control via Coherent Population Trapping of a NV Center, Ethan Turner¹, Shuhao Wu¹, Hailin Wang¹; ¹*Univ. of Oregon, USA*. We report the experimental demonstration of continuous real-time magnetometry and feedback control via coherent population trapping of a NV center. The real-time update can take place with the detection of just a single photon.

QM2C.3 • 11:00 (Invited)

A Quantum Coherent Single Electronic Spin in a van der Waals Material at Room Temperature, Hannah Stern¹; ¹*Univ. of Manchester, UK*. I will present a new optically addressable carbon-related spin defect with a spin-triplet electronic ground state that is

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embedded in hexagonal boron nitride. I show how quantum coherent control of this spin is possible under ambient conditions and demonstrate that the spin coherence is predominantly governed by coupling to only a few proximal nuclei and is prolonged by decoupling protocols.

QM2C.4 • 11:30 (Invited)

Nanoscale NMR Enabled by Diamond Spin Qubits, Fedor Jelezko¹; ¹*Universitat Ulm, Germany*. Abstract not available.

13:30 -- 15:30

Room: Ariane 2

AM3A • Photonics and Sensing

Presider: Tanya Myers; Pacific Northwest National Laboratory, USA

AM3A.1 • 13:30 (Invited)

Mid-Infrared (Bio)Photonics: From Emerging Tool to Enabling Technology, Boris Mizaikoff^{1,2}; ¹*Ulm Univ., Germany*; ²*Hahn-Schickard, Germany*. Infrared spectroscopy plays an increasingly important role in modern biondiagnostics, environmental analysis, biotechnological production and food safety/quality scenarios. This has led to the evolution of mid-infrared photonics from an emerging tool into an enabling technology. In particular, with the emergence of quantum and interband cascade laser technology, the on-chip hybridization of entire MIR sensing devices is on the horizon ultimately leading to IR-lab-on-chip systems.

AM3A.2 • 14:00 (Invited)

Enhancing Single Cell Phase Contrast Imaging: Intracellular Specificity via Advanced Flow Tomography, Pietro Ferraro¹; ¹*Inst. of Intelligent Systems ISASI, Italy*. We show that flow-tomography could enhance intracellular specificity in Single Cell Phase-Contrast Imaging filling the gap toward fluorescent microscopy. Strategies and techniques for precise cellular extraction and 3Dv-isualization are investigated promising insights into cellular biology.

AM3A.3 • 14:30

Use of Multi-Spectral Sensor for Evaluation of Optical Phantom: Toward Point-of-Care Testing in Biophotonics Application, Hyunseon Yu¹, Donghwan Ko¹, Byungjo Jung¹; ¹*Biomedical Engineering, Yonsei Univ., Korea (the Republic of)*. We introduce a miniaturized spectral sensor and evaluate optical feasibility using optical phantom for PoC testing in biophotonics application. Reflectance data measured by spectral sensor and a commercial spectrometer shows a good correlation with $R^2=0.856$.

AM3A.4 • 14:45

A non-Dominated Sorting Genetic Algorithm Based Optimization Study of Wide Band Model in Infrared Remote Detection, Yihan Li¹; ¹*Beihang Univ., China*. A non-dominated sorting genetic algorithm was employed to optimize the Multi-Scale Multi-Group Wide-Band model (MSMGWB) for the grouping strategy, Gaussian quadrature scheme, and reference temperature parameters in infrared remote detection computation.

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AM3A.5 • 15:00 (Invited)

Applications of THz Time-Domain Spectroscopy, Martin Koch¹; ¹*Philipps Universitat Marburg, Germany*. A whole range of applications are foreseen for THz time-domain spectroscopy, a technique the considerably developed over the last decades. The presentation will focus on potential applications in the fields of pharmacy and plant physiology.

13:30 -- 15:30

Room: Caravelle 2

CM3B • Advances in Computational Microscopy I

Presider: Seung Ah Lee; Yonsei Univ., Republic of Korea

CM3B.1 • 13:30 (Invited)

Scanning Light-Field Microscopy With Digital Adaptive Optics, Jiamin Wu¹; ¹*Tsinghua Univ., China*. In this talk, I will discuss our recent work in mesoscale intravital fluorescence microscopy based on computational imaging methods.

CM3B.2 • 14:00

Extended Field of View Mueller Matrix Polarimetric Microscopy, Ariel Fernández¹, Roman Demczyklo¹, Diego Silva¹, Federico Lecumberry¹; ¹*Universidad de la República, Uruguay*. A microscopy setup incorporating Division of Focal Plane sensing and linearly independent States of Polarization in the input allows to obtain 3x3 Mueller matrix of tissue samples. Image stitching techniques allow to extend the Field of View for whole-slide imaging and multi-scale characterization.

CM3B.3 • 14:15

Filter-Free Polarimetric Digital Holography With Light-Emitting Diode and no 4f Optical System, Tatsuki Tahara¹; ¹*National Inst of Information & Comm Tech, Japan*. I have proposed filter-free polarimetric incoherent holography (Opt. Lett. 48 (2023) 3881.) in which 4f optical system was introduced. This time I propose filter-free polarimetric holography techniques with daily-use light and no 4f optical system.

CM3B.4 • 14:30

RePro LFM: Adaptable and Reprogrammable Lightfield Microscope, Hamidreza Hasani Balyani¹, Oliver Cossairt¹, Jipeng Sun², Shuyu Iris Zhu³, Qiangzhou Rong³, Florian Willomitzer⁴, Geoffrey Goodhill³; ¹*Northwestern Univ., USA*; ²*Princeton Univ., USA*; ³*Washington Univ. in St. Louis, USA*; ⁴*Univ. of Arizona, USA*. This study introduces Reprogrammable Lightfield Microscopy, enhancing wide-field fluorescence microscopy with a spatial light modulator and tunable lens, showcasing rapid prototyping using different microlens array designs and complex biological structure capture through simulations and experiments.

CM3B.5 • 14:45

Large Range Interferometric Optical Profiling Using Encoded Search Focal Scan, Narcís Vilar^{1,2}, Roger Artigas¹, Martí Duocastella², Guillem Carles¹; ¹*Sensofar Tech, Spain*; ²*Applied Physics, Univ. of Barcelona, Spain*. We implement Encoded Search Focal Scan, a technique to reconstruct microscopic height maps of surfaces, on an interferometric microscope, to

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demonstrate ultra-fast topographic imaging at high resolution and precision with extended axial measurement ranges.

CM3B.6 • 15:00 (Invited)

Enhancing Super-Resolution Microscopy With Deep Learning, Christophe Zimmer¹; ¹*Institut Pasteur Paris, France*. Abstract not available.

13:30 -- 15:30

Room: Argos

IM3G • Advances in Microscopy I

Presider: Chrysanthe Preza; Univ. of Memphis, USA

IM3G.1 • 13:30 (Invited)

Novel Structured Illumination Microscopy System, Genaro Saavedra¹, Chrysanthe Preza²; ¹*3D Imaging and Display Laboratory, Universitat de Valencia, Spain*; ²*Computational Imaging Research Laboratory, The Univ. of Memphis, USA*. Structured illumination microscopy (SIM) provides accurate 3D images of translucent samples by using non-uniform irradiance patterns in combination with digital post processing. We present here a novel setup, tunable SIM, that provides shorter registration times, higher signal-to-noise ratios, and increased optical sectioning capabilities respect to classical SIM implementations.

IM3G.2 • 14:00

Three-Dimensional Sparse Lattices for High-Throughput Fluorescence Microscopy, Victor Chuman^{1,2}, Filip Milojkovic^{1,2}, Pol Van Dorpe^{1,2}, Niels Verellen¹; ¹*imec, Belgium*; ²*Dept. of Physics and Astronomy, Research unit Quantum Solid-State Physics, KU Leuven, Belgium*. We propose using sparse optical lattices to enable the design of structured illumination microscopy systems based on photonic integrated circuits (PIC). We show simulations of sample lattices and their application to digital confocal microscopy.

IM3G.3 • 14:15

High-Resolution 3D Reconstruction of Two-Photon Synthetic Aperture Microscopy Under Spatially Mismatched Sparse Sampling, Zhifeng Zhao¹, Tianhong Gao², Yiliang Zhou¹, Jiaqi Fan^{1,3}, Jiamin Wu¹, Qionghai Dai¹; ¹*Department of Automation, Tsinghua Univ., China*; ²*Department of Electronic Engineering, Tsinghua Univ., China*; ³*Tsinghua Shenzhen International Graduate School, Tsinghua Univ., China*. Harnessing the two-photon synthetic aperture microscopy (2pSAM), we achieved high-quality 3D reconstruction, even with quadruple downsampling. This method fully utilizes the information redundancy inherent in four-dimensional spatial and angular scanning.

IM3G.4 • 14:30

Assessment of a Novel Tunable 3D Structured Illumination Microscopy (TSIM) System, Arash Atibi¹, Abdulaziz Alqahtani¹, Chrysanthe Preza¹; ¹*Univ. of Memphis, USA*. The study explored the impact of regularization on achieved resolution in 3D restorations using the MBPC iterative algorithm and the TSIM system, at different noise levels. Results indicate significant resolution enhancement.

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IM3G.5 • 14:45

PreciFree: a Multiphoton Slide Scanner for Histopathology, Dobryna Zalvidea¹, Vaisakh Paingad¹, Zhetao Dong¹, Thomas Märsch¹; ¹*PreciPoint, Germany*. A multiphoton slide scanner, PreciFree, that generates label-free two-photon and three-photon autofluorescence, and second and third harmonic generation images is introduced. Whole slide images can be generated in less than 5 min for Clinical Pathology.

IM3G.6 • 15:00

Holographic Illumination for Fast Wide-Field Third-Harmonic Generation Imaging, Olivier Bernard¹, Vasiliki Stergiopoulou^{3,1}, Satoshi Hasegawa², Yoshio Hayasaki², Jeff Squire⁴, Martin Vetterli³, Yves Bellouard¹; ¹*Galatea Laboratory, École polytechnique fédérale de Lausanne, Switzerland*; ²*Center for Optical Research and Education, Utsonomiya Univ., Japan*; ³*Audiovisual Communications Laboratory, École polytechnique fédérale de Lausanne, Switzerland*; ⁴*Department of Physics, Colorado School of Mines, USA*. We demonstrate a throughput increase of third-harmonic generation microscopy imaging using arbitrary illumination patterns. A 'camera-in-the-loop' feedback control optimizes the hologram displayed by a spatial light modulator and two different image reconstruction methods are implemented.

IM3G.7 • 15:15

Nanoscale Polarized Imaging in 3D, Isael Herrera¹, Luis A. Aleman-Castaneda¹, Miguel A. Alonso^{1,2}, Sophie Brasselet¹; ¹*Institut Fresnel, Aix Marseille Univ, CNRS, Centrale Med, France*; ²*The Inst. of Optics, Univ. of Rochester, USA*. We present an experimental approach to measure the complete characteristics of 3D-oriented optical dipoles at nanoscales, including spin and depolarization. We detect electric-induced dipoles in gold nanoparticles and fluorophores.

13:30 -- 15:30

Room: Guillaumet 1

LM3E • Advanced Flow Diagnostics

Presider: Venkat Athmanathan; Purdue Univ., USA

LM3E.1 • 13:30 (Invited)

Laser-Based Velocity Measurements in Large Transonic Cryogenic Wind Tunnels: Challenges and Opportunities, Paul M. Danehy¹, Ross A. Burns¹, Jian Gao¹, Olivia K. Tyrrell¹; ¹*NASA Langley Research Center, USA*. Two different approaches for velocimetry have been implemented in transonic cryogenic wind tunnels at the NASA Langley Research Center. Challenges associated with measuring velocity in these facilities are summarized and two different measurement techniques are described.

LM3E.2 • 14:00 (Invited)

Towards Ultra-Narrowband and Wavelength-Agile Burst-Mode Molecular Filtered Rayleigh Scattering, Amanda M. Braun¹, Mikhail N. Slipchenko^{1,2}, Neil S. Rodrigues³, Jason Leicht², Paul M. Danehy³, Sukesh Roy², Terrence R. Meyer¹; ¹*Purdue Univ., USA*; ²*Spectral Energies, LLC, USA*; ³*NASA Langley Research Center, USA*. This work investigates the

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feasibility and performance of an ultra-narrowband and a rapidly wavelength-tunable burst-mode filtered Rayleigh scattering (FRS) system for single- or multi-parameter measurements of density, pressure, temperature, and velocity in high-speed flows.

LM3E.3 • 14:30 (Invited)

PLIF for Space Technology and Exploration Applications, Neil S. Rodrigues¹, Paul M. Danehy¹, Olivia K. Tyrrell¹, Naibo Jiang², Paul S. Hsu², Brian Hollis¹, Ashley Korzun¹, Sukesh Roy²; ¹NASA Langley Research Center, USA; ²Spectral Energies, LLC, USA. Highlights from recent PLIF test campaigns at large-scale NASA facilities and lab-scale developments are summarized. The measurements presented here have the potential to aid researchers in validating complex simulations and inform designs for spaceflight vehicles.

LM3E.4 • 15:00

Microsecond Lifetime Nitric Oxide MTV With 1+1 REMPI, Paul S. Hsu¹, Naibo Jiang¹, Sukesh Roy¹, Jincheng Wang², Hui Hu², Neil S. Rodrigues³, Paul M. Danehy³; ¹Spectral Energies LLC, USA; ²Iowa State Univ., USA; ³NASA Langley Research Center, USA. Long-lived NO fluorescence with a lifetime of several microseconds is demonstrated for MTV using an efficient 1+1 resonant-enhanced-multiphoton-ionization (REMPI) process. This measurement technology is particularly applicable to high-speed flows under a wide pressure range.

LM3E.5 • 15:15 (Top-Scored)

100-KHz Rate CO Imaging Using Burst-Mode OPO, Awnik Roy¹, Paul S. Hsu²; ¹The Miami Valley School, USA; ²Spectral Energies, LLC, USA. Demonstration of two-photon planar laser-induced fluorescence imaging (TP-PLIF) of carbon monoxide (CO) using a narrow linewidth optical parametric oscillator (OPO). This development allows high-speed, time-resolved CO measurements in dynamic hypersonic boundary layers and combustion environments.

13:30 -- 15:30

Room: Spot

LM3F • Ultrafast Laser Applications

Presider: Daniel Richardson; Sandia National Laboratories Albuquerque, USA

LM3F.1 • 13:30 (Invited)

Femtosecond Two-Photon Laser Induced Fluorescence Measurements of H and N in Plasma Assisted NH₃ Synthesis, Ning Liu¹, Xingqian Mao¹, Christopher Kondratowicz¹, Timothy Chen¹, Bowen Mei¹, Ziyu Wang¹, Yijie Xu¹, Hongtao Zhong¹, Zhiyu Shi¹, Anatoli Morozov¹, Arthur Dogariu^{2,1}, Yiguang Ju^{1,3}; ¹Mechanical and Aerospace Engineering, Princeton Univ., USA; ²Aerospace Engineering, Texas A&M Univ., USA; ³Princeton Plasma Physics Laboratory, USA. This work developed femtosecond two-photon absorption laser induced fluorescence for atomic nitrogen and hydrogen measurements, applied it to plasma aided ammonia synthesis, and unraveled the kinetic role of vibrational energy transfer of hydrogen molecules.

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LM3F.2 • 14:00 (Invited)

Advances in Laser Sources for Femtosecond, Picosecond, and Nanosecond High-Speed Laser Diagnostics, Mikhail N. Slipchenko^{1,2}, Jason Leicht², Christopher Crabtree², Mateo Gomez², Terrence R. Meyer¹, Sukesh Roy²; ¹*Purdue Univ., USA*; ²*Spectral Energies, LLC, USA*. This work present recent advances in laser technology including the performances of 1 kJ burst-mode system for linear and non-linear optical high-speed diagnostics in reacting and non-reacting flows.

LM3F.3 • 14:30

One-Dimensional fs/ps Coherent Anti-Stokes Raman Scattering in a Post-Shock Environment, Laurie Elkowitz¹, Ryan J. Thompson¹, Chloe E. Dedic¹; ¹*Univ. of Virginia, USA*. Spatially resolved measurements of post-shock rotational temperatures in N₂ and CO₂ rich environments are performed using one-dimensional fs/ps coherent anti-Stokes Raman scattering. The spatially-dependent temperature rise associated with post-shock conditions are studied.

LM3F.4 • 14:45

Hybrid fs/ps CARS Thermometry of CO₂ in Nanosecond-Pulsed Discharges, Ryan J. Thompson¹, Laurie Elkowitz¹, Chloe E. Dedic¹; ¹*Univ. of Virginia, USA*. Hybrid fs/ps CARS temperature measurements of CO₂, N₂, and CO were performed in an atmospheric-pressure nanosecond repetitively pulsed dielectric barrier discharge. The time- and concentration-dependence of the discharge temperature is presented.

LM3F.5 • 15:00

1 kHz Rate Measurement of Vibrational/Rotational Nonequilibrium Using Hybrid Femto/Picosecond Coherent Anti-Stokes Raman Scattering in Plasma, Laila Dakroub^{1,2}, Michael Scherman¹, Sean McGuire², Clément Pivard¹, Nelly Dorval¹, Denis Packan¹, Philippe Nicolas¹, Rosa Santagata¹, Brigitte Attal-Trétout¹; ¹*DPHY, ONERA, Université Paris-Saclay, France*; ²*EM2C, CentraleSupélec, Université Paris-Saclay, France*. We report simultaneous 1 kHz single-shot measurement of rotational and vibrational temperature of N₂ using hybrid femto/picosecond coherent anti-Stokes Raman scattering of the Q branch of N₂ in a non-equilibrium DC glow discharge.

LM3F.6 • 15:15

Observation of Sodium D-Line Quantum Beat in LIF Using Stepwise fs Excitation, Gautier Vilmart¹, Michael Scherman¹, Anais Chiabaut², Nelly Dorval¹; ¹*Office Natl d'Etudes Rech Aérospatiales, France*; ²*Thales, France*. We report a direct observation of quantum beating between ³P_{1/2} and ³P_{3/2} levels of atomic sodium using ultrashort laser pulses. Comparison with a semi-classical model shows very good agreement with the experimental signal.

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13:30 -- 15:30

Room: Diamant

QM3D • Quantum Sensing with Solid-State Spins III

Presider: Kasturi Saha; Indian Inst. of Technology, Bombay, India

QM3D.1 • 13:30 (Invited)

Optically Pumped Solid State Quantum Magnetometers for Space Application, Andreas Gottscholl¹, Corey J. Cochrane¹, Hannes Kraus¹; ¹*NASA Jet Propulsion Laboratory, California Inst. of Technology, USA*. Magnetometry is a crucial tool for planetary science, earth science, heliophysics, defense and surveying. We present a new generation of quantum solid state magnetometers, leveraging optical and electrical interrogation of quantum centers in silicon carbide.

QM3D.2 • 14:00 (Invited)

Metrology Solutions With Diamond Quantum Sensors, Remi Jean Geiger¹, Thomas Hingant¹; ¹*WAINVAM-E, France*. KWAN-TEK is a French deep-tech company founded in April 2020 which develops and commercializes metrology solutions based on diamond quantum sensors, for applications in instrumentation and industrial control.

QM3D.3 • 14:30

A Scanning Magnetometer With Nitrogen-Vacancy Spins in a Fiber-Coupled Diamond Nanobeam, Yufan Li^{1,2}, Gesa Welker¹, Richard Norte², Toeno van der Sar¹; ¹*Department of Quantum Nanoscience, Kavli Inst. of Nanoscience, Delft Univ. of Technology, Netherlands*; ²*Department of Precision and Microsystems Engineering, Faculty of Mechanical, Maritime and Materials Engineering, Delft Univ. of Technology, Netherlands*. We demonstrate scanning nitrogen-vacancy center magnetometry using a tapered diamond nanobeam optically coupled to a tapered optical fiber as the scanning probe, facilitating implementation of NV magnetometry in low-temperature setups and other challenging environments.

QM3D.4 • 14:45 (Top-Scored)

Perfectly-Aligned Diamond Quantum Sensors to Visualize Superconducting Vortices, Shunsuke Nishimura¹, Taku Kobayashi¹, Kensuke Ogawa¹, Takeyuki Tsuji^{2,3}, Takayuki Iwasaki², Mutsuko Hatano², Kento Sasaki¹, Kensuke Kobayashi¹; ¹*the Univ. of Tokyo, Japan*; ²*Tokyo Inst. of Technology, Japan*; ³*National Inst. of Materials Science, Japan*. We present a wide-field imaging technique using perfectly-aligned diamond quantum sensors to accurately visualize superconducting vortices in a thin film. Our results agree with theoretical models, validating our method's precision and versatility in characterizing superconductors.

QM3D.5 • 15:00

A Compact Device for Millimetre-Scale Magnetic Imaging Based on Diamond Quantum Sensors, Alex Shaji¹, Kevin Rietwyk¹, Islay O. Robertson¹, Philipp Reineck^{1,2}, David A. Broadway¹, Jean-Philippe Tetienne¹; ¹*RMIT Univ., Australia*; ²*ARC Centre of Excellence for Nanoscale BioPhotonics, RMIT Univ., Australia*. We demonstrate a self-contained device that integrates a diamond magnetic sensor into a compact head to allow magnetic field imaging over millimetre-scale field of view with a micrometre resolution.

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QM3D.6 • 15:15

Depth-Dependent Radiative Lifetimes in Shallow Nitrogen-Vacancy Centers in Diamond, Maryam Zahedian¹, Ricardo Vidrio¹, Shimon Kolkowitz², Jennifer Choy¹; ¹*Univ. of Wisconsin-Madison, USA*; ²*Univ. of California, Berkeley, USA*. We experimentally demonstrate correlation between the radiative lifetime of NV centers and their distance from the diamond-air interface, which paves the way for using lifetime measurements to estimate NV depth.

13:30 -- 15:30

Room: Ariane 1

SM3C • Single-Point Optical Fiber Sensors

Presider: Xin Lu; Bundesanstalt für Materialforschung und, Germany

SM3C.1 • 13:30 (Invited)

Ultrasensitive Fiber Sensing Based on Random Optical Parametric Oscillator, Pedro Tovar¹, Xiaoyi Bao¹; ¹*Physics, Univ. of Ottawa, Canada*. We demonstrate ultrasensitive fiber sensor based on random optical parametric oscillator for the first time. It has distributed potential for static and dynamic mK temperature and nano-strain accuracy enabled by Rayleigh and parametric amplification.

SM3C.2 • 14:00 (Top-Scored)

Integrated High-Speed Sub-Picometer Wavemeter Based on Silicon Carrier-Depletion Modulator, Javier Elaskar¹, Simone Cammarata^{1,2}, Francesca Samà¹, Fabrizio Di Pasquale¹, Claudio Oton¹; ¹*Scuola Superiore Sant'Anna, Italy*; ²*Istituto Nazionale di Fisica Nucleare, Italy*. We present a silicon integrated high-speed wavemeter with a range from 1520 to 1580 nm. Experimental results show a standard deviation of 0.16 pm with 150 kHz bandwidth and FBG detection up to 42 kHz.

SM3C.3 • 14:15

Embedded Coupled-Core Fiber for Force Sensing Applications, Marco A. Contreras², Amaia Berganza¹, Florian Lindner³, Joerg Bierlich³, Joseba Zubia⁴, Katrin Wondraczek³, Joel Villatoro^{4,5}; ¹*Department of Applied Mathematics, Univ. of the Basque Country UPV/EHU, Spain*; ²*Department of Electronic Engineering, Universidad de Guanajuato, Mexico*; ³*Leibniz Inst. of Photonic Technology (Leibniz IPHT), Germany*; ⁴*Department of Communications Engineering, Univ. of the Basque Country UPV/EHU, Spain*; ⁵*IKERBASQUE, Basque Foundation for Science, Spain*. In this work, a coupled-core fiber embedded in a 3D printed cantilever for force sensing in the milli-Newton range is demonstrated. A Bragg grating was added to the coupled-core fiber to simplify the sensor interrogation.

SM3C.4 • 14:30 (Invited)

An Overview of Plasmonic Plastic Optical Fiber Biosensors for Different Application Fields, Nunzio Cennamo¹, Luigi Zeni¹; ¹*Univ della Campania Luigi Vanvitelli, Italy*. The work reports several kinds of POF-based plasmonic probes (extrinsic and intrinsic schemes) combined with receptor layers (biomimetic or biological) that offer different efficiencies, producing the desired performances in terms of substance and detection range.

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SM3C.5 • 15:00

Non-Contact Bidirectional Lateral Displacement Sensor Based on Coherent Control of Vortex Beams, Kang Yang^{2,1}, Shouju Liu¹, Guoyu Li², Huiyi Guo³, Chao Wang¹; ¹*Univ. of Kent at Canterbury, UK*; ²*Handan Univ., China*; ³*Nankai Univ., China*. This paper proposes a non-contact lateral movement sensor utilizing a Mach-Zehnder interferometer with two conjugated vortex beams. It features easy generation of vortex beams, high measurement precision and the capability of bidirectional movement sensing.

SM3C.6 • 15:15

A Sub-Hz-Linewidth Brillouin/Erbium Fiber Laser Module for Optical Sensing, Mo Chen¹, Zhou Meng¹, Min Zhu¹; ¹*College of Meteorology and Oceanology, National Univ. of Defense Technology, China*. We demonstrate an ultranarrow-linewidth Brillouin/erbium fiber laser module. Its output power is 16 mW. The Lorentzian linewidth is 0.55 Hz. The size of the module is 133 mm×113 mm×20 mm. It presents important applications in highly coherent optical fiber sensors.

15:30 -- 16:30

Room: Cassiopée

JM4A • Joint Poster Session I

JM4A.1

Design of Biomimetic Optical Sensor for Underwater Fluid Velocity Measurement, Dongmin Seo², Sangwoo Oh¹, Seungoh Han³; ¹*Ocean and Maritime Digital Technology Research Division, Korea Research Inst. of Ships & Ocean Engineering, Korea (the Republic of)*; ²*Department of Electrical & Electronic Engineering, Semyung Univ., Korea (the Republic of)*; ³*Department of Robotics, Hoseo Univ., Korea (the Republic of)*. To develop an optical sensor that mimics the neuromast, a sensory organ in the fish used to detect movement, vibration and pressure gradient, we propose a design of a pillar, a sensor structure with robust properties in the underwater, and present conditions and analysis results for simulating the displacement of the pillar in the flow field.

JM4A.2

Multipoint Strain Monitoring on a Metal Structure Using Embedded Fiber Bragg Grating Sensors, Qiang Bian^{2,3}, Andrea Stadler³, Fabian Buchfellner³, Constantin Bauer¹, Zhou Meng², Wolfram Volk¹, Johannes Roths³; ¹*Chair of Metal Forming and Casting, Technical Univ. of Munich, Germany*; ²*College of Meteorology and Oceanography, National Univ. of Defense Technology, China*; ³*Photonics Laboratory, Munich Univ. of Applied Sciences, Germany*. A fiber Bragg grating (FBG) array embedded in an aluminum structure by casting was used to monitor external strain during a tensile test. Work hardening effect was observed, and strain sensitivity of the middle embedded FBG agreed well with theory.

JM4A.3

Adaptive Structured Light for Inspecting Objects With Curvature, Hanjin Cho¹, Eunbi Lee¹, Siwoo Lee¹, Juhyun Lee¹, Chen Chun¹, Yoonchan Jeong¹, ByoungHo Lee¹; ¹*Department of Electrical and Computer Engineering, Seoul National Univ., Korea (the Republic of)*. In the

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surface inspection, it is necessary to irradiate light from various angles to improve visibility. In this paper, we propose a method that uses structured light to quickly irradiate the entire surface of objects to be inspected at various angles and to optimize the distortion of the structured light caused by the object's curvature.

JM4A.4

Effect of Dye Concentration on the Spatial Coherence Measured by the Use of a Fresnel Zone Plate, Han Mingon¹, Jeong Gyun Na¹, Hongjae Jeong¹, Yoonchan Jeong¹; ¹*Seoul National Univ., Korea (the Republic of)*. The random laser using Rh6G and TiO₂ with Nd:YAG laser was focused by a FZP and the size of the beam at the focal plane was measured to determine the relationship between the concentration of the Rh6G and the degree of coherence of the beam. As the concentration increased from 2.1 mM to 6.3 mM, the size of the beam increased by approximately 25%

JM4A.5

Transmission-Loss Characteristics of Microfiber in Liquids for Multimode Interference Sensors, Mitsuru Kihara¹; ¹*Osaka Electro-Communication Univ., Japan*. Experimental results indicate that microfibers can be effective as multimode interference sensors for measuring refractive indices (RIs) below 1.45. The RI is linearly proportional to measured wavelength shift, and the slope is 901.5 nm/RIU.

JM4A.6

Quantitative Phase Imaging and Machine Learning for Spermatozoa Analysis, Ankit Butola¹, Sigurd Hellberg¹, Farhad Niknam¹, Mona Nystad¹, Krishna Agarwal¹; ¹*UiT The Arctic Univ. of Norway, Norway*. Conventional methods of assessing sperm quality are based on qualitative analysis of semen. In this paper, we combined time-lapse quantitative phase imaging and deep learning for the classification of healthy and unhealthy sperm cells

JM4A.7

Design of a Loop-Terminated Plasmonic Mach-Zehnder Modulator on Silicon Nitride-Loaded Thin Film Lithium Niobate on Insulator, Gregory B. Tanyi¹; ¹*CSIRO, Australia*. We showcase a loop terminated Mach-Zehnder plasmonic modulator with a low driving voltage (1.2V) and compactness (60 μ m x 42 μ m). The modulator has applications in on-chip distributed acoustic sensing, where its ability for square pulse modulation is critical for enhancing sensing distance and spatial resolution.

JM4A.8

Configuration Simplification and Data Reduction in a DAS System for Monitoring Large Infrastructures, Xin Lu¹, Katerina Krebber¹; ¹*Bundesanstalt für Materialforschung und, Germany*. The distributed acoustic sensor based on an imbalanced Mach-Zehnder interferometer with a 3x3 coupler is simplified by using a balanced detector instead of three identical photodetectors. The obtained data is reduced by two third accordingly.

JM4A.9

Trace Gas Sensor Based on Differential Integrating Sphere, Chu Zhang¹, Ying He¹, Shunda Qiao¹, Yufei Ma¹; ¹*Harbin Inst. of Technology, China*. A differential integrating sphere based

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photoacoustic spectroscopy (PAS) gas sensor is proposed. The photoacoustic signal of the sensor was double enhancement and the noise was suppressed.

JM4A.10

Trace Determination of Cardiac Troponin I Using a Label-Free Fiber Optical Localized Surface Plasmon Resonance Biosensors, Chang Yue Chiang¹, Chien Hsing Chen², Chien Tsung Wang¹, Chin Wei Wu¹, Hsing Yu Chiang¹; ¹*National Yunlin Univ. of Science and Technology, Taiwan*; ²*National Pingtung Univ. of Science and Technology, Taiwan*. This work proposes a carboxyl-graphene-oxide-based fiber optic localized surface plasmon resonance biosensor which employed anti-Cardiac Troponin I (anti-cTnI) as the recognition element to detect the cTnI-protein in 10 min with a limit of detection (LOD) of 5.8 pM, which meets the acceptable LOD for clinical testing of 0.04 ng/mL.

JM4A.11

Combining Line Confocal and Scanning Light Field Microscopy to Achieve High-Resolution Observations in Deep Tissues, Zhi Lu¹, Jiamin Wu¹, Qionghai Dai¹; ¹*Tsinghua Univ., China*. We combine line confocal scheme and scanning light-field microscopy (sLFM) to develop a confocal scanning light-field microscopy (csLFM). By introducing simple modifications in the illumination path, csLFM enables high-resolution imaging with reduction in background.

JM4A.12

Small Displacements Sensing via Enhanced Temporal Measurement, Shouju Liu¹, Kang Yang^{2,1}, Chao Wang¹; ¹*Univ. of Kent at Canterbury, UK*; ²*Handan Univ., China*. This paper proposed a novel precise measurement of small displacement by MMF. It not only demonstrates the potential of multimode fibers in high-precision measurement fields but also provides important technical measurement in optical systems.

JM4A.13 • 15:30

Spatiotemporal Digital Holography Microscopy Fringes Addresses new Challenges in Biological Microfluidic Imaging, Pietro Ferraro¹; ¹*Inst. of Intelligent Systems ISASI, Italy*. Space-Time Digital Holography (STDH) enables high-resolution biological imaging by reassembling holographic interference fringes. For imaging the flowing cells within microfluidic channel, STDH breaks through depth of focus limits and smartly adapts to microfluidic speed.

JM4A.14 • 15:30

Hybrid Illumination Angle Calibration for Fourier Ptychography Microscope, Chen Liang¹, Feng Fan², Pingyong Xu^{3,4}, Heng Mao¹; ¹*LMAM, School of Mathematical Sciences, Peking Univ., China*; ²*GBA Inst. of Collaborative Innovation, China*; ³*Key Laboratory of RNA Biology, Inst. of Biophysics, Chinese Academy of Sciences, China*; ⁴*National Laboratory of Biomacromolecules, Inst. of Biophysics, Chinese Academy of Sciences, China*. We proposed a hybrid calibration method for quantitative correction of illumination angle misalignments in Fourier ptychography microscope. This method combines system parameter pre-calibration with online sample-include calibration to ensure high-quality results.

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Tuesday, 16 July

08:00 -- 09:30

Room: Ariane 2

ATu1A • Enabling Technologies I

Presider: Diana Bailey; National Inst of Standards & Technology, USA

ATu1A.1 • 08:00 (Invited)

The Broadband Aluminum Oxide Integrated Photonics Platform: Applications in Spectroscopy, Dawson Bonneville¹, Ward A. Hendriks¹, Nadia Chahir¹, Meindert Dijkstra¹, Sonia García-Blanco¹; ¹*Universiteit Twente, Netherlands*. The Al₂O₃ waveguide platform demonstrates broadband operation with low loss, enabling UV enhanced Raman spectroscopy that is spectrally separated from autofluorescence. Material fabrication, recent results, and future work towards sensing and integration will be discussed.

ATu1A.2 • 08:30 (Invited)

Plasmonic Platforms for SERS Sensing, Isabel Pastoriza-Santos¹; ¹*Universidade de Vigo, Spain*. This seminar will provide an overview of the latest results of the FunNanoBio Group in the Nanoplasmonic field with special emphasis on the fabrication of plasmonic nanostructures for (bio)sensing based on surface-enhanced Raman scattering

ATu1A.3 • 09:00

Multiple Greenhouse gas Sensor Based on Integrated Photonic Spectral Correlation, Simon Dallaire¹, Antoine Hamel¹, Ross Cheriton¹, John Weber¹, Martin Vachon¹, Shurui Wang¹, Dan-Xia Xu¹, Pavel Cheben¹, Siegfried Janz¹, Jens Schmid¹, Francis Vanier¹, Daniel Gagnon¹; ¹*National Research Council Canada, Canada*. This paper presents a novel multi-gas sensor based on a spectral correlation integrated photonic chip. It expected to monitor a wide dynamic range of four gases in industrial conditions.

ATu1A.4 • 09:15

Beryl Unveiled: Probing Molecular Dynamics Through High-Temperature Infrared and Raman Spectroscopy, Naini Bajaj¹, Aparajita Bandyopadhyay¹, Amartya Sengupta¹; ¹*Indian Inst. of Technology Delhi, India*. Beryl was studied at high temperatures using Infrared and Raman spectroscopy. The findings reveal stability up to 600oC through the response of its distinctive vibrational modes, which are related to their stability in metamorphic rocks.

08:00 -- 09:30

Room: Argos

ATu1G • Enabling Technologies II

Presider: Tanya Myers; Pacific Northwest National Laboratory, USA

ATu1G.1 • 08:00 (Invited)

Surface Enhanced Infrared Absorption Spectroscopy to Detect Harmful Compounds as SARIN Gas or Vanillin, Thierry Taliercio¹, Pierre Fehlen², Guillaume Thomas³, Fernando Gonzalez Posada¹, Julien Guise¹, Melissa Najem⁴, Laurent Cerutti¹, Denis Spitzer³; ¹*Inst. for*

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Electronics and Systems (IES), Univ. of Montpellier, France; ²*IIT-CBN, Italy;* ³*Nanomaterials for systems under extreme stress (NS3E), UMR 3208 ISL, CNRS/Unistra, France;* ⁴*CEA-LETI, France.* Heavily doped semiconductor or aluminium-based plasmonic resonators have been developed to detect organophosphorus gas or vanillin molecules by surface-enhanced infrared absorption spectroscopy.

ATu1G.2 • 08:30 (Invited)

Spectroscopy Combined With Machine Learning to Study Oak Barrels Reusability in Wine Industry, Tatevik Chalyan¹, Indy Magnus¹, Heidi Ottevaere¹; ¹*Vrije Universiteit Brussel, Belgium.* To monitor the reusability of oak barrels in the wine industry for highly efficient wine aging purposes, various non-invasive spectroscopic techniques are studied in combination with machine learning algorithms.

ATu1G.3 • 09:00 Postdeadline Submission

Exploring Laser-Induced Fluorescence as a Process Analytics Method for Dissolved Oxygen, Anatoliy A. Kosterev¹; ¹*Yokogawa Corporation of America, USA.* Laser-induced fluorescence of oxygen in organic solvents is considered for a contactless process analytics method. Neither a photosensitizer nor singlet oxygen traps were added to solvents. Singlet oxygen self-quenching and solvent contamination effects reported.

ATu1G.4 • 09:15 Postdeadline Submission

Characterization of Different Dietary Fibers With Near-Infrared Spectroscopy and Wavelength Ratio Analysis., Claudia P. Tricanji¹, Lien Smeesters², Steven van der Berg¹; ¹*The Hague Univ. of Applied Sciences, Netherlands;* ²*Photonics, Vrije University Brussels, Belgium.* We demonstrate that near-infrared (NIR) reflection spectroscopy combined with a wavelength ratio analysis allows for consistent distinguishing different types of dietary fibers. This non-destructive dietary fiber analysis is promising for improved nutritional labeling.

08:00 -- 09:30

Room: Caravelle 2

CTu1B • Advances in Computational Microscopy II

Presider: Seung Ah Lee; Yonsei Univ., Republic of Korea

CTu1B.1 • 08:00 (Invited)

Physics-Informed Multifocus Fluorescence and Quantitative Phase Imaging for Comprehensive Cellular Analysis, Julia Alonso¹, Alejandro Silva¹, Juan M. Llaguno¹, Roman Demczyklo¹, Ariel Fernández¹, Miguel Arocena¹; ¹*Universidad de la República, Uruguay.* This talk will provide an in-depth overview of computational microscopy, emphasizing its strong foundation in optics and physics. We will focus specifically on multifocus fluorescence imaging and quantitative phase imaging. By outlining key open problems in these areas, we aim to foster collaborative research opportunities.

CTu1B.2 • 08:30

Method for in-Line Holographic Microscopy Reconstruction of Low Signal-to-Noise Ratio Holograms, Mikolaj Rogalski¹, Piotr Arcab¹, Maciej Trusiak¹; ¹*Warsaw Univ. of Technology,*

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Poland. This work presents an in-line holographic reconstruction method for low signal-to-noise ratio data. Algorithm is positively validated in terms of shot noise suppression, twin image minimization and high lateral resolution.

CTu1B.3 • 08:45

Multiplexed Label-Free High-Throughput Holographic Lensless Method for Live Cell Migration Sensing, Maciej Trusiak¹, Piotr Arcab¹, Mikolaj Rogalski¹, Luiza Stanaszek²;

¹*Warsaw Univ. of Technology, Poland;* ²*Mossakowski Medical Research Inst., Polish Academy of Sciences, Poland.* Cell migration plays crucial role in regeneration, morphogenesis and cancer metastasis. We present a novel hardware-software method for multiplexed (3-cameras) holographic lensless label-free full-culture live-cell quantitative migration sensing with single-cell sensitivity and sub-cellular motion precision.

CTu1B.4 • 09:00

Adaptive Cascade Calibrated Multi-Plane Phase Retrieval, Jun Wang¹, Jiabao Wang¹, Ni Chen²; ¹*Sichuan Univ., China;* ²*Univ. of Arizona, USA.*

By automatically detecting feature points in the refocus sample space and continuously calculating the transformation matrix of neighbouring planes, we introduce a novel Adaptive Cascade Calibrated (ACC) multi-plane phase retrieval method to address the misalignment issue.

08:00 -- 09:30

Room: Ariane 1

JTu1C • Adaptive Optics and the Atmosphere (Joint AO + pcAOP)

Presider: Caroline Kulcsar; Institut d'Optique Graduate School, France

JTu1C.1 • 08:00 (Invited)

Optical Topologies in Turbulence, Andrew Forbes¹; ¹*Univ. of Witwatersrand, South Africa.*

Light can be imbued with a topology, but is the topological invariant immune to turbulence? Here I outline how to find invariants in light's degrees of freedom for noise-free communication through turbulence.

JTu1C.2 • 08:30

CIAO, a VERSATILE and SIMPLE ADAPTIVE OPTICS SYSTEM for ASTRONOMY and SATELLITE COMMUNICATION, Guillaume Dovillaire¹, Cora Leveder¹, Patrick Grand-Chavin¹;

¹*Imagine Optic, France.* Imagine Optic has developed a simple, versatile and affordable adaptive optics system dedicated to telescope in the range 0.3 to 1m meter diameter. We present the architecture of the existing prototype as well as the first experimental results;

JTu1C.3 • 08:45 (Invited)

Laser Transmission Cabin for Free-Space Classical and Quantum Communication Experiments: First Trials, Jaime A. Anguita^{1,2}, Carlos S. Pirela^{1,2}, Andrés Seguel^{1,2};

¹*Universidad de los Andes, Chile, Chile;* ²*Millennium Inst. for Research in Optics MIRO, Chile.* We describe a new laser transmission cabin built at Universidad de los Andes for long-term

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experiments in the classical and quantum domains. Initial trials with optical vortices and quantum states detection over 1 km are presented.

JTu1C.4 • 09:15

SLODAR System Development for Atmospheric Profiling at Geochang SLR Observatory in Korea, Ji Yong Joo¹, Seung Hyeon Kim¹, Han Seok Gi¹, Jun ho Lee¹, Tim Butterley²; ¹*Kongju National Univ., Korea (the Republic of)*; ²*Department of Physics, Univ. of Durham, UK*. We developed a SLODAR system at Geochang Observatory, South Korea, for atmospheric measurements to enhance adaptive optics. It uses wavefront sensors for atmosphere profiling, showing similar conditions to other Korean observatories.

08:00 -- 09:30

Room: Guillaumet 1

LTu1E • Non-Equilibrium Gas Diagnostics

Presider: Caroline Winters; Sandia National Laboratories, USA

LTu1E.1 • 08:00 (Invited)

Spatio-Temporal Mapping of Nanosecond-Pulsed High-Frequency Discharges for Ignition Applications, Timothy Ombrello¹; ¹*US Air Force Research Laboratory, USA*. Diagnostic strategies of emission spectroscopy, infrared imaging thermometry, and O and OH laser-induced fluorescence were used to characterize the spatio-temporal processes of energy deposition and ignition kernel development when using nanosecond-pulsed high-frequency discharges.

LTu1E.2 • 08:30 (Invited)

Laser Based Three-Dimensional Imaging of a Hypersonic Sphere's Chemically Reacting Wake, Robert Macdermott¹, Nicholas Mueschke², John Macha², Naibo Jiang³, Sukesh Roy³; ¹*Air Force Inst. of Technology, USA*; ²*Southwest Research Inst., USA*; ³*Spectral Energies LLC, USA*. Chemically reacting hypersonic wakes are not well understood. 200 kHz Planar Laser Induced Fluorescence was utilized to investigate NO concentrations behind Mach 10 spheres. Observations were taken up to 60 base diameters into the wake.

LTu1E.3 • 09:00

Resonantly Ionized Photoelectron Thermometry (RIPT), Zhili Zhang¹, Walker McCord¹, Mark Gragston¹, Aleksander Clark¹; ¹*Univ. of Tennessee Knoxville, USA*. One-dimensional (1D) Oxygen-tagging and Nitrogen-tagging Resonantly Ionized Photoelectron Thermometry technique was developed and used to characterize linewise thermal gradients present within ambient air, high-speed flows, and large-scale Mach 4 Ludwig tube.

LTu1E.4 • 09:15

THz Absorption Spectroscopy of Atomic Oxygen in Plasmas: a Comparison to ps-TALIF and CRDS, Jente R. Wubs¹, Uwe Macherius¹, Andy S. Nave¹, Laurent Invernizzi², Kristaq Gazeli², Guillaume Lombardi², Xiang Lü³, Lutz Schrottke³, Klaus-Dieter Weltmann¹, Jean-Pierre H. van Helden¹; ¹*Leibniz Inst. for Plasma Science and Technology (INP), Germany*; ²*Laboratoire des Sciences des Procédés et des Matériaux (LSPM), CNRS, Université Sorbonne Paris Nord*,

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France; ³Paul-Drude-Institut für Festkörperelektronik, Leibniz-Institut im Forschungsverbund Berlin e. V., Germany. Terahertz absorption spectroscopy with quantum cascade lasers has recently been utilized for investigating ground state atomic oxygen densities in plasmas. The results are in excellent agreement with those obtained with well-known diagnostics ps-TALIF and CRDS.

08:00 -- 09:30

Room: Spot

LTu1F • Mid-IR Gas Sensing

Presider: Paul Hsu; Spectral Energies LLC, USA

LTu1F.1 • 08:00 (Top-Scored)

In-Situ Plasma Diagnostics Using Mid-Infrared Supercontinuum Sources Based on Nonlinear Fibers, Roderik Krebbers¹, Frans J. Harren¹, Amir Khodabakhsh¹, Simona M. Cristescu¹; ¹Life Science Trace Detection Laboratory, Inst. for Molecules and Materials, Radboud Univ., Netherlands. Broadband mid-infrared supercontinuum sources were used to perform in-situ spectroscopy on plasma-based chemical conversions. The concentrations of multiple molecular species have been monitored simultaneously, while also retrieving their rotational and vibrational temperatures.

LTu1F.2 • 08:15

Multispecies Open-Path Spectroscopy in the Mid-Infrared Region Using a Fiber-Based Supercontinuum Source, Amir Khodabakhsh¹, Roderik Krebbers¹, Kees van Kempen¹, Simona M. Cristescu¹; ¹Radboud Universiteit Nijmegen, Netherlands. Novel mid-infrared nonlinear-fiber-based supercontinuum sources provide high spectral power and broad spectral coverage in a small footprint which makes them interesting for in-situ open-path multispecies detection. Here, we demonstrate our recent results for this application.

LTu1F.3 • 08:30

Deep Learning Algorithms for Chemometric Analysis in MIR Gas Spectroscopy, Sanghoon Chin¹, Jérôme Van Zaen¹, Séverine Denis¹, Enric Mnntané¹, Steve Lecomte¹, Laurent Balet¹; ¹CSEM SA, Switzerland. We have implemented machine learning techniques into a mid-infrared gas spectrometer for two specific goals: the improvement of chemometric analysis using artificial neural networks and geostatistical analysis over a geographic area using Kriging.

LTu1F.4 • 08:45

Design and Realization of a Broadband Optical Sensor for Air Pollution Monitoring, Laurent Balet¹, Christoph Hofer¹, Laurent Giriens¹, Sanghoon Chin¹, Jérôme Van Zaen², Enric Mnntané³, Séverine Denis¹, Steve Lecomte¹; ¹BU-I Instrumentation, CSEM SA, Switzerland; ²BU-D Medtech, CSEM SA, Switzerland; ³BU-S Digital Stack, CSEM SA, Switzerland. Driven by the realization of a fiber-based mid-IR broadband supercontinuum light source, this study reports on the design and realization of a field-compatible and portable Fourier Transform Spectrometer for comprehensive air pollution monitoring.

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LTu1F.5 • 09:00

Thulium-Based Pumping of Mid-Infrared Supercontinua: a Comparative Bandwidth and Noise Study, Callum R. Smith¹, Dung-Han Yeh², Patrick B. Montague², Christian R.

Petersen^{1,3}, Ole Bang^{1,3}; ¹*Technical Univ. of Denmark, Denmark*; ²*NKT Photonics A/S, Denmark*; ³*NORBLIS ApS, Denmark*. We compare bandwidth and noise properties of mid-infrared supercontinua pumped by thulium-based gain-switched and modelocked systems. We demonstrate how a simple pump and efficient concatenation of fibers can maximize mid-infrared bandwidth beyond 5 μm .

LTu1F.6 • 09:15

Mid-Infrared Dual-Comb Spectroscopy Using Difference Frequency Generation for SO₂

Gas Detection, Syed T. Ahmad¹, Luca Moretti², Mathieu Walsh³, Davide Gatti², Jerome

Genest³, Marco Marangoni², Aamir Farooq¹; ¹*School of Physical Sciences, King Abdullah Univ. of Science and Technology, Saudi Arabia*; ²*Dipartimento di Fisica, Politecnico di Milano, Italy*;

³*Centre d'optique, photonique et laser, Université Laval, Canada*. Presented is the comb-resolved dual-comb spectroscopy spanning 7.5-11.5 μm , utilizing Erbium-fiber oscillators. SO₂ spectral line detection confirms HITRAN line parameters. The scheme offers multispecies detection with high-resolution and rapid-acquisition, vital for environmental monitoring and chemical kinetic applications.

08:00 -- 09:30

Room: Diamant

QTu1D • Atomic Clocks

Presider: Philippe Bouyer; Technische Universiteit Eindhoven, Netherlands

QTu1D.1 • 08:00 (Invited)

Transportable Optical Lattice Clocks and Applications, Hidetoshi Katori^{2,1}; ¹*RIKEN, Japan*; ²*Applied Physics, The Univ. of Tokyo, Japan*. We report transportable optical lattice clocks with 18-digit precision, allowing chronometric leveling with cm-level height resolution. We also report our progress toward longitudinal spectroscopy to improve the clocks' stability.

QTu1D.2 • 08:30 (Invited)

Compact Platforms for Cold-Atom Clocks, Paul Griffin¹, Aidan S. Arnold¹, James P. McGilligan¹, Erling Riis¹; ¹*Univ. of Strathclyde, UK*. We examine solutions for miniaturizing atomic clocks for performance at the 10⁻¹⁵ level. Microwave and optical interrogation of a rubidium microwave clock are highlighted. MEMS and additively manufactured vacuum and spectroscopy cells will be presented.

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08:00 -- 09:30

Room: Guillaumet 2

STu1H • Optical Biological and Chemical Sensors II

Presider: Sachin Srivastava; Indian Inst. of Technology Roorkee, India

STu1H.1 • 08:00

Development of Quantum-dot Luminescent Probes for the Creation of Wearable Acetone Sensors, Diego Mendez-Gonzalez¹, Jaime Ceres-Martinez¹, Jorge Rubio-Retama¹, Riccardo Marin², Juan Pedro Cascales¹; ¹*Universidad Complutense de Madrid, Spain*; ²*Universidad Autónoma de Madrid, Spain*. We explore CuInS₂ luminescent quantum dots as gaseous acetone sensors, with specific interactions due to surface-functionalization with L-cysteine. We present optical characterization measurements of QD-based films and proof-of-principle results obtained with a prototype device.

STu1H.2 • 08:15

Intelligent Optical Microresonator-Based Biochip: Bridging the Gap Between Laboratory and Real-World Applications, Anton Saetchnikov¹, Andreas Ostendorf¹; ¹*Ruhr Univ. Bochum, Germany*. This paper proposes an optical microresonator-based biochip designed for immunosensing in complex solutions. It leverages multiplexed microresonator imaging and computational methods to reduce the reliance on chip manufacturing consistency, pushing WGM-based biosensing towards real-world applicability.

STu1H.3 • 08:30

Photonic Integrated Circuits With Protein Catalyzed Capture Agents for Biosensing in Complex Media, Jennifer M. Morales¹, Justin Bickford¹, Sanchao Liu¹, Alexander Winton¹, Matthew Coppock¹, Pak Cho¹, Paul M. Pellegrino¹; ¹*US Army Research Laboratory, USA*. Overview of integrated photonics sensors and peptides for the recognition of streptavidin and interleukin-6 in 10% fetal bovine serum.

STu1H.4 • 08:45 (Invited)

Towards Decentralized Diagnostics for Women's Health Using Integrated Silicon Resonators, Samantha M. Grist^{1,2}, Lauren S. Puumala^{1,2}, Sheri J. Chowdhury¹, Mohammed A. Al-Qadasi¹, Stephen Kioussis¹, Ben Cohen-Kleinstein¹, Karyn Newton¹, Yuting Hou¹, Sajida Chowdhury¹, Avineet Randhawa¹, Matthew Mitchell^{1,2}, Lukas Chrostowski^{1,2}, Sudip Shekhar^{1,2}, Karen C. Cheung¹; ¹*Univ. of British Columbia, Canada*; ²*Dream Photonics, Inc., Canada*. Targeting portable, low-cost, data-rich diagnostics, we summarize our progress in photonic design, sensor biofunctionalization, and photonic wire bond laser integration. We will present a resonator architecture supporting fixed-wavelength laser readout, reducing system size and cost.

STu1H.5 • 09:15

Hyperspectral Microscopy Methods for Building a Spectral Reference Data Set to Support Spectral Mixture Analysis for Surveillance of Harmful Algal Blooms (SMASH), Natalie Hall¹, Carl J. Legleiter¹; ¹*U.S. Geological Survey, USA*. This study provides a proof-of-concept case study where cyanobacteria genera were differentiated using space-based

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hyperspectral imagery and a reference spectral dataset. Methods are also introduced to expand upon the reference spectral data using hyperspectral microscopy.

10:00 -- 12:00

Room: Concorde 1

JTu2A • Joint Plenary Session I

JTu2A.1 • 10:00 (Plenary)

An Eventful Exploration With Computational Neuromorphic Imaging, Edmund Y. Lam¹;

¹*Univ. of Hong Kong, Hong Kong*. In this talk, I will discuss computational neuromorphic imaging, which involves the use of event sensors to capture rapid changes in pixel intensities. I will outline their usage in a computational optical imaging setting and efforts in processing the event data for different applications.

JTu2A.2 • 10:00 (Plenary)

Integrated Metasurfaces for Biosensing and Bioimaging, Hatice Altug¹; ¹*Ecole Polytechnique Federale de Lausanne, Switzerland*. Abstract not available.

13:30 -- 15:00

Room: Ariane 2

ATu3A • IR Sources for Industrial Applications

Presider: Mark Phillips; Univ of Arizona, Coll of Opt Sciences, USA

ATu3A.1 • 13:30 (Invited)

Broadband and Metrology-Grade Frequency Combs From Integrated Photonic Chips,

Tobias Herr¹; ¹*Universität Hamburg, Germany*. We report on our recent progress on chip-scale frequency combs and photonic chip-based generation of broadband spectra for optical sensing and spectroscopy from ultra-violet to mid-infrared wavelengths.

ATu3A.2 • 14:00

Miniaturized, Powerful and Broadband Radiation Sources for Near-Infrared

Spectroscopy, Marco Schossig¹; ¹*INFRASOLID GmbH, Germany*. New developments towards miniaturized, powerful and broadband near-infrared (NIR) radiation sources are presented and compared to the most commonly used light source in near-infrared spectroscopy, the tungsten incandescent light bulb.

ATu3A.3 • 14:15 (Invited)

Single Cavity Dual-Comb Lasers With Efficient Wavelength Extensions for Sensing Applications,

Benjamin Willenberg¹, Carolin Bauer¹, Sandro L. Camenzind¹, Justinas Pupeikis¹, Zofia Bejm¹, Michelle Bollier¹, Alexander Nussbaum-Lapping¹, Benoît Sierro², Anupamaa Rampur², Lars Liebermeister³, Robert Kohlhaas³, Björn Globisch³, Alexander Heidt², Ursula Keller¹, Christopher R. Phillips¹; ¹*Department of Physics, Inst. for Quantum Electronics, ETH Zurich, Switzerland*; ²*Inst. of Applied Physics, Univ. of Bern, Switzerland*; ³*Fraunhofer Inst. for Telecommunications, Heinrich Hertz Inst., Germany*. We present advances in high-sensitivity

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dual-comb measurement technology: THz time-domain spectroscopy with PCAs at GHz repetition rates, Watt-level shot-noise limited dual-comb supercontinuum from an ANDi fiber, and intra-cavity cross-comb spectroscopy in the mid-IR with a dual-comb OPO.

13:30 -- 15:00

Room: Caravelle 2

CTu3B • Computational Imaging using Tailored Illumination

Presider: Giuliano Scarcelli; Univ. of Maryland at College Park, USA

CTu3B.1 • 13:30

Generation of High-Order Conveyor Beams, Minghui SHI¹, Xin Dong¹, Hongsen He^{2,4}, Kenneth K. Wong^{1,3}; ¹*The Univ. of Hong Kong, Hong Kong*; ²*Department of Electronic Engineering, Xiamen Univ., China*; ³*Xiamen Univ., Hong Kong*; ⁴*Fujian Key Laboratory of Ultrafast Laser Technology and Applications, Xiamen Univ., China*. A class of high-order conveyor beams is simulated and demonstrated. By virtue of its ring-like profile, it can work as a versatile optical conveyor belt to manipulate and rotate particles in axial direction.

CTu3B.2 • 13:45

Twin Bessel Beams for Depth-Resolved Microscopy, Xin Dong¹, Minghui Shi¹, Hongsen He^{2,4}, Kenneth K. Wong^{1,3}; ¹*The Univ. of Hong Kong, Hong Kong*; ²*Department of Electronic Engineering, Xiamen Univ., China*; ³*Advanced Biomedical Instrumentation Centre, Hong Kong*; ⁴*Fujian Key Laboratory of Ultrafast Laser Technology and Applications, Xiamen Univ., China*. We demonstrated twin Bessel beams with a z-to-x linear mapping relationship with $R^2 = 0.9976$ in a range of 55 μm , improved by 72%, which potentially provides ability to resolve the depth in volumetric imaging.

CTu3B.3 • 14:00 (Top-Scored)

Twin-Image Free Single-Shot Phase Retrieval Using Vortex Phase Illumination, Muskan Kularia¹, Manidipa Banerjee², Kedar Khare^{1,3}; ¹*Optics and Photonics Center, Indian Inst. of Technology Delhi, India*; ²*Kusuma School of Biological Sciences, Indian Inst. of Technology Delhi, India*; ³*Department of Physics, Indian Inst. of Technology Delhi, India*. Twin image stagnation has been a major challenge in single-shot Fourier phase retrieval. Using our simulation studies with the hybrid input-output algorithm, we show that a charge-1 vortex phase illumination eliminates this problem.

CTu3B.5 • 14:15 (Invited)

Streamlined Deconvolution for Fast Tailored Lightsheet Microscopy, Tom Vettenburg¹; ¹*Univ. of Dundee, UK*. The large bandwidth of lightsheet microscopy acquisition is a challenge for digital image processing. Off-line processing breaks the experimental feedback loop. We demonstrate an efficient, streamlined, deconvolution algorithm for translation-variant lightsheets, capable of on-the-fly deconvolution.

CTu3B.4 • 14:45

Two-Dimensional Discrete Frozen Waves of Infinite Energy in Lossy Stratified Media, Jhonas O. de Sarro¹, Leonardo A. Ambrosio¹; ¹*Univ. of São Paulo, Brazil*. We design "frozen-

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wave"-type light sheets inside the last layer of lossy stratified structures. The field is evaluated using the transfer-matrix method and the resulting beam may mimic any desired intensity 2D (or even 3D) pattern.

13:30 -- 15:00

Room: Argos

ITu3G • Advances in Biomedical Imaging

Presider: Kristina Irsch; Vision Inst. (CNRS) & Wilmer (JHU), France

ITu3G.1 • 13:30 (Top-Scored)

Quantitative Assessment of Brain Biomechanics Using non-Contact Dynamic Optical Coherence Elastography, Yirui Zhu^{1,2}, Jiulin Shi¹, Xingdao He¹; ¹*Nanchang Hangkong Univ., China*; ²*Nanjing Univ., China*. We develop an air-coupled ultrasonic transducer for noncontact excitation of surface waves in brain tissue, using optical coherent elastography (OCE) to detect and quantify the shear modulus of brain tissue with high resolution.

ITu3G.2 • 13:45

Multizonal Design to Correct Ocular Regular Astigmatism With Increased Tolerance Under Rotation, Diana Gargallo¹, Sara Perchés¹, Victoria Collados¹, Jorge Ares¹; ¹*Applied Physics, Zaragoza Univ., Spain*. Two novel optical designs for compensating astigmatism with enhanced rotation tolerance are introduced. The design features concentric annular regions with varying spherocylindrical powers. Visual quality was assessed by numerical simulation demonstrating superior performance under rotation errors compared to the conventional compensation.

ITu3G.3 • 14:00

Jacobian Control Surfaces, Maik Locher¹, Ewan Eaglesham¹, Johannes Courtial¹; ¹*Univ. of Glasgow, UK*. By controlling the Jacobian of a surface, we propose an improved compact view rotator aimed to aid in the treatment of torsional diplopia. Theoretical ray trace simulations are used to demonstrate the feasibility.

ITu3G.4 • 14:15

Hologram Authentication and Classification via a Convolutional Neural Network, Prakruthi Ganiga¹, Priyadarshini M¹, Vineela Chandra Dodda², Ravi Kumar³, Inbarasan Muniraj¹; ¹*Alliance Univ. Bengaluru, India*; ²*Amrita Vishwa Vidyapeetham, Amaravati Campus, India*; ³*SRM AP Univ., India*. Authentication techniques can be used to overcome the hologram counterfeiting problems. Here, we demonstrate an authentication scheme for digital holograms in a raw-complex form that is stored either in the cloud or on the metasurface using a CNN.

ITu3G.5 • 14:30 (Invited)

Optical Coherence Tomography for the Investigation of Ocular Biomechanics: Towards Improved Diagnosis and Treatment Options in Ophthalmology, Judith S. Birkenfeld¹; ¹*Inst. of Optics "Daza de Valdés" (IO-CSIC), Spain*. The biomechanics of the eye play an important role in maintaining its form and function. Abnormal biomechanical properties may indicate an ocular pathology. Here, we present applications on recently developed Optical Coherence

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Tomography (OCT)-based methods for the investigation of corneal and scleral biomechanics, including cross-meridian air-puff deformation OCT, multi-meridian ultrasonic wave-based Optical Coherence Elastography, and acoustic-based Optical Coherence Vibrometry.

13:30 -- 15:00

Room: Guillaumet 1

LTu3E • Advanced Techniques and Special Applications

Presider: Paul Danehy; NASA Langley Research Center, USA

LTu3E.1 • 13:30 (Invited)

Tunable Diode Laser Absorption Diagnostics for Atmospheric Entry Ground Test Facilities, Megan Macdonald¹; ¹*NASA Ames Research Center, USA*. The Thermophysics Facilities Branch at NASA Ames Research Center employs tunable diode laser absorption diagnostics to measure flow characteristics of high-enthalpy ground test facilities. This is a high-level summary of three laser absorption projects.

LTu3E.2 • 14:00 (Invited)

High-Speed Self-Aligned Focusing Schlieren and Background-Oriented Schlieren With Pulsed Laser Illumination, Brett F. Bathel¹, Joshua M. Weisberger¹, Matthew T. Boyda¹, Wayne Page^{1,2}; ¹*Advanced Measurements and Data Systems Branch, NASA Langley Research Center, USA*; ²*Department of Mechanical and Aerospace Engineering, The Ohio State Univ., USA*. Results from a self-aligned focusing schlieren system developed at NASA Langley and a background-oriented schlieren system using pulsed laser illumination are presented to highlight the effectiveness of these light sources.

LTu3E.3 • 14:30

High-Speed 1D Interferometric Rayleigh Scattering in Pre-Chamber for Temperature and Velocity Measurements, Xinguang Luo¹, Priybrat Sharma¹, Gaetano Magnotti¹; ¹*King Abdullah Univ. of Science and, Saudi Arabia*. A novel approach utilizing a high-speed one-dimensional interferometric Rayleigh scattering technique, combined with a virtually imaged phased array, was implemented in the prechamber to measure the velocity and temperature

LTu3E.4 • 14:45

Ultrafast Phosphor Surface Heating Optical Thermometry (UP-SHOT) for Transient Thermal Environments, Noelle M. Collins¹, Joseph P. Klesko¹, Luke M. McClintock², Tenzin Norden², Caroline Winters¹; ¹*Sandia National Laboratories, USA*; ²*Los Alamos National Laboratory, USA*. Ultrafast (GHz) thermometry requires considerations of signal-to-noise, heat conduction, and temperature sensitivity. Ultrafast Phosphor Surface Heating Optical Thermometry (UP-SHOT) exploits the sub-nanosecond excitonic response of zinc oxide. Time-resolved photoluminescence is presented.

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13:30 -- 15:00

Room: Spot

LTu3F • Image and Data Analysis Techniques

Presider: Neil Rodrigues; NASA Langley Research Center, USA

LTu3F.1 • 13:30 (Invited)

3D Flow Field Quantification in an Artery Model Using Optical Flow Method Based on Simulated Multi-Angle Angiography, Zifeng Yang¹, Hang Yi¹, Luke Bramlage¹, Bryan Ludwig¹; ¹*Wright State Univ., USA*. 3D flow field in a numerically simulated arterial model is quantified using the three-dimensional optical flow method based on simulated simultaneous multi-angle X-ray angiography of the blood flow with contrast agent perfusions.

LTu3F.2 • 14:00 (Top-Scored)

Deep Learning Based Optical Flow Analysis of High-Speed Flows, Daniel Zhang¹, Zifeng Yang²; ¹*Farragut High School, USA*; ²*Wright State Univ., USA*. Two-dimensional Rayleigh scattering imaging is utilized to quantify the high-speed flow velocity by employing deep learning based optical flow analysis, along with density and temperature fields from Rayleigh scattering intensity profiles.

LTu3F.3 • 14:15

Using PCA and DNN for Fitting raw TDLAS Spectra: Application to a Supersonic Flow, Gautier Vilmart¹; ¹*Office Natl d'Etudes Rech Aerospatiales, France*. A novel method is described for fitting raw Tunable Diode Laser Absorption Spectroscopy (TDLAS) spectra leveraging Principal Component Analysis (PCA) in conjunction with Deep Neural Networks (DNN). It showed promising results for weakly absorbing transitions.

LTu3F.4 • 14:30

Generating Blood Analog for Laser Induced Fluorescent Particle Image Velocimetry, Chungyiu Ma¹, Jared Chong², Hang Yi², Luke Bramlage², Bryan Ludwig²; ¹*Student, St. Andrew's College, Canada*; ²*Wright State Univ., USA*. To mimic blood non-Newtonian viscosity features under designated temperatures from 305 to 315 K, transparent blood analogs were generated by the mixture of xanthan gum and deionized water with fluorescent particles for laser induced fluorescent particle image velocimetry.

13:30 -- 15:00

Room: Diamant

QTu3D • Quantum Electromagnetic Sensing

Presider: Shau-Yu Lan; National Taiwan Univ., Taiwan

QTu3D.1 • 13:30 (Invited)

Rydberg Atom Electric Field Sensors for Metrology, Radiometry, and Communications, Alexandra B. Artusio-Glimpse¹; ¹*National Inst of Standards & Technology, USA*. Rydberg alkali atoms are highly sensitive, self-calibrating sensors for the detection of electric fields. These sensors are unique for their extreme tunability from DC to THz, wavelength-independent size, metal-free construction, and SI-traceability.

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QTu3D.2 • 14:00

Widefield Quantum Sensing Microscopy Platform for Cellular Studies, Alfonso Fernandez-Garcia¹, Eva Caravaca¹, Fernando J. Hidalgo², Cristina De Dios², Pablo Acedo²; ¹*Arquimea Research Center, Spain*; ²*Universidad Carlos III de Madrid, Spain*. Here, a widefield quantum sensing microscopy platform is described to be used for magnetic field measurements in cellular studies. Preliminary results have shown that the obtained spatial resolution and sensitivity are suitable for such applications.

QTu3D.3 • 14:15

Towards Entangled Two-Photon Absorption in Cesium Atoms, Michael S. Caracas Núñez¹, Mayerlin Nunez Portela¹, Dario Egloff¹; ¹*Universidad de los Andes, Colombia*. We address challenges in entangled two-photon absorption (ETPA) experiments, focusing on distinguishing ETPA signals in atomic systems, in particular, cesium. Our study presents theoretical and experimental methods to calculate and measure TPA and ETPA cross-sections.

QTu3D.4 • 14:30 (Invited)

Quantum Sensing With Thermal Atomic Beams on Chip, Chandra Raman¹; ¹*Georgia Tech Research Inst., USA*. Abstract not available.

13:30 -- 15:00

Room: Ariane 1

STu3C • Distributed Optical Fiber Sensors I

Presider: Aldo Minardo; Univ della Campania Luigi Vanvitelli, Italy

STu3C.1 • 13:30 (Invited)

Distributed Measurement of Gas Pressure Evolution Within Hollow Core Fibres Using Optical Time Domain Reflectometry, Natalie V. Wheeler¹, Elizaveta Elistratova¹, Thomas Kelly¹, Ian Davidson¹, Jaroslaw Rzegocki¹, Ghafour Amouzad Mahdiraji¹, Somarpita Pradhan¹, Austin Taranta¹, Francesco Poletti¹, Radan Slavík¹, Peter Horak¹; ¹*Univ. of Southampton, UK*. Gas composition and pressure within a hollow-core fibre are critical for optical and long-term performance. We present distributed measurements of gas pressure within HCFs, immediately after fabrication and during gas purging/venting, and compare with simulations.

STu3C.2 • 14:00

Analysis of Surface Waves in Trackside Dark Fibers Using Distributed Acoustic Sensing (DAS), Miguel Gonzalez-Herraez¹, Maximilian Schaedler², Javier Preciado-Garbayo³, Hugo F. Martins⁴, Beatriz Gaité-Castrillo⁵, Jose B. Bravo-Monge⁵, Irene de Maria⁶, Miguel Rodriguez-Plaza⁶; ¹*Universidad de Alcalá, Spain*; ²*Huawei Munich Research Center, Germany*; ³*Aragon Photonics Labs, Spain*; ⁴*Instituto de Óptica, CSIC, Spain*; ⁵*Instituto Geografico Nacional, Spain*; ⁶*Administrador de Infraestructuras Ferroviarias (ADIF), Spain*. The application of array seismology methods in Distributed Acoustic Sensing data gathered in trackside fibers can provide a significant amount of information on the terrain features and the railway superstructure.

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STu3C.3 • 14:15

Measurement of Slowly Changing and Quasi-Static Strain Signals for Ground Motion Monitoring Applications Using Distributed Acoustic Sensing, Konstantin Hicke¹, Xin Lu¹, Sebastian Chruscicki¹, Katerina Krebber¹; ¹*Bundesanstalt für Materialforschung und -prüfung (BAM), Germany*. The suitability of wavelength-scanning COTDR for distributed dynamic strain sensing (DAS) along buried fiber cables for long-term geotechnical monitoring applications is demonstrated by experiments showing the method's capability to demodulate slowly varying and quasi-static signals.

STu3C.4 • 14:30

Quasi-Integer Ratio Time-Expanded Φ OTDR System for High Sampling Rate Dynamic Curvature Sensing, Camilo Escobar-Vera¹, Miguel Soriano-Amat¹, Hugo F. Martins², David Barrera³, Sonia M. Martin-Lopez¹, Miguel Gonzalez-Herraez¹, Maria R. Fernandez-Ruiz¹; ¹*Universidad de Alcala, Spain*; ²*Daza de Valdés Inst. of Optics (IO-CSIC), Spain*; ³*PRL, Photonics Research Labs, Universitat Politècnica de València, Spain*. We present a curvature sensing scheme based on quasi-integer-ratio time-expanded phase-sensitive optical time domain reflectometry (QIR-TE- Φ OTDR) with 5cm resolution, 125m range and 1kHz sampling rate, opening the door to monitoring real live processes.

STu3C.5 • 14:45 (Top-Scored)

Frequency-Time 2D Matched Filter to Reduce Calibration Time in Multifrequency Database CP- Φ OTDR, Pedro J. Vidal-Moreno¹, Maria R. Fernandez-Ruiz¹, Hugo F. Martins², Sonia M. Martin-Lopez¹, Miguel Gonzalez-Herraez¹; ¹*Universidad de Alcala, Spain*; ²*CSIC, Spain*. Specific post-processing strategies allow to reduce calibration time in Multi-Frequency Database Demodulation CP- Φ OTDR systems. Calibration time has been reduced by a factor of 1000 times by utilizing a novel 2D filtering method, unlocking real-world applicability.

13:30 -- 15:00

Room: Guillaumet 2

STu3H • Optical Biological and Chemical Sensors III

Presider: Jennifer Morales; US Army Research Laboratory, USA

STu3H.1 • 13:30 (Invited)

Waveguide-Enhanced Raman Spectroscopy for Field Detection of Hazardous Vapors, Erik D. Emmons¹; ¹*DEVCOM Chemical Biological Center, USA*. Waveguide-enhanced Raman spectroscopy with visible excitation using compact Raman spectrometers and fiber-attached sorbent-coated photonic integrated circuit waveguides is being used for detection of low concentrations of hazardous vapors for defense applications.

STu3H.2 • 14:00

Compact, Mid-Infrared Spectrometer System for in-Situ Monitoring of Water Quality, Filip Labaj^{2,1}, Rafal Stojek², Marta Lowcewicz², Jerzy Kalwas², Ryszard Piramidowicz^{1,2}; ¹*Inst. of Microelectronics and Optoelectronics, Warsaw Univ. of Technology, Poland*; ²*VIGO Photonics S.A., Poland*. We present results of the design and development of a compact optoelectronic

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system for *in-situ* monitoring of water contaminants based on a tunable, mid-infrared (3 – 5 μm and 7 – 10 μm) optical cavity.

STu3H.3 • 14:15

Digistain IR-Based Breast Cancer Diagnosis Technology, an N = 801 Validation Study., Christopher Phillips¹, Charles Coombes¹, Christina Angelou¹, Zamzam al-Khalili¹, William Hart¹, Darius Francescatti², Nicholas Wright³, Ian Ellis⁴, Andrew Green⁴, Emad Rakha⁴, Hemmel Amrania¹, Carlo Palmieri⁵; ¹*Imperial College London, UK*; ²*surgery, rush medical College, USA*; ³*Barts Cancer Inst., Queen Mary Univ. of London, UK*; ⁴*School of Medicine, Nottingham Univ., UK*; ⁵*molecular and clinical cancer medicine, Liverpool Univ., UK*. Digistain measures the elevated DNA levels in Cancer biopsies using mid-IR transmission. We show, in a 801 patient trial, that it provides accurate prognostic indicators, that can save lives by obviating unnecessary chemotherapy.

STu3H.4 • 14:30

Surface Enhanced Raman Spectroscopy (SERS) Based Optical Sensor for Detection of Urea in Trace Quantity, Sibashish Chakraborty¹; ¹*IIT Delhi, India*. Surface enhanced Raman spectroscopy (SERS) detects ultra-trace analytes rapidly and accurately. We demonstrate chemically synthesized silver nanoparticles that can detect urea up to 10^{-10} M with an enhancement factor of 10^{10} utilizing 785 nm laser source.

STu3H.5 • 14:45

Aerogel-Lined Capillaries as Liquid Core Waveguides for Real-Time Raman Spectroscopy of the Synthesis of Platform Chemicals From Biomass-Derived Feedstocks, Felix Spiske¹, Andreas S. Braeuer¹; ¹*Inst. of Thermal, Environmental and Resources' Process Engineering (ITUN), TU Bergakademie Freiberg, Germany*. We present the application of newly developed aerogel-lined capillaries which serve as step-index liquid-core waveguides to enable a signal gain in non-invasive real-time Raman spectroscopy of the synthesis of platform chemicals from biomass-derived feedstocks.

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17:15 -- 18:30

Room: Guillaumet 1

JTu5A • Joint Postdeadline Paper Session I

Presider: Adam Fleisher; National Inst of Standards & Technology, USA

JTu5A.1 Postdeadline Submission

Eclipse Turbulence Evaluation and Sensor Testing (EEST), Matthew R. Whiteley¹; ¹MZA Associates Corporation, USA. Turbulence and correlated weather measurements were made during the total solar eclipse across the continental USA on April 8, 2024. Sensor terminals were installed along the path of totality and varying percentages of partial eclipse, quantifying the impact of the eclipse conditions on weather-driven C_n^2 .

JTu5A.2 Postdeadline Submission

Methodologies for High Speed Optical Turbulence Measurements, Thomas J. Miletich¹, Yakov Diskin², Matthew R. Whiteley², Jason D. Schmidt², Eric P. Magee², Matthew Miltner², Kevin Jackovitz², Mitchell Grose², Matthew Salfer-Hobbs¹, Martin Richardson¹, Robert Crabbs¹; ¹Univ. of Central Florida, USA; ²MZA Associates Corporation, USA. While the native reporting rate for common atmospheric sensors is typically once per minute, this paper examines high-speed processing methodologies for the Scintec Boundary Layer Scintillometer (BLS), the MZA Delayed Tilt-Anisoplanatism (DELTA) and other atmospheric instruments.

JTu5A.3 Postdeadline Submission

Imaging Through Scattering Media With Ultrafast Spatiotemporal Gating on Epsilon-Near-Zero Materials, Yang Xu¹, Saumya Choudhary¹, Zahirul Alam², Robert Boyd^{1,2}; ¹Univ. of Rochester, USA; ²Department of Physics, Univ. of Ottawa, Canada. We use a femtosecond spatiotemporal gated four-wave mixing on ITO to image objects through scattering media. The selected ballistic photons give an excellent enhancement of the signal-to-noise ratio in the presence of strong optical diffusers.

JTu5A.4 Postdeadline Submission

Quantum-Enhanced Dual-Comb Spectroscopy Beyond the Shot Noise Limit, Daniel I. Herman¹, Mathieu Walsh², Molly Kate Kreider^{1,3}, Noah Lordi³, Eugene Tsao¹, Alexander Lind¹, Matthew Heyrich^{1,3}, Joshua Combes¹, Jérôme Genest², Scott Diddams^{1,3}; ¹Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; ²Centre d'Optique, Photonique et Laser, Université Laval, Canada; ³Physics, Univ. of Colorado Boulder, USA. Soliton squeezing suppresses the amplitude noise of a frequency comb by >3 dB. Dual-comb interferometry enables mode-resolved spectroscopy of H₂S with signal-to-noise ratio ~2.6 dB beyond the shot noise limit.

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Wednesday, 17 July

08:00 -- 10:00

Room: Ariane 2

AW1A • Gas Sensing for Environmental and Energy Applications

Presider: Tanya Myers; Pacific Northwest National Laboratory, USA

AW1A.1 • 08:00 (Invited)

Quantitative Photoacoustic Spectroscopy of Gases and Aerosols, Zoltan Bozoki^{1,2}; ¹*Szegedi Tudományegyetem, Hungary*; ²*Hilase Ltd., Hungary*. Examples of successful implementation of the photoacoustic gas concentration measurement method in various applications including oil and natural gas industry, soil science, airborne and exhaust measurements, etc. are given. Furthermore, the unique application possibilities opened up by the use of the combination of an external cavity mid-infrared interband cascade laser combined with a dual cell photoacoustic system are discussed.

AW1A.2 • 08:30 (Invited)

Application of an Open-Path Broadband Source-Based Mobile Instrumentation for Greenhouse Gas Monitoring, Simona M. Cristescu¹, Roderik Krebbers¹, Kees van Kempen¹, Amir Khodabakhsh¹; ¹*Radboud Universiteit Nijmegen, Netherlands*. Open-path spectroscopy using broadband coherent light sources can provide highly sensitive multispecies detection capability for various real-life applications. Using these systems, we present our recent results for monitoring gas emissions from a wastewater treatment plant.

AW1A.3 • 09:00 (Invited)

In-Situ Characterization of Combustion in Methane Flares Using Standoff Infrared Laser Spectroscopy, Mark C. Phillips¹; ¹*Univ of Arizona, Coll of Opt Sciences, USA*. A broadband swept-wavelength external cavity quantum cascade laser measures CO, CO₂, H₂O, and temperature, while a tunable diode laser measures CH₄, providing standoff and *in-situ* measurements of combustion efficiency within methane flares.

AW1A.4 • 09:30 (Invited)

Remote Sensing Instrumentation and Spectral Imagers for Monitoring Methane Emissions., Jayshri Sabarinathan¹; ¹*The Univ. of Western Ontario, Canada*. Methane is a potent greenhouse gas commonly emitted from landfills and agriculture. Spectral imagers for drone based methane detection are being developed. Preliminary data with commercial instruments from local site will be used to validate analysis.

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08:00 -- 10:00

Room: Caravelle 2

CW1B • Tomographic Imaging

Presider: Maciej Trusiak; Warsaw Univ. of Technology, Poland

CW1B.1 • 08:00 (Invited)

Machine-Learning Enhanced Photoacoustic Computed Tomography, Lei S. Li¹; ¹*Rice Univ., USA*. We developed a machine-learning-based smart reconstruction for photoacoustic computed tomography (PACT). It can mitigate reconstruction artifacts due to acoustic heterogeneity while maintaining the reconstruction speed. Moreover, deep learning accelerates the localization-based super-resolution PACT.

CW1B.2 • 08:30

Gradient Based Common-Path Optical Diffraction Tomography, Piotr Zdankowski¹, Julianna Winnik¹, Maciej Trusiak¹; ¹*Warsaw Univ. of Technology, Poland*. Common-path self-referenced total-shear quantitative phase imaging is often limited to sparse samples due to cumbersome overlapping of object replicas. We present initial steps towards low-coherence shearing optical diffraction tomography with sensitivity to refractive index gradient.

CW1B.3 • 08:45

Non-Interferometric Intensity Diffraction Tomography for Label-Free 3D Microscopy, Chao Zuo¹, Shun Zhou¹, Jiasong Sun¹, Qian Chen¹; ¹*Nanjing Univ of Science and Technology, China*. Non-interferometric optical diffraction tomography techniques have drawn increasing attention for their system simplicity, speckle-free imaging quality, and compatibility with existing microscopes. We recently introduced a series of intensity diffraction tomography techniques based on illumination angular scanning or axial scanning of samples.

CW1B.4 • 09:00

Label-Free Dynamic 3D Imaging of Live-Cell Based on Fourier Ptychographic Diffraction Tomography, Shun Zhou¹, Qian Shen¹, Qian Chen¹, Chao Zuo¹; ¹*Nanjing Univ. of Science and Techno, China*. We realize high-resolution label-free dynamic 3D live-cell imaging in a non-interferometric manner with the proposed illumination coded Fourier ptychographic diffraction tomography. The dynamic tomographic imaging of PLC cells validates the capabilities of this technique in monitoring and analyzing various dynamic biological processes.

CW1B.5 • 09:15

ICE-TIDE: Implicit Cryo-ET Imaging and Deformation Estimation, Valentin Debarnot¹, Vinith Kishore¹, Ricardo D. Righetto³, Ivan Dokmanic^{1,2}; ¹*Department of Mathematics and Computer Science, Univ. of Basel, Switzerland*; ²*Department of Electrical and Computer Engineering, Univ. of Illinois at Urbana-Champaign, USA*; ³*Biozentrum, Univ. of Basel, Switzerland*. We present ICE-TIDE, a method for cryogenic electron tomography (cryo-ET) that simultaneously aligns observations and reconstructs a high-resolution volume. ICE-TIDE relies on a coordinate-based implicit neural representation of the volume which acts as an effective regularizer, allowing for partially restoring the missing wedge information.

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08:00 -- 10:00

Room: Guillaumet 2

DW1H • Deep Learning for 3D Imaging I

Presider: Adrian Stern; Ben Gurion Univ. of the Negev, Israel

DW1H.1 • 08:00 (Invited)

Learning-Based Wide-Angle Design Optimization for Improved Depth Estimation, Julie Buquet^{1,2}, Jean-François Lalonde³, Simon Thibault²; ¹*Immervision Inc., Canada*; ²*Physics, Universite Laval, Canada*; ³*Universite Laval, Canada*. Using wide-angle systems' distortion optimization for improved monocular depth estimation as a case study, we investigate the scope, benefits, and limitations of current end-to-end optical design practices in a context of machine perception.

DW1H.2 • 08:30 (Top-Scored)

Attention U-Net for Denoising the Multiplexed Digital Holographic Microscopy, Dodda V. Chandra¹, Lakshmi Kuruguntla², Manoj Kumar³, Osamu Matoba³, Inbarasan Muniraj⁴; ¹*ECE, Amrita Vishwa Vidyapeetham, India*; ²*Koneru Lakshmaiah Educational Foundation, India*; ³*Kobe Univ., Japan*; ⁴*Alliance Univ., India*. Here, we demonstrate the efficacy of an attention-based U-Net architecture for denoising the reconstructed noisy amplitude and phase from a multi-beam interference-based digital holographic microscopy. The results demonstrate the effectiveness of our proposed network.

DW1H.3 • 08:45

SLICE: Combined Super Linear Iterative Clustering and Earth Mover's Distance for Brain Tumour Classification, Pavan Mohan Neelamraju², Inbarasan Muniraj¹; ¹*Alliance Univ. Bengaluru, India*; ²*IIT Madras, India*. We demonstrate that the combination of Super Linear Iterative Clustering and Earth Mover's Distance efficiently segments tumours from the MRI dataset. Despite using a smaller training dataset our approach achieves an accuracy of 86.2%.

DW1H.4 • 09:00 (Invited)

Investigating the Efficacy of Deep Learning Networks for 3D Imaging and Processing, Inbarasan Muniraj¹; ¹*Alliance Univ., Bengaluru, India*. Artificial intelligence techniques, such as machine learning (ML) and deep learning (DL), are now widely used in various vision-based applications. Here, we summarize some of the most recent advances in Computational Integral Imaging using DL networks.

DW1H.5 • 09:30 (Invited)

Title to be Announced, Wolfgang Heidrich¹; ¹*King Abdullah Univ of Sci & Technology, Saudi Arabia*. Abstract not available.

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08:00 -- 10:00

Room: Spot

IW1D • Novel Imaging Optics/Systems

Presider: Olivier Francois; Huawei Technologies, Finland

IW1D.1 • 08:00

Silicon-Based 3-D Imaging With Terahertz Light-Field, Hamadi Sadkaoui¹, Miguel Heredia Conde¹, Marcel Andree¹, Arjith Chandra Prabhu¹, Abdulraouf Kutaish¹, Ehsan Hamzeh¹, Ullrich Pfeiffer¹; ¹*Bergische Universität Wuppertal, Germany*. Terahertz (THz) light-field imaging offers a solution for material identification and imaging of opaque objects. This paper explores THz techniques, including coherence-based approaches and light-field methods, showcasing experimental setups and results.

IW1D.2 • 08:15

Rotation Aperture Synthesis for Flat and Conformal Imaging, Andrew S. McAvenue¹, Guillem Carles¹, Andrew R. Harvey¹; ¹*Univ. of Glasgow, UK*. We present proof-of-concept demonstration of high-resolution aperture-synthetic imaging that enables high-resolution imaging from flat camera modules. The order-of-magnitude reduction in the depth of camera modules has potential applications ranging from mobile-phone cameras to remote sensing from space.

IW1D.3 • 08:30 (Invited)

Optical/Digital co-Design Approach: Methods, Applications - and how to Trick Your Commercial Optical Design Software, Marie-Anne Burcklen¹, Alice Fontbonne², Hervé Sauer¹, Caroline Kulcsar¹, François Goudail¹; ¹*Laboratoire Charles Fabry, Institut d'Optique Graduate School, France*; ²*ONERA, France*. Co-design refers to the joint optimization of optical elements and image processing algorithms to improve the global performance of an imaging system. We present co-design methods for different types of optical systems, starting from binary phase masks to more complex multi-lens systems with high aperture and large field of view. We demonstrate on various examples that this approach can increase imaging performance and lead to lighter and more compact systems.

IW1D.4 • 09:00

Imaging the Energy Deposited by a 20 MeV Proton Beam Using a Commercial Liquid Scintillator, Peter R. Hobson¹, Maria Maxouti², Jeffrey Bamber³, Kenneth Long²; ¹*Queen Mary Univ. of London, UK*; ²*Physics, Imperial College London, UK*; ³*Physics, Inst. of Cancer Research and Royal Marsden NHS Foundation Trust, UK*. To image the three-dimensional distribution of the energy deposited by a 20 MeV proton beam in a radiobiological phantom we have simulated, using non-sequential raytracing, the visible light emitted by a commercial liquid scintillator.

IW1D.5 • 09:15

Intelligent Vision System Optimization Through end-to-end Simulation, Julie Buquet^{1,2}, Jocelyn Parent¹, Patrice Roulet¹, Simon Thibault^{1,2}; ¹*Immervision Inc., Canada*; ²*Universite Laval, Canada*. As more and more cameras are dedicated to machine perception applications,

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we present an end-to-end vision system simulation pipeline to redefine key performance indicators when cameras are used alongside machine learning algorithms.

IW1D.6 • 09:30 (Invited)

Flat Optics, Mikhail Kats¹; ¹*Univ. of Wisconsin-Madison, USA*. Abstract not available.

08:00 -- 10:00

Room: Argos

OW1F • Microscopy and Bioimaging I

Presider: Peter Kner; Univ. of Georgia, USA

OW1F.1 • 08:00

Adaptive RESOLFT Microscopy, Ruizhe Lin^{2,1}, Ilaria Testa^{2,1}; ¹*SciLifeLab, Sweden*; ²*KTH Royal Inst. of Technology, Sweden*. By integrating confocal scanning, structured illumination, and adaptive optics, the adaptive RESOLFT microscopy overcomes performance limits caused by sample-induced optical aberrations, enabling super-resolution imaging at depth in complex live tissues.

OW1F.2 • 08:15

Two Photon Adaptive Microscopy Using Walsh Mode Based Neural Network Aberration Estimation, Yuyao Xiao¹, Qi Hu¹, Martin J. Booth¹; ¹*Univ. of Oxford, UK*. Existing adaptive optics methods correcting aberrations with complex high-order shapes are commonly inefficient. A neural network encapsulating the mathematics of Walsh mode lattices was proposed. Results suggested it had the potential to outperform conventional methods.

OW1F.3 • 08:30

Adaptive Optical Quantitative Phase Imaging of Living Cells Based on Fourier Ptychographic Microscopy, Jiasong Sun¹, Yefeng Shu¹, Chao Zuo¹; ¹*Nanjing Univ. of Science and Techno, China*. In this report, we present an adaptive optical Quantitative Phase Imaging (AO-QPI) method based on annular illumination Fourier Ptychographic Microscopy (FPM). Using only six low-resolution images that match the objective, we're able to recover high-resolution quantitative phase images and characterize the aberrations in real time.

OW1F.4 • 08:45

Adaptive Optics in two-Photon Fluorescence Microscopy for Functional Neuroimaging, Alice Guillaume-Manca^{1,2}, Sophia Imperato^{2,1}, Jean-François Léger¹, Mathias Mercier^{2,3}, Fabrice Harms⁴, Laurent Bourdieu¹, Alexandra Fragola³; ¹*Institut de biologie de l'Ecole Normale Supérieure, PSL, INSERM, CNRS, France*; ²*Laboratoire de Physique et d'Etude des Matériaux, Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris, PSL, France*; ³*Institut des Sciences Moléculaires d'Orsay, Université Paris Sud, CNRS, France*; ⁴*Imagine Optic SA, France*. Integrating extended-source adaptive optics into a two-photon microscope allows to measure and correct aberrations in strongly scattering conditions, enhancing resolution and intensity for imaging mouse fixed brain slices and live cortex.

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OW1F.5 • 09:00 (Top-Scored)

Reconstructionless Autofocus Method for Hadamard-Based Single-Pixel Microscopy., Heberley Tobón¹, Samuel Zapata-Valencia¹, Lindsey Willstatter², Stefano Bonora², Andrea Farina³, Jesús Lancis¹, Enrique Tajahuerce¹; ¹*Universitat Jaume I, Spain*; ²*Inst. of Photonics and Nanotechnology, CNR, Italy*; ³*Department of physics, Politecnico di Milano, Italy*. An autofocus method for Hadamard-based single-pixel microscopy without image retrieving is presented. An iterative gradient descent algorithm finds the focusing plane by analyzing the intensity obtained by projecting a reduced number of Hadamard patterns

OW1F.6 • 09:15

Direct Zernike Coefficient Prediction and Correction From Aberrated Images Using Deep Learning, Yong Kok¹, Alexander Bentley¹, Andrew Parkes¹, Michael Somekh¹, Amanda Wright¹, Michael Pound¹; ¹*Univ. of Nottingham, UK*. Optical imaging quality is severely degraded by system and sample induced aberrations. This study demonstrates the application of deep learning to characterise and correct optical aberrations by reconstructing the Zernike coefficients from phase-diverse optical images.

OW1F.7 • 09:30 (Invited)

Adaptive Optical Microscopy for Bioimaging, Qinrong Zhang¹; ¹*City Univ. of Hong Kong, Hong Kong*. This talk covers the history and developments in adaptive optics (AO), its applications in bioimaging, and our progress in advancing AO for high-resolution, *in vivo* imaging of the mouse brain and eye.

08:00 -- 10:00

Room: Diamant

QW1G • Enabling Technologies for Integrated Quantum Hardware

Presider: Alexandra Artusio-Glimpse; National Inst. of Standards & Technology, USA

QW1G.1 • 08:00 (Tutorial)

Photodetector Technologies for Quantum Sensing, Sebastian Beer¹; ¹*Hamamatsu Photonics Deutschland GmbH, Germany*. Photodetector Technologies are an integral part of most quantum sensing methods. During the tutorial, the basic operation as well as the most popular types of single photon detectors will be discussed.

QW1G.2 • 09:00 (Invited)

Towards Scalable Trapped-ion Quantum Computing, Sara L. Campbell¹; ¹*Quantinuum, USA*. We describe recent progress at Quantinuum, both on full-stack commercial quantum computers and on integrated photonics testbeds, to solve fundamental challenges on the path towards scaling up trapped-ion quantum computers.

QW1G.3 • 09:30 (Invited)

Title to be Announced, Scott Davis¹, Bennett Sodergren¹; ¹*Vescent, USA*. Abstract not available.

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08:00 -- 10:00

Room: Ariane 1

SW1C • Optical Biological and Chemical Sensors IV

Presider: Jennifer Morales; US Army Research Laboratory, USA

SW1C.1 • 08:00 (Top-Scored)

Improving the Sensitivity of Refractive Index Interferometric Sensors on Silicon Chip,

Francesca Samà¹, Flaminia Piretta², Francesca Bontempi³, Javier Elaskar¹, Debora Angeloni², Claudio Oton¹; ¹*Inst. of Mechanical Intelligence, Scuola Superiore Sant'Anna, Italy;* ²*Inst. of Biorobotics, Scuola Superiore Sant'Anna, Italy;* ³*CNR - IEIT, Italy.* We present an interferometric chemical sensor on silicon chip measuring refractive index variations in contacting liquids, optimized at 1310 nm wavelength and TM polarization, and tripling the sensitivity of a 1550 nm TE polarization counterpart.

SW1C.2 • 08:15

Preliminary Results on Refractometric Sensors Based on Silicon Nitride Ring

Resonators, Annabella la Grasta², María I. Gómez-Gómez¹, Amadeu Griol¹, Martino De Carlo², Vittorio M. Passaro², Alejandro Martínez¹, Francesco Dell'Olio²; ¹*Nanophotonics Technology Center, Universitat Politècnica de València, Spain;* ²*Department of Electrical and Information Engineering, Polytechnic Univ. of Bari, Italy.* We report on refractometric sensors based on silicon nitride ring resonators operating in the TE mode around 1310 nm wavelengths to use in the area of biosensing.

SW1C.3 • 08:30 (Invited)

Nanophotonics Biosensors for the Clinical Management of Infectious Diseases, Laura M.

Lechuga¹; ¹*Catalan Inst. of Nanoscience and Nanotechnology, Spain.* Point-of-care nanophotonics biosensors are rapid diagnostic platforms which can solve the problem of the rapid and accurate diagnostics of infections by providing sensitive, reliable, and selective analysis and using low sample volume at bedside.

SW1C.4 • 09:00

Tilted Fiber Bragg Grating for Rapid Clinical Detection of Platinum Ion, YiFan Duan¹,

Jiahui Jin¹, You Lv¹, Yunting Du², Ji Shi², Xiaojing Tong², Qiao Wang¹, Yang Zhang¹, Zhenguo Jing¹, Wei Peng¹; ¹*Dalian Univ. of Technology, China;* ²*Cancer Hospital of Dalian Univ. of Technology (Liaoning Cancer Hospital & Inst.), China.* In this study, we utilized TFBG-SPR combined with a DNA biosensor to develop a highly sensitive and practical platinum ion sensor, bringing significant promise to clinical cancer diagnosis and drug development.

SW1C.5 • 09:15

Real-Time Monitoring of Single Molecules With Rolling Circle Amplification by Surface Plasmon-Enhanced Fluorescence Imaging, Katharina Schmidt¹, Naoto Asai¹, Andres de los

Santos Pereira², Tomas Riedel², Nicholas Scott Lynn Jr³, Diega Fernando Dorado Daza², Jakub Dostalek^{1,3}; ¹*Danube Private Univ. GmbH (DPU), Austria;* ²*Inst. of Macromolecular Chemistry, Czechia;* ³*FZU-Inst. of Physics, Czechia.* The immuno-rolling circle amplification assay is demonstrated for the detection of cancer biomarkers in serum samples with high sensitivity. Real-time imaging of single molecules is possible with surface plasmon-enhanced fluorescence.

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08:15 -- 10:00

Room: Guillaumet 1

LW1E • Sensing Beyond Gas Phase

Presider: Timothy Ombrello; US Air Force Research Laboratory, USA

LW1E.1 • 08:15 (Invited)

Mid-IR Photonic Integrated Circuits for on-Chip Liquid Sensing and Beyond, Borislav Hinkov^{1,2}, Mauro David², Georg Marschick², Elena Arigliani², Xaver Gsodam², Dominik Koukola², Florian Pilat², Nikola Opacak², Andreas Schwaighofer³, Alicja Dabrowska³, Axel Evirgen⁴, Salvatore Pes⁴, Benedikt Schwarz², Bernhard Lendl³, Gottfried Strasser²; ¹*Silicon Austria Labs, Austria*; ²*TU Wien Inst. of Solid State Electronics, Austria*; ³*TU Wien Inst. of Chemical Technologies and Analytics, Austria*; ⁴*III-V Lab, a joint Thales, Nokia and CEA-LETI laboratory, France*. We present design and realization of novel types of monolithic mid-IR photonic integrated circuits (PICs) based on quantum-cascade (QC) technology and Ge-Au/PE-Au plasmonics. We demonstrate linear lab-on-a-chip devices and fully monolithic integrated heterodyne receivers.

LW1E.2 • 08:45 (Invited)

Non-Invasive Material Diagnostics Used in the LLNL Energy Matter Interaction Tunnel (EMIT), Benjamin M. Goldberg¹, Erik Busby¹, Rich Shuttlesworth¹, Jordan Lum¹, Lionel Keene¹, Spencer Jeppson¹, German F. Ellsworth¹, Kambiz Salari¹, Aric Rousso¹; ¹*Lawrence Livermore National Laboratory, USA*. The recently completed hypersonic test facility at LLNL has been purposefully built to enable non-invasive optical diagnostics yielding simultaneous material and gas phase measurements. We will present the design of the facility as well as results from initial experimental campaigns.

LW1E.3 • 09:15 (Invited)

Application of High Energy KrF Excimer Laser for Shock Compression of Emerging Materials, Manny Gonzales¹, Jason Bates², Max Karasik², James Weaver², Alexander Velikovich², Yefim Aglitskiy²; ¹*Space Vehicles Directorate, U.S. Air Force Research Laboratory, USA*; ²*Plasma Physics Division, U.S. Naval Research Laboratory, USA*. Direct absolute equation of state measurements for CH foams were obtained with direct drive laser shock compression at the NIKE KrF laser. Excimer lasers offer superior performance over glass architectures for extreme environment investigations.

LW1E.3 • 09:45

Simultaneous Temperature and Thickness Measurements in Microfluidic Flows Using Two-Color Laser-Induced Fluorescence, Xiyu Chen^{1,2}, Xin Li^{1,2}, Jiwei Li^{1,2}, Qiu Wang¹, Yejun Wang¹, Wei Zhao^{1,2}; ¹*Inst. of Mechanics, Chinese Academy of Sciences, China*; ²*Univ. of Chinese Academy of Sciences, China*. Characterization of two-dye/two-color laser-induced fluorescence is explored for liquid-phase applications. The dependence of laser energy, dye concentration, and temperature on the signal are studied, simultaneous temperature and thickness measurements are further demonstrated in microfluidic flows.

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10:30 -- 12:30

Room: Concorde 1

JW2A • Joint Plenary Session II

JW2A.1 • 10:30 (Plenary)

Polarized Super-Resolution Microscopy in 3D to Image Complex Biomolecular Organizations, Sophie Brasselet¹; ¹*Fresnel Institut, France*. We report the imaging of the orientation of fluorescent single molecules in 3D, using polarized optical microscopy at high numerical apertures. We apply this approach to super resolution imaging of proteins' organizations in cells.

JW2A.2 • 10:30 (Plenary)

Chip-Scale Atomic Devices: From Clocks to Brain Imaging and Beyond, John Kitching¹; ¹*National Inst of Standards & Technology, USA*. Chip-scale atomic clocks and sensors combine elements of precision atomic spectroscopy, silicon micromachining and photonics technology to achieve good performance with small size and low power consumption. Recent advances will be discussed including compact optical clocks, micromachined atomic beam clocks.

14:00 -- 16:00

Room: Ariane 2

AW3A • Agriphotonics, Food and Water Safety

Presider: Heidi Ottevaere; Vrije Universiteit Brussel, Belgium

AW3A.1 • 14:00 (Invited)

Spectroscopy for Everyday Life: Precision Agriculture, Food and Healthcare, Bassam Saadany¹; ¹*Si-Ware, Egypt*. In this talk, we discuss the use of micro spectrometers – as tiny optical sensors- with lab-grade performance for precision agriculture, food testing as well as healthcare applications. Showing how the small size, light weight and scalability of a MEMS based sensor enables in-field testing through hand-held and connected scanners. We will be showing the widespread use of applications and the positive impact in real life examples.

AW3A.2 • 14:30

Rapid Identification of Microplastics Through Spectral Reconstruction From RGB Images, Yuxing Li¹, Jianqing Huang¹, Jingyan Chen¹, Edmund Y. Lam¹; ¹*Hong Kong Univ., Hong Kong*. We propose a method to generate hyperspectral bands and extract spectral signatures from RGB images. Experimental results validate its efficacy in streamlining microplastic identification through comprehensive spectroscopic analysis and reducing imaging time requirements.

AW3A.3 • 14:45 (Invited)

Towards a non-Destructive and Sensitive Food Quality Inspection Using Broadband Diffuse Reflection Spectroscopy and Machine Learning, Lien Smeesters¹; ¹*Department of Applied Physics and Photonics, B-PHOT Brussels Photonics, Vrije Universiteit Brussel, Belgium*. Diffuse reflection spectroscopy (400nm–1700nm) offers a non-destructive and accurate food quality and safety evaluation. Optimal results are achieved after co-optimization

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of the spectroscopic measurement procedure and machine learning analysis, showing classification performances exceeding 92%.

AW3A.4 • 15:15 (Invited)

Spectroscopy and Disinfection Byproducts in Water Treatment, Christoph Wagner¹; ¹*s::can GmbH, Austria*. This study presents UV/VIS and fluorescence measurements to predict disinfection byproducts in drinking water. Data indicates good correlations, highlighting these techniques' potential for real-time monitoring and improving water safety and quality control.

AW3A.5 • 15:45

Portable Shifted Excitation Raman Difference Spectroscopy: Towards Qualitative and Quantitative on-Site Soil Analysis, Kay Sowoidnich¹, Stefan Pätzold², Markus Ostermann³, Martin Maiwald¹, Bernd Sumpf¹; ¹*Ferdinand-Braun-Institut gGmbH, Germany*; ²*Inst. of Crop Science and Resource Conservation (INRES), Soil Science and Soil Ecology, Univ. of Bonn, Germany*; ³*Federal Inst. for Materials Research and Testing (BAM), Process Analytical Technology, Germany*. Portable shifted excitation Raman difference spectroscopy effectively overcomes fluorescence and ambient light interference during on-site soil investigations. This enables to identify selected soil components and to predict the contents of carbonate and soil organic carbon.

• 16:00 (Invited)

Using Spectroscopic Based Surrogates for Controlling Trace Organic Contaminants in Water Treatment Processes, Paolo Roccaro¹; ¹*Universita degli Studi di Catania, Italy*.

Absorbance and fluorescence spectroscopy can be used to monitor trace organic contaminants during water treatment processes. The presentation will deal with the formation of disinfection by-products and the removal of pharmaceuticals and PFAS.

14:00 -- 16:00

Room: Caravelle 2

CW3B • Ptychography I

Presider: Lars Loetgering; ZEISS Research Microscopy Solutions, Germany

CW3B.1 • 14:00 (Invited)

Near-Field Multi-Slice Optical Ptychography, Andrew Maiden^{1,2}, Ziyang Hu¹, Yiqian Zhang¹; ¹*Univ. of Sheffield, UK*; ²*Diamond Light Source, UK*. We show how near-field multi-slice ptychography can be implemented on an optical microscope to realize computational sectioning of thick samples. We use the method to section a 90 µm-thick sample into 40 slices.

CW3B.2 • 14:30

Dynamic Fourier Ptychography via Space-Time Optimization, Ming Sun¹, Kunyi Wang¹, Yogeshwar N. Mishra¹, Simeng Qiu¹, Wolfgang Heidrich¹; ¹*KAUST, Saudi Arabia*. We introduce a dynamic Fourier ptychography (FP) technique via a spacetime framework, jointly recovering object states and deformation fields for detailed observation of rapid, complex behaviors in living cells.

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CW3B.3 • 14:45

High-Speed, High-Throughput Fourier Ptychographic Microscopy With Hybrid Coherent/Incoherent Illumination, Yao Fan¹, Jiasong Sun¹, Chao Zuo¹; ¹*Nanjing Univ. of Science and Technology, China*. We propose an efficient synthetic aperture scheme for FPM, termed ESA-FPM, which employs both coherent and incoherent illuminations to maximize the efficiency of data utilization and achieves an imaging bandwidth of $3NA/\lambda$ requiring only 7 images.

CW3B.4 • 15:00

Multiplexing Scalability in Ptychography: Information Oversampling and Beam Overlap, Daniel S. Penagos Molina^{1,2}, Wilhelm Eschen^{1,2}, Chang Liu^{1,2}, Jens Limpert^{1,2}, Jan Rothhardt^{1,2}; ¹*Helmholtz Inst. Jena, Germany*; ²*Inst. of applied physics and Abbe Center of Photonics, Friedrich-Schiller-Univ. Jena, Germany*. We present a detailed numerical and experimental analysis on spatial multiplexing capabilities in ptychography for boosting performance. By considering beam overlap and oversampling ratio, a more than 10-fold scale in performance can be achieved.

CW3B.5 • 15:15

Sparse Color Fourier Ptychographic Microscopy With Implicit Neural Representations, Matthew A. Chan¹, Haowen Zhou², Brandon Y. Feng^{1,3}, Chris A. Metzler¹; ¹*Department of Computer Science, Univ. of Maryland, College Park, USA*; ²*Department of Electrical Engineering, California Inst. of Technology, USA*; ³*Computer Science and Artificial Intelligence Laboratory, Massachusetts Inst. of Technology, USA*. We apply implicit neural representations--which naturally capture spectral regularity---to reconstruct color Fourier ptychographic microscopy images from spectrally-sparse measurements. We conduct experiments on real-world specimens and demonstrate reconstruction quality comparable with fully sampled methods.

CW3B.6 • 15:30

Automatic Differentiation-Assisted Fourier Ptychographic Microscopy, Jun Wang¹, Yang Wu¹, Chao Tan¹, Ni Chen²; ¹*Sichuan Univ., China*; ²*Univ. of Arizona, USA*. Fourier ptychographic microscopy (FPM) enables wide-field-of-view and high-resolution imaging. However, the precise offset should align LED array before recovering, otherwise it causes artifacts. To tackle it, we present a differentiable FPM technique to handle misalignments.

CW3B.7 • 15:45

Non-Interferometric Quantitative Phase Microscopy Based on Kramers-Kronig Relations for Large Phase Objects, Qian Shen¹, Jiasong Sun¹, Qian Chen¹, Chao Zuo¹; ¹*Nanjing Univ of Science And Technology, China*. High-speed, high-accuracy phase retrieval of large-phase objects remains a challenge. We propose a non-interferometric quantitative phase imaging technique beyond the weak object approximation based on Kramers-Kronig relations, realizing fast reconstruction with a few iterations.

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14:00 -- 16:00

Room: Guillaumet 2

DW3H • Deep Learning for 3D Imaging II

Presider: Wolfgang Heidrich; King Abdullah Univ. of Sci & Technology, Saudi Arabia

DW3H.1 • 14:00 (Invited)

CodedEvents: Optimal Point-Spread-Function Engineering for 3D-Tracking With Event Cameras, Chris A. Metzler¹, Sachin Shah¹, Matthew A. Chan¹, Haoming Cai¹, Jingxi Chen¹, Sakshum Kulshrestha¹, Chahat Deep Singh¹, Yiannis Aloimonos¹; ¹*Univ. of Maryland at College Park, USA*. This talk explores the fundamental limits of 3D tracking with PSF engineering and event cameras. We demonstrate existing phase masks are already near-optimal for localizing flashing point sources, but suboptimal for tracking moving objects.

DW3H.2 • 14:30

Compressive Learning Holography by LPTNet, Adrian Stern¹, Vladislav Kravets¹; ¹*Ben Gurion Univ. of the Negev, Israel*. Learned compressive sensing involves data-driven methods for both designing the sensing mechanism and reconstructing the signal. Here we describe a learned compressive holography method utilizing our recently introduced LPTNet

DW3H.3 • 14:45

Cholangiocarcinoma Classification Using Semi-Supervised Learning Approach, Sravan Kumar Sikkakolli¹, Suresh Aala¹, Sunil chinnadurai¹, Inbarasan Muniraj², Anuj Deshpande¹; ¹*SRM UNIV., India*; ²*Alliance Univ., India*. This article introduces a novel semi-supervised learning method for Cholangiocarcinoma detection using inherent statistical parameters of the image on the multidimensional Choledochal dataset. Results closely match the pathologist's annotations, validated by image similarity indices.

DW3H.4 • 15:00 (Invited)

Machine Learning Assisted Single Pixel Imaging for Weak Light Detection, Yasuhiro Mizutani¹, Shoma Kataoka¹, Tsutomu Uenohara¹, Yasuhiro Takaya¹, Osamu Matoba²; ¹*Department of Mechanical Engineering, Osaka Univ., Japan*; ²*Center of Optical Scattering Image Science, Kobe Univ., Japan*. Single-pixel imaging, which allows imaging with a single-pixel detector and correlation method, can be accelerated by combining machine learning. In addition, the estimation accuracy is improved by using the predictive uncertainty by machine learning.

14:00 -- 16:00

Room: Spot

IW3D • Computational Imaging

Presider: Chrysanthe Preza; Univ. of Memphis, USA

IW3D.1 • 14:00 (Top-Scored)

Image Restoration via Learning on a Digital Twin for Multi-Core Fiber Endoscopy, Tijue Wang^{1,2}, Jakob Dremel^{1,2}, Sven Richter^{3,2}, Witold Polanski^{3,2}, Ortrud Uckermann^{3,2}, Ilker Eyüpoglu^{3,2}, Juergen W. Czarske^{1,2}, Robert Kuschmierz^{1,2}; ¹*Laboratory of Measurement and*

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Sensor System Technique, TU Dresden, Germany; ²*Else Kröner Fresenius Center for Digital Health, TU Dresden, Germany;* ³*Department of Neurosurgery, Univ. Hospital Carl Gustav Carus, TU Dresden, Germany.* Fiber endoscopy has great potential in all-optical biopsies but suffers fiber-specific distortions. We propose a method based on deep learning and digital twins for image reconstruction with a few training samples to enable clinical transfer.

IW3D.2 • 14:15

Noise Amplification and Ill-Convergence of Richardson-Lucy Deconvolution, Yiming Liu¹, Spozmai Panezai¹, Yutong Wang¹, Sjoerd Stallinga¹; ¹*Technische Universiteit Delft, Netherlands.* Richardson-Lucy deconvolution can offer an increase in contrast, but converges poorly, and is sensitive to noise. We show that the Cramér Rao Lower Bound (CRLB) diverges, which explains the problematic behaviour.

IW3D.3 • 14:30

Image-Reconstruction Algorithm for an Object Surrounded by a Strongly Scattering Medium, Jakub Belin^{1,2}, Miroslav Duris¹, Radim Chmelik^{1,2}; ¹*Central European Inst. of Technology, Czechia;* ²*Brno Univ. of Technology, Czechia.* We present an algorithm for image reconstruction when the target object is surrounded by a strongly scattering medium.

IW3D.4 • 14:45

Integration of Laser Speckle Contrast Imaging and Subcutaneous Vein Imaging for Multimodal Optical Imaging, Donghwan Ko¹, Hyunseon Yu¹, Byungjo Jung¹; ¹*Yonsei Univ., Korea (the Republic of).* An integration optical imaging system of laser speckle contrast image and subcutaneous vein image was developed for non-invasive real-time imaging, enhancing blood flow and vessel visualization. The system was evaluated on vascular optical tissue phantom.

IW3D.5 • 15:00 (Invited)

Computational Endoscopy, Rafael Piestun¹; ¹*Univ. of Colorado at Boulder, USA.* Abstract not available.

IW3D.6 • 15:30 (Invited)

Imaging Through Scattering, Sylvain Gigan¹; ¹*Sorbonne Université, France.* Abstract not available.

14:00 -- 16:00

Room: Guillaumet 1

LW3E • Laser Sensing Applications

Presider: Benoit Fond; ONERA - the French Aerospace Lab, France

LW3E.1 • 14:00 (Invited)

Imaging Light Ray Deviations for Reactive Supersonic Flow Sensing and Tomography, Olivier Leon¹, David Donjat¹, Pierre Doublet¹, Adrien Langenais¹, Aurélien Plyer¹, Frédéric Champagnat¹; ¹*Office Natl d'Etudes Rech Aerospatiales, France.* This work demonstrates the application of high-speed Background Oriented Schlieren for the quantitative analysis of

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reactive supersonic jets. Tomographic reconstructions of refractive index fields are compared with OH* visualizations and a reactive RANS model.

LW3E.2 • 14:30 (Invited)

Recent Advances in Quartz Tuning Forks- Based Gas Sensing and Spectroscopy, Vincenzo Spagnolo¹; ¹*Politecnico di Bari, Italy*. Starting from the basic physical principles, I will review new advancements achieved exploiting crystal tuning fork-based gas sensing for real-world applications in environmental monitoring, as well as safety and security, and industrial fields.

LW3E.3 • 15:00

Light-Induced Thermoelastic Spectroscopy-Based Novel Temperature Measurement Method, Xiaonan Liu¹, Yufei Ma¹; ¹*Harbin Inst. of Technology, China*. A novel temperature measurement method based on light-induced thermoelastic spectroscopy (LITES) was demonstrated. The relative error of the measured temperature was less than 5%, which indicated that the LITES temperature sensor has excellent detection accuracy.

LW3E.4 • 15:15

Ammonia-Nitrogen Gas Phase Diagnostics Applying Laser Induced Electrostrictive and Thermal Gratings, Jonas I. Hölzer^{1,2}, Dimitrii N. Kozlov³, Thomas Seeger^{1,2}; ¹*Engineering Thermodynamics, Univ. of Siegen, Germany*; ²*Center for Sensor Systems (ZESS), Univ. of Siegen, Germany*; ³*Optical Spectroscopy, Prokhorov General Physics Inst. of the Russian Academy of Sciences, Russian Federation*. Pump-laser absorption of ammonia at 1064nm may generate a thermal contribution to a laser-induced grating (LIG) in ammonia-nitrogen gas mixtures. We demonstrate a simplified approach for simultaneous mixture composition and temperature evaluation in this system using the LIG technique.

LW3E.5 • 15:30

OH-PLIF Diagnostics of Niacin Dust Flames, Christian Schweizer¹, Matthew Hay¹, Chad Mashuga², Waruna Kulatilaka¹; ¹*J. Mike Walker '66 Department of Mechanical Engineering, Texas A&M Univ., USA*; ²*Artie McFerrin Department of Chemical Engineering, Texas A&M Univ., USA*. Hydroxyl radical planar laser-induced fluorescence (OH-PLIF) imaging is implemented to characterize the flame structure of burning niacin dust clouds. The flame morphology is analyzed using two-dimensional flame area and curvature measurements.

14:00 -- 16:00

Room: Argos

OW3F • Ophthalmoscopy I

Presider: Robert Zawadzki; Univ. of California Davis, USA

OW3F.1 • 14:00 (Invited)

Adaptive Optics Ophthalmoscopy: Clinical Applications, Kate Grieve¹; ¹*Institut De La Vision Paris, France*. A review of the clinical use of adaptive optics technology in ophthalmology will be presented, including flood and scan technologies, quantification of biomarkers, clinical cases of pathology, and future perspectives.

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OW3F.2 • 14:30

High Refresh Rate Display Integrated With Adaptive Optics Retinal Imaging and Eye-Tracking, Benjamin Moon¹, Glory Linebach¹, Angelina Yang¹, Samantha K. Jenks¹, Michele Rucci¹, Martina Poletti¹, Jannick P. Rolland¹; ¹*Univ. of Rochester, USA*. By integrating an external display operating at 360 Hz with an Adaptive Optics Scanning Laser Ophthalmoscope for human foveal imaging, we demonstrate color stimulus delivery at high spatial and temporal resolution with sub-arcminute eye-tracking uncertainty.

OW3F.3 • 14:45

Using Image Sharpness Metrics to Improve and Monitor AOSLO Performance, Penny Lawton¹, Laura Young¹; ¹*Univ. of Newcastle, UK*. We describe here the use of image sharpness metrics to give a measure of image quality and system performance in the Adaptive Optics Scanning Laser Ophthalmoscope; a system which images cells in the retina at high resolution.

OW3F.4 • 15:00

AO-FIO for Fixational eye Movements Tracking and Drusen Visualization in Presymptomatic AMD, Jimmy Murari¹, Josselin Gautier², Joël Daout¹, Léa Krafft³, Pierre Senée³, Pedro Mecê⁴, Kate Grieve¹, William Seiple⁵, Serge Meimon³, Denis Sheynikhovich¹, Michel Paques², Angelo Arleo¹; ¹*Institut de la Vision - Sorbonne Uni, France*; ²*Quinze-Vingts Hospital CIC, France*; ³*DOTA, ONERA, France*; ⁴*Institut Langevin, France*; ⁵*Lighthouse guild, USA*. Using Adaptive Optics Flood-Illumination Ophthalmoscopy, we showed that small asymptomatic foveal drusen had a significant effect on fixation stability. Particularly, the closer the drusen were from the fovea center, the larger the microsaccades.

OW3F.5 • 15:15 (Invited)

Navigating Adaptive Optics Hurdles in Microscopy and Ophthalmoscopy: Leveraging Deformable Phase Plate Technology, Pouya Rajaeipour¹; ¹*Phaseform GmbH, Germany*. Widespread adoption of adaptive optics in microscopy and ophthalmoscopy has been hampered by complex and costly system integration and the limited size of the isoplanatic patch. I present a summary of possible solutions, focusing on the enabling role of deformable phase plates. Exceptionally compact dimensions, the ability to perform high-order corrections, and scalability make this new class of refractive wavefront modulators capable of unprecedented adaptive optics configurations.

14:00 -- 16:00

Room: Diamant

QW3G • Quantum-Enhanced Sensing I

Presider: Chandra Raman; Georgia Inst. of Technology, USA

QW3G.1 • 14:00 (Invited)

At the Intersection: Macroscopic Quantum Mechanics and Gravity, Haocun Yu¹; ¹*Universitat Wien, USA*. From entangled photons measuring Earth's rotation to testing macroscopic quantum phenomena in metrology, I will discuss exploring the interface between quantum mechanics and gravity, two fundamental pillars of modern physics.

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QW3G.2 • 14:30 (Invited)

Fiber-Based Atom Interferometric Sensors, Shau-Yu Lan¹; ¹*National Taiwan Univ., Taiwan*. I present an atom interferometer inside a hollow-core photonic crystal fiber. The results permit bringing atoms close to source fields for sensing and could lead to compact inertial quantum sensors with a submillimeter resolution.

QW3G.3 • 15:00 (Top-Scored)

Heisenberg-Limited Quantum Lidar for Joint Range and Velocity Estimation, Maximilian Reichert^{1,2}, Quntao Zhuang^{3,4}, Mikel Sanz^{1,2}; ¹*Department of Physical Chemistry, Univ. of the Basque Country, Spain*; ²*EHU Quantum Center, Univ. of the Basque Country, Spain*; ³*Ming Hsieh Department of Electrical and Computer Engineering, Univ. of Southern California, Los Angeles, USA*; ⁴*Department of Physics and Astronomy, Univ. of Southern California, USA*. We propose a quantum lidar protocol that uses pulsed squeezed light to simultaneously estimate target range and velocity. By engineering temporal modes and employing homodyne detection, we achieve the Heisenberg limit for both parameters.

QW3G.4 • 15:15

Optimality and Noise-Resilience of Critical Quantum Sensing, Uesli Alushi^{1,2}, Wojciech Górecki⁵, Simone Felicetti^{2,4}, Roberto Di Candia^{1,3}; ¹*Aalto Univ., Finland*; ²*National Resource Council, Inst. for Complex Systems, Italy*; ³*Dipartimento di Fisica, Università degli studi di Pavia, Italy*; ⁴*Physics Department, Sapienza Univ., Italy*; ⁵*Sezione Pavia, INFN, Italy*. We compare critical quantum sensing to passive quantum strategies to perform frequency estimation. Critical strategies achieve quadratic scaling in the number of photons even in dissipative scenarios, thus outperforming passive quantum strategies

14:00 -- 16:00

Room: Ariane 1

SW3C • Distributed and Quasi-Distributed Optical Fiber Sensors

Presider: Marcelo Soto; Universidad Técnica Federico Santa María, Chile

SW3C.1 • 14:00 (Invited)

Fiber Optic Sensors Based on Artificially-Controlled Backscattering Fiber Reflectors, Rosa Ana Pérez-Herrera^{1,2}, Pablo Roldan-Varona^{4,3}, Arturo Sanchez-Gonzalez^{1,2}, José Miguel López-Higuera^{4,5}, Manuel Lopez-Amo^{1,2}, Luis Rodriguez Cobo⁵; ¹*Universidad Publica de Navarra, Spain*; ²*ISC - Inst. of Smart Cities, Spain*; ³*Inst. of Photonics and Quantum Sciences, Heriot-Watt Univ., UK*; ⁴*Photonics Engineering Group, Universidad de Cantabria, Spain*; ⁵*CIBER-BBN, Instituto de Salud Carlos III, Spain*. The use of femtosecond fiber-lasers for the fabrication of artificially controlled backscattering fiber reflectors has enabled their use and optimization within the field of fiber optic sensors, being able to measure different parameters with higher resolutions than commercial reflectors. This presentation provides an overview of the latest advances in this technology.

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SW3C.2 • 14:30

Adjustable Sensitivity Dual-Wavelength Differential Detection of Tilted Fiber Bragg Gratings Using a Broadly Tunable MG-Y Laser, Yang Cheung^{2,1}, Wei Dang², Yang Zhang¹, Da-Peng Zhou¹, Wei Peng¹, Xiaoqun zheng², Zhenguo Jing^{2,1}; ¹*School of Physics, Dalian Univ. of Technology, China*; ²*Central Hospital of Dalian Univ. of Technology, China*. A dual-wavelength differential detection technique based on a broadly tunable MG-Y laser is proposed to achieve demodulation of TFBGs with adjustable sensitivity. This technique provides a real-time and novel approach for on-site applications of TFBGs.

SW3C.3 • 14:45

Dynamic Brillouin Sensor in Optical Fibres Using Fast Fourier Analysis and Low-Bandwidth Acquisition, Sanghoon Chin¹, Marcelo A. Soto²; ¹*CSEM SA, Switzerland*; ²*Universidad Técnica Federico Santa María, Chile*. A dynamic Brillouin sensor using spontaneous Brillouin scattering and low bandwidth electronics is developed. The Brillouin frequency is obtained by time-division fast Fourier analysis on Brillouin signals, reaching a temperature resolution of 62mK at 1kHz.

SW3C.4 • 15:00

Combined Frequency- and Correlation-Domain Brillouin Analysis for Static and Dynamic Strain Measurements, Raffaele Vallifuoco¹, Luigi Zeni¹, Aldo Minardo¹; ¹*Univ della Campania Luigi Vanvitelli, Italy*. We demonstrate a hybrid stimulated Brillouin scattering interrogation scheme, making use of an intensity- and frequency-modulated probe light. The system realizes static measurements at high spatial resolution, and position-selective dynamic measurements at high sampling rate

SW3C.5 • 15:15

Integrating Dual-Comb Interrogation and Neural Networks for Enhanced Optical CO₂ Sensing Using LPG Sensors, Diogo V. Coelho^{1,2}, Jose A. Garcia-Souto², Felipe O. Barino¹, Alexandre B. dos Santos¹, Pablo Acedo²; ¹*Dept. of Electrical Circuits, Universidade Federal de Juiz de Fora, Brazil*; ²*Dept. of Electronic Technology - SITec, Universidad Carlos III de Madrid, Spain*. This paper explores the integration of Long Period Grating (LPG) sensors, dual-comb instrumentation systems, and neural networks for advanced optical gas sensing. It tackles refractive index measurement challenges, temperature cross-sensitivity, and CO₂ concentration estimation accuracy.

SW3C.6 • 15:30

A Remote FBG Sensor Interrogation System Based on a 45-Degree Tilted Fibre Grating, Yue Feng^{2,1}, Yuanli Yue², Shouju Liu², Chao Wang²; ¹*Harbin Univ. of Science and Technology, China*; ²*Univ. of Kent, UK*. We present a remote FBG sensor interrogation system that uses a 45-degree tilted fibre grating for simultaneous wireless light coupling and wavelength analysis. This novel two-in-one design features high accuracy and greatly reduced system cost.

SW3C.7 • 15:45

A Statistical Approach for Calibrating High Temperature Femtosecond-Laser Inscribed Fiber Bragg Grating, Manuel Jerez¹, Joaquín Granada¹, Alejandro Carballar¹; ¹*Electronic Engineering Department, Universidad de Sevilla, Spain*. An end-to-end calibration method is

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proposed for high-temperature FBGs sensors working up to 700 Celsius. A fourth-order polynomial function reduces absolute measurement errors below 2.5 Celsius along the full operation range.

16:30 -- 18:00

Room: Guillaumet 1

JW4B • Optica Sensing Congress: Industry Panel I

Presiders: Pierre Chazan; Laser Components SAS, France and Borislav Hinkov; Silicon Austria Labs, Austria and Johannes Kunsch; Laser Components Germany GmbH, Germany and Timothy Olsen; Spectral Systems LLC, USA

JW4B.1 • 16:30 (Invited)

30 Years of QCL, Part I, Fundamental, Carlo Sirtori¹; ¹*Ecole Normale Superieure, France*. Abstract not available.

JW4B.2 • 16:50 (Invited)

30 Years of QCL Part II, Application – Finally Sufficient Photons for IR Spectroscopy: QCL-Based Sensors for Medical Applications, Werner Mäntele¹; ¹*DiaMonTech AG, Germany*. QCL applications for IR based sensors in medical applications are presented. High brilliance, compact size and availability for most relevant molecular fingerprints has led to portable instruments. An example for non-invasive glucose measurement is presented.

JW4B.3 • 17:10 (Invited)

Recent Developments in Long Wavelengths Semiconductor Emitters and Their Use in Midsize and Mass Markets, Johannes Koeth¹; ¹*Nanoplus Nanosystems and Tech GmbH, Germany*. Quantum Cascade Lasers, Interband Cascade Lasers and GaSb-based lasers and LEDs have become versatile light sources for the mid infrared spectral region. Due to their spectral overlap with strong absorption features of gases, liquids and solids, they become increasingly used in industry applications and are on the way to enter mid- and mass markets, like leak monitoring and healthcare.

JW4B.4 • 17:20 (Invited)

Wavelength Versatile Semiconductor Lasers (VECSELs): Technology Overview and New Applications, Mircea D. Guina¹; ¹*Tampereen Teknillinen Yliopisto, Finland*. Recent progress in developing commercial vertical-external-cavity surface-emitting lasers (VECSELs) is presented. Key technology aspects are discussed in connection with applications requirements for wavelength coverage, high-brightness single-frequency operation, and wavelength tunability.

JW4B.5 • 17:35 (Invited)

EMILIE - Nanomechanical Photothermal Infrared Spectroscopy for Nanomaterial Characterization, Silvan Schmid¹; ¹*Technische Universität Wien, Austria*. Invisible-Light Labs introduces EMILIE, an innovative nanomechanical IR detector for analyzing nanomaterials, addressing their application benefits and potential health risks. This advancement promises safer nanomaterial use and a deeper understanding of their characteristics. Silvan will explain the technology behind EMILIE and highlight its applications.

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JW4B.6 • 17:50 (Invited)

Commercializing Quantum Cascade Surface Emitting Lasers - From the Lab to Market, David Stark¹, Mathieu Bertrand¹, Philipp Täschler¹, Réka-Eszter Vass¹, Moritz Müller¹, Emilio Gini¹, Mattias Beck¹, Jérôme Faist¹; ¹*Quantum Electronics, ETH Zurich, Switzerland.* Progress on the development and commercialization of low-power and cost-effective mid-infrared Quantum Cascade Surface Emitting Lasers (QCSELS) is presented. Our goal is to supply these cutting-edge lasers for the next generation of optical gas sensors.

08:00 -- 10:00

Room: Caravelle 2

CTh1B • Ptychography II

Presider: Chao Zuo; Nanjing Univ of Science and Technology, China

CTh1B.1 • 08:00

Advancing Metrology via Multi-Illumination Fourier Ptychographic Microscope, Hyun-su Kim^{1,2}, Balajji Sake^{3,2}, Peter Schelkens^{2,1}; ¹*imec, Belgium;* ²*VUB, Belgium;* ³*Chemnitz Univ. of Technology, Germany.* Improving the metrology based on phase retrieval of complex amplitude through multi-illumination Fourier Ptychographic microscopy offers enhanced accuracy and efficiency in optical measurements and defect analysis, enriching the signal obtained from the sample.

CTh1B.2 • 08:15

Noise-Robust Latent Vector Reconstruction in Ptychography Using Deep Generative Models, Jacob Seifert^{2,1}, Yifeng Shao³, Allard P. Mosk¹; ¹*Utrecht Univ., Netherlands;* ²*ARCNL, Netherlands;* ³*Imaging Physics Department, Optics Research Group, Netherlands.* We introduce a novel approach for ptychographic reconstruction, integrating a pre-trained autoencoder within a reconstruction framework based on automatic differentiation. This enables noise-robust imaging and insight into optimization landscapes for applications with prior object knowledge.

CTh1B.3 • 08:30

Structured Illumination EUV Imaging, Leona Licht^{1,2}, Wilhelm Eschen^{1,2}, Chang Liu^{1,2}, Daniel S. Penagos Molina^{1,2}, Thomas Siefke^{2,3}, Thomas Pertsch^{2,3}, Jens Limpert^{1,2}, Jan Rothhardt^{1,2}; ¹*Helmholtz Inst., Germany;* ²*Inst. of Applied Physics, Germany;* ³*Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany.* We present table-top EUV imaging at 13.5 nm. Using an EUV phase diffuser for generating a highly structured illumination, improves the image quality and resolution in ptychography and opens new avenues for single-shot EUV imaging.

CTh1B.4 • 08:45

Efficient Hard X-ray Projection Imaging at a sub-10 nm Resolution, Wenhui Zhang¹, Lukas Dresselhaus², Holger Fleckenstein¹, Mauro Prasciolu¹, Margarita Zakharova¹, Nikolay Ivanov¹, Chufeng Li¹, Oleksandr Yefanov¹, Tang Li², Dmitry Egorov¹, Ivan De Gennaro Aquino¹, Philipp Middendorf¹, Johannes Hagemann¹, Sasa Bajt^{1,2}, Henry Chapman^{1,2}; ¹*DESY, Germany;* ²*The Hamburg Centre for Ultrafast Imaging, Germany.* A noise-robust sub-10 nanometer imaging resolution from a Siemens star sample was achieved, by ptychographically reconstructing

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projection holograms recorded at an effective magnification of more than 11,800 in the regime of hard X-rays.

08:00 -- 10:00

Room: Guillaumet 2

DTh1H • Sensing and Processing

Presider: Ana Doblas; Univ. of Massachusetts Dartmouth, USA

DTh1H.1 • 08:00 (Invited)

Exploiting Spatiotemporal Priors for Motion-Resolved Holographic Imaging, Liangcai Cao¹, Yunhui Gao¹; ¹*Tsinghua Univ., China*. We introduce spatiotemporally regularized inversion (STRIVER) as a general computational framework for dynamic holographic imaging. We experimentally demonstrate the use of spatiotemporal sparsity and implicit priors to obtain time-resolved holographic video of living organisms.

DTh1H.2 • 08:30 (Invited)

Holographic Optical Engine (HoOE) for Material Laser Processing, Volumetric Display, and Computational Imaging, Yoshio Hayasaki¹; ¹*Utsunomiya Univ., Japan*. Holographic optical engine composed of a spatial light modulator, imagers, relay optics, and a control computer offers an easy installation and easy use of holographic beam shaping.

DTh1H.3 • 09:00

Integral Phase Imaging for 3D Refractive Index Retrieval With the Transport of Intensity Equation, Ariel Fernández¹, Alejandro Silva¹, Miguel Arocena¹, Julia Alonso¹; ¹*Universidad de la República, Uruguay*. Transport of Intensity Equation allows for phase recovery from a given point of view. By recovering phase for different perspectives and introducing a multi-slice model of a sample, 3D distribution of its refractive index can be obtained.

DTh1H.4 • 09:15 (Top-Scored)

GPU-Parallelized Semi Heuristic Phase Compensation for Digital Holographic Microscopy, Johan Morales¹, Sofia Obando-Vásquez¹, Carlos Trujillo¹; ¹*Universidad EAFIT, Colombia*. The Semi Heuristic Phase Compensation algorithm is fast and accurate for compensating digital holographic microscopy holograms. This work presents its parallelized version, leveraging the *pyCUDA* library, which effectively reduces the required execution time by threefold.

DTh1H.5 • 09:30

Color and Shape Measurement of Foot by Using Smartphone Sensors, Fuminori Yamasaki¹, Yukie Tahara¹, Ayumi Amemiya¹, Chawan Koopipat², Masato Takahashi¹, Norimichi Tsumura¹, Shinsuke Akita¹, Keiko Ogawa-Ochiai³, Mariko Masujima¹, Naoaki Rikihisa⁴; ¹*Chiba Univ., Japan*; ²*Chulalongkorn Univ., Thailand*; ³*Hiroshima Univ. Hospital, Japan*; ⁴*Oyumino Central Hospital, Japan*. We measured the color and shape of foot using the smartphone RGB camera and LiDAR sensors. As a result, we found that these measurements are accurate enough for practical use in nursing fields.

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DTh1H.6 • 09:45

A Novel and Robust Preprocessing Technique for Bloodstain Classification in Hyperspectral Imaging Using ML, Suresh Aala¹, Sravan Kumar Sikhakolli¹, Inbarasan Muniraj², Anuj Deshpande¹, Karthikeyan Elumalai¹, Sunil Chinnadurai¹; ¹SRM Univ. - AP, India; ²Alliance School of Applied Engineering, Alliance Univ., India. In crime investigations, rapid bloodstain identification is crucial. Hyperspectral imaging (HSI) offers a non-destructive solution. Our investigation into preprocessing techniques to improve classification accuracy and reduce computation time reveals that the best options are max-normalization and mean filter.

08:00 -- 10:00

Room: Spot

ITh1D • QPI and Label Free Microscopy

Presider: Randy Bartels, Morgridge Institute & U of Wisconsin, United States

ITh1D.2 • 08:00 (Invited)

Coherent Stokes Raman Scattering (CSRS) Microscopy, Sandro Heuke¹; ¹Fresnel Institut, France. I report about the first implementation of laser scanning coherent Stokes Raman scattering (CSRS) microscopy and show how to suppress the fluorescence background. In a second part, I will explain CSRS' potential for direct backscattering.

ITh1D.3 • 08:30

Computational Adaptive Optics Harmonic Generation Synthetic Aperture Holographic Microscopy, Randy A. Bartels¹, Yusef Farah¹, Olivier Pinaud²; ¹Morgridge Inst. & U of Wisconsin, USA; ²Mathematics, Colorado State Univ., USA. Computational adaptive optical imaging is demonstrated with synthetic spatial frequency aperture second harmonic generation and synthetic spatial apertures third harmonic generation holographic imaging. Aberration free amplitude and phase images are obtained.

ITh1D.4 • 08:45

True Definition of Carrier Frequency for Digital Holograms of Phase Objects, Nishant Goyal¹, Kedar Khare²; ¹Physics, Indian Inst. of Technology Delhi, India; ²Optics and Photonics Centre, Indian Inst. of Technology Delhi, India. We show that the centroid of power spectrum of cross-term offers a more reliable definition of carrier-fringe-frequency compared to the popularly used cross-term amplitude peak criterion and leads to the least fluctuating complex object wave.

ITh1D.1 • 09:00 (Invited)

SRS Microscopy for Bioimaging, Naveen Gajendra¹, Hervé Rigneault², Sandro Heuke², Barbara Sarri¹, Elliot Cornet¹; ¹Lightcore Technologies, France; ²Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, France. A label free SRS microscope that can perform instantaneous virtual histology and chemical imaging for research and scientific applications by targeting simultaneously two vibrational frequencies that can be tuned anywhere across the vibrational spectrum.

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Thursday, 18 July

08:00 -- 10:00

Room: Ariane 2

LTh1A • Advanced Spectroscopy Techniques

Presider: Mikhail Slipchenko; Purdue Univ., USA

LTh1A.1 • 08:45 (Invited)

Dual-Comb Photothermal and Photoacoustic Spectroscopy, Wei Ren¹; ¹*The Chinese Univ. of Hong Kong, Hong Kong*. Dual-comb spectroscopy plays an important role in molecular spectroscopy. I will discuss our recent innovations in dual-comb photothermal and photoacoustic spectroscopy, enabling highly powerful analytical tools for broadband, high-precision and high-sensitivity spectroscopic measurements.

LTh1A.2 • 09:15 (Invited)

Quantum Cascade Laser Absorption Tomography via Boltzmann Regression for Nitrous Oxide Temperature and Concentration in Small-Diameter Reacting Flows, Daniel Pineda¹, Benjamin Steavenson¹; ¹*Univ. of Texas at San Antonio, USA*. Laser absorption tomography in the mid-wave infrared is coupled with Boltzmann regression techniques to spatially resolve nitrous oxide concentration and temperature in small-diameter reacting flows relevant to nitrogen-based fuels.

LTh1A.3 • 09:45

Quasi-Mode Hop Free Tuning for an Ultra-Broadband External Cavity Quantum Cascade Laser Spectrometer, Nicholas Kosan¹, Zane Meyer², Keith Nowicki², Scot Rafkin², Gerard Wysocki¹; ¹*Princeton Univ., USA*; ²*Southwest Research Inst., USA*. We develop quasi-mode hop free tuning of a midinfrared external cavity quantum cascade laser spectrometer designed for extraterrestrial environments. Tuning is achieved through synchronization of ECQCL parameters and mode-hop tracking.

08:00 -- 10:00

Room: Argos

OTh1F • Wavefront Correctors

Presider: Qi Hu; Univ. of Oxford, UK

OTh1F.1 • 08:00 (Invited)

Large, Contactless Thin Adaptive Mirror Technology: 30 Years of Continuous Improvement, Roberto Biasi¹; ¹*Microgate, Italy*. The large, contactless adaptive mirror technology started in 1993, and was continuously improved so that it's currently adopted by the major observatories, including the next-generation ELTs. We present the technology evolution and new application fields.

OTh1F.2 • 08:30

All-Numerical Optimization of Deformable Mirrors, Matthias Goy¹, Paul Boettner¹, Daniel Heinig¹, Pedro de Dios^{1,2}; ¹*Fraunhofer IOF, Germany*; ²*Faculty of Physics and Astronomy,*

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Friedrich Schiller Univ., Germany. The growing market of space-borne telescopes requires adaptive optical correctors to compensate for system aberrations. This work will provide a method for an all numerical approach of optimizing deformable mirrors for this application.

OTh1F.3 • 08:45

Simple Tunable Laser Written Liquid Crystal Based Aberration Correctors, Alec Xu¹, Camron Nourshargh¹, Patrick Salter¹, Steve Elston¹, Stephen Morris¹, Martin J. Booth¹; ¹*Univ. of Oxford, UK.* Novel devices created using direct laser-written polymerization in liquid crystals correct Zernike or other modes with continuous tunability. We demonstrate several modal devices offering a low cost, simple alternative to traditional adaptive optics correctors.

OTh1F.4 • 09:00 (Invited)

Deformable Mirror Development and Applications, Paul Bierden¹; ¹*Boston Micromachines Corporation, USA.* The presentation explores the development and diverse applications of deformable mirrors in adaptive optics. Highlighting advances in MEMS technology, this presentation showcases improvements in precision and performance for astronomy, biomedical imaging, and defense systems.

OTh1F.5 • 09:30 (Invited)

Large Field of View Adaptive Optics With Multiple Deformable Lenses, Stefano Bonora¹; ¹*Consiglio Nazionale delle Ricerche, IFN, Italy.* Abstract not available.

08:00 -- 10:00

Room: Guillaumet 1

PTh1E • Measuring and Modeling Propagation Quantities I

Presider: Svetlana Avramov-Zamurovic; US Naval Academy, USA

PTh1E.1 • 08:00 (Invited)

Characterization of the Dome Seeing of the Giant Magellan Telescope With Computational Fluid Dynamics Simulations, Rodolphe Conan¹, Konstantinos Vogiatzis¹, Henry Fitzpatrick¹; ¹*GMTO, USA.* The image quality of ground based telescopes is limited by atmospheric turbulence. The turbulence inside the dome of the telescopes, or dome seeing, accounts for a significant fraction of the image degradation. The Giant Magellan Telescope (GMT) is using extensively computational fluid dynamics simulations, to investigate GMT dome seeing for a large set of environmental conditions.

PTh1E.2 • 08:30

Fine-Wire Measurements of Intermittency in Optical Turbulence Near the Ground, Andreas Muschinski¹, Eric L. Wagner¹; ¹*NorthWest Research Associates, USA.* An important characteristic of atmospheric turbulence is intermittency. Here we present and discuss fine-wire measurements of intermittency in optical turbulence near the ground.

PTh1E.3 • 08:45 (Top-Scored)

A Measure-Correlate-Predict Approach for Optical Turbulence (C_n^2) Using Gradient Boosting, Maximilian Pierzyna¹, Sukanta Basu², Rudolf Saathof¹; ¹*Delft Univ. of Technology,*

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Netherlands; ²*Atmospheric Sciences Research Center, Univ. at Albany, USA.* We present a machine learning-based measure-correlate-predict approach that predicts a multi-year time-series of optical turbulence strength (C_n^2) with high accuracy ($r = 0.78$ at 16 locations) based on a single year of in-situ C_n^2 measurements and reanalysis data.

PTTh1E.4 • 09:00 (Invited)

Impact of Atmospheric Turbulence on Optical Signal Near the Ground From Large Eddy Simulations, Gael Kermarrec¹, Matthias Sührling¹, Wardeh Al-Younis²; ¹*Leibniz Univ. Hannover, Germany;* ²*Faculty of Engineering, Jadara Univ., Jordan.* Atmospheric turbulence alters the propagation of optical waves, particularly near the ground. We use Large Eddy Simulations and simulate wave propagation to investigate what affects the outer scale length of turbulence (surface heterogeneities, daily variations).

PTTh1E.5 • 09:30 (Invited)

Next-Generation Vertical Atmospheric Optical Turbulence Monitors, James Osborn¹, Lisa Bardou¹, Kathryn Barrett¹, Lily Beesley¹, Tim Butterley¹, Oliver J. Farley¹, Ryan Griffiths¹, Kathryn Hartley¹, Richard Wilson¹, Edison Bustos², Andrei Tokovinin², Miska Le Louarn³, Angel Otarola⁴, Marcus Birch⁵, Francis Bennet⁵, Tony Travouillon⁵, David Alaluf⁶; ¹*Durham Univ., UK;* ²*Cerro Tololo Inter-American Observatory, Chile;* ³*ESO, Germany;* ⁴*ESO, Chile;* ⁵*ANU, Australia;* ⁶*ESA, Netherlands.* Routine vertical optical turbulence monitoring is generally restricted to night-time astronomical observatories. There is an increasing demand for 24hours atmospheric optical data in various environments. Here we review some of the next generation monitors.

Room: Diamant

08:00 -- 10:00

QTh1G • Quantum-Enhanced Sensing II

Presider: Haocun Yu; Universitat Wien, USA

QTh1G.1 • 08:00 (Invited)

Nonlinear Hydrodynamics on a Chip: Wave Breaking and Multisoliton Fission in a Superfluid Waveflume, Christopher Baker¹, Walter Wasserman¹, Matthew Reeves¹, Raymond Harrison¹, Igor Marinkovic¹, Glen Harris¹, Warwick Bowen¹; ¹*ARC Centre of Excellence for Engineered Quantum Systems, School of Mathematics and Physics, Univ. of Queensland, Australia.* I will present a novel photonic sensor enabling the generation and measurement (within a sub-millimetre-sized device in a laboratory setting) of extreme nonlinear hydrodynamic phenomena, including soliton fission, dispersive shock waves and optomechanical dissipative solitons.

QTh1G.2 • 08:30

Modal Entanglement Enhanced Deflectometry, Wenhua He¹, Christos N. Gagatsos¹, Dalziel J. Wilson¹, Saikat Guha¹; ¹*Univ. of Arizona, USA.* We show that exciting a particular high-order spatial mode in a squeezed state affords increased sensitivity for probing a small surface tilt, over optimum classical illumination and Gaussian quantum illumination with a HG00 beam.

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QTh1G.3 • 08:45

Cancer Detection Using Quantum Imaging With Undetected Photons., Christopher Phillips¹, Emma Pearce¹, Nathan Gemmell¹, Jefferson Florez¹, Jaiye Ding¹, Rupert Oulton¹, Alex S. Clark²; ¹*Imperial College London, UK*; ²*electrical, electronic and Mechanical Engineering, Bristol Univ., UK*. QUIP shifts image wavelengths using quantum entanglement, allowing for imagers that work beyond the cutoff of our Si camera. We plan to use them to image the elevated DNA concentrations characteristic of Cancer.

QTh1G.4 • 09:00 (Top-Scored)

Towards Pulsed High-Gain Quantum Imaging With Undetected Photons, Jingrui Zhang¹, Arthur Cardoso¹, Rowan A. Hoggarth¹, Jinghan Dong¹, Weijie Nie¹, Haichen Zhou¹, John G. Rarity¹, Alex S. Clark¹; ¹*Univ. of Bristol, UK*. High-gain nonlinear interferometry (NLI) is useful for measuring small mid-infrared transmission changes in lossy samples by detecting near-infrared light. We experimentally reach a parametric down-conversion gain of ~3 and will present progress towards NLI imaging.

QTh1G.5 • 09:15

Sensing Methane With Undetected Mid-Infrared Photons, Jinghan Dong¹, Arthur C. Cardoso¹, Haichen Zhou¹, Jingrui Zhang¹, Weijie Nie¹, Alex S. Clark¹, John G. Rarity¹; ¹*Univ. of Bristol, UK*. Here we demonstrate a high-precision, rapid and low-cost methane optical sensor. Our method exploits undetected mid-infrared photons for accurate gas concentration detection and spectral analysis using a CMOS camera.

QTh1G.6 • 09:30

Unlocking Diagnostic Potentials: Polarization-Entangled Photon Scattering in Tissue-Mimicking Phantom, Vira Besaga¹, Ivan Lopushenko², Oleksii Siery², Alexander Bykov², Frank Setzpfandt^{1,3}, Igor Meglinski⁴; ¹*Inst. of Applied Physics, Friedrich-Schiller-Universität Jena, Germany*; ²*Opto-Electronics and Measurement Techniques, Univ. of Oulu, Finland*; ³*Fraunhofer Inst. for Applied Optics and Precision Engineering IOF, Germany*; ⁴*College of Engineering and Physical Sciences, Aston Univ., UK*. We perform comprehensive experimental studies of the behavior of polarization entangled photon pairs when probing realistic samples using tissue-mimicking phantoms and show the applicability of polarization-entangled photons for detecting diagnosis-relevant properties despite scattering losses.

QTh1G.7 • 09:45

A Simple Model for Understanding and Calculating Geometric Phase, Nathan Hagen¹, Luis Garza-Soto¹; ¹*Utsunomiya Univ., Japan*. We show how geometric phases derive from the elementary geometry of waves, and that geometric phases can be calculated from simple geometric transformations.

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08:00 -- 10:00

Room: Ariane 1

STh1C • Laser Based Sensors I

Presider: Yoonchan Jeong; Seoul National Univ.

STh1C.1 • 08:00 (Invited)

Broadband Laser Sources in the Mid-IR and Application to Spectroscopy, Idris Tiliouine¹, Rémi Bizot², Yann Leventoux¹, Lamine Ferhat¹, Melek Jedidi¹, Cristian Jimenez¹, Frédéric Désévéday², Pierre Mathey², Bertrand Kibler², Frédéric Smektala², Sebastien Fevrier¹;

¹*Universite de Limoges, France;* ²*Laboratoire Interdisciplinaire Carnot de Bourgogne, France.*

We report on our progress towards the realization of mid-infrared octave-spanning supercontinuum sources orders of magnitude brighter than third generation synchrotrons. The fiber-based sources are used for spectroscopy of methane in hollow fibers.

STh1C.2 • 08:30 (Top-Scored)

Integrated Optical Parametric Oscillators for Mid-Infrared Spectroscopy, Alexander Y. Hwang¹, Hubert S. Stokowski¹, Taewon Park¹, Marc Jankowski², Timothy P. McKenna², Carsten Langrock¹, Jatadhari Mishra¹, Vahid Ansari¹, Martin Fejer¹, Amir H. Safavi-Naeini¹; ¹*Ginzton Laboratory, Stanford Univ., USA;* ²*Physics and Information Labs, NTT Research Inc., USA.* We present progress on advancing nanophotonic optical parametric oscillators for low-power and broadband mid-infrared spectroscopy.

STh1C.3 • 08:45

MicroRing Based Ultra Sensitive Wavelength Locking, Philippe Velha¹; ¹*Universita degli Studi di Trento, Italy.* This study investigates the use of integrated optics micro-ring for precise measurement of wavelength shift, demonstrating high accuracy (< MHz) and large dynamic range experimentally for laser wavelength locking applications.

STh1C.4 • 09:00 (Invited)

Broadband, High-Resolution Dual-Comb Spectroscopy in the Near-IR and its Extension Into the UV Range, Abel Feuvrier^{1,2}, Huu Dat Nguyen^{1,2}, Patrick Rairoux^{1,2}, Sandrine Galtier^{1,2};

¹*Universite Claude Bernard Lyon 1, France;* ²*Institut Lumière Matière - CNRS, France.*

Detecting reactive trace gases in the atmosphere requires fast acquisition time and in-situ probing without air sampling. We develop a Dual Comb Spectrometer using a bidirectional Ti:Sa laser cavity, dedicated to the detection of trace gases in the UV range. We will present open-path O₂ detection to quantitatively characterize the setup in the near-IR range and will show preliminary UV-DCS interferograms using second harmonic generation.

STh1C.5 • 09:30 (Invited)

Diffraction Limited Hyperspectral Mid-Infrared Laser Spectroscopy, Markus Brandstetter¹; ¹*Res. Center for Non Destructive Testing, Austria.* Different concepts for hyperspectral imaging, based on quantum cascade lasers and supercontinuum lasers are presented. Experimental results for application in chemical imaging with diffraction-limited resolution are shown, achieved either by scanning or single-pixel imaging.

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10:00 -- 11:00

Room: Cassiopée

JTh2A • Joint Poster Session II

JTh2A.1

Photoacoustic Gas Spectroscopy With Custom Quartz Tuning Forks on the Path to Industrialization, Maxime Duquesnoy¹, Jean-Michel Melkonian¹, Marie-Hélène Mammez², Raphaël Levy¹, Guillaume Aoust³, Myriam Raybaut¹; ¹ONERA, France; ²SATT Paris-Saclay, France; ³Mirsense, France. We present a 10-year retrospective overview of our work on photoacoustic spectroscopy, from the first analytical models to sensor industrialization, as well as our latest results.

JTh2A.2

Imaging Thermal Gradients on a Li-ion Battery Cell During Operation Using Frequency-Domain Phosphor Thermometry, Joel Lopez Bonilla², Henrik-Christian Graichen², Frank Beyrau², Gunar Boye², Benoit Fond¹; ¹Department of Aerodynamics, ONERA - the French Aerospace Lab, France; ²Inst. of Fluid Dynamics and Thermodynamics, Otto von Guericke Univ. Magdeburg, Germany. Phosphor thermometry is applied on a mechanically loaded Li-ion pouch cell battery during operation. Using an optimised frequency domain method. Temperature images were obtained with a precision better than 0.1°C, revealing thermal patterns on the battery during charging and discharging.

JTh2A.3

High-Speed 1-D Raman Scattering Measurement in Transient Hydrogen Jets Issued by a Single-Hole Injector, Bin Wu¹, Hao Wu¹, Moez Ben Houidi¹, Priybrat Sharma¹, Emre Cenger², Abdullah S. AlRamadan², William Roberts¹, Gaetano Magnotti¹; ¹Clean Combustion Research Center, King Abdullah Univ. of Science and Technology, Saudi Arabia; ²Transport Technologies R&D Division, Research & Development Center, Saudi Aramco, Saudi Arabia. Quantitative 1-D measurement of H₂ mole fraction in transient jets is reported. By using the pulse-burst laser along with the EMCCD cameras operated in subframe burst gating mode, repetition rate of 50 kHz is achieved.

JTh2A.4

A Near-UV Photoacoustic Spectrophone for Filter-Free Measurement of Light Absorption Properties of Brown Carbon in the CESAM Simulation Chamber, Zhijin Shang^{1,2}, Layal Fayad³, Claudia Di Biagio³, Mathieu Cazaunau³, Edouard Pangui³, Antonin Bergé³, Bénédicte Picquet-Varrault⁴, Jean Francois Doussin⁴, Fabrice Cazier¹, Dorothee Dewaele¹, Nicolas Houzel¹, Hongpeng Wu², Lei Dong², Claire Thauray⁵, Markus W. Sigrist⁶, Weidong Chen¹; ¹Universite du Littoral, France; ²Shanxi Univ., China; ³Université Paris Cité and Univ Paris Est Créteil, France; ⁴Université Paris Est Créteil and Université Paris Cité, France; ⁵ENVEA, France; ⁶ETH Zurich, Switzerland. Filter-free measurement of light absorption properties of brown carbon has been performed in the CESAM simulation chamber using a photoacoustic spectrophone operating at 405 nm.

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JTh2A.5

Temperature Dependent Determination of the S-Branch N₂-H₂O Broadening Coefficient, Henry Misoi¹, Jonas I. Hölzer^{1,2}, Thomas Seeger^{1,2}; ¹*Engineering Thermodynamics, Univ. of Siegen, Germany*; ²*Center for Sensor Systems (ZESS), Univ. of Siegen, Germany*. The S-branch N₂-H₂O Raman broadening coefficients were determined from time resolved RCARS experiments up to 1900 K. Use of these linewidths for combustion diagnostics are expected to improve accuracy of temperature and mixture composition determination.

JTh2A.6

Alternative Dual-SLM Optimization for Polarimetric Calibrated Holographic Display, Xiaomeng Sui^{2,3}, Liangcai Cao¹, Daping Chu²; ¹*Tsinghua Univ., China, UK*; ²*Univeristy of Cambridge, UK*; ³*Utrecht University, Netherlands*. Dual-SLM computer-generated holography can suppress phase aberrations and faithfully reconstruct initial objects. Herein, an alternative strategy of optimization for dual-SLM holographic display is proposed, allowing for a further improved reconstructing quality with polarimetric calibration.

JTh2A.7 (Top-Scored)

Photon-Counting Fluorescence Imaging of Tobacco Cultured Cells Using Transport of Intensity Equation, Shiori Matsuda^{1,2}, Marin Shoda¹, Naru Yoneda^{1,3}, Manoj Kumar^{1,3}, Osamu Matoba^{1,3}; ¹*Kobe Univ., Japan*; ²*Japan Society for the Promotion of Science, Japan*; ³*Center of Optical Scattering Image Science, Japan*. In this paper, a three-dimensional fluorescent imaging using the transport of intensity equation using photon-counting image sensor is investigated by applying it to tobacco cultured cells. Experimental results showed that numerical refocusing is implemented.

JTh2A.8

Development of the Light-Field Camera With Switchable Micro-Lens Array for Utilizing UAM Application, Tae-Hyung Lee¹, Min-Kyu Park¹, Sungjin Lim¹, Ki-Dong Lim¹, Kyung-Il Joo¹; ¹*Korea Photonics Technology Inst., Korea (the Republic of)*. We developed a light-field (LF) camera which can switch between 2D and 3D capturing mode. LF camera was developed with switchable micro-lens array (MLA) according to the polarization state of incident light.

JTh2A.9

Optical Characteristic Analysis System Based on Directional Illumination Polarized Imaging for Next-Generation Optical Elements, Jung Hun Choo¹, Tae-Hyun Lee¹, Ki-Dong Lim¹, Jiyeon Kim¹, Kyung-Il Joo¹, Min-Kyu Park¹, Sungjin Lim¹; ¹*Korea Photonics Technology Inst., Korea (the Republic of)*. In this paper, we propose optical characteristic analysis system based on directional illumination polarized imaging for meta lenses with large aperture. optical properties such as Zernike polynomial aberration, color aberration, and optical distortion are calculated based on the geometric phase map with wide-FOV and high-resolution.

JTh2A.10

Proteus Effect in Vertical Jumping Wearing a Head-Mounted Display, Ayumu Kandori¹, Masato Takahashi¹, Chawan Koopipat², Norimichi Tsumura¹; ¹*Chiba Univ., Japan*; ²*Chulalongkorn Univ., Thailand*. We investigated the influence of the Proteus effect on physical

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activity. We found that obese avatar recorded the lower height about the vertical jump than normal one.

JTh2A.11

Laser Tomography Error Analysis for Laser Tomography Adaptive Optics System, Han Seok Gi¹, Ji Yong Joo¹, Chan Lee¹, Jun Ho Lee¹; ¹*Kongju National Univ., Korea (the Republic of)*. LTAO (Laser Tomography Adaptive Optics), there are errors occur from adaptive optics and those due to laser tomography. This paper focuses on the analysis of errors under various operational conditions in laser tomography.

JTh2A.12

Design of a SiC Deformable Mirror for High Power Laser Application, Pilseong Kang¹, Jaehyun Lee¹, Hyug-Gyo Rhee^{1,2}; ¹*KRISS, Korea (the Republic of)*; ²*Department of Precision Measurement, Univ. of Science and Technology, Korea (the Republic of)*. For high power laser application, two types of SiC deformable mirrors with different actuator array shapes are designed and studied. It is shown that they perform similarly and achieve the design goals.

JTh2A.13

Extremely Fast Calibration of Phase-Only Spatial Light Modulators With Fresnel Zone Plates, Luis Ordóñez¹, Erick Ipus¹, Omel Mendoza-Yero¹; ¹*Universitat Jaume I, Spain*. This study presents a novel direct calibration method for Liquid Crystal Spatial Light Modulators (LC-SLM) using encoded Fresnel zone plates on a phase mask, enabling complete calibration from a single image, bypassing iterative or multiple measurements.

JTh2A.14

Ultra-Violet Reflective Fourier Ptychographic Microscopy Using a Parabolic Mirror, Hee Kyung Ahn¹, Van Huan Pham¹, Byong Hyuk Chon¹; ¹*Korea Research Inst of Standards & Sci, Korea (the Republic of)*. Here, we propose a reflective FPM using ultra-violet LEDs. To show the resolution improvement, a reflective FPM using 365 nm ultra-violet LEDs is demonstrated by resolving 173 nm half-pitch patterns in a USAF 1951 target.

JTh2A.15 • 10:00

Compressive Fourier Domain Optical Coherence Tomography, Isaac Y. August¹, Yacov Svetlitski², Adrian Stern²; ¹*Shamoon College of Engineering (SCE), Israel*; ²*Electro -Optics and Photonics Unit, Ben-Gurion Univ. of the Negev, Israel*. We present a new method for designing a Fourier domain optical coherence tomography system. Our method is based on replacing the diffraction grating-based spectrometer with a compressive sensing spectrometer.

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11:00 -- 12:30

Room: Guillaumet 1

JTh3A • Optica Sensing Congress: Industry Panel II

Presiders: Pierre Chazan; Laser Components SAS, France and Borislav Hinkov; Silicon Austria Labs, Austria and Johannes Kunsch; Laser Components Germany GmbH, Germany and Timothy Olsen; Spectral Systems LLC, USA

JTh3A.1 • 11:00 (Invited)

On the Road to Mid-IR Photonic Integrated Circuits – From MIRPIC to HyperPIC, Ryszard Piramidowicz¹; ¹*Warsaw Univ. of Technology, Poland*. This work presents the results of developing the new integrated photonic platform for the mid-IR spectral range. The platform's concept will be presented along with the library of building blocks developed and tested so far.

JTh3A.2 • 11:20 (Invited)

Vibrational Fingerprinting of Blood to Phenotype Health and Disease, Mihaela Zigman¹; ¹*DiaMonTech AG, Germany*. Our objective is to advance vibrational spectroscopy as an analytical framework for cross-molecular human biofluid profiling and to evaluate the feasibility of infrared fingerprinting with machine learning for *in vitro* biomedical diagnostics and medical screening.

JTh3A.3 • 11:40 (Invited)

Mid IR Based Blood Analysis for Point-of-Care Applications, Werner Mäntele¹; ¹*DiaMonTech AG, Germany*. Mid-IR spectroscopy can be used for rapid analysis of microliter blood samples. Based on >2000 reference samples, 8-12 clinically relevant blood parameters are determined at clinical precision. A point-of-care system for blood analysis is presented.

JTh3A.4 • 11:50 (Invited)

Open FTIR – Mid-Infrared Spectroscopy Simplified, Matthias Budden¹, Thomas Gebert¹, Johannes Kunsch²; ¹*WiredSense GmGH, Germany*; ²*Laser Components Germany GmbH, Germany*. FTIR, being a powerful tool for optical source and chemical materials analysis, relies on complex and expensive instrumentation and data analysis. Our mission is to lower these barriers, making FTIR more accessible to users and developers.

JTh3A.5 • 12:00 (Invited)

Broadband Radiation Source for Infrared and Terahertz Spectroscopy, Marco Schossig¹; ¹*INFRASOLID GmbH, Germany*. New developments towards miniaturized and powerful infrared spectrometers are limited by the availability of appropriate components. A novel black-body radiation source with broadband emissivity in the infrared range is presented and compared to state-of-the-art sources.

JTh3A.6 • 12:10 (Invited)

Bringing Spectroscopy to the People: Miniaturizing NIR Spectroscopy Towards Consumer Electronics, Christian Müller¹, Celal Mohan Ögün¹, Florian Pröll¹, Wilfried Hermes¹; ¹*trinamiX GmbH, Germany*. TrinamiX is taking mobile near infrared spectroscopy to another level by miniaturizing the hardware and integrating the technology into consumer electronics.

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Therefore, a fully integrated spectrometer module including auto calibration and temperature compensation was developed.

14:00 -- 16:00

Room: Ariane 2

CTh4A • Advances in Compressed Sensing

Presider: Esteban Vera; P. Universidad Católica de Valparaíso, Chile

CTh4A.1 • 14:00 (Invited)

Coded Aperture Strategies for High-Speed Video Sensing, Felipe O. Guzmán¹, Esteban Vera¹; ¹*P. Universidad Católica de Valparaíso, Chile*. This work discusses innovative high-speed imaging methods, merging hardware and algorithms in computational imaging. It focuses on techniques like rolling shutter, and coded aperture compressive temporal imaging for efficient data capture and high quality compression.

CTh4A.2 • 14:30

Single-Shot Efficient Transient Imaging With Optimal Coded Shutter Based on Time-Compressive CMOS Image Sensor, Michitaka Yoshida^{2,1}, Daisuke Hayashi¹, Lioe D. Xing¹, Keita Yasutomi¹, Shoji Kawahito¹, Keiichiro Kagawa¹, Hajime Nagahara³; ¹*Shizuoka Univ., Japan*; ²*Japan Society for the Promotion of Science, Japan*; ³*Osaka Univ., Japan*. We propose an efficient light-speed transient imaging system with a dedicated charge-domain time compressive CMOS image sensor. The reconstruction neural network and the spatio-temporal coded shutter applied to the sensor are simultaneously optimized.

CTh4A.3 • 14:45

Parallel Single-Pixel Digital Holography Using Fractional Talbot Effect, Erick Ipus¹, Luis Martínez-León¹, Jesús Lancis¹, Enrique Tajahuerce¹; ¹*Universitat Jaume I, Spain*. We propose a digital holography method combining parallel phase-shifting and single-pixel imaging techniques using the fractional Talbot effect. The sampling patterns are encoded using a DMD as amplitude spatial light modulator

CTh4A.4 • 15:00

Single-Pixel Cameras Under Photon Noise: Which Gain (or Loss) as Compared to Point-Scanning, for Hadamard and Cosine Positive Modulation?, Camille Scotté¹, Frédéric Galland², Hervé Rigneault²; ¹*INRAE (UMR ITAP), France*; ²*Institut Fresnel, France*. We theoretically, numerically and experimentally assess the signal-to-noise ratio of some classes of single-pixel cameras, under Poisson noise. This leads decision rules for when and how to use single-pixel cameras instead of point-scanning.

CTh4A.5 • 15:15

High Throughput Fluorescence Lifetime Microscope Based on Single Pixel Camera, Alberto Ghezzi^{1,3}, Elisabetta Avanzi¹, Valerio Gandolfi¹, Ariel Garcia Fleitas^{1,2}, Laura Di Sieno¹, Alberto Dalla Mora¹, Stefano Santabarbara⁴, Andrea Bassi^{1,3}, Gianluca Valentini¹, Andrea Farina³, Cosimo D'Andrea^{1,2}; ¹*Politecnico di Milano, Italy*; ²*Center for Nano Science and Technology, Istituto Italiano di Tecnologia, Italy*; ³*Istituto di Fotonica e Nanotecnologie, Consiglio*

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Nazionale delle Ricerche, Italy; ⁴Istituto di Biologia e Biotecnologia Agraria, Consiglio Nazionale Delle Ricerche, Italy. A system for high throughput fluorescence lifetime imaging based on single-pixel camera and compressed-sensing is presented. Moreover a fast fitting algorithm for multidimensional data set is proposed and experimentally validated.

14:00 -- 16:00

Room: Caravelle 2

CTh4B • Machine Learned Imaging

Presider: Liang Gao; Univ. of California Los Angeles, USA

CTh4B.1 • 14:00 (Invited)

Exploring Generalization Capability of Deep Learning-Based Approaches for Holographic Image Reconstruction, Mooseok Jang¹; *¹Dept. of Bio & Brain Engineering, KAIST, Korea (the Republic of).* This talk will explore ways to incorporate physical forward models in applying deep learning approaches to solve inverse problems in holographic image reconstruction under perturbative configurations.

CTh4B.2 • 14:30

Differentiable Chief-ray Tracing Simulator for Coded-Aperture Spectral Imaging, Léo Paillet¹, Antoine Rouxel¹, Hervé Carfantan², Antoine Monmayrant¹, Simon Lacroix¹; *¹LAAS-CNRS, France; ²IRAP, France.* We introduce an end-to-end differentiable simulation framework for designing Coded-Aperture Snapshot Spectral Imagers (CASSI) and exploring acquisition strategies.

By leveraging automatic differentiation, we dimension the optical system and optimize the coded aperture, enhancing imaging quality and facilitating effective co-design of the instrument.

CTh4B.3 • 14:45

Limitations of Hyperspectral Imaging From RGB Images: a Data Perspective, Qiang Fu¹, Matheus Souza¹, Eunsue Choi², Suhyun Shin², Seung-Hwan Baek², Wolfgang Heidrich¹; *¹King Abdullah Univ of Sci & Technology, Saudi Arabia; ²Pohang Univ. of Science and Technology, Korea (the Republic of).* Recent progress in spectral reconstruction from RGB images with deep learning seems promising for snapshot hyperspectral imaging. However, we show that significant limitations do exist arising from the lack of diversity in the prevailing datasets.

CTh4B.4 • 15:00

Information-Theoretic Design for High-Dimensional Computational Imaging, Eric Markley^{1,2}, Leyla Kabuli³, Tiffany Chien³, Henry Pinkard³, Laura Waller³; *¹Bioengineering, UC Berkeley, USA; ²Bioengineering, UC San Francisco, USA; ³Electrical Engineering and Computer Science, UC Berkeley, USA.* We present a technique for information-theoretic optimization of computational imaging systems demonstrated in snapshot 3D microscopy. By directly evaluating measurement quality and decoupling optimization from downstream decoders, computational cost is reduced relative to end-to-end design.

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CTh4B.5 • 15:15

3D Image Restoration Using Implicit Neural Representations for Brightfield and Widefield Fluorescence Microscopy, Chenyu Xu¹, Zhouyu Jin¹, Bo Xiong², You Zhou¹, Xun Cao¹; ¹*Nanjing Univ., China*; ²*Peking Univ., China*. 3D stacks captured by conventional brightfield and widefield fluorescence microscopes suffer from inter-plane crosstalk, hindering high-quality 3D imaging. We present a physics-informed self-supervised machine learning method for 3D image stack restoration.

CTh4B.6 • 15:30

Quantization of Neural Network for Computing Complex Holograms, Yutaka Endo¹, Minoru Oikawa², Timothy D. Wilkinson³, Tomoyoshi Shimobaba⁴, Tomoyoshi Ito⁴; ¹*Kanazawa Univ., Japan*; ²*Kochi Univ., Japan*; ³*Univ. of Cambridge, UK*; ⁴*Chiba Univ., Japan*. This study demonstrates quantizing of a neural network for computing complex holograms to reduce the model size for computationally limited platforms. We evaluate the model size and output hologram quality, comparing quantized and non-quantized models.

CTh4B.7 • 15:45

Non-Destructive Surface Defect Metrology Using Deep Learning and Diffraction Phase Microscopy, Subrahmanya K. N¹, Dhruvam Pandey¹, Rajshekhar Gannavarpu^{1,2}; ¹*Electrical Engineering, Indian Inst. of Technology Kanpur, India*; ²*Center for Lasers and Photonics, Indian Inst. of Technology Kanpur, India*. We present an approach that utilizes a deep learning network to compute phase gradient for defect identification. The efficacy of this method is showcased through the analysis of experimentally acquired noisy interferograms.

14:00 -- 16:00

Room: Guillaumet 2

DTh4H • 3D Microscopy and Biomedical I

Presider: Manuel Martinez-Corral; Univ. of Valencia, Spain

DTh4H.1 • 14:00 (Invited)

Smart Scanning Microscopy With Adaptive Lenses and Prisms, Katharina Schmidt¹, Nektarios Koukourakis¹, Ulrike Wallrabe², Juergen W. Czarske¹; ¹*Faculty of Electrical and Computer Engineering, Technische Universität Dresden, Germany*; ²*Department of Microsystems Engineering, Univ. of Freiburg, Germany*. We present smart microscopic setups to scan biological 3D samples. The combination of machine learning algorithms and adaptive optical elements improves scanning and aberration correction for multiple microscopic techniques.

DTh4H.2 • 14:30

Three-Dimensional Interferometric Interrogation Using a Broad Range of Light-Sheet Modalities, Mariana Potcoava¹, Christopher Mann^{2,3}, Jonathan Art¹, Simon Alford¹; ¹*Anatomy and Cell Biology, Univ. of Illinois at Chicago, USA*; ²*Applied Physics and Materials Science, Northern Arizona Univ., USA*; ³*Center for Materials Interfaces in Research and Development, Northern Arizona Univ., USA*. We present quantitative 3D live nerve cell imaging using Gaussian-beam light-sheet modalities with conventional lattice light-sheet and interferometric

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optical detection approaches. The interferometric detection approach offers maximum FOV scanning area than the conventional one.

DTh4H.3 • 14:45

Assessment of Processing Time and Measurement Accuracy of Different Phase Compensation Methods in Quantitative Phase Imaging via Digital Holographic Microscopy Applied to Biological Specimens Holographic Microscopy, Sofía Obando-Vásquez¹, Ana Doblás², Carlos Trujillo¹; ¹*Universidad EAFIT, Colombia*; ²*Department of Electrical & Computer Engineering, Univ. of Massachusetts Dartmouth, USA*. Six different methods for phase compensation in Digital Holographic Microscopy are compared using a calibrated test target and a *Toxocara canis* larva sample regarding processing time, measurement accuracy, and usefulness in biological imaging.

DTh4H.4 • 15:00

Snapshot Quantitative Phase Imaging in Multi-Perspective Microscopy, Ariel Fernández¹, Juan M. Llaguno¹, Alejandro Silva¹, Julia Alonso¹; ¹*Universidad de la República, Uruguay*. Quantitative phase microscopy using the Transport of Intensity Equation can be achieved in real-time by exploiting the redundancy derived from multi-perspective sensing of a sample. Validation experiments for phase retrieval from differently focused sub-aperture images are presented.

DTh4H.5 • 15:15

Learning-Based Model Using Unpaired Datasets for Super-Resolution Confocal Microscopy, Carlos Trujillo², Lauren Thompson³, Omar Skalli³, Ana Doblás¹; ¹*Univ. of Massachusetts Dartmouth, USA*; ²*School of Applied Science and Engineering, EAFIT Univ., Colombia*; ³*Department of Biological Sciences, The Univ. of Memphis, USA*. One of the major drawbacks of confocal microscopy is its limited spatial resolution. This work assesses the performance of an unpaired learning-based model to provide confocal images with improved resolution.

DTh4H.6 • 15:30 (Invited)

Advanced Optical Systems Through Flat Optics for Biomedical Applications, Yuan Luo¹; ¹*National Taiwan Univ., Taiwan*. Optical microscopic and endoscopic techniques are the most commonly used methods in biology and medical research. This talk will introduce the latest studies on the biomedical use of structured light, as well as metasurface.

14:00 -- 16:00

Room: Spot

ITh4D • Imaging Applications and Devices (General)

Presider: Marie-Anne Burcklen; Institut d'Optique Lab Fabry, France

ITh4D.1 • 14:00

Comparative Performance Analysis of Multi-Level Diffractive Lens and Lens Fabricated by Grayscale Lithography and Soft-Imprinting, Hadi Amata¹, Qiang Fu¹, Wolfgang Heidrich¹; ¹*King Abdullah Univ of Sci & Technology, Saudi Arabia*. Grayscale Diffractive Optical Elements

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(DOEs) offer superior versatility and precision in shaping light fields compared to multi-level DOEs. Its continuous grayscale modulation enables finer control, leading to enhanced performance in various optical applications.

ITh4D.2 • 14:15

Camera-Readable Scales for Motion Control in Automation and Robotic Applications, Olivier Acher¹; ¹*HORIBA France SAS, France*. We present patterned position scales to measure displacements with great accuracy over short or long distances along three in-plane degrees of freedom. These scales can be read using any machine vision camera.

ITh4D.3 • 14:30

Wigner Rotation Performed by a System of Skew Lenses, Jakub Belin^{1,2}, Matus Sobona¹, Radovan Sokol²; ¹*Central European Inst. of Technology, Czechia*; ²*Brno Univ. of Technology, Czechia*. We present an arrangement of six non-parallel lenses that perform Wigner rotation of an object space.

This device could be used for image rotation around the optical axis.

ITh4D.4 • 14:45

Impact of Stray Light on Image Quality in LWIR Imaging Systems, Ha Neul Yeon¹, Jun ho Lee¹, Deok Ki Hong¹, Chan Lee¹, Seung Hun Choi¹, Kwang Woo Park²; ¹*Kongju National University, Korea (the Republic of)*; ²*Agency for Defense Development, Korea (the Republic of)*. We conducted an analysis of stray light in long-wave infrared cameras and, through the photoelectric conversion model, converted it into digital numbers to quantitatively assess the image degradation caused by stray light.

ITh4D.5 • 15:00

Stray Light Analysis of K-DRIFT Pathfinder, Jihun Kim^{1,2}, Yunjong KIM^{1,2}, Gayoung Lee³, Seunghyuk Chang⁴, Il Kweon Moon⁵, Hyukson Kwon⁶, Dohoon Kim⁷, Changhee Lee⁷, Woowon Byun¹, Yongseok Lee¹, Yeonsik Kim³, Daewook Kim⁸, Jongwan Ko^{1,2}; ¹*Korea Astronomy & Space Science Inst, Korea (the Republic of)*; ²*Univ. of Science and Technology, Korea (the Republic of)*; ³*Kyungpook National Univ., Korea (the Republic of)*; ⁴*Center for Integrated Smart Sensors, Korea (the Republic of)*; ⁵*Korea Research Inst. of Standards and Science, Korea (the Republic of)*; ⁶*ADSOLUTION Co., Ltd., Korea (the Republic of)*; ⁷*Green Optics Co., Ltd., Korea (the Republic of)*; ⁸*Univ. of Arizona, USA*. We analyze the stray light characteristics of the Korea Astronomy and Space Science Inst. (KASI) Deep Rolling Imaging Fast Telescope (K-DRIFT) using non-sequential raytracing, identify causes, and propose optimal baffle-and-vain design updates to improve the scientific observation performance of the K-DRIFT.

ITh4D.6 • 15:15 (Plenary)

Novel Systems Enabled by Micro-LED, Nikhil Balram¹; ¹*Mojo Vision Inc., USA*. Micro-LED will disrupt the display market, enabling personal AI Glasses, immersive AR, large TVs and video walls and new categories like transparent displays and light field tables. It will integrate sensing and computing to enable intelligent displays and serve non-display applications like bio-imaging, 3D printing and high-speed data transfer.

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14:00 -- 16:00

Room: Argos

OTh4F • Microscopy and Bioimaging II

Presider: Martin Booth; Univ. of Oxford, UK

OTh4F.1 • 14:00 (Invited)

Adaptive Microscope Methods With Embedded Intelligence, Qi Hu¹, Huriye Atilgan¹, Jingyu Wang¹, Martin J. Booth¹; ¹*Univ. of Oxford, UK*. Adaptive optics (AO) was shown to improve microscope imaging quality. However, issues like prolonged sample exposures are often associated with sensorless AO implementation. We present an AO solution with embedded intelligence to achieve outstanding performance.

OTh4F.2 • 14:30

Machine Learning Estimate the Optical Properties of Tissue, Yihan Zhang¹, Bowen Deng¹, Amanda Wright¹, Michael Somekh¹, Michael Pound¹, Andrew Parkes¹; ¹*Univ. of Nottingham, UK*. A method to extract scattering coefficients from random media is presented. A deep learning network is trained from Monte Carlo simulations. Using angular and spatial information together greatly improved robustness and accuracy over previous approaches.

OTh4F.3 • 14:45

Self-Interference Digital Holography With Computational Adaptive Optics, Shaoheng Li¹, Peter Kner¹; ¹*Univ. of Georgia, USA*. Self-interference Digital Holography (SIDH) based single molecule localization microscopy has the potential to perform large volume 3D super-resolution imaging without mechanical refocusing of the sample. This work presents a fast, guide-star-free computational Adaptive Optics method for SIDH.

OTh4F.4 • 15:00

Physically Inspired Scattering Correction for Non-Linear Excitation Imaging of Tissues., Giuseppe Chirico¹, Mario Marini¹, Davide Panzeri¹, Luca Presotto¹, Laura Sironi¹, Margaux Bouzin¹, Laura D'Alfonso¹, Maddalena Collini¹; ¹*Universita degli studi di Milano-Bicocca, Italy*. In nonlinear optical microscopy through skin, the laser energy is attenuated, and the spot size increases. Holographic corrections work only on small isoplanatic patches. We test Physically-Inspired-Neural-Networks for scattering correction, enhancing speed and overcoming non-isoplanatism.

OTh4F.5 • 15:15

Multiple Scattering Fluorescence Conjugation Using a Wavefront Sensor, Tengfei Wu¹, Yixuan Zhang¹, Baptiste Blochet¹, Payvand Arjmand¹, Pascal Berto², Marc Guillon¹; ¹*Universite Paris Cite - SPPIN, France*; ²*Institut de la vision, France*. We demonstrate the ability to perform single-shot digital optical phase conjugation from a Stokes shifted fluorescent incoherent guide stars hidden behind a forward scattering sample with a high-resolution wavefront sensor

OTh4F.6 • 15:30 (Top-Scored)

Non-Invasive and Noise-Robust Confocal Wavefront Shaping, Dror Aizik¹, Anat Levin¹; ¹*Technion Israel Inst. of Technology, Israel*. We use a double modulation of both excitation and

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emission light to correct aberration and image through thick scattering tissue. The approach is noise robust and successfully images weak fluorescent neurons inside brain tissue.

OTh4F.7 • 15:45

Polarization Adaptive Optics for Diattenuation Aberration Correction, Yifei Ma¹, Zimo Zhao¹, An Wang¹, Steve Elston¹, Stephen Morris¹, Martin J. Booth¹, Chao He¹; ¹*Univ. of Oxford, UK*. We propose the use of optical skyrmions as a way to probe an optical system and provide metrics that characterise the performance of a polarisation adaptive optics system in the presence of diattenuation aberrations.

14:00 -- 16:00

Room: Guillaumet 1

PTh4E • Measuring and Modeling Propagation Quantities II

Presider: Jason Schmidt; MZA Associates Corporation, USA

PTh4E.1 • 14:00 (Invited)

Turbulence Modeling and Forecasting Using Machine Learning and Regional Weather, Eric P. Magee¹, Yakov Diskin¹, Matthew Whiteley¹, Mitchell Grose¹; ¹*MZA Associates Corporation, USA*. Modeling the relationship between meteorological conditions and optical turbulence is a challenging multifaceted problem. We observed simultaneous weather and turbulence to develop a modeling approach that produces volumetric site-specific models capable of forecasting optical conditions.

PTh4E.2 • 14:30

Aerosol Extinction From Combined Micro- & Nano-Particle Counts, Steven Fiorino¹, Kevin Keefer¹, Jaclyn Schmidt¹, Dan Haegele¹, Halley Turner¹, Brannon Elmore¹, Santasri R. Bose-Pillai¹; ¹*Air Force Inst. of Technology, USA*. Analysis suggests combining nanoparticle (i.e. MAGIC) and air pollution (i.e. Purple Air) micro-particle number concentrations can yield fairly accurate quantifications of aerosol scatter and absorption coefficients without having to employ larger footprint aerosol instrumentation.

PTh4E.3 • 14:45 (Top-Scored)

A Model for Atmospheric Optical Turbulence Using low-Frequency Measurements, Anand N. Sarma¹, Ravikiran S. Hegde¹, Satheesh S K², K Krishna Moorthy²; ¹*IISER Thiruvananthapuram, India*; ²*Indian Inst. of Science, India*. A model for atmospheric refractive index structure parameter is presented based on low-frequency measurements carried out at a semi-arid region. The model considers wind shear and thermal gradients also as input parameters

PTh4E.4 • 15:00 (Invited)

Plenoptic Wavefront Sensing in Deep Turbulence, Abbie T. Watnik¹; ¹*US Naval Research Laboratory, USA*. Abstract not available.

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PTTh4E.5 • 15:30

Departures From Gaussianity in Image Wandering Under Controlled Optical Turbulence, Dario G. Perez¹, Antonio M. Macedo², Hishan Farfan¹, Ivan R. Gonzalez¹; ¹*P. Universidad Catolica de Valparaiso, Chile;* ²*Departamento de Fisica, Universidade Federal de Pernambuco, Brazil.* We explore the probability density function and power spectral exponent of a square array of bright spots observed through optical turbulence. Their limited deflections within a finite region lead to non-Gaussian statistics, which has implications in the validity of the frozen turbulence hypothesis.

PTTh4E.6 • 15:45

Atmospheric Cn2 Profile Requirements for GEO-Feeder Uplink AO Optimization, Perrine Lognoné¹, Oliver J. Farley¹, Ryan Griffiths¹, Jean-Marc Conan², James Osborn¹; ¹*Department of Physics, Durham Univ., UK;* ²*DOTA, Onera, Université Paris Saclay, France.* To prepare telecom ground-to-GEO AO optimisation demonstrations, we evaluate the state-of-the-art phase estimator at PAA sensitivity to prior uncertainties, especially the Cn2 profile resolution. Four layer profiles are shown to suffice reducing the pre-compensation phase error.

14:00 -- 16:00

Room: Diamant

RTh4G • RadIT I: Time-Resolved X-Rays

Presider: Alexander Rack; European Synchrotron Radiation Facility, France and Richard Sandberg; Brigham Young Univ., USA

RTh4G.1 • 14:00 (Invited)

Extending Bragg Coherent Diffraction Imaging to the Atomic Scale With Physics-Based Optimization, Jason Meziere¹, Richard L. Sandberg¹, Ross Harder², Anastasios Pateras³; ¹*Brigham Young Univ., USA;* ²*Advanced Photon Source, Argonne National Laboratory, USA;* ³*Center for Free-Electron Laser Science, German Electron Synchrotron DESY, Germany.* As upgrades to synchrotrons increase coherent flux, atomic resolution in Bragg Coherent Diffraction Imaging has become a distinct possibility. We present a new method that shows the capability to achieve atomic resolution for small nanoparticles.

RTh4G.2 • 14:30 (Invited)

Time-Resolved X-Ray Diffraction With Ultrafast HCMOS X-Ray Imagers at the National Ignition Facility (NIF), Laura Robin Benedetti¹, Neal E. Palmer¹, Cara E. Vennari¹, Peter R. Nyholm¹, Jon H. Eggert¹, Arthur C. Carpenter¹, Neal Bhandarkar¹, David K. Bradley¹, Andrew J. MacKinnon¹, Sabrina R. Nagel¹, Yuan Ping¹, Camelia V. Stan¹, Damian Swift¹, Clement Trosseille¹; ¹*Lawrence Livermore National Laboratory, USA.* We present strategies and results for x-ray diffraction of laser-compressed materials, documenting phase transitions with several measurements in a single experiment. We also discuss ultrafast-sensor-specific experimental challenges for imaging, diffraction, and radiography.

RTh4G.3 • 15:00 (Invited)

X-Ray Multi-Projection Imaging: a Novel 3D Acquisition and Reconstruction for Fast X-Ray Imaging, Yuhe Zhang¹; ¹*Lunds Universitet, Sweden.* Abstract not available.

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RTh4G.4 • 15:30 (Invited)

Unveiling the Unseen: Exploring Sub-Surface Dynamics Under Shock Loading Using Real-Time Synchrotron X-Ray Imaging, Daniel Eakins¹; ¹*Univ. of Oxford, UK*. Abstract not available.

14:00 -- 16:00

Room: Ariane 1

STh4C • Terahertz I

Presider: Ullrich Pfeiffer; Bergische Universität Wuppertal, Germany

STh4C.1 • 14:00 (Invited)

How Advancements in Modern Spectrometers Are Breaking New Barriers in THz Applications for Science and Industry, Adrien Aubourg¹, Lauren Gingras¹, Prince Bawuah¹, Ronald Holzwarth¹; ¹*Menlo Systems GmbH, Germany*. Modern commercial time-domain terahertz spectrometers are leading a revolution probing the far infrared. We explore how their recent development has helped push fundamental research and unlocked applications in the pharmaceutical, automotive and electronics industries.

STh4C.2 • 14:30 (Invited)

Uncooled Kilohertz Speed Direct Power THz Receiver Family: Applications and Updates, Johannes Kunsch¹, Shankar B. Baliga³, Matthias Budden², Anselm Deninger⁴; ¹*Infrared Components, Laser Components Germany GmbH, Germany*; ²*WiredSense GmbH, Germany*; ³*Laser Components Detector Group, USA*; ⁴*Terahertz, TOPTICA Photonics AG, Germany*. This paper describes updates in the LTO based pyroelectric receiver family and its application in a frequency domain terahertz platform. High resolution water vapor spectra were taken from 40 GHz to 2330 GHz and benchmarking against an InGaAs photomixer was performed.

STh4C.3 • 15:00 (Invited)

Eight-Channel Optoelectronic THz-FMCW System, Nico Vieweg¹, Lauri M. Schwenson², Florian Walter², Lars Liebermeister², Konstantin Wenzel², Robert Kohlhaas², Shiva Mohammadzadeh³, Andreas Keil³, Fabian Friederich³; ¹*Toptica Photonics, Germany*; ²*Fraunhofer Inst. for Telecommunications, Heinrich-Hertz-Inst., HHI, Germany*; ³*Fraunhofer Inst. for Industrial Mathematics ITWM, Germany*. We introduce a new optoelectronic FMCW-THz system that features eight parallel coherent emitter- and receiver channels, all driven by a single laser unit. This approach not only reduces costs per channel but also enables applications such as SAR, MIMO, tomography, and more.

STh4C.4 • 15:30 (Invited)

Title to be Announced, Ullrich Pfeiffer¹; ¹*Bergische Universität Wuppertal, Germany*. Abstract not available.

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16:30 -- 18:00

Room: Caravelle 2

CTh5A • Inverse Problems in Imaging

Presider: Chrysanthe Preza; Univ. of Memphis, USA

CTh5A.1 • 16:30 (Invited)

Learning of Nonlinearities for Stable Iterative Image Reconstruction, Michael Unser¹;

¹*Ecole Polytechnique Fédérale de Lausanne, Switzerland*. We present a variational framework for learning nonlinearities within a recurrent neuronal architecture for image reconstruction. Our use of second-order total variation regularization induces solutions that are adaptive linear splines.

CTh5A.2 • 17:00

Image Reconstruction in Structured Illumination Microscopy Using the Plug-and-Play

Methods, Arash Atibi¹, Abdulaziz Alqahtani¹, Chrysanthe Preza¹; ¹*Univ. of Memphis, USA*. We investigated the use of Plug-and-Play methods in structured illumination microscopy using a 2D-processing approach and information from multiple 2D defocused PSFs. The achieved resolution in results from noisy simulation is better than that obtained with traditional 3D processing.

CTh5A.3 • 17:15

Non-Contact Measurement of Intraocular Pressure (IOP) via Corneal Deformation

Induced by Natural Blinking, Vito I. D'Alessandro¹, Justin Schumacher², Filippo Attivissimo¹, Amal Isaiah³, Giuliano Scarcelli²; ¹*Department of Electric and Information Engineering, Polytechnic Univ. of Bari, Italy*; ²*Fischell Department of Bioengineering, Univ. of Maryland, USA*; ³*Univ. of Maryland Medical School, USA*. We report a non-invasive technique to measure intraocular pressure by laterally imaging the eyeball during blinking. Eyelid-induced corneal deformation was analyzed to extrapolate IOP-induced corneal response. It was validated in vivo using the Valsalva maneuver.

CTh5A.4 • 17:30

Permutation Transient Attention Encoder for None-Line-of-Sight Imaging, Xiaxu Chen^{1,2},

Wenjie Yue^{1,2}, Gangping Liu^{1,2}, Edmund Y. Lam³, Jun Ke^{1,2}; ¹*School of Optics and Photonics, Beijing Inst. of Technology, China*; ²*Key Laboratory of Photo-electronic Imaging Technology and System, Ministry of Education of China, China*; ³*Department of Electrical and Electronic Engineering, Univ. of Hong Kong, Hong Kong*. This paper introduces Permutation Transient Attention Encoders as a novel and efficient approach for NLOS reconstruction. Our method, utilizing Transient Attention Blocks and Permute-MLP, enhances transient feature extraction and offers more discriminative feature representations than existing approaches.

CTh5A.5 • 17:45

Two-Edge-Resolved Passive Non-Line-of-Sight Imaging in Three Dimensions, John

Murray-Bruce¹; ¹*Univ. of South Florida, USA*. We overview a technique to reconstruct, in 3D, a scene hidden from view using a single non-line-of-sight (NLOS) photograph of penumbral shadows cast by two perpendicular edges of a doorway.

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16:30 -- 18:00

Room: Guillaumet 2

DTh5F • 3D Microscopy and Biomedical II

Presider: Osamu Matoba; Kobe Univ., Japan

DTh5F.1 • 16:30 (Invited)

Exploring Limits in Off-Axis Digital Holographic Microscopy, Manuel Martinez-Corral¹, Emilio Sanchez-Ortiga¹, Carlos Buitrago-Duque², Jorge Garcia-Sucerquia²; ¹*Univ. of Valencia, Spain*; ²*Universidad Nacional de Colombia, Colombia*. It is shown that reliable QPI can be extracted from off-axis DHM recorded under very adverse experimental conditions. Specifically, we demonstrate the QPI of quasi-opaque samples, with transmittances even below 1%. We also show that the bit depth requirement can be reduced to 3 bits.

DTh5F.2 • 17:00

CPU Based Real-Time Full Volume Processing and Automatic Dynamic Focal Plane Projection Display of 4D Optical Coherence Microscopy at 265 kA-Scans/s, Samuel J. Lawman¹, Uazman Alam¹, Yao-Chun Shen¹, Yalin Zheng¹; ¹*Univ. of Liverpool, UK*. For OCM to replace IVCN as a screening tool for DPN, the equivalent nerve *en-face* projection needs to be displayed in real time. Here we show it can be done with a moderate spec CPU.

DTh5F.3 • 17:15

Structured Illumination Digital Holographic Microscopy via two Integrated Mach-Zehnder Interferometers, Sofía Obando-Vásquez¹, Carlos Trujillo¹, Rene Restrepo¹, Ana Doblas²; ¹*Universidad EAFIT, Colombia*; ²*Department of Electrical & Computer Engineering, Univ. of Massachusetts Dartmouth, USA*. We propose two Mach-Zehnder interferometers coupled to create a structured illumination digital holographic microscope with tunable modulation frequency capability, expanding the system's numerical aperture regardless of the microscope objective lens used.

DTh5F.4 • 17:30

Rapid Computational Algorithm With Minimum User Input for Reconstructing Phase Images in Structured Illumination Digital Holographic Microscopy, Sofía Obando-Vásquez², Raul Castaneda², Rene Restrepo², Carlos Trujillo², Ana Doblas¹; ¹*Univ. of Massachusetts Dartmouth, USA*; ²*School of Applied Science and Engineering, EAFIT Univ., Colombia*. A rapid computational algorithm is presented for Structured Illumination in Digital Holographic Microscopy. The proposed algorithm is based on the minimization of two cost functions to reconstruct improved resolution images with minimum user input automatically.

DTh5F.5 • 17:45

Aerial-Imaging Light-Field Camera and Integral 3D Video Communication System, Shoma Kono¹, Masanari Kameyama¹, Masahiro Kawakita¹; ¹*Osaka Inst. of Technology, Japan*. We researched an aerial-imaging light-field camera with a wide viewing angle. We developed a real-time integral 3D video communication system using light-field camera.

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16:30 -- 18:00

Room: Spot

ITh5C • Advances in Microscopy II, Super Resolution

Presider: Rafael Piestun; Univ. of Colorado at Boulder, USA

ITh5C.1 • 16:30 (Invited)

Single-Molecule Localization Microscopy and Molecular Diffusion in the Brain Tissue Complexity, Laurent Cognet^{1,2}; ¹*Université de Bordeaux, France*; ²*LP2N, Inst. of Optics - CNRS, France*. By combining single particle tracking of near-infrared-emitting carbon nanotubes with analytical methods derived from single-molecule localization microscopy, we reveal the nanoscale organization of the extracellular space of living brain tissue in healthy and pathological conditions.

ITh5C.2 • 17:00

Nanoscale Mid-IR Spectroscopic Imaging of Cellular Ultrastructure., Christopher Phillips¹, George Greaves¹, Holger Auner¹, Alexandra Porter¹; ¹*Imperial College London, UK*. Our knowledge of cells' internal organelles, comes mostly from EM but here we image them optically, for the first time. Our ~20nm resolution beats diffraction by ~400x, and our mid-IR spectroscopy gives label-free chemical contrast.

ITh5C.3 • 17:15

Single Image Fourier Ring Correlation, Bernd Rieger¹, Sjoerd Stallinga¹; ¹*Technische Universiteit Delft, Netherlands*. We address (super)resolution assessment of light microscopy via Fourier Ring Correlation (FRC), based on a single camera image. Based on Poisson statistics we can split an image into two noise independent halves, and use this to compute the FRC. The technique is demonstrated on widefield, STED, ISM, and RCM modalities.

ITh5C.4 • 17:30

Advanced Large Kernel Hybrid Attention Approach for Enhanced Light Field Image Super-Resolution, Yi Sun¹, Yuduo Guo¹, Qionghai Dai¹, Sen Wan¹; ¹*Tsinghua Univ., China*. We present LF-DET-LKHAB, leveraging large kernel attention and spatial-angular Transformers for superior light field spatial super-resolution, capturing local and global information of the picture, outperforming state-of-the-art methods.

16:30 -- 18:00

Room: Argos

OTh5E • Ophthalmoscopy II

Presider: Kate Grieve; Institut De La Vision Paris, France

OTh5E.1 • 16:30 (Invited)

Retinal Imaging With AO-OCT: Recent Developments and Clinical Applications, Elisabeth Brunner², Laura Eva Kunze³, Victoria Hutterer¹, Daniel Jodlbauer⁴, Wolfgang Drexler², Ronny Ramlau^{1,4}, Andreas Pollreisz³, Michael Pircher²; ¹*Industrial Mathematics Inst., Johannes Kepler Universität, Austria*; ²*Center for Medical Physics and Biomedical Engineering, Medizinische Universität Wien, Austria*; ³*Department of Ophthalmology and Optometry, Medizinische*

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Universität Wien, Austria; ⁴*Johann Radon Inst. for Computational and Applied Mathematics, Austria.* Adaptive optics optical coherence tomography (AO-OCT) enables the 3D visualization of retinal features in the living eye with microscopic resolution. Its potential and remaining challenges for clinical translation are highlighted.

OTh5E.2 • 17:00

Modeling of Aberrations and Spatial Coherence for Retinal Imaging With Full-Field Optical Coherence Tomography, Inès Loukili^{1,2}, Laurent Mugnier², Vincent Michau², Kate Grieve¹, Pedro Mece³, Serge Meimon²; ¹*INSERM U968 Institut de la Vision, Université de la Sorbonne, France;* ²*DOTA, ONERA, Université Paris Saclay F-91123, France;* ³*Institut Langevin, ESPCI Paris, CNRS, PSL Univ., France.* We propose a condensed wave-optics model to simultaneously study the influence of aberrations and spatial coherence of the illumination on the resolution of a full-field optical coherence tomography imaging system.

OTh5E.3 • 17:15 (Top-Scored)

Influence of Source Coherence and Retinal Eccentricity on the Optoretinogram, a Non-Invasive Means of Assessing the Photoreceptors Functionality, Julia Granier^{1,2}, Ayoub Lassoued^{1,2}, Elena Gofas-Salas^{1,2}, Kate Grieve^{1,2}; ¹*Institut de la Vision, France;* ²*CHNO des Quinze-Vingts, France.* We record optoretinogram signals with an Adaptive Optics Scanning Light Ophthalmoscope on living human retina and we investigate the influence of the coherence of the source and of the retinal eccentricity on the signal obtained.

OTh5E.4 • 17:30 (Top-Scored)

Full-Field OCT Assisted by Woofer-Tweeter Sensorless AO Approach for Large Field-of-View High-Resolution Clinical Retinal Imaging, Clémentine Callet¹, Maxime Bertrand², Yao Cai^{1,3}, Michel Paques^{1,4}, Kate Grieve^{1,4}, Pedro Mece³; ¹*Institut de la Vision, France;* ²*Sharpeye, France;* ³*Institut Langevin, France;* ⁴*CHNO des Quinze-Vingts, France.* Full Field OCT assisted by a plug'n'play woofer-tweeter sensorless AO approach enables large FOV high-resolution in vivo retinal imaging with a robust clinical-adapted system, paving the way towards new studies on patients.

16:30 -- 18:00

Room: Guillaumet 1

PTh5D • Optical Communication Applications

Presider: Melissa Beason; Air Force Inst. of Technology, USA

PTh5D.1 • 16:30 (Invited)

TILBA-ATMO: a Multi-Plane Light Conversion (MPLC) Based Turbulence Mitigation Solution for Laser Communications., Thibault Michel¹, Antonin Billaud¹, Cédric Dautancourt¹, Claire Autebert¹, Pu Jian¹; ¹*Cailabs, France.* Cailabs' TILBA-ATMO, leveraging Multi-Plane Light Conversion (MPLC) technology, provides turbulence mitigation for atmospheric communication. We demonstrate turbulence mitigation over 45 modes, meeting requirements for low-Earth orbit satellite signals at high Greenwood frequency and large D/r_0 .

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PTTh5D.2 • 17:00 (Invited)

Proposing a Standardized Metric for Comparing Free Space Optical Communication Systems, Samuel N. Mellon¹, Jonathan Wells¹, Jakob W. Kunzler¹, Jason D. Schmidt²; ¹*NIWC Atlantic, USA*; ²*MZA Associates, USA*. Performance metric standardization eludes free space optical communication systems, resulting in assessment inconsistency. The authors propose that bits per joule capacity should be a standard system engineering metric for free space optical communications systems.

PTTh5D.3 • 17:30 (Invited)

Using Local Sensors to Enhance Real-Time Performance Models, Melissa K. Beason¹, Brannon Elmore², Steve Fiorino¹, Jaclyn Schmidt², Jack McCrae¹, Kevin Keefer¹, Santasri R. Bose-Pillai¹, Yogendra Raut², Justin Sherman³, Anthony Erickson³, Richard J. Drye⁴, Matthew Whitely⁴, Yakov Diskin⁴; ¹*Air Force Inst. of Technology, USA*; ²*Applied Research Solutions, USA*; ³*NASIC/GSPR, USA*; ⁴*MZA Associates Corp., USA*. Propagation and imaging models in combination with NWP and radiative effects can be used to estimate system performance. This presentation describes using local sensors to enhance model performance and considers data obtained during recent eclipse.

16:30 -- 18:00

Room: Ariane 1

STh5B • Terahertz II

Presider: Lars Liebermeister; Fraunhofer HHI, Germany

STh5B.1 • 16:30

Terahertz Velocity and Spectroscopy Sensing With Self-Mixing Interference of Quantum Cascade Lasers, Jiaxuan Cai^{1,2}, Yan Xie³, Ning Yang^{1,2}, Weidong Chu^{1,2}, Yingxin Wang³, Ziran Zhao³; ¹*Inst Appl physics & computational Math, China*; ²*National Key Laboratory of Computational Physics, China*; ³*Department of Engineering Physics, Tsinghua Univ., China*. Coherence measurement system based on self-mixing interferometry with quantum cascade lasers could be employed for various of sensing applications, such as multi-target velocity and broadband terahertz spectroscopy sensing which are demonstrated in this work.

STh5B.2 • 16:45 (Invited)

Optoelectronic Sources and Detectors for High Dynamic Range THz Time- and Frequency-Domain Spectroscopy, Lars Liebermeister¹, Alexander Dohms¹, Milan Deumer¹, Tina-Celine Heßelmann¹, Sebastian Lauck¹, Simon Nellen¹, Robert Kohlhaas¹; ¹*Fraunhofer HHI, Germany*. We present our latest advances in THz emitters and receivers for excitation at 1550 nm that use ultrafast photoconductors based on MBE-grown InGaAs:Fe and InGaAs:Rh. These state-of-the-art devices achieve unprecedented spectral bandwidth, output power and dynamic range.

STh5B.3 • 17:15

Characterization of Temperature Shifts in Terahertz Whispering Gallery Modes Utilizing Comb-Locked Spectroscopy, Sebastian Müller^{1,2}, Thomas Puppe¹, Yuriy Mayzlin¹, Dominik W. Vogt^{3,4}; ¹*Toptica Photonics, Germany*; ²*Inst. of Microwaves and Photonics, Friedrich-*

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Alexander Univ., Germany; ³Department of Physics, Univ. of Auckland, New Zealand; ⁴Dodd-Walls Centre for Photonic and Quantum Technologies, New Zealand. We present precision measurements of terahertz whispering gallery mode resonances using a novel comb-locked frequency domain spectrometer. Absolute long-term frequency stability and resolution allows to accurately resolve temperature shifts across multiple modes.

STh5B.4 • 17:30

Advanced Pyroelectric Detectors for Spectroscopy, Pierre Chazan², Shankar B. Baliga¹;

¹*Laser Components Detector Group, Inc., USA;* ²*Laser Components S.A.S., France.*

Pyroelectric infrared detectors are used in spectroscopy at relatively high modulation frequencies and long IR wavelengths out to THz. This paper describes continued advances in Lithium Tantalate pyroelectric detectors that provide for higher performance in a scalable, disruptive sensing technology.

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Friday, 19 July

08:00 -- 10:00

Room: Ariane 2

CF1A • Advances in Lensless Imaging

Presider: Maciej Trusiak, Politechnika Warszawska, Poland

CF1A.1 • 08:00 (Invited)

On the Use of Machine Learning for Estimation of Complex Graph Networks and Flows, With Application to Retina Vasculature and Glaucoma Diagnostics, George Barbastathis^{1,2}, Sandip Mondal², Thiara Sana Ahmed³, Bingyao Tan^{3,4}, Fabian Braeu³, Qihang Zhang⁵, Liangcai Cao⁵, Michael Girard³, Leopold Schmetterer^{3,4}, Aung Tin⁴; ¹*Massachusetts Inst. of Technology, USA*; ²*Singapore-MIT Alliance for Research and Technology Centre, Singapore*; ³*Nanyang Technological Univ., Singapore*; ⁴*Singapore Eye Research Inst., Singapore*; ⁵*Tsinghua Univ., China*. We show that graph connectivity and the associated flow properties are mapped onto spatial and temporal fluctuations in the far field. The autocorrelation functions are processed by unsupervised and supervised algorithms to invert this mapping.

CF1A.2 • 08:30 (Top-Scored)

Information-Theoretic Experimental Analysis of Lensless Imagers, Leyla Kabuli¹, Clara Hung¹, Eric Markley¹, Henry Pinkard¹, Laura Waller¹; ¹*Univ. of California, Berkeley, USA*. We analyze the information content of experimental data from lensless cameras with different phase mask encoders. We show that our mutual information metric predicts image reconstruction quality without performing a reconstruction.

CF1A.3 • 08:45

Generalizing Learning-Based Lensless Image Reconstruction to Mask Pattern Changes, Eric Bezzam¹, Martin Vetterli¹; ¹*Ecole polytechnique federale de Lausanne, Switzerland*. Previous work has not shown if learned components for lensless image reconstruction can generalize to physical modifications. In this work, we train a reconstruction approach on an open-sourced, multi-mask dataset, and demonstrate improved generalizability.

CF1A.4 • 09:00

Hybrid Scanning Lensless Imaging by Diffractive Neural Field, Yifei Liu¹, Weizhi Song¹, You Zhou², Bo Xiong³, Xun Cao¹; ¹*School of Electronic Science and Engineering, Nanjing Univ., China*; ²*Medical School, Nanjing Univ., China*; ³*National Engineering Laboratory for Video Technology (NELVT), Peking Univ., China*. We report a lensless imaging strategy that achieves pixel-super-resolution and high-accuracy reconstruction by employing hybrid scanning and self-supervised learning.

CF1A.5 • 09:15

Design and Fabrication of Self-Coded CMOS Image Sensor for Compact Omnidirectional Lensless Cameras, Fuki Hosokawa¹, Tomoki Nakamura¹, Keiichiro Kagawa¹, Kiyotaka Sasagawa², Jun Ohta², Tomoya Nakamura³; ¹*Shizuoka Univ., Japan*; ²*Nara Inst. of Science and Technology, Japan*; ³*Osaka Univ., Japan*. We designed and fabricated a CMOS image sensor

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that works as a coding mask. Pinholes were formed in the image sensor by deep reactive ion etching. Image reproduction was performed by a Wiener filter.

08:00 -- 10:00

Room: Caravelle 2

CF1B • Unconventional Imaging

Presider: Ashley Lyons; Univ. of Glasgow, UK

CF1B.1 • 08:15 (Invited)

Computational and Quantum Techniques for Microscopy, Daniele Faccio¹; ¹*Univ. of Glasgow, UK*. Abstract not available.

CF1B.2 • 08:45

Approaching the Quantum Limit of Wavefront Sensing With Spatial Mode Sorting, Jacob Trzaska¹, Amit Ashok^{1,2}; ¹*James C. Wyant College of Optical Sciences, Univ. of Arizona, USA*; ²*Department of Electrical and Computer Engineering, Univ. of Arizona, USA*. We describe a wavefront sensor that is asymptotically quantum-optimal in the limit of small phase error. The sensor could be used with an adaptive optics system to sense residual errors when in closed loop.

CF1B.3 • 09:00

Experimental Demonstration of a Quantum-Optimal Direct-Imaging Coronagraph, Nicolas J. Deshler¹, Itay Ozer¹, Amit Ashok¹, Saikat Guha¹; ¹*Univ. of Arizona, USA*. We built a quantum-optimal direct-imaging coronagraph that rejects all light from an on-axis star using a double-pass spatial mode sorter. With this system, we experimentally localize synthetic exoplanets below the diffraction limit at $10^3:1$ star-planet contrasts.

CF1B.4 • 09:15

Second Order Correlation Interference Imaging, Khaled Kassem¹, Ashley Lyons¹, Areeba Fatima¹, Patrick Cornwall², Florian Willomitzer², Daniele Faccio¹; ¹*Univ. of Glasgow, UK*; ²*Wyant College of Optical Sciences, Univ. of Arizona, USA*. We demonstrate that utilizing intensity correlation rather than phase-interference enables phase-noise robust imaging across a diverse array of applications. From high-resolution cellular bioimaging to non-line-of-sight scenarios, we highlight the versatility and effectiveness of this approach.

CF1B.5 • 09:30

Enhanced Single Pixel Imaging in Atmospheric Turbulence, Yin Cheng¹, Yusen Liao¹, Shuaijun Zhou³, Edmund Y. Lam², Jun Ke¹; ¹*Beijing Inst. of Technology, China*; ²*Univ. of Hong Kong, China*; ³*China Aerospace Science and Technology Corporation, China*. The imaging quality of single pixel imaging in atmospheric turbulence is enhanced by combining a deep learning model with classical methods. The effectiveness of this method was confirmed by optical experiments.

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CF1B.6 • 09:45

Design of Phase Plate for Far Field Super-Rayleigh Speckle in GISC Spectral Camera, Jianrong Wu^{1,2}, Pengwei Wang^{1,2}, Shensheng Han^{1,2}; ¹*Key Laboratory for Quantum Optics, Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China;*

²*Aerospace Laser Technology and System Department, Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China.*

A far field super-Rayleigh speckle modulation scheme for GISC spectral camera is proposed. The design and fabrication of the phase plate generating super Rayleigh speckles are carried out. Experimentally the contrast is basically greater than 1 from 550nm to 800nm, and reaches the maximum of 1.8 at 600nm.

08:00 -- 10:00

Room: Guillaumet 2

DF1H • AR/VR and 3D Displays

Presider: Yuzuru Takashima; Univ. of Arizona, Coll of Opt Sciences, USA

DF1H.1 • 08:00 (Invited)

Binary Amplitude Hologram Generation for Digital Micromirror Device-Based Holographic Displays

Alejandro Velez-Zea is a 2023 Optica Foundation Challenge Winner

Optica.org/FoundationChallenge, Alejandro Velez-Zea¹, Cesar Antonio Hoyos-Peláez¹, John Fredy Barrera-Ramírez¹; ¹*Universidad de Antioquia, Colombia.* We compare several binary amplitude hologram generation methods used in holographic displays based on digital micromirror devices. We demonstrate that a combination of gradient descent, subsampling, and time multiplexing offers improved performance over conventional approaches.

DF1H.2 • 08:30 (Top-Scored)

3D Holographic Display Without Speckle and Zeroth-Order Light Using Mobile Phone Screen, Otoy Shigematsu¹, Makoto Naruse¹, Ryoichi Horisaki¹; ¹*The Univ. of Tokyo, Japan.*

We propose a method of computer-generated holography using a screen device. Holograms are synthesized by solving an inverse problem of incoherent light propagation. This method realizes a compact holographic display without speckle and zeroth-order light.

DF1H.3 • 08:45

Multicore Fiber Based Lightweight Exit Pupil Expansion Display in Augmented Reality,

Jae-Sang Lee¹, Seong-Hyeon Cho¹, Do Hun Baek¹, Woo June Choi^{2,1}, Young-Wan Choi^{2,1};

¹*Department of Intelligent of semiconductor engineering, Chung-Ang Univ., Korea (the Republic of);* ²*School of the electrical and electronics engineering, Chung-Ang Univ., Korea (the Republic of).*

In this paper, we aim to deliver image with the eye by multicore fiber from a beam projector in the pocket. Head-worn device can be lighted in weight with this approach.

DF1H.4 • 09:00

3D Visuospatial Perception in Augmented Reality Based on Multifocus Imaging, Julia

Alonso¹, Ariel Fernández¹, Bahram Javidi²; ¹*Universidad de la República, Uruguay;* ²*Univ. of Connecticut, USA.* We present our recent advances regarding augmented reality based on

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multifocus sensing to adjust the visuospatial perception which could be useful in therapy devices regarding binocular treatment or to alleviate stereo visual fatigue.

DF1H.5 • 09:15

Mitigating Efficiency and Image Quality Tradeoffs in AR Waveguide Displays, Jeremy Goodsell¹, Daniel K. Nikolov¹, Nick Vamivakas¹, Jannick P. Rolland¹; ¹*Univ. of Rochester, USA*. Diffractive waveguide displays have low optical efficiency from multiple in-coupler interactions. Single-zone designs trade efficiency for image quality, but we demonstrate how a multi-zone in-coupler mitigates this tradeoff.

DF1H.6 • 09:30 (Invited)

Human Gesture Recognition in Degraded Environments With Multi-Dimensional Integral Imaging: an Overview, Bahram Javidi¹, Gokul Krishnan¹, Filiberto Pla²; ¹*Univ. of Connecticut, USA*; ²*Universitat Jaume I., Spain*. We present an overview of human gesture recognition in degraded environments with multi-dimensional integral imaging. It is shown that for human gesture recognition in degraded environments such as low light, and occlusion, we can gain substantial improvements in performance over conventional 2D imaging.

08:00 -- 10:00

Room: Spot

IF1D • Advances in Microscopy III

Presider: Ji Yi; Johns Hopkins Univ., USA

IF1D.1 • 08:00

When Microscopes get Cooler: High Resolution Imaging of Cold Biology in Physiological Conditions., Anne-Pia Marty^{1,2}, Edward Ward¹, Melody Clark², Lloyd Peck², Clemens Kaminski¹; ¹*Univ. of Cambridge, UK*; ²*British Antarctic Survey, UK*. Traditional optical microscopy faces limitations in observing samples requiring cold conditions due to heat transfer and condensation. We present a method for super-resolution optical microscopy at circa-0°C, for studying cell biology in the cold.

IF1D.2 • 08:15

Computational Correction of Scanner Non-Linearity in 3D Microscopy, Lena Zhukova¹, Roger Artigas¹, Guillem Carles¹; ¹*Sensofar, Spain*. Optical profilometers use axial scanning to measure object heights, and non-linear movement of the scanner yields measurement errors. We show a computational method to correct for non-linearity errors, thereby increasing measurement precision without added components.

IF1D.3 • 08:30 (Invited)

Improving the Resolution of Optical Microscopy Using Random Illumination, Anne Sentenac¹; ¹*Fresnel Institut, France*. We describe the basic principles of super-resolved Random Illumination Microscopy (RIM) and present different applications in fluorescence and non-linear imaging.

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IF1D.4 • 09:00

Single Shot Spatial Frequency Modulation for Imaging, Randy A. Bartels¹, Seth Cottrell², Daniel Scarbough², John Czerski², Jeff Squire²; ¹*Morgridge Inst. & U of Wisconsin, USA*; ²*Colorado School of Mines, USA*. Imaging with spatial frequency modulation for imaging (SPIFI) is pushed to the limits of imaging speed and detection sensitivity. Images are captured with a single 30-fs pulse. Signal sensitivity is improved through photon counting detection.

IF1D.5 • 09:15

Improving Optical Sectioning in Wide-Field Two-Photon Excitation Microscopy Using Random Illumination, Xiangyi Li¹, Assia Benachir¹, Sandro Heuke¹, Hervé Rigneault¹, Anne Sentenac¹; ¹*Institute Fresnel, France*. Wide-field two-photon microscopy using a collimated excitation is plagued by poor optical sectioning. In this work, we show analytically that exciting the sample with randomly varying speckled illuminations could significantly improve the optical sectioning ability while keeping the same large Field of View.

IF1D.6 • 09:30

3D Visualization of Plant-Pathogen Interaction Inside Plant Leaves With Dynamic Contrast Optical Coherence Tomography, Jos d. Wit¹, Sebastian Tonn², Mon R. Shao², Guido V. Ackerveken², Jeroen Kalkman¹; ¹*TU Delft, Netherlands*; ²*Univ. Utrecht, Netherlands*. We show dynamic OCT functional in vivo 3D imaging of *Bremia*, a downy mildew, in a lettuce plant. Dynamic OCT imaging is applied to disease resistance quantification and longitudinal study of pathogen growth.

08:00 -- 10:00

Room: Argos

OF1F • Wavefront Sensing

Presider: Noelia Martinez-Rey; Australian National Univ., Australia

OF1F.1 • 08:00 (Invited)

Phase Diversity-Based Wavefront Sensing for Fluorescence Microscopy, Courtney C. Johnson¹, Min Guo^{2,3}, Magdalena C. Schneider¹, Yijun Su^{1,3}, Satya Khuon¹, Nikolaj Reiser⁴, Yicong Wu³, Patrick J. La Riviere⁴, Hari Shroff^{1,3}; ¹*Janelia Research Campus, USA*; ²*Zhejiang Univ., China*; ³*National Insts. of Health/National Inst. of Biomedical Imaging and Bioengineering, USA*; ⁴*Univ. of Chicago, USA*. Optical aberrations degrade image quality when imaging through biological samples. Here we demonstrate phase diversity-based wavefront sensing for microscopy, a method adapted from astronomy with the potential to facilitate easy-to-implement adaptive optics for biological imaging.

OF1F.2 • 08:30

Singleshot Multispectral Wavefront Sensing, Baptiste Blochet¹, Nathalie Lebas², Dimitri Papadopoulos², Marc Guillon¹; ¹*SPPIN, Universite Paris Cite, France*; ²*LULI, Ecole Polytechnique, France*. We demonstrate a speckle-based singleshot multispectral wavefront sensor. The instrument is quantitative and was applied to characterize a single pulse from a high-power laser facility

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OF1F.3 • 08:45

Detection of Piston Using a Digital Pyramid Wavefront Sensor, Deborah C. Malone^{1,2}; ¹*Durham Univ., UK*; ²*Physics, Univ. of Galway, Ireland*. Pyramid Wavefront Sensors are sensitive to piston. Here we present the preliminary work, which uses a spatial light modulator as a digital pyramid wavefront sensor to detect the piston from a segmented phase screen.

OF1F.4 • 09:00

Simulation of LQG Control With Pyramid Wavefront Sensor: Preparation of PAPHYRUS implementation, Nicolas Levraud¹, Nicolas Galland², Henri François Raynaud², Romain Fétick^{3,4}, Jonathan Dray⁴, Yann Clénet¹, Caroline Kulcsar²; ¹*LESIA, Observatoire de Paris-Meudon, France*; ²*Laboratoire Charle Fabry, Institut d'optique Graduate School, France*; ³*DOTA, Office Nationale d'etude et de Recherches Aérospatiales, France*; ⁴*GRD, Laboratoire d'Astrophysique de Marseille, France*. As the LQG relies on modelling of the atmospheric turbulence, it will be in particular important to test the robustness to parameters variation with respect to the on-sky conditions faced by PAPHYRUS. Longer simulations as well are needed to insure the stability of this solution.

OF1F.5 • 09:15

High-Resolution Space-Variant Shack–Hartmann Wavefront Reconstruction, Fan Feng¹, Chen Liang²; ¹*GBA Inst. of Collaborative Innovation, China*; ²*LMAM, School of Mathematical Sciences, Peking Univ., China*. Space-variant wavefront reconstruction plays a crucial role in large field-of-view imaging. Instead of using affine transformation, displacement fields of subimages within Shack–Hartmann sensor are evaluated using polynomial model, resulting in improved resolution for space-variant functions.

08:00 -- 10:00

Room: Guillaumet 1

PF1E • Beam-Waves in Turbulence

Presider: Jeremy Bos; Michigan Technological Univ., USA

PF1E.1 • 08:00 (Invited)

Anisoplanatic Limits of Phase Compensation in Beam Control, Derek Burrell¹; ¹*The Univ. of Arizona, USA*. This work identifies a phase-compensation performance limit that arises when the seeing angle exceeds the isoplanatic angle in deep atmospheric turbulence. Beyond this limit, it demonstrates the potential for beam-control performance improvement through full-field compensation.

PF1E.2 • 08:30

Speckle Texture Based Identification of OAM Beams Propagating Through Atmosphere, Priyanka Lochab¹, Kedar Khare²; ¹*Applied Sciences and Humanities, IGDTUW, India*; ²*Optics and Photonics Center, IIT Delhi, India*. A new method for identification of OAM beams based on the principal component analysis of the texture of their speckle intensity pattern obtained on long-range atmospheric propagation is proposed.

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PF1E.3 • 08:45

Gerchberg-Saxton Algorithm to Retrieve Phase of Laguerre-Gaussian Beams That Carry OAM, Owen O'Malley¹, Svetlana Avramov-Zamurovic¹, Nathaniel A. Ferlic², K. Peter Judd³; ¹*US Naval Academy, USA*; ²*Naval Air Warfare Center Aircraft Division, USA*; ³*USA Naval Research Laboratory, USA*. We estimate the phase of laser beams using the Gerchberg-Saxton algorithm after propagation through experimental and simulated optical turbulence. Synchronous pupil-plane and focal-plane intensities of Gaussian and Laguerre-Gaussian beams are leveraged.

PF1E.4 • 09:00

Newton Disk Revisited for Atmospheric Turbulence Measurement, Regis Barille², Dario Perez¹; ¹*Catholic Univ. of Valparaiso, Chile*; ²*MOLTECH-Anjou, Univ. of Angers, France*. Acquired chromatic change information generated by the atmospheric optical turbulence due to a color mixing process are characterized. A RGB Fourier transform-based color space is used to analyze chromatic information of the target images.

PF1E.5 • 09:15

Tracking Limitations Imposed by Atmospheric Turbulence Without Adaptive-Optics Compensation, Matthew Kalensky¹, Darren Getts¹, Mark Spencer²; ¹*NAVSEA NSWC Dahlgren Division, USA*; ²*Joint Directed Transition Office, USA*. We derive a modified fundamental tracking frequency, which is applicable for beam-control systems that do not employ adaptive-optics compensation. We show that if higher-order aberrations are not compensated, there are diminishing returns on tracking faster than the modified fundamental tracking frequency.

PF1E.6 • 09:30

Estimates of C_n^2 in the Open Ocean From the MREP 20 Sea Trial., Jeremy P. Bos¹; ¹*Michigan Technological Univ., USA*. Using data from the MREP 20 sea trial I evaluate the index of refraction based on temperature and salinity measurements. The index of refraction structure function is estimated pointwise between measurements at 0.5 increments and the structure constant found to be between 10 to the -16 to -13 with units of meters to the -13/6.

PF1E.7 • 09:45

Spatial and Temporal Study of Controlled Underwater Optical Turbulence From Synchronous Measurements, Svetlana Avramov-Zamurovic¹, Nathaniel A. Ferlic², Thomas Kelly¹, Owen O'Malley¹, K. Peter Judd³; ¹*US Naval Academy, USA*; ²*Naval Air Warfare Center Aircraft Division, USA*; ³*NRL, USA*. We experimentally record intensity of laser light at the pupil and focal planes after propagation through underwater optical turbulence. We study the temporal and spatial properties of intensity correlations and angle of arrival fluctuations.

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08:00 -- 10:00

Room: Ariane 1

SF1C • Laser Based Sensors II

Presider: Yoonchan Jeong; Seoul National Univ., Republic of Korea

SF1C.1 • 08:00 (Invited)

Optical Fiber as a Sensor: Seismic Observatory on the Telecom Fiber Network Using Coherent Laser Interferometry, Davide Calonico¹, Simone Donadello¹, Cecilia Clivati¹, Filippo Levi¹, Alberto Mura¹, Roberto Concasa¹, Elio Bertacco¹, Francesco Carpentieri², Daniele Brenda², Marianna Hovsepyan², Lucia Margheriti³, Aladino Govoni³, Maurizio Vassallo³, Andrè Herrero³; ¹*Istituto Nazionale di Ricerca Metrologica (INRIM), Italy*; ²*Open Fiber, Italy*; ³*Istituto Nazionale di Geofisica e Vulcanologia (INGV), Italy*. We demonstrated coherent laser interferometry in fibre sensing for seismic detection. The technique was originally developed for the remote comparison of atomic clocks. After first implementations on submarine cables, we moved on with networks on land, realizing a permanent observatory, gaining a quantitative characterization of the sensor.

SF1C.2 • 08:30 (Invited)

Single-Mode Random Lasers With Tunable Field Sizes, Myungjae Lee¹; ¹*Seoul National Univ., Korea (the Republic of)*. We present a novel approach to single-mode random lasers, leveraging controlled disorder in photonic crystal alloys to achieve tailored modal properties. We explore the modal properties and demonstrate their tunability for customizable light sources.

SF1C.3 • 09:00

Ultrasensitive Detection of Mouse IgG Using an Erbium-Doped Microbubble Laser, Yuchan Hu¹, Kang Xu¹, Wenyu Wang¹, Lei Shi¹, Xinliang Zhang¹; ¹*Huazhong Univ of Science and Technology, China*. An ultrahigh-Q erbium-doped microbubble laser is utilized for the highly sensitive detection of mouse IgG. A sensitivity of 3.095 dBm/(fg/mL) and a detection limit of 20 ag/mL for mouse IgG are achieved.

SF1C.4 • 09:15

3D Micro-Printed Limacon-Shaped Whispering-Gallery-Mode Microcavity for Cavity-Enhanced Fluorescence Spectroscopic Sensing, Nan Wang¹, Zhi Zheng Wang¹, Bin Zhou¹, Yuwen Qin², Aping Zhang¹; ¹*Hong Kong Polytechnic Univ., Hong Kong*; ²*School of Information Engineering, Guangdong Univ. of Technology, Guangzhou, China., China*. Abstract: A 3D micro-printed Limacon-shaped whispering-gallery-mode (WGM) microcavity is presented. It can achieve both high Q value and directional emission and thus is promising for on-chip cavity-enhanced fluorescence spectroscopic sensing applications.

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08:30 -- 09:30

Room: Diamant

RF1G • RadIT II: Data Fusion and AI

Presider: Wei Liu; Mayo Clinic, USA and Liangzhong Xiang; Univ. of California Irvine, USA

RF1G.2 • 08:30 (Invited)

X-ray Induced Acoustic Computed Tomography (XACT), Liangzhong Xiang¹; ¹*Univ. of California Irvine, USA*. X-ray-induced acoustic computed tomography (XACT) produces CT-like images using a single X-ray projection, enhancing imaging speed and reducing radiation exposure. This presentation will cover recent advancements and future prospects in biomedical applications and materials science.

RF1G.3 • 09:00 (Invited)

Synchrotron-Based X-Ray Fluorescence Ghost Imaging, Nicola Viganò¹, Mathieu Manni^{1,2}, Adi Ben-Yehuda², Yishai Klein², Bratislav Lukic¹, Andrew Kingston³, Alexander Rack¹, Sharon Schwartz²; ¹*ESRF - The European Synchrotron, France*; ²*Physics Department and Inst. of Nanotechnology and Advanced Materials, Bar Ilan Univ., Israel*; ³*Department of Materials Physics, Research School of Physics, The Australian National Univ., Australia*. We achieve synchrotron-based x ray fluorescence ghost imaging (XRF-GI), via the design of a new acquisition protocol. XRF-GI enables the study of previously inaccessible samples (e.g. liquids) with traditional pencil-beam methods (based on raster scanning).

RF1G.1 • 09:30 (Invited)

Using Short-Pulse Lasers for Multi-Probe Radiography, Steven Batha¹, Mariana Alvarado-Alvarez¹, David Broughton¹, Chengkun Huang¹, Zhehui (Jeph) Wang¹, Bradley Wolfe¹, C. -S. Wong¹, Robert Reinovsky¹; ¹*Los Alamos National Laboratory, USA*. More information can be obtained from dynamic experiments by radiographing them with different species of probes. We test this hypothesis by creating beams with short-pulse lasers and reporting on the resulting radiographs.

10:00 -- 11:00

Room: Cassiopée

JF2A • Joint Poster Session III

JF2A.1

Tracking Before Imaging With Ghost Imaging Camera, Xiao Han Wan^{1,2}, Mengyu Chen^{1,2}, Li Chen^{1,2}, Pengwei Wang², Zhentao Liu², Shensheng Han²; ¹*Univ. of Chinese Academy of Science, China*; ²*Key Laboratory for Quantum Optics, Shanghai Inst. of Optics and Fine Mechanics, China*. Using the high-dimensional light field information obtained by a single exposure of ghost imaging camera, we propose a passive tracking before imaging method to improve the detection and tracking ability of weak and small target.

JF2A.2

Single-Shot Phase and Polarimetric Microscopy, Baptiste Blochet¹, Marc Guillon¹; ¹*Universite Paris Cite - SPPIN, France*. We introduce a polarimetric wavefront imager that

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provides both the phase and the full-Stokes polarimetric images at high resolution in a single acquisition of a multiplexed image

JF2A.3

Two-Dimensional Walsh Code Ordering of the Hadamard Basis for Single-Pixel Imaging With Compressive Sensing, Oliver Pitts¹, Costel Flueraru¹; ¹*National Research Council Canada, Canada*. An improved Hadamard measurement basis sorting is proposed and evaluated for single pixel imaging with a low measurement ratio, based on a two-dimensional evaluation of sign changes using the Walsh code.

JF2A.4

Deep Learning-Based Automated Defect Detection in Digital Holographic Microscopy, Dhruvam Pandey¹, Subrahmanya K. N¹, Rajshekhar Gannavarpu¹; ¹*Indian Inst. of Technology, Kanpur, India*. The article introduces a defect identification method using digital holographic microscopy and deep learning. It utilizes wrapped phase from holograms to generate binary defect maps trained for high noise levels. Experimental results validate its efficacy.

JF2A.5

Spectral Reconstruction for a Heterogeneous Structure Static Modulation Fourier Transform Spectrometer, Juyong Cho¹, Won Kweon Jang¹; ¹*Hanseo Univ., Korea (the Republic of)*. Spectral reconstruction was performed for a heterogeneous structure static modulation Fourier transform spectrometer. This design is analyzed and discussed, enabling the spectrometer to have high performance across wide spectral range.

JF2A.6

A Blind Deconvolution Approach for Wide-Field Microscopy, Farhad Niknam¹, Krishna Agarwal¹; ¹*Department of Physics and Technology, UiT The Arctic Univ. of Norway, Norway*. We present a blind deconvolution method for 3D heterogeneous samples. The deconvolution is performed with the PSFs independently optimized at different regions such that the heterogeneity of the sample can be incorporated.

JF2A.7

Specular Reflections for Classification of Unresolved Surfaces, Ahmed Alghamdi¹; ¹*Univ. of Arizona, USA*. Unresolved specular surfaces can be classified by sampling their radiance field. We present a way of distinguishing between two unresolved reflective targets. This is applicable for target identification in unresolved remote sensing situations.

JF2A.8

Multiplexed Multispectral Filter Array by 3D Sphere Packing Design, Alejandro Alvarado¹, Nelson Díaz¹, Pablo Meza², Esteban Vera¹; ¹*PUCV, Chile*; ²*Universidad de la Frontera, Chile*. We extended the 3D-Sphere Packing to design a Multiplexed Multispectral Filter Array that increases the measurement signal-to-noise ratio and allows an increase in the of number bands, approaching the resolutions expected for hyperspectral imaging systems.

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JF2A.9

Dynamic Deflectometry for Real-Time 3D Surface Measurements, Young-Sik Ghim^{1,2}, Manh T. Nguyen¹, Hyug-Gyo Rhee^{1,2}; ¹*Korea Res. Inst of Standards and Science, Korea (the Republic of)*; ²*Univ. of Science and Technology, Korea (the Republic of)*. We propose a simple, efficient, and robust one-shot phase retrieval method for measuring a surface phase. Using only a derivation operation for the high carrier-frequency composite pattern, we can retrieve the surface phase with high processing speed.

JF2A.10

An Implemented Fluorescence Imaging System for Real-Time Monitoring of Colorectal Cancer Location, Joo Beom Eom¹, Yoo-kyoung Shin¹, You-rim Park¹; ¹*Dankook Univ., Korea (the Republic of)*. We report a method for real-time monitoring of colorectal cancer, lymph node metastasis, and tumor growth inhibition of colorectal cancer cells through photodynamic therapy (PDT) using a near-infrared fluorescence diagnostic therapeutic system and fucoidan-based therapeutics.

JF2A.11

UNN-Based Self-Calibrated Multi-Layer Imaging of Lens-Less Ptychographic Microscopy, Yewon Kim¹, Chulmin Joo¹; ¹*Mechanical Engineering, Yonsei Univ., Korea (the Republic of)*. We propose a strategy for multi-layer reconstruction with self-calibration for lens-less ptychographic microscopy, utilizing an Untrained Neural Network (UNN) that does not require a precise forward model or large training datasets.

JF2A.12

Exploiting Meta AI's Object Segmentation Model on Distributed Acoustic Sensing Data for Spatio-Temporal Train Localization, Abdelkader Hamadi¹, Gabriel Papaiz Garbini¹, Tarik Hammi¹, Ali Kabalan¹, Annie Ho¹, Katia Amer Yahia¹, Tilleli Ayad¹, Martin Ruffel¹, Imen Benamara¹, Walid Talaboulma¹, Pierre-Antoine Lacaze¹; ¹*SNCF Réseau, France*. The French railway company (SNCF) is investing efforts to exploit emerging state-of-the-art results to develop its own train tracking solution. We present in this article an approach that exploit Meta's Segment Anything model for spatio-temporal train localization on data sensed by a distributed acoustic sensing system.

JF2A.13

Design and Fabrication of Wider Angle Field of View Hybrid DOEs for a Compact Imaging Optics, Hyug-Gyo Rhee¹, NNH Anh¹, Young-Sik Ghim¹; ¹*Korea Res. Inst of Standards & Science, Korea (the Republic of)*. Hybrid DOEs, which are diffraction patterns fabricated on curved refractive optical elements, have the ability to widen the field of view angle and make a compact imaging optics, but manufacturing it is challenging. We provides a method to manufacture it with superior performance in both diffraction efficiency and resolution.

JF2A.14

Design of a Coudé Mirror Assembly in a Large Ground Telescope for Astronomical Imaging, Jaehyun Lee¹, Kisoo Park², Eui Seung Son², Suseong Jeong³, Hyug-Gyo Rhee^{1,4}, Pilsong Kang¹; ¹*KRISS, Korea (the Republic of)*; ²*Defense Rapid Acquisition Technology Research Inst., Korea (the Republic of)*; ³*Hanwha Systems, Korea (the Republic of)*; ⁴*Precision*

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Measurement, Univ. of Science and Technology, Korea (the Republic of). We develop a 1-m ground telescope for astronomical observation. To accurately guide beam to AO system, we employ a coudé mirror assembly. Its mirror shape and mount structure are optimized to minimize wavefront error.

JF2A.15 • 10:00

Random Illumination Coherent Anti-Stokes Raman Scattering Microscopy (RIM-CARS),

Eric M. Fantuzzi¹, Sandro Heuke¹, Simon Labouesse², Dominykas Gudavičius³, Randy A. Bartels⁴, Anne Sentenac¹, Hervé Rigneault¹; ¹*Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, Marseille, France., France;* ²*Toulouse Université, CNRS, Centre de Biologie Intégrative, Toulouse, France., France;* ³*Light Conversion, Keramiku st.2B LT-10233 Vilnius; Lithuania & Cardiff Univ., School of Physics and Astronomy, The Parade, Cardiff CF24 3AA, UK., Lithuania;* ⁴*Colorado State Univ., Fort Collins, USA., USA.* We show how speckle illuminations improve wide-field coherent Raman microscopy by introducing optical sectioning and enhancing the lateral resolution. In addition, the speckle illumination facilitates the optical alignment and reduces the experiment's susceptibility to optical aberrations.

11:00 -- 12:30

Room: Guillaumet 1

JF3A • Joint Postdeadline Paper Session II

JF3A.1 • 11:00 Postdeadline Submission

Design and Characterization of Flattop Beam Shapes Through Volume Holographic

Grating for Confocal Imaging, Yuan Luo², Surag A. Suresh¹, J Andrew Yeh¹; ¹*National Tsing Hua Univ., Taiwan;* ²*National Taiwan Univ., Taiwan.* Beam shapes with uniform intensity all over the diameter (flattop) have been designed, recorded, and reconstructed through photopolymer (PQ-PMMA) based volume holographic (VH) optical element with ISO standards for confocal imaging of fluorescent samples.

JF3A.2 • 11:15 Postdeadline Submission

High-Resolution Multicolor 3D Imaging Through Spatial Coherence of Light,

Gianlorenzo Massaro¹; ¹*Universita degli Studi di Bari, Italy.* Wide-field imaging's limitations in 3D applications stem from the trade-off between resolution and depth of field. Using spatially coherent illumination overcomes this, achieving enhanced resolution and depth, enabling advanced 3D microscopy without scanning.

JF3A.3 • 11:30 Postdeadline Submission

Random Illumination Microscopy Using a Few Light Grid Illuminations,

Pierre Barbault¹, Jérôme Idier², Marc Allain¹, Thomas Mangeat³, Simon Labouesse³, Anne Sentenac¹; ¹*Fresnel Institut, France;* ²*LS2N, France;* ³*LITC, France.* Random Illumination Microscopy (RIM) forms a super-resolved reconstruction of the sample from the statistics of images obtained under speckled illuminations. We show that RIM is also effective under few specific light grids to illuminate the sample, improving the temporal resolution of RIM while sustaining robustness to illumination distortion.

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JF3A.4 • 11:45 Postdeadline Submission

Binary Coded Aperture Design by Sphere Packing in Compressive Ultrafast

Photography, Nelson E. Diaz¹, Madhu Beniwal², Felipe O. Guzmán¹, Miguel Marquez², Jinyang Liang², Esteban Vera¹; ¹*Pontificia Univ Catolica de Valparaiso, Chile*; ²*INRS, Centre Énergie Matériaux Télécommunications, Canada*. This work presents a binary coded aperture (CA) design using sphere packing (SP) to determine the number of light entries in a compressive ultrafast photography (CUP) system. Our proposed approach leverages the uniform sensing that yields SP and the temporal shifting induced by the galvanometer to achieve uniform sensing.

JF3A.5 • 12:00 Postdeadline Submission

Computational Hyperspectral Single-Pixel Camera Based on Liquid Crystal Metasurface,

Jiewen Nie^{1,2}, Tao Chen¹, Shan Jiang², Peng Dai², Daping Chu², Haining Yang¹; ¹*School of Electronic and Science and Engineering, Southeast Univ., China*; ²*Centre for Photonic Devices and Sensors, Univ. of Cambridge, UK*. This paper demonstrated a hyperspectral single-pixel imaging camera based on the tunable meta-optics. The demonstration delivered 64x64 hyperspectral 2D imaging with a spectral resolution of 0.5 nm between 1500 nm – 1630 nm.

JF3A.6 • 12:15 Postdeadline Submission

Randomness and Blur Offer Polarimetric Compressed Sensing With Mostly-air Films, Ji

Feng¹, Altai Perry¹, Xiaojing Weng¹, Luat Vuong¹; ¹*Univ. of California at Riverside, USA*. Established methods of sensing light polarization and beam pointing entail a reduction in resolution. Here, we demonstrate that this trade-off can be significantly circumvented with random, air-filled, meso-ordered, diffractive encoders and temporal blur.

14:00 -- 16:00

Room: Ariane 2

CF4A • Advances in 3D Imaging

Presider: Ashley Lyons; Univ. of Glasgow, UK

CF4A.1 • 14:00

Panoramic Integral Imaging for Zero-Light 3D Situational Awareness,

Paul B. Wagenaar¹, Laura V. Cowan², Nick Wood^{1,2}, Andrew R. Harvey¹; ¹*Univ. of Glasgow, UK*; ²*Electro-optics, Thales UK, UK*. We report panoramic multi-camera, integral imaging at thermal infrared wavelengths to yield the first immersive, zero-light 3D imaging system. Our scalable architecture demonstrates automated 3D detection of partially occluded objects in clutter.

CF4A.2 • 14:15

Stairstep Versus Pilot-Tone 3D Imaging: Empirical Signal-to-Noise Ratio Studies,

Matthias T. Banet¹, Felix Wong², James R. Fienup²; ¹*Directed Energy Directorate, US Air Force Research Laboratory, USA*; ²*Inst. of Optics, Univ. of Rochester, USA*. This paper compares motion-insensitive stairstep and pilot-tone coherent 3D imaging in simulation in the presence of noise. Stairstep outperforms pilot-tone on average, but pilot-tone can be superior for facets of the object that have modest slopes.

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CF4A.3 • 14:30

3D Active Structured Illumination Compressive Sensing Using Si-Photonic Optical Phased Arrays, Channing Philbrick^{1,2}, Daniel Feldkhun^{1,3}, Nathan Dostart⁴, Kelvin Wagner¹, Howard Dao⁵, Milos Popovic⁵; ¹*Department of Electrical, Computer, & Energy Engineering, Univ. of Colorado Boulder, USA*; ²*Space & Mission Systems, BAE Systems, Inc., USA*; ³*LambdaMetrics, LLC, USA*; ⁴*Remote Sensing Branch, NASA Langley Research Center, USA*; ⁵*Department of Electrical & Computer Engineering, Boston Univ., USA*. We demonstrate an 8x8 array of addressable 2D wavelength-steered Si-photonic serpentine optical phased arrays producing multiple spatio-spectrally nonredundant arrays of emitters for multibeam interferometric 3D imaging via an active structured illumination compressive sensing technique.

CF4A.4 • 14:45

Fringe Pattern Analysis Using Deep Learning and Physical Priors, Wei Yin¹, Shijie Feng¹; ¹*Nanjing University of Sci. and Tech., China*. We propose a deep-learning-based fringe pattern analysis method that employs physical priors. It can achieve accurate and efficient single-shot phase reconstruction and exhibits strong generalization capability to unseen samples.

CF4A.5 • 15:00 (Top-Scored)

Deep-Learning-Enabled Temporally Super-Resolved Multiplexed Fringe Projection Profilometry: High-Speed kHz 3D Imaging With Low-Speed Camera, Wenwu Chen¹, Shijie Feng¹, Chao Zuo¹; ¹*Nanjing Univ. of Science and Technology, China*. Deep learning-enabled multiplexed fringe projection profilometry allows to achieve high-resolution and high-speed 3D imaging at near-one-order of magnitude-higher 3D frame rate with conventional low-speed cameras. Then the method is demonstrated by measuring a transient scene of bullet fired from a toy gun, at 1,080 Hz using 120 Hz cameras.

CF4A.6 • 15:15

Deep Learning Approach for Full-Field Vibration Profilometry in Time-Averaged Interference Microscopy, Maria Cywinska¹, Wiktor Forjasz¹, Emilia Wdowiak¹, Michal Jozwik¹, Adam Styk¹, Maciej Trusiak¹; ¹*Politechnika Warszawska, Poland*. This work discusses the use of the convolutional neural network to aid the vibration amplitude estimation from time-averaged interferograms. We propose a novel approach fitted to the Bessel function, which outperforms the classical method tailored to cosine variations.

CF4A.7 • 15:30 (Invited)

Scanning-Free Volumetric Imaging Based on Light Correlations, Milena D'Angelo¹, Gianlorenzo Massaro¹, Francesco V. Pepe¹; ¹*Dipartimento di Fisica & INFN Bari, Universita degli Studi di Bari, Italy*. Correlation plenoptic imaging enables scanning-free 3D imaging by exploiting spatio-temporal correlations of light. SPAD arrays and AI are shown to potentially lead to real time high-resolution volumetric. Extension to hyperspectral imaging is also presented.

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14:00 -- 16:00

Room: Caravelle 2

CF4B • Super Resolution

Presider: Piotr Zdankowski, Warsaw University of Technology, Poland

CF4B.1 • 14:00 (Invited)

Advancing Super-Resolution Microscopy Into the Third Dimension, Andrew R. Harvey¹; ¹*Univ. of Glasgow, UK*. We describe how computational imaging enables imaging of extended 3D biological structures with a precision and volume that exceeds the fundamental diffraction limit by orders of magnitude— and in a single snapshot.

CF4B.2 • 14:30 (Invited)

Pseudo Random Illuminations for Live Super-Resolution Imaging, Simon Labouesse¹, Thomas Mangeat¹, Pierre Barbault², Marc Allain², Jérôme Idier³, Anne Sentenac²; ¹*LITC, CBI, France*; ²*Institut Fresnel, France*; ³*LS2N, France*. Random Illumination Microscopy (RIM) requires capturing around 200 fluorescence images with speckle illuminations. Implementing Pseudo-Random Illuminations reduces this number by a factor of 10, enabling robust real-time super-resolution imaging of biological specimens. Our study explore the trade-off between the robustness and speed in pseudo-RIM.

CF4B.3 • 15:00

Twin-Airy Point Spread Function for 3D Super-Resolution Microscopy, Conall J. Thompson¹, Michael Handley¹, Daniel Olesker¹, Jonathan Taylor¹, Andrew R. Harvey¹; ¹*Univ. of Glasgow, UK*. We demonstrate how a Twin-Airy Point Spread Function can be employed in superresolution microscopy to combine state-of-the-art 3D localisation precision and depth of field with the potential for an order-of-magnitude increase in emitter densities.

CF4B.4 • 15:15

Super-Resolution Imaging Based on Compound eye Camera Arrays, Bowen Wang¹, Minqi Wang¹, Chao Zuo¹; ¹*Nanjing Univ. of Science and Technology, China*. We propose a novel computational super-resolution imaging technique, coded aperture super-resolution imaging based on a compound eye camera array, which is to reverse the aliasing information by introducing four different coded modulations.

CF4B.5 • 15:30

Self-Supervised FLIM Super-Resolution Using Data Fusion., Valentin Kapitany¹, Areeba Fatima¹, Vytautas Zickus^{1,2}, Jamie Whitelaw^{4,3}, Ewan McGhee^{1,3}, Robert Insall³, Laura Machesky^{5,3}, Daniele Faccio¹; ¹*Univ. of Glasgow, UK*; ²*Department of Laser Technologies, Center for Physical Sciences and Technology, Lithuania*; ³*Beatson Inst., UK*; ⁴*Univ. of the West of Scotland, UK*; ⁵*Univ. of Cambridge, UK*. Traditional super-resolution methods often rely on extensive training sets, risking out-of-distribution hallucinations. We address by using high-resolution intensity images to self-supervise the upsampling of fluorescence lifetime images, by factors up to 16x16.

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CF4B.6 • 15:45

A Universal High-Resolution Light-Field Framework for Super Large Depth-of-Field Imaging, Yuduo Guo^{2,1}, Fenghai Li¹, Hao Zhang¹, Sen Wan¹, Zhi Lu¹, Jiamin Wu¹, Qionghai Dai¹, Lu Fang²; ¹*Automation, Tsinghua Univ., China*; ²*Electronic Engineering, Tsinghua Univ., China*. We propose a universal light-field framework overcoming resolution degradation without optical modifications, leveraging a supervised recurrent network. This approach enhances spatial resolution and depth-of-field by nearly tenfold, offering a significant advance for light field imaging.

14:00 -- 16:00

Room: Guillaumet 2

DF4H • 3D Acquisition

Presider: Simon Thibault; Université Laval, Canada

DF4H.1 • 14:00 (Invited)

Epi-Illumination Quantitative Phase Imaging (QPI) and 3D Refractive Index (RI) Tomography in Thick Scattering Samples With Quantitative Oblique Back-Illumination Microscopy, Francisco E. Robles¹; ¹*Georgia Inst. of Technology, USA*. Quantitative oblique back illumination microscopy (qOBM) is a novel technology that enables QPI and 3D RI tomography of arbitrarily thick samples. Here I will describe the theory, implementation and exciting biomedical applications of this technology.

DF4H.2 • 14:30 (Invited)

Optical Tomography of Clouds and Atmospheric Turbulence From Space and Ground-Based Cameras, Yoav Y. Schechner¹, Nir Shaul¹, Vadim Holodovsky¹, Amit Aides¹, Klaus Schilling², Ilan Koren³; ¹*Technion Israel Inst. of Technology, Israel*; ²*Zentrum fur Telematik, Germany*; ³*Weizmann Inst. of Science, Israel*. Novel tomographic principles yield 3D atmospheric fields using multi-view imagery. Turbulence strength is mapped by observing scintillation of bulbs. Extinction in clouds is mapped volumetrically from polarimetric cameras onboard a satellite formation.

DF4H.3 • 15:00

Iterative Phase-Retrieval From Single-Shot Recording by Space Division Multiplexing, Sudheesh K. Rajput¹, Ryuju Todo¹, Yuki Kumon¹, Kenzo Nishio¹, Osamu Matoba², Yasuhiro Awatsuji¹; ¹*Kyoto Inst. of technology, Japan*; ²*Center of Optical Scattering Image Science, KOBE UNIV., Japan*. We propose an iterative phase estimation from two diffraction images recorded by space division multiplexing. Two intensity images can be captured by polarization camera after separating object intensity of two planes in different polarization directions

DF4H.4 • 15:15

3D Holography Using Communication Mode Optics, Vinicius de Angelis^{1,2}, Ahmed Dorrah¹, Leonardo A. Ambrosio², David Miller³, Federico Capasso¹; ¹*Harvard Univ., USA*; ²*Univ. of São Paulo, Brazil*; ³*Stanford Univ., USA*. We demonstrate a holographic technique based on interfering the optimum orthogonal communication modes connecting a source plane and a

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receiver volume, enabling 3D holography with high resolution, low cross-talk, and realistic depth perception.

DF4H.5 • 15:30 (Invited)

I-COACH With Structured Beams: 3D Imaging Techniques by a Single Camera Shot Without Two-Wave Interference, Vijayakumar Anand^{2,3}, Joseph Rosen¹; ¹*School of Electrical and Computer Engineering, Ben Gurion Univ. of the Negev, Israel*; ²*Inst. of Physics, The Univ. of Tartu, Estonia*; ³*Optical Sciences Center, School of Science, Computing and Engineering Technologies, Swinburne Univ. of Technology, Australia*. Interferenceless coded aperture correlation holography (I-COACH) is a well-established 3D imaging method that has revolutionized the field of imaging. Here, we summarize the latest developments in I-COACH using ensembles of spatially structured longitudinal light beams.

14:00 -- 16:00

Room: Spot

IF4D • Medical Imaging

Presider: Sandro Heuke; Fresnel Institut, France

IF4D.1 • 14:00 (Invited)

Light Transport Through Scattering Media, Daniele Faccio¹; ¹*Univ. of Glasgow, UK*. We present work motivated by the problem of photon transport through the human head and brain imaging. We demonstrate light guiding mechanisms in scattering media and widefield imaging of brain tissue stiffness for tumour identification.

IF4D.2 • 14:30

Multi-tap CMOS Image Sensor With Programmable Functional Exposure: Application to Structured Light Based Quantitative Tissue Imaging, Yu Feng¹, Naoshi Yoneyama², Kamel Mars³, Yusuke Tanihata², Sota Nakazawa², Kanta Iyanagi², Ryotaro Mori², Manabu Machida⁴, Keita Yasutomi³, Shoji Kawahito³, Keiichiro Kagawa³; ¹*Graduate School of Science and Technology, Shizuoka Univ., Japan*; ²*Graduate School of Integrated Science and Technology, Shizuoka Univ., Japan*; ³*Research Inst. of Electronics, Shizuoka Univ., Japan*; ⁴*Faculty of Engineering, Kindai Univ., Japan*. Multi-tap CMOS image sensors have the capability of programmable exposure. We employed a 4-tap sensor to extend the dynamic range up to 118.3dB for simultaneous imaging of shallow and deep tissues with scanned structured light.

IF4D.3 • 14:45 (Top-Scored)

Effects of Intraocular Straylight on Temporal Contrast Sensitivity, Pilar Casado¹, Victoria Collados¹, Francisco Avila¹, Jorge Ares¹; ¹*Applied Physics, Univ. of Zaragoza, Spain*. This research evaluated temporal contrast sensitivity in a young population at different levels of straylight. The results showed an improvement in temporal contrast sensitivity in the presence of a glare source.

IF4D.4 • 15:00 (Invited)

AI in Medical Imaging, Color and Spectral Imaging, Christine Fernandez-Maloigne¹; ¹*Universite de Poitiers, France*. Abstract not available.

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IF4D.5 • 15:30

Observing Spatially-Varying Elliptical Retardance in the Living Human Eye, Meredith Kupinski¹; ¹*Univ of Arizona, Coll of Opt Sciences, USA*. Mueller polarimetry is used to solve for optimal polariscopic contrast of the human eye. The birefringent cornea produces patterns of retardance exceeding a half wave with a fast-axis varying from linear, circular, and elliptical states.

IF4D.6 • 15:45

Angular Dependence of Scattering Coefficients of Brain Tissues Determined by Wide-Field Time-of-Flight Measurements., André Stefanov¹, Pascal Tijkorte¹, Gijs Hannink¹, Martin Frenz¹; ¹*Universitat Bern, Switzerland*. We present the angle-resolved determination of the scattering coefficients of white and gray matter in brain from wide-field time-of-flight measurements with a time-resolved single-photon camera.

OF4F.6 • 15:45

Performance Analysis of REVOLT From Laboratory and on-sky Tests, TARUN KUMAR¹, David Andersen², Kathryn Jackson³, Maaïke van Kooten³, Olivier Lardiere³, Jean-Pierre Veran³; ¹*Univ. of Victoria, Canada*; ²*TMT International Observatory, USA*; ³*NRC Herzberg Astronomy and Astrophysics, Canada*. REVOLT is an adaptive optics bench to test key adaptive optics technologies being developed by NRC Herzberg. Here, we present the detailed performance analysis of REVOLT including wavefront error budget and compare them with simulations.

14:00 -- 16:00

Room: Argos

OF4F • AO Methods and Applications

President: John Girkin; Durham Univ., UK

OF4F.1 • 14:00 (Invited)

Towards 100% sky Coverage, Challenges and Potential Solutions for tip-Tilt Sensing in Laser Guide Star Adaptive Optics, Noelia Martinez-Rey¹; ¹*Australian National Univ., Australia*. Laser Guide Star Adaptive Optics (LGS AO) corrects atmospheric distortions in astronomy, but determining tip-tilt parameters remains a challenge. This presentation delves into the intricacies of tip-tilt determination in LGS AO, exploring current methodologies, technological advancements, and unresolved issues.

OF4F.2 • 14:30

Selective Modal Excitation of a Nanophotonic Cavity With a Programmable Phase Mask, Antoine Rouxel¹, Antoine Monmayrant¹, Stéphane Calvez¹, Olivier Gauthier-Lafaye¹; ¹*LAAS-CNRS, France*. Selective spatial mode excitation of a grating-coupled multimode micro-cavity is achieved using an incident beam shaped with a programmable phase mask. Real-time control of the phase mask coupled to differential evolution algorithm allows access to individual modes with high selectivity up to the tenth order.

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OF4F.3 • 14:45

Focal Plane Intensity-Based Adaptive Optics With Low-Resolution Image Acquisition,

Oliver Pitts¹, Mohamadreza Pashazanoosi², Idriss A. Ali^{1,3}, Costel Flueraru¹, Antony Orth¹, Steve Hranilovic²; ¹*National Research Council Canada, Canada*; ²*Department of Electrical & Computer Engineering, McMaster Univ., Canada*; ³*School of Electrical Engineering and Computer Science, Univ. of Ottawa, Canada*. An adaptive optics method is proposed and numerically evaluated based on sequential optimization of focal plane pixel phase values using a single-point coupled power measurement, starting from a low-resolution focal plane image.

OF4F.4 • 15:00 (Invited)

Adaptive Optics for Exoplanet Detection From Space, Pierre Baudoz¹; ¹*Observatoire de Paris de Meudon, France*. After describing our knowledge of the field of exoplanets, I will focus on the specific requirements of adaptive optics for such an application and describe the next steps that are underway and planned.

OF4F.5 • 15:30

Holographic Generation of a Cylindrical Vector Beam at the Tip of a Few-Mode Fiber,

Angel S. Cifuentes¹, Miguel Varga¹, Gabriel Molina-Terriza^{1,2}; ¹*Centro de Física de Materiales, UPV-EHU/CSIC, Spain*; ²*Donostia International Physics Center, Spain*. Controlling light at the tip of a multimode fiber holds great potential for sensing applications. Here, we present how by measuring the transmission matrix, we may produce a cylindrical vector beam at the fiber tip.

14:00 -- 16:00

Room: Guillaumet 1

PF4E • Laser and Beacon Applications

Presider: Jeremy Bos; Michigan Technological Univ., USA

PF4E.1 • 14:00 (Invited)

Wavelength Correlation of Fried's Hidden Phase, Milo W. Hyde¹, Jack McCrae¹, Matthew

Kalensky², Mark Spencer^{3,1}; ¹*Air Force Inst. of Technology, USA*; ²*Naval Surface Warfare Center Dahlgren Division, USA*; ³*Joint Directed Energy Transition Office, USA*. We study the wavelength correlation of Fried's hidden phase for use in two-wavelength adaptive optics systems operating in strong scintillation. We find the correlation to be weak implying that there is little benefit to correcting the hidden phase in such systems.

PF4E.2 • 14:30

Using LGS to Calibrate Scintillation for Time Resolved Photometry, Kathryn Hartley¹,

James Osborn¹, Domenico Bonaccini Calia¹, Felipe Pedreros Bustos², Mauro Centrone³, Marco Faccini³, David Jenkins⁴; ¹*Durham Univ., UK*; ²*European Southern Observatory, Germany*; ³*INAF - National Inst. for Astrophysics, Italy*; ⁴*European Space Agency, Germany*. We present a new technique to correct photometric noise produced by atmospheric effects by using a laser guide star, projected along the same line of sight as the astronomical target, as a comparison star.

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PF4E.3 • 14:45

Improvements to the Stacked Beacon TARDIS Analysis, Benjamin C. Wilson¹, Santasri R. Bose-Pillai¹, Jack McCrae¹, Steven Zuraski², Steve Fiorino¹; ¹*AFIT, USA*; ²*Sensors Directorate, Air Force Research Lab, USA*. Improvements to the Turbulence and Aerosol Research Dynamic Interrogation System (TARDIS) analysis are presented. This includes accounting for square sub-apertures and advanced noise reduction. Low signal-to-noise ratio (SNR) still presents challenges for accurate turbulence profiling.

PF4E.4 • 15:00

Laser Beacon Laboratory Surrogate Source, Jason D. Schmidt¹, Richard J. Drye¹, Eric P. Magee¹, Amy M. Ngwele¹, Carl M. Liebig²; ¹*MZA Associates Corporation, USA*; ²*Sensors Directorate, Air Force Research Laboratory, USA*. When laser beacons are sensed with a wavefront sensor, their finite extent often affects the measurements. We discuss development of a surrogate beacon source for laboratory usage when on-sky experiments are unavailable or impractical.

PF4E.5 • 15:15

Convective Asymmetries in Thermal Blooming Experiments, Jeremiah S. Lane¹, Benjamin Akers¹; ¹*Air Force Inst. of Technology, USA*. Simulation and experiment of steady-state thermal blooming of a laser within a confined propagation chamber are compared. The global fluid response to asymmetric laser heating induces local asymmetries in the beam irradiance profile after propagation.

PF4E.6 • 15:30

Optimising Optical Ground Station Locations for Satellite Communications Through Atmospheric Turbulence With Adaptive Optics Mitigation, Oliver J. Farley¹, James Osborn¹; ¹*Durham Univ., UK*. Optimisation of a hypothetical network of optical ground stations in Europe is presented, including outages from both cloud and atmospheric turbulence, with detailed simulation of turbulence mitigation by adaptive optics under diverse turbulence conditions.

14:00 -- 15:30

Room: Diamant

RF4G • RadIT III: Emerging Frontiers

Presider: Cameron Brown; Los Alamos National Laboratory, USA and Zhehui (Jeph) Wang; Los Alamos National Laboratory, USA

RF4G.1 • 14:00 (Invited)

X-ray Diffraction of Shocked Aluminum at Extreme Pressure and Temperature Conditions, Cameron Brown¹, Laura B. Smilowitz¹, Bryan Henson¹, Pam Bowlan¹, Bethany Chidester¹, Dennis Remelius¹, Natalya Suvorova¹; ¹*Los Alamos National Laboratory, USA*. In this talk we describe our progress in designing a benchtop flash X-ray diffraction diagnostic for probing aluminum phase changes in high explosive samples at the Los Alamos National Laboratory LARS facility.

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RF4G.2 • 14:30 (Invited)

Quantum Imaging: Will It Ever Be Practical? How Single-Photon Cameras Could Help, Edoardo Charbon¹; ¹*Ecole Polytechnique Federale de Lausanne, Switzerland*. Abstract not available.

RF4G.3 • 15:00 (Invited)

High-Resolution, High-Speed CMOS Image Sensors for SWIR, X-Ray and Electrons, Renato Turchetta¹; ¹*IMASENIC Advanced Imaging S.L., Spain*. I will present our latest high-resolution and high-speed CMOS image sensors for imaging beyond the visible, including the world-fastest, high-resolution, wafer-scale CMOS image sensor, which has 4MPixel and over 5,000 fps in full frame.

14:00 -- 16:00

Room: Ariane 1

SF4C • Distributed Optical Fiber Sensors II

Presider: Katerina Krebber; Federal Inst. for Materials Research, Germany

SF4C.1 • 14:00 (Invited)

Long-Range, Telecom-Compatible Distributed Sensing Using Chirped-Pulse DAS, Ezra Ip¹; ¹*NEC Laboratories America Inc., USA*. There is recent interest in overlaying distributed sensing over telecom infrastructure for wide-area remote sensing. We review recent work using chirped pulse DAS, and discuss enabling technologies and node architectures needed to support long-range distributed sensing.

SF4C.2 • 14:30

Coherent Spectral Averaging on Time-Expanded ϕ OTDR, Miguel Soriano-Amat¹, Neethu Sasikumar², Balaji Srinivasan², Sonia M. Martin-Lopez¹, Miguel Gonzalez-Herraez¹, Maria R. Fernandez-Ruiz¹; ¹*Universidad de Alcala, Spain*; ²*Indian Inst. of Technology Madras, India*. We experimentally demonstrate 4-fold improvement in measurement accuracy of a TE- ϕ OTDR through averaging of the downconverted spectrum across 11 consecutive Nyquist zones.

SF4C.3 • 14:45

Distributed Dynamic Temperature and Strain Discrimination Based on Brillouin Enhanced Four-Wave Mixing and Rayleigh Scattering, Yuan Wang¹, Xiaoyi Bao¹; ¹*Univ. of Ottawa, Canada*. We demonstrate a hybrid Brillouin and Rayleigh sensing system for simultaneous temperature/strain measurement, achieving dynamic and high spatial resolution ability with state of art discrimination noises of $2.7\text{ n}\epsilon/\sqrt{\text{Hz}}$ and $0.12\text{ m }^\circ\text{C}/\sqrt{\text{Hz}}$, respectively.

SF4C.4 • 15:00

Acoustic Source Localisation Based on Distributed Acoustic Sensing and Sequential Least Squares Programming, Diego Badillo¹, Marcelo A. Soto¹; ¹*Universidad Técnica Federico Santa María, Chile*. A method based on beamforming and sequential least squares programming is proposed for acoustic source localisation using fibre-optic distributed acoustic sensors. The method is experimentally validated and compared with another state-of-the-art approach.

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SF4C.5 • 15:15

A Novel NA-OFDR Method for Distributed Vibration Sensing Based on I/Q Demodulation, Alayn Loayssa², Raffaele Vallifuoco¹, Rizwan Zahoor¹, Luigi Zeni¹, Aldo Minardo¹; ¹*Univ della Campania Luigi Vanvitelli, Italy*; ²*Inst. of Smart Cities and Department of Electrical, Electronic and Communications Engineering, Universidad Pública de Navarra, Spain*. We demonstrate the use of an I/Q demodulation scheme to detect the Rayleigh backscatter generated by a double sideband (DSB) modulated probe light. The demodulated signal reveals the location and amplitude of any perturbation occurring along the fiber

SF4C.6 • 15:30

Optical Frequency-Domain Reflectometry for Distributed Thermal Monitoring Inside Lithium-Ion Pouch Cell, Sanghoon Chin¹, Mohammed Srout¹, Jannis Holzer¹, Séverine Denis¹, Andrea Ingenito¹, Yves Stauffer¹; ¹*CSEM SA, Switzerland*. We have successfully integrated a strand of optical fiber inside a lithium-ion pouch cell as optical sensor. Then, an optical frequency-domain reflectometer is connected to the sensing fiber for distributed temperature monitoring inside the battery.

SF4C.7 • 15:45

U-Bent Fiber Optic Sensor Probe Coated With Cobalt-Doped UiO-66 as Cadmium Ion Sensor, Sourav Dutta^{2,1}, Swetha Menon², Nandini Swaminathan², Narayanan Madaboosi¹, V. V. Raghavendra Sai²; ¹*Department of Biotechnology, Indian Inst. of Technology Madras, India*; ²*Applied Mechanics and Biomedical Engineering, Indian Inst. of Technology Madras, India*. Cadmium ions are human carcinogenic environmental toxins that demand vigilant monitoring to ensure water quality. Here, a Cobalt-doped UiO-66 coated fiber optic sensor is developed for the selective and sensitive detection of Cd(II) ions within its permissible limits.

16:30 -- 18:00

Room: Diamant

RF5B • RadIT IV: Enabling Materials and Technologies

Presider: Francesca Cova; Univ. of Milano-Bicocca, Italy and Anton Tremsin; Univ. of California, Berkeley, USA

RF5B.1 • 16:30 (Invited)

Novel Scintillators for Radiation Detection and Medical Imaging, Francesca Cova¹; ¹*Univ. of Milano-Bicocca, Italy*. In medical imaging, the main building blocks of radiation detectors are scintillating materials, that absorb and down-convert the energy deposited by incoming ionizing radiation to low-energy UV-Vis-IR light, which is easily readout by common photodetectors.

RF5B.2 • 17:00 (Invited)

Large Grain Scintillator Screens for Imaging, Christopher Morris¹; ¹*Los Alamos National Laboratory, USA*. Abstract not available.

RF5B.3 • 17:30 (Invited)

Development of a Robust Laser-Driven X-Ray Source for Medical Imaging, Francesca Mastropietro¹; ¹*ALPhANOV, France*. Abstract not available.

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16:30 -- 18:00

Room: Caravelle 2

SF5A • Optical Fiber Sensors

Presider: Ali Masoudi; Univ. of Southampton, UK

SF5A.1 • 16:30

3-Axis Fiber-Optic Acoustic-Velocity Hydrophone Based on Castor-oil-Loaded Fiber-Laser Cantilever, Mo Chen¹, Jiaze Zhao¹, Jianfei Wang¹, Xiaoyang Hu¹, Zhou Meng¹, Yang Lu¹; ¹*College of Meteorology and Oceanology, National Univ. of Defense Technology, China.*

We demonstrate a three-axis fiber-optic acoustic-velocity hydrophone based on three orthogonal planar fiber-laser cantilevers in a shell full of castor oil. It presents pressure sensitivity independent of frequency and excellent directivity. It can find many applications in low frequency acoustic signal measurement, and etc.

SF5A.2 • 16:45

Smart Traffic Monitoring Based on Chirped-Pulse Distributed Acoustic Sensing, Jorge Canudo^{2,1}, Pascual Sevillano², Javier Preciado-Garbayo¹, Jesús Subías², Miguel Angel Pastor³, Alfonso Ortega³, Luis Vicente³, Carlos Heras⁴; ¹*Aragon Photonics Labs, Spain;* ²*Applied Physics, Universidad de Zaragoza, Spain;* ³*Inst. of Engineering Research (I3A), Universidad de Zaragoza, Spain;* ⁴*Electronic and Communications Engineering, Universidad de Zaragoza, Spain.* Distributed fiber optic sensing technology has emerged as a cost-effective solution to infrastructure monitoring where real-time measurements of high spatial resolution are required, such as road traffic. By monitoring vibrations induced by vehicles via CP- Φ OTDR technique, information of single vehicles and road status can be obtained in real-time.

SF5A.3 • 17:00

A Fiber SPR Respiration Monitoring Device Based on SF-LiBr Composite Film, Zhuo Ren^{1,2}, Yu Zhang^{1,2}, Yifan Qin^{1,2}, Huigai Guo^{1,2}, Zihai Liu^{1,2}; ¹*Key Laboratory of In-Fiber Integrated Optics, Ministry of Education, Harbin Engineering Univ., China;* ²*Key Laboratory of Photonic Materials and Device Physics for Oceanic Applications, Ministry of Industry and Information Technology of China, Harbin Engineering Univ., China.* This article proposes fiber surface plasmon resonance (SPR) respiration sensor based on a LiBr-doped silk fibroin film. The refractive index of SF-LiBr composite film changes with changes in humidity, so respiratory status can be monitored.

SF5A.4 • 17:15

Phase-Sensitive OTDR System Based on an Improved 3x3 Coupler Demodulation Scheme, Jianzhong Zhang¹, Tingyu Wang¹, Zhe Ma¹, Mingjiang Zhang¹; ¹*Taiyuan Univ. of Technology, China.* We propose an improved 3x3 coupler phase demodulation scheme, which includes a three-port cross-side detection module and demodulation algorithm, enhancing the spatial resolution and phase demodulation quality of the interferometer-based ϕ -OTDR system.

SF5A.5 • 17:30

Bessel Beam Trapping Based Fabrication of a 'Nanoparticle Over Metal' - SERS Platform With Enhanced Performance, Riya Choudhary¹, Kaushal Vairagi², Samir K. Mondal², Sachin K. Srivastava^{1,3}; ¹*Department of Physics, Indian Inst. of Technology, Roorkee, India;* ²*Micro and*

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Nano Optics Centre (μ -NOC), CSIR-CSIO, Chandigarh, India; ³Center for Photonics and Quantum Communication Technology, Indian Inst. of Technology Roorkee, India. A nanoparticles over metal (NPoM) SERS platform was fabricated using Bessel beam based trapping. Our method yields 5-fold enhancement in SERS as compared to the drop cast method, and hence, has enhanced sensing capability.

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JD6A • Joint Poster Session (On Demand)

JD6A.1

A Six-Core Microstructured Fiber for Sensing Applications, Akshat Agarwal¹, Shweta Mittal¹, Sushma Punia¹, Ankur Saharia¹, Anton V. Burdin², Oleg G. Morozov³, Ivan K. Meshkov⁴, Yaseera Ismai⁵, Ghanshyam Singh⁶, Manish Tiwari¹; ¹*Manipal Univ. Jaipur, India*; ²*Department of Communication Lines, PSUTI, Samara 443010, Russia, Russian Federation*; ³*Department of Radiophot. and Microwave Tech., Kazan National Research Technical Univ., Kazan 420111, Russia, Russian Federation*; ⁴*Department of Telecommunication Systems, Ufa Univ. of Science and Technology, Ufa 450000, Russia, Russian Federation*; ⁵*Department of Physics, Stellenbosch Univ., Stellenbosch, 7600, South Africa, South Africa*; ⁶*ECE MNIT Jaipur, India*. A surface plasmon resonance biosensor design is presented, comprising of gold - coated six-core microstructured fiber. The designed sensor exhibits phase matching characteristics for a wider refractive index range of 1.37 - 1.41

JD6A.2

High-Speed Phase Transition Imaging Using Spike Streams, Bo Xiong¹, Ruliang Wang², You Zhou³, Xuyang Sun⁴, Yaxiong Yang⁵, Changqing Su¹; ¹*National Engineering Research Center of Visual Technology, Peking Univ., China*; ²*School of Medicine, Tsinghua Univ., China*; ³*Nanjing Univ. Medical School, China*; ⁴*School of Engineering Medicine, Beihang Univ., China*; ⁵*School of Biological Science and Medical Engineering, Beihang Univ., China*. Phase transition process occurs rapidly and at unpredictable time, posing challenges for traditional cameras to capture the entire process at high speed. Here, we present a self-supervised learning enhanced high-speed phase transition imaging method based on spike streams.

JD6A.3

Simple Fluorescent Sensors Based on ZnS-Doped Mn Capped Chitosan Nanomaterials to Detect Ampicillin, Son Nguyen¹, Van-Nhat Nguyen², Mai Tran^{2,3}; ¹*School of Mechanical Engineering, Hanoi Univ. of Science and Technology, Viet Nam*; ²*College of Engineering and Computer Science, VinUniv., Viet Nam*; ³*VinUni-Illinois Smart Health Center, VinUniv., Viet Nam*. The paper introduces an optical biosensor based on ZnS-doped Mn capped chitosan for detecting ampicillin. The sensor demonstrates high sensitivity from 13.1 to 72.2 μM and has a detection limit of 5.42 μM .

JD6A.4

Thermal Analysis of Photodetectors in Steady-State, Ishraq Md Anjum¹, Alexander S. Hastings², David A. Tulchinsky², Keith J. Williams², Curtis R. Menyuk¹, Ergun Simsek¹; ¹*UMBC, USA*; ²*U.S. Naval Research Laboratory, USA*. This study introduces a method to approximate temperature distribution in steady-state photodetectors under optical excitation. Findings underscore the influence of temperature on key attributes, revealing overestimation with constant temperature assumptions. Insights aid in optimizing photodetector performance.

JD6A.5

Simulation of Overlapped FBG Sensors in a Sensor Network for Strain Measurement, Sugumar Venkatesan¹, Subashini Ponnusamy², Kathirvel Venugopal³, Pandian Chelliah¹; ¹*Ramakrishna Mission Vivekananda College, India*; ²*Department of Computer Science,*

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Government Arts College for Men, Nandanam, India; ³*Department of Physics and Nanotechnology, SRM Inst. of Science and Technology, India.* FBGs with overlapped spectra in a series network are interrogated with spectral division multiplexing (SPDM) for strain measurement. SPDM converts the wavelength interrogation into a non-linear regression curve-fitting problem. Neural networks are employed to solve this.

JD6A.6

Distributed Optic Fiber Sensing With High Frequency Response and Multi-Points Phase Demodulation, Kun Jia¹, Xin Lai¹, Qiaobo Wang¹, Yixiao Ma¹, Lai Zhang¹, Qian Xiao¹, Bo Jia¹; ¹*FUDAN UNIV., China.* A novel distributed optic fiber vibration sensing system is proposed by combining an in-line Sagnac interferometer and ϕ -OTDR. The system can realize high frequency response and multi-points phase demodulation.

JD6A.7

Single-Shot Illumination-Multiplexed Macroscopic Fourier Ptychography With a Camera Array, Sheng Li¹, Bowen Wang¹; ¹*NJUST, China.* We demonstrate a high-time-resolution macroscopic Fourier ptychographic imaging methodology. A 5 × 5 monochromatic camera array is designed for the acquisition of low-resolution images with three-wavelength illuminations, allowing high spatial-bandwidth product (SBP) reconstruction with snapshot.

JD6A.8

Synchronous Angio-Lymphography Based on Speckle Spectrum Contrast OCT, Yudan Hu¹; ¹*Jiangxi Science & Technology Normal Uni, China.* A speckle spectrum contrast optical coherence tomography (SSC-OCT) technique is proposed for achieving synchronous imaging of blood vessels and lymphatic vessels, solving misidentification of blood vessel walls, and detecting tumor lymphangiectasia.

JD6A.9

Damping Analysis of Optical Fiber Inverted Pendulum Seismometer With Rubber Ring, Wentao Zhang¹, Yiqian Huang¹, Wenzhu Huang¹; ¹*Chinese Academy of Sciences, China.* Using a rubber ring as the damping element, the sensitivity of the optical fiber inverted pendulum seismometer increases from 1250.3 rad/g to 1715.7 rad/g, along with effective mitigation of the resonance peak.

JD6A.10

Vibration Signal Analysis of Fiber Optic Seismometers for Intrusion Recognition in Subway Tunnels, Wentao Zhang¹, Guisheng Zhao¹, Wenzhu Huang¹, Fang Li¹; ¹*Chinese Academy of Sciences, China.* Time-frequency analysis is used in recognition of subway tunnel vibration signals. The results show that the feature extracted from the energy distribution can be used in identifying the drilling events.

JD6A.11

Optimized Design of Thick Holography Based on Deep Learning and Fourier Modal Method, Nanxing Chen¹, Yubin Cao², Jiandong Meng³, Jianyi Li¹, Qingbo Yang¹, Kairui Cao¹; ¹*Harbin Inst. of technology, China;* ²*Space Center, Innovation Inst., CSCN, China;* ³*Zhongxing Telecommunication Equipment Corporation, China.* This paper introduces a deep neural

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network architecture, which is inspired by the Fourier modal method, facilitating layered iterative processing of thick holography to achieve high diffraction efficiency.

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FD1 • On Demand Oral Session

FD1.1 (Top-Scored)

Optical Characterization of Thin Films From Transmission Data Using Deep Learning, Manuel Ballester Matito¹, Christoph Würsch², Emilio Marquez³, Florian Willomitzer⁴, Aggelos Katsaggelos¹; ¹*Northwestern Univ., USA*; ²*OST Eastern Switzerland Univ. of Applied Sciences, Switzerland*; ³*Cadiz Univ., Spain*; ⁴*Wyant College of Optical Sciences, Univ. of Arizona, USA*. We present a novel Deep Learning technique based on a CNN-LSTM architecture that directly performs the optical characterization of thin-film materials from their UV-VIS-IR transmission spectra.

FD1.2

Application of Image Processing in Optical Method, Moiré Deflectometry for Investigating the Optical Properties of Zinc Oxide Nanoparticle, Fatemeh Jamal¹; ¹*vali-e-asr Univ., Iran (the Islamic Republic of)*. In this paper, Moiré deflectometry is the main optical method used to determine for measure the refractive index of zinc oxide nanomaterial with two different stabilizers.

FD1.3

A 2D Single-Core Chirped Fiber Bragg Gratings (CFBGs) Utilizing Spatial Encoding Near-Field Diffraction Lithography, Min Zhu¹, Pan Xu¹, Jun Wang¹, Peng Zhang¹; ¹*national Univ. of defense technology, China*. A 2D chirped fiber Bragg gratings (CFBGs) in single mode fiber based on spatial encoding near-field diffraction lithography was proposed.

FD1.4

Locating Objects Inside Scattering Media Through Foveated Sampling, Muralidhar Madabhushi Balaji¹, Danyal Ahsanullah¹, Prasanna V. Rangarajan¹; ¹*Southern Methodist Univ., USA*. This submission presents a framework that utilizes foveated sampling to reduce the ill-posedness of the diffuse optical imaging inverse problem in locating objects embedded inside a scattering medium.

FD1.5

Metalens-Based Snapshot Ptychography, Xiao Wang¹, Ni Chen¹, Chengyu Wang¹, Johannes Froech², Arka Majumdar², David J. Brady¹; ¹*Wyant College of Optical Sciences, Univ. of Arizona, USA*; ²*Department of Electrical and Computer Engineering, Univ. of Washington, USA*. We demonstrate a wavefront camera using a metalens. The metalens consists of a 5 by 5 array of overlapping focal apertures. We use a hybrid neural phase retrieval algorithm to image remote complex valued fields.

FD1.6

Simulating Diffusion and Repulsion of Charges in Single Photon Semiconductor Detectors, Manuel Ballester Matito¹, Jaromir Kaspar², Francesc Massanés², Alexander Hans Vija², Aggelos Katsaggelos¹; ¹*Northwestern Univ., USA*; ²*Siemens Medical Solutions USA, USA*. We introduce a novel Monte Carlo approach for simulating charge propagation in semiconductor detectors, accounting for Coulomb repulsion and diffusion over time.

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FD1.7

Timely Wildfire Perimeter Mapping for Unmanned Aerial Platforms, Andrew Rittenbach¹, Connor Imes¹, John Paul Walters¹; ¹*USC Information Sciences Inst., USA*. Wildfire perimeter mapping currently relies on deferred processing of data from manned and orbital platforms using hand-tuned physics-based models. We demonstrate real-time on-board multispectral data processing on cost-efficient unmanned aerial platforms using ML-based semantic segmentation.

FD1.8 (Top-Scored)

Experimental Evaluation of Photothermal Conversion Magnetite Nanofluids Under the Influence of Dynamic Magnetic Field., Juan J. Alcalde Castro¹, Laura Álvarez-Gil¹, Alejandro Restrepo-Martinez¹; ¹*Universidad Nacional de Colombia- Sede Medellín - Facultad de Minas. Departamento de Ingeniería Mecánica. Grupo GPIMA - Núcleo el Río, Bloque 04. Carrera 64C No. 63 – 120, Medellín, Código Postal 050034 - Colombia, Colombia*. The study investigates improved energy conversion efficiency in solar thermal systems using an oscillating magnetic field in nanofluid applications. Three concentrations of magnetite/ethylene glycol nanoparticles and ethylene glycol alone are evaluated.

FD1.9

Simulation of Quasi-Bound States in the Continuum Driven All-Dielectric Nano-Slit Array-Based Sensor: Probing Absorptive Analytes Under Visible Light, Swapnil Khurana¹, Sachin K. Srivastava^{1,2}; ¹*Department of Physics, Indian Inst. of Technology Roorkee, India*; ²*Centre for Photonics and Quantum Communication Technology, Indian Inst. of Technology Roorkee, India*. An all-dielectric quasi-BIC sensor with narrow linewidth has been simulated for detecting absorptive analytes. The spectral and transmittance sensitivities were calculated to be 204.08 nm/RIU, and 1223.045 %/RIU, respectively.

FD1.10

Polarized Microscopy Based on Liquid Crystals and a Polarization Camera: new Tools for Studying Oocytes, Alejandro Restrepo-Martinez¹, Juan J. Alcalde Castro¹, Giovanni Restrepo Betancur¹; ¹*Universidad Nacional de Colombia, Colombia*. A strategy combining liquid crystal retarders and a polarization camera with an optical microscope was developed. Results show of the meiotic spindle oocyte, indicating stage of maturation.