

Frontiers in Optics + Laser Science Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 25 September. For updated and complete information with special events, reference the online schedule or mobile app.

Monday, 28 September

Grand Lilac Ballroom North

08:00 -- 09:00

FM1A • Complex States of Light

Presider: Eileen Otte; Univ. of Rochester, USA

FM1A.1 • 08:00

Correlations of Speckle from Ultrafast Pulsed Light Through Heavily Scattering Media, David W.

Alexander¹, Christopher M. Lacny¹, Kevin J. Webb¹; ¹*Purdue Univ., USA*. We demonstrate time-correlated single-photon counting for measuring speckle from an ultrafast pulsed laser through heavily scattering media, while maintaining utility in imaging scenarios despite severe degradation of the speckle contrast ratio.

FM1A.2 • 08:15

Structuring Optical Coherence in Nonlinear Optics, Zihao Pang¹, Ady Arie¹; ¹*Tel Aviv Univ., Israel*. We propose and experimentally validate a nonlinear optical extension of the van Cittert-Zernike theorem, showing that both the shaped incoherent pump and engineered nonlinearity control the optical coherence at the second harmonic.

FM1A.3 • 08:30 (Invited)

Structured Beams for Ultrafast and Real-Time Extreme Ultraviolet Ptychography, Giulia Fulvia

Mancini¹, Nicola Giani¹, Claudia Schrama¹; ¹*Universita degli Studi di Pavia, Italy*. We report the generation and optimization of extreme ultraviolet structured beams for ultrafast and single-shot ptychography, and compare results from Tabletop and Free Electron Laser experiments.

Highland Room AK

08:00 -- 09:00

FM1B • Photonic Mode Design

Presider: Jeffrey Holzgrafe; HyperLight Corporation, USA

FM1B.1 • 08:00

Unsupervised Generative Inverse Design of Fabrication-Aware Freeform Nanophotonic Devices, Wendi

Xu¹, Sha Liu¹, Jirong Bao¹, Haining Yang¹, Mengdi Sun¹; ¹*Southeast Univ. (China), China*. We present a physics-driven, unsupervised generative inverse design framework for fabrication-aware nanophotonics. Without prior datasets, it synthesizes 2x2 photonic matrix-vector multipliers in a single forward pass with a 1.74×10^{-4} average error in 1.5 milliseconds.

FM1B.2 • 08:15

PINN Inspired Effective Index Prediction of Strip Waveguides for Fundamental Modes, Jaymit M.

Surve¹, Martin Sanchez¹, Christer Everly¹, Sophia A. Korono¹, Lukas Weituschat¹, Pablo Postigo¹; ¹*Univ. of Rochester, USA*. We present a PINN-inspired effective index prediction for strip waveguides accounting for sidewall angle, achieving $< 0.017\%$ error versus COMSOL simulations and high prediction accuracy of $R^2 = 0.9992$, outperforming the conventional effective index method.

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FM1B.3 • 08:30 (Invited)

Engineering High-Dimensional Light with Integrated Multimode Waveguides, Stefan Rothe¹;

¹*Universiteit Twente, Netherlands*. Integrated wavefront shaping transforms multimode waveguides into programmable photonic processors. This talk introduces distributed control of multimode propagation and highlights multimode photonics as versatile and scalable devices for communications, quantum technologies, and waveguide amplifiers.

Highland Room BJ

08:00 -- 09:00

FM1C • Novel Optical Fibers: Multicore, Hollow Core, and Beyond

Presider: Giovanni Milione; Sintela, Inc., USA

FM1C.1 • 08:00 (Invited)

Trends in New Optical Fibers: Opportunities and Challenges, Ming-Jun Li¹; ¹*Corning Inc., USA*. This talk explores recent advancements in optical fiber technology for enhancing fiber transmission capacity and optical interconnect density. It will examine opportunities of these new optical fibers as well as challenges for practical applications.

FM1C.2 • 08:30

Reducing Core Number for Efficient Return Loss Testing of Random Mated Multi-Core Fiber MPO

Connectors, Chisato Fukai¹, Ryo Koyama¹, Takui Uematsu¹, Yukiko Sawano¹, Nobutomo Hanzawa¹;

¹*Access Network Service Systems Labs., NTT, Inc., Japan*. We investigate influence of core numbers on measured return loss of random mated 4-core fiber MPO connectors. Results show that measuring two diagonally arranged cores yield results equivalent to those of measuring all four cores.

FM1C.3 • 08:45

Effect of Mode Field Shape Matching on the Direct Coupling Efficiency Between Hollow-Core Photonic Bandgap Fibers and Waveguides, Zequan Li¹, Xiaobin Xu¹, Jinjing Xie¹, Fuyu Gao¹, Qifeng Zuo¹; ¹*Beihang Univ., China*. This work investigates the main factors limiting the direct coupling efficiency between hollow-core photonic bandgap fibers and integrated-optic circuits, and reveals that better mode field shape matching improves direct coupling efficiency.

Highland Room CH

08:00 -- 09:00

FM1D • Visible-Wavelength Integrated Photonic Devices

Presider: Seth Catano; Blue Laser Fusion Inc

FM1D.1 • 08:00 (Invited)

Scaling Visible Photonic Integrated Circuits, Aseema Mohanty¹; ¹*Tufts Univ., USA*. This talk will highlight recent work in silicon nitride visible photonic integrated circuits towards scalable multiplexing structures for precise and dynamic chip-scale light delivery for quantum and neuroscience applications.

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FM1D.2 • 08:30

Nonlocal Metasurface Hybridized Bloch Resonant Cavity InGaN/GaN MicroLEDs, Roark Chao¹, Stephen Gee², Shuji Nakamura², Steven DenBaars^{1,2}, Jon Schuller¹; ¹*Department of Electrical and Computer Engineering, Univ. of California, Santa Barbara, USA*; ²*Materials Department, Univ. of California, Santa Barbara, USA*. We demonstrate hybridized metasurface–nanoporous DBR cavities for InGaN/GaN microLEDs, enabling Bloch-resonant emission control with enhanced intensity, spectral narrowing, and beam shaping for compact and next-generation visible displays and optical links.

FM1D.3 • 08:45

On-Chip Fourth-Harmonic UV Light Generation in a Silicon Nitride Microresonator, Arghadeep Pal^{1,2}, Alekhya Ghosh^{1,2}, Haochen Yan^{1,2}, Shuangyou Zhang⁴, Luca O Trinchão^{1,3}, Toby Bi^{1,2}, Gustavo S. Wiederhecker³, Pascal Del'Haye^{1,2}; ¹*Max-Planck-Inst Physik des Lichts, Germany*; ²*Physics Department, Friedrich Alexander Univ., Germany*; ³*Gleb Wataghin Physics Inst., Univ. of Campinas, Campinas 13083-859, Brazil, Brazil*; ⁴*Technical Univ. of Denmark, Denmark*. We demonstrate fourth-harmonic UV generation in a single integrated silicon nitride microresonator, reaching the lower-wavelength edge of its transparency window at 398 nm. Second and third harmonics are also generated simultaneously.

Highland Room DG

08:00 -- 09:00

FM1E • Optical Methods for Biomedical Characterization

Presider: Ruikang Wang; Univ. of Washington, USA

FM1E.1 • 08:00

Light Sheet Optical Tweezers as a Force Transducer for *in Situ* Mechanical Characterization of Soft Tissue, Krishangi Krishna¹, Gannon Lemaster¹, Kimani C. Toussaint Jr.¹; ¹*Brown Univ., USA*. We present the first optical tweezers platform for direct biomechanical interrogation of soft tissues, integrating femtosecond-pulsed light-sheet trapping, digital videography, two-photon excitation microscopy for high-throughput mechanical characterization with simultaneous microstructural visualization.

FM1E.2 • 08:15

Slant Stack Transform of Optically Measured Rayleigh Waves Generated by Acoustic Radiation Force, Mariella Pellmann¹, Jinjun Xia¹; ¹*Lawrence Technological Univ., USA*. We developed an air-coupled fiber-optic Sagnac interferometer elastography for biological tissue mechanical property characterization [1]. Slant stack transform was used to visualize the time delay for three different concentrations of tissue mimicking phantoms.

FM1E.3 • 08:30

Skin-Tone Bias in Pulse Oximetry: A First-Principles Model and Three-Wavelength Solution, Gurnoor Kaur², Simarjeet S. Saini¹; ¹*Univ. of Waterloo, Canada*; ²*Cameron Heights Collegiate Inst., Canada*. Pulse oximetry overestimates oxygen saturation in dark-skinned patients. We show this is a tissue-transport effect predictable from first principles via two-scale effective medium theory, and that a third LED near 800 nm eliminates it.

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FM1E.4 • 08:45

Ultra-Low Frequency Raman Spectroscopic Characterization of Finerenone, Kashika Khatri¹, Amartya Sengupta¹, Aparajita Bandyopadhyay¹; ¹*Indian Inst. of Technology Delhi, India*. Finerenone is a drug used to treat chronic kidney disease. In this study we report for the first time the ultra-low frequency Raman spectrum of pure Finerenone down to $\pm 10 \text{ cm}^{-1}$ extracted from commercial Kerendia® 20mg tablets.

Grand Lilac Ballroom South

08:00 -- 09:30

LM1F • LS Dissertation Award Presentations

Presider: Michael Chini; Ohio State Univ., USA

LM1F.1 • 08:00 (Invited)

Coherent Chemistry in the Gas Phase, Ian Gabalski¹; ¹*Department of Chemistry, Univ. of California Davis, USA*. This thesis develops and applies femtosecond strong-field and X-ray laser methods to link evolving molecular spectra and structure, image the rearrangement of valence electrons, and coherently control chemical reactions with intense light fields.

LM1F.2 • 08:30 (Invited)

Sculpting Light across Space, Frequency, and Time, Olivia Long¹; ¹*University of California Berkeley, USA*. We investigate light control across space, frequency, and time through engineered light-matter interactions in photonic crystals, modulated ring resonators, and transient light excitations to enable new optical functionalities and probe fundamental physical phenomena.

LM1F.3 • 09:00 (Invited)

Exploiting Electron Dynamics in Petawatt Laser Fields for Fundamental Measurements, Smrithan Ravichandran¹; ¹*Laboratory for Laser Energetics, Univ. of Rochester, USA*. We demonstrate that the distribution of electrons expelled from residual gas in the focal volume of petawatt lasers provides critical information for improved control of extreme fields, enabling precision measurements of nonlinear quantum electrodynamics.

Grand Lilac Ballroom North

09:15 -- 10:00

FM2A • FIO Visionary Session I: Space Optics

Presider: Zachary Lapin; Fibertek Inc., USA

FM2A.1 • 09:15 (Visionary)

NASA Laser Communications Networks, Gregory Heckler¹; ¹*NASA Laser Communications Networks, USA*. Abstract not available.

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Grand Lilac Ballroom North

10:30 -- 12:00

FM3A • Space Optics Theme: Space Optics in NASA Programs

Presider: Zachary Lapin; Fibertek Inc., USA

FM3A.1 • 10:30 (Invited)

The Laser Interferometer Lunar Antenna (LILA), James Trippe¹; ¹*Vanderbilt Univ., USA*. The Laser Interferometer Lunar Antenna (LILA) program aims to place a midband interferometric gravitational wave detector on the Moon. Multimessenger astronomy, cosmological background measurements, and tests of quantum gravity are among LILA's science goals.

FM3A.2 • 11:00 (Invited)

Roman Space Telescope: Optical Telescope Assembly, Peter Miller¹; ¹*L3Harris, USA*. The Nancy Grace Roman Space Telescope is NASA's next flagship astrophysics observatory. An overview of the mission science goals, telescope design, and predicted optical performance will be presented, focusing on the Optical Telescope Assembly.

FM3A.3 • 11:30 (Invited)

The NASA Landolt Mission, Peter Plavchan¹; ¹*George Mason Univ., USA*. The NASA Landolt mission will launch in 2029 NIST-calibrated single-mode fiber-fed laser beacons to a geostationary orbit to calibrate ground-based telescopes and address key astrophysics questions limited by the accuracy of stellar brightnesses.

Highland Room AK

10:30 -- 12:30

FM3B • Quantum Information Processing

Presider: Yingwen Zhang; Univ. of Ottawa, Canada

FM3B.1 • 10:30 (Invited)

High Dimensional Quantum Information Processing, Mehul Malik¹; ¹*Heriot-Watt Univ., UK*. The multi-modal properties of quantum light promise a pathway towards scalable and noise-robust quantum technologies. In this talk, I will introduce the field of high-dimensional quantum photonics and discuss how we control and manipulate highly complex quantum states of light encoded in the space and time.

FM3B.2 • 11:00

Programmable Photonic Realization of a Continuous-Variable QAOA Ansatz, Shota Yokoyama¹, Atsushi Sakaguchi¹, Jun-ichi Yoshikawa¹, Hironari Nagayoshi², Warit Asavanant^{3,1}, Kan Takase^{3,1}, Takuji Hiraoka^{4,3}, Akira Furusawa^{2,1}, Hidehiro Yonezawa¹; ¹*Riken, Japan*; ²*The Univ. of Tokyo, Japan*; ³*OptQC Corp., Japan*; ⁴*Fixstars Amplify Corporation, Japan*. We demonstrate a programmable photonic continuous-variable quantum approximate optimization algorithm (QAOA) ansatz on a quad-rail-lattice cluster state, enabling the experimental investigation of quadratic optimization problems up to 100 variables and 5 depths.

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FM3B.3 • 11:15

Ultrafast Time-Multiplexed Heralded Single Photon Source, Nathan Roberts^{1,2}, Philip J. Bustard¹, Duncan England¹, Frédéric Bouchard¹, Guillaume Thekkadath¹, Benjamin J. Sussman^{1,2}; ¹*National Research Council Canada, Canada*; ²*Univ. of Ottawa, Canada*. Single-photon sources based on spontaneous parametric down-conversion are inherently probabilistic. Here we use ultrafast time-bins, free-space delay lines, and a binary division multiplexing scheme to improve the brightness of our single photon source.

FM3B.4 • 11:30

Relativistic Bohmian Trajectories of a Single Photon, Sayantan Das¹, Daniel S. Dahl³, Daniel Peace¹, Marcelo P. Almeida¹, Abhishek Roy², Markus Rambach¹, Andrew G. White¹, Timothy C. Ralph¹, Jacqueline Romero¹; ¹*Univ. of Queensland, Australia*; ²*Macquarie Univ., Australia*; ³*Univ. of Sydney, Australia*. We show an experimental reconstruction of relativistic Bohmian trajectories of a single photon interfering in a Michelson-Sagnac interferometer. We observe subluminal and superluminal features of the Bohmian trajectories of the photon traversing through the fringes.

FM3B.5 • 11:45

Simulation-to-Experiment Transfer Learning for Accelerated Quantum State Tomography, Raman Khurana¹, Yu Dong Deng¹, Gamze Gul¹, Gina Talcott¹, Prem Kumar¹; ¹*Northwestern Univ., USA*. We present a transfer-learning-based neural network for two-qubit quantum state tomography. Pre-trained with realistic noise models and fine-tuned on experimental data, it recovers maximum-likelihood fidelities in 10⁵ shorter integration times.

FM3B.6 • 12:00

High-Rate Generation of Non-Gaussian States via Multi-Stage Loop-Based Photon Subtraction, Raustin Reyes¹, Shun Kawakami¹, Yoshihide Tonomura¹, Koichi Takasugi¹; ¹*Network Innovation Laboratories, NTT Inc., Japan*. We propose a loop-based photon subtraction scheme using time-domain multiplexing and repeat-until-success logic. Our numerical analysis demonstrates significantly enhanced herald probabilities while maintaining high fidelity, enabling MHz-rate generation for scalable quantum computing and communication.

FM3B.7 • 12:15

Quantum Tautochrone in Nonuniform Optical Lattices, Georgios Simopoulos^{2,1}, Ioannis Kiorpelidis^{2,1}, Georgios E. Pavlou^{2,1}, Georgios A. Siviloglou^{2,1}, Konstantinos Makris^{2,1}; ¹*Forth-Iesl, Greece*; ²*Physics, Univ. of Crete, Greece*. We introduce engineered photonic lattices, where nonuniform couplings lead to quantum tautochrone dynamics. By analyzing higher-order correlation functions, we show that photons launched from different positions arrive simultaneously at a common spatial location.

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Highland Room BJ

10:30 -- 12:30

FM3C • Free Space, Satellite and Advanced Optical Communication Links

Presider: Ming-Jun Li; Corning Inc., USA

FM3C.1 • 10:30

Demonstration of a 2-Gbit/s Mid-IR QPSK Free-Space Link Under Dust Conditions with Different Wavelengths, Yingning Wang¹, Huibin Zhou¹, Yue Zuo¹, Ruoyu Zeng¹, Abdulrahman Alhaddad¹, Yichen Li¹, Yixuan Zhang¹, Zile Jiang¹, Heng Wu¹, Hongkun Lian¹, Wing Ko¹, Andrew Ross², Adam Heiniger², Moshe Tur³, Alan Willner¹; ¹Univ. of Southern California, USA; ²TOPTICA Photonics Inc., USA; ³School of Electrical Engineering, Tel Aviv Univ., Israel. We demonstrate mid-IR FSO links through dust at different wavelengths. Compared with 1.55 μm , a 2-Gbit/s QPSK link at 4.0, 4.5, and 4.9 μm reduces the power loss from ~22-24 dB to ~12, ~9, and ~7 dB, improving EVM from > 50% to 30.8%, 28.6%, and 24.8%.

FM3C.2 • 10:45

Entanglement-Assisted Targeting System for Free-Space Optical Communications and Sensing Using OAM and Gaussian Beam Steering, Ignacio A. Rojas¹; ¹Univ. of Arizona, USA. In this paper, we present the results of implementing a system that uses both OAM and Gaussian beam steering to establish an FSO link with a receiver of unknown position with degenerate entanglement-assisted beams.

FM3C.3 • 11:00

Demonstration of 16 Optical Logic Gates for Phase-Encoded Data in a PPLN Waveguide, Abdulrahman Alhaddad¹, Wing Ko¹, Zile Jiang¹, Muralekrishnan Ramakrishnan¹, Yue Zuo¹, Yuxiang Duan¹, Yingning Wang¹, Yichen Li¹, Yixuan Zhang¹, Narek Karapetyan¹, Amir Minoofar¹, Ahmed Almainan², Moshe Tur³, Alan Willner^{1,4}; ¹Univ. of Southern California, USA; ²Electrical Engineering, King Saud Univ., Saudi Arabia; ³Electrical Engineering, Tel Aviv Univ., Israel; ⁴Physics & Astronomy, Univ. of Southern California, USA. We demonstrate all 16 possible optical logic gates for two binary phase-encoded inputs at 5-Gbit/s. Tunable wave mixing in a PPLN waveguide generates each phase-encoded output with error-free logic results over 1600 bits.

FM3C.4 • 11:15

Single-mode Weak Value Amplification, Justin Gruber¹, Yuhan Mei², Jaime Cardenas^{1,2}; ¹The Inst. of Optics, Univ. of Rochester, USA; ²Department of Physics and Astronomy, Univ. of Rochester, USA. We present a weak value amplification architecture that operates entirely in a single spatial and polarization mode and show an 18 dB SNR enhancement on a fiber interferometer compared to a standard Mach-Zehnder interferometer.

FM3C.5 • 11:30

Time-Series Feature-Based OSNR and Spectral Separation Estimation in Gridless Nyquist-WDM Systems, David Florez-Ospitia¹, Oscar A. Gutierrez Rivadeneira¹, Jhon J. Granada Torres¹; ¹Universidad de Antioquia, Colombia. We propose an interpretable time-series feature-based method for OSNR and spectral-separation estimation in gridless Nyquist-WDM systems using statistical, temporal, and spectral descriptors extracted from received I/Q symbol sequences

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FM3C.6 • 11:45

Site-Stable Closed-Form Bias Predictors for Polarization-Linewidth Estimators in LEO-to-Ground Coherent Downlinks, Taedong Ryoo¹; ¹*Department of Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA*. Slant-path extension of the Czegledi polarization model yields atmospheric cross-coupling that limits coherence-time gain to 1.47x despite 3.60x Fried-parameter advantage, and closed-form polynomial predictors of SOP-AC bias with R-squared at least 0.987 at both sites.

FM3C.7 • 12:00

Error-Histogram-Based Performance Monitoring and Burst Error Mitigation for Optical Modules, Yuxiang Huang¹, Daniel Kaixiang Wang², Jiaonan Zhang¹, Zhongqi Pan³, Yang Yue¹; ¹*Xi'an Jiaotong Univ., China*; ²*Carlmont School, USA*; ³*Univ. of Louisiana at Lafayette, USA*. By comparing symbol error histogram accumulated from forward error correction frames against the Poisson distribution, we detect burst errors, optimize signal integrity, estimate burst-free bit error rate, and quantify impact by averaging delta-Q factors.

FM3C.8 • 12:15

Virtual Session ID-Based Handover for LEO Satellite Networks, Zilong Ye^{2,1}, Philip N. Ji², Giovanni Milione², Ting Wang²; ¹*California State Univ. Los Angeles, USA*; ²*NEC Laboratories America, USA*. We propose a virtual session ID-based satellite handover scheme for LEO satellite networks. The proposed scheme can significantly reduce latency spikes and packet loss during handover, thus achieving seamless session-level continuity and improved communication performance.

Highland Room CH

10:30 -- 12:30

FM3D • Scalable Integrated Photonic Platforms and Devices

Presider: Tzu-Yung Huang; Nokia Bell Labs, USA

FM3D.1 • 10:30 (Invited)

Large Scale Silicon Photonics, Takako Hirokawa¹; ¹*Global Foundries, USA*. Abstract not available

FM3D.2 • 11:00

Demonstration of a Compact L-shape PN Junction SOI Ring Modulator Developed in AIM Photonics' 300 mm QFlex Process Technology, Mohammad Rakib Uddin¹, Jin Wallner¹, Anthony Aiello¹, Amit Dikshit¹, Javery Mann¹, Amir Begovic¹, Phung Nguyen¹, Basanth Jagannathan¹, Yukta Timalsina¹, Ashish Chanana¹, Gerald Leake Jr.¹, Christopher Baiocco¹, David Haramé¹, Nicholas Fahrenkopf¹, Fei Jia¹; ¹*AIM Photonics, USA*. Compact ring modulator with L-shaped PN-junction is developed in AIM Photonics' 300 mm QFlex Process Technology. It offers 25 dB extinction ratio, 14 nm FSR, 30 pm/V modulation and a 21 GHz frequency 3-dB bandwidth

FM3D.3 • 11:15 (Invited)

Integrated photonics with TFLN and TFLT, Ayed Al A. Sayem¹; ¹*Nokia Bell Labs, USA*. We will present recent developments in thin-film lithium tantalate (TFLT) and lithium niobate (TFLN) integrated photonic circuits for classical and quantum applications, with a focus on stability and high-speed modulation for next-generation photonic systems.

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FM3D.4 • 11:45

Vertical-Cavity Optical Parametric Oscillators: a Route for Massive Scalability in Integrated Nonlinear Photonics, Ouri Karni¹, Ryotatsu Yanagimoto¹, Yassine Bakkouch¹, Chirag Vaswani¹, Thibault Chervy¹; ¹NTT Research Inc., USA. We propose a practical route to fabricate integrated vertical-cavity optical parametric oscillators (VCOPO), promoting extremely-scalable and parallel nonlinear photonics. We present and numerically explore the design considerations towards efficient performance of degenerate VCOPOs.

FM3D.5 • 12:00

Low-Loss Thin-Film Lithium Tantalate Integrated Photonics for Ion-Based Quantum Systems, Nicholas Achuthan¹, Anna Shelton¹, Laurel Barnett¹, Andrea Cordaro¹, Xudong Li¹, Irene Occhiodori¹, Leticia Magalhaes¹, Xinrui Zhu¹, Hana Warner¹, Keith Powell², Michael Pushkarsky³, Amirhassan Shams-Ansari³, Marko Loncar¹; ¹Harvard Univ., USA; ²Lumina USA, USA; ³Monarch Quantum, USA. We demonstrate a 493-nm thin-film lithium tantalate platform with propagation losses as low as 1 dB/cm, enabling low-loss electro-optic circuits for trapped-ion quantum control.

FM3D.6 • 12:15

Optical Harmonic Filtering for Quantum Optics by Multimode Interferometry in Thin-Film LiNbO₃, Alison Haskin¹, Xiangwen Guo¹, Devaaya Latta¹, Xu Yi¹, Olivier Pfister¹; ¹Univ. of Virginia, USA. We demonstrate a compact, broadband, dichroic filter for pump rejection in parametric amplification on thin-film LiNbO₃ (TFLN), implemented as a 1×1 multimode interferometer (MMI) that transmits 1550 nm light while blocking 775 nm.

Highland Room DG

10:30 -- 12:30

FM3E • Optical Coherence Tomography

Presider: Shuichi Makita; Univ. of Tsukuba, Japan

FM3E.1 • 10:30 (Invited)

Monitoring and Guidance of Cardiac Ablation Therapy with Optics, Christine P. Hendon¹; ¹Columbia Univ., USA. I will present the use of optical coherence tomography and near-infrared spectroscopy to monitor and guide radiofrequency ablation treatment of cardiac arrhythmias, directly interrogating the tissue for real-time characterization.

FM3E.2 • 11:00 (Invited)

Towards Robotic High-Resolution Endoscopic Optical Biopsy, Wu Yuan¹; ¹Chinese Univ. of Hong Kong, Hong Kong. This talk will summarize our recent progress in high-resolution OCT endoscopy and outline ongoing developments that integrate soft robotics for atraumatic navigation with deep learning for automated image interpretation and volumetric quantification.

FM3E.3 • 11:30

Programmable Wavefront OCT for Real-Time Speckle Suppression, Junwei Xue¹, Qingliang Zhao¹, Ruikang K. Wang²; ¹Xiamen Univ., China; ²Univ. of Washington, USA. We combine SLM-enabled speckle decorrelation with W-Net denoising to suppress OCT speckle from single-frame inputs, enabling real-time cross-platform microstructural imaging across 840 nm, 1060 nm and 1310 nm systems.

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FM3E.4 • 11:45

Real-Time OCT-Guided Suprachoroidal Injection in Living Rabbits Using a Low-Cost Customizable Delivery System, Phuc Nguyen¹; ¹*Johns Hopkins Univ., USA*. Real-time OCT-guided suprachoroidal injection using a low-cost customized needle enabled precise and safe posterior segment ocular delivery in rabbits. OCT allowed visualization of needle placement and fluid dynamics, while injections demonstrated minimal toxicity and successful retinal gene therapy transduction.

FM3E.5 • 12:00

Robotic Steering and Stabilization of Endobronchial OCT in the Lungs, Tinghua Zhang¹, Wu Yuan¹; ¹*Chinese Univ. of Hong Kong, Hong Kong*. We present a robotic endobronchial OCT system capable of precise steering and stabilization within complex bronchial anatomies, enabling improved imaging and interventional accuracy in dynamic, breathing lungs.

FM3E.6 • 12:15

Computational Aberration Correction and De-Speckling of Optical Coherence Tomography Based on Image Formation Theory, Shuichi Makita¹, Xibo Wang¹, Suzuyo Komeda¹, Yoshiaki Yasuno¹; ¹*Computational Optics Group, Univ. of Tsukuba, Japan*. We present high-resolution *in vivo* retinal OCT imaging by computationally restoring degraded spatial resolution. The model-based aberration-correction method and the de-speckling algorithm have been applied. High-resolution *in vivo* retinal volumetric imaging is enabled without hardware extension or multiple acquisitions.

Grand Lilac Ballroom South

10:30 -- 12:30

LM3F • Advances in Nanophotonics, Metamaterials, and Polaritonics

Presider: Xiaoqin Li; Univ. of Texas at Austin, USA

LM3F.1 • 10:30 (Invited)

Phonon Polariton Enhanced Thermal Transport, Joshua Caldwell¹; ¹*Vanderbilt Univ., USA*. In this talk, we will discuss the influence of phonon polaritons within polar crystals to enhanced thermal conductivity and interfacial thermal boundary conductance. We demonstrate phonon polariton driven enhancements to thermal conductivity of up to 25% and ultrafast thermal dissipation across heterogeneous interfaces at sub-picosecond timescales.

LM3F.2 • 11:00

Quantum Vibrational Nano-Imaging and -Spectroscopy, Markus B. Raschke¹; ¹*Physics, Univ. of Colorado, USA*. Infrared vibrational nano-imaging and -spectroscopy is used to probe coupling between molecular vibrations in nano-scale ensembles with hybridization, entanglement, and collective modes to sensitively resolved local electric fields (Stark effect), intermolecular distance, and relative molecular orientation in functional molecular materials.

LM3F.3 • 11:15 (Invited)

Sensitivity Kernels in Coherent Wave Tomography: A Unified Picture and Wavefield Compression, Alexey Yamilov¹; ¹*Missouri Univ of Science & Technology, USA*. We present an approach to wave tomographies, treating the imaged wave speed and attenuation as parts of one complex material parameter. A consequence of this treatment is that sensitivity kernels organize into just two classes.

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LM3F.4 • 11:45

Pulse Management and Negative Group Velocities with Primordial Metamaterials, Jacob LaMountain¹, Alexander Ware², Seth Bank², Daniel Wasserman², Evgenii Narimanov³, Viktor A. Podolskiy¹;

¹*Department of Physics and Applied Physics, Univ. of Massachusetts Lowell, USA;* ²*The Chandra Department of Electrical and Computer Engineering, Univ. of Texas at Austin, USA;* ³*Department of Electrical Engineering, Purdue Univ., USA.* Primordial metamaterials, a new class of optical composites structured on the scale of their inherent optical nonlocality, show a strong nonlocal response. This novel behavior enables negative group velocities in regimes with relatively low losses.

LM3F.5 • 12:00

Enhanced Second Harmonic Generation from Plasmonic Nanocavity Metasurface, Sky Semone¹, Christos Argyropoulos¹; ¹*Pennsylvania State Univ., USA.* We experimentally demonstrate five-order-of-magnitude enhancement of second-harmonic generation in centrosymmetric Au/TiO₂ nanogap metasurfaces. Strong plasmonic confinement amplifies second-order surface nonlinearities via nanocavity resonances, validated by simulation, enabling compact platforms for integrated nonlinear and quantum photonics.

LM3F.6 • 12:15

Investigation of Achiral Plasmonic Nanostructures Showing Spin-Dependent Angular Scattering due to Excitation of Higher-Order Electric Moments, Pranay Agrawal¹, Apurv C. N.¹, Israel De Leon Arizpe^{2,3};

¹*MIT World Peace Univ., India;* ²*ASML Netherlands B.V., Netherlands;* ³*School of Electrical Engineering and Computer Science, Univ. of Ottawa, Canada.* Chiro-optical effects are typically exhibited by chiral structures. Investigating this further, we show that angle-dependent chiro-optical effects, such as circular intensity differential scattering (CIDS), are present in achiral structures as well, due to the excitation of higher-order electric moments.

Grand Lilac Ballroom North

14:00 -- 15:00

FM4A • Space Optics Theme: Novel Space Optics

Presider: Justin Cook; Fibertek, Inc, USA

FM4A.1 • 14:00 (Invited)

Optical Orbital Debris Detection, Andrew Nicholas¹; ¹*U.S. Naval Research Laboratory, USA.* The sensor concept is based on creating a sheet of laser light in front of the host spacecraft and observing photons scattered by objects passing through the lightsheet. LARADO launched on StpSat-7 in April 2026.

FM4A.2 • 14:30 (Invited)

An Optical System for a Space Solar Energy Satellite, Patrick Mock¹; ¹*Overview Energy, USA.* Overview Energy's satellites will deliver energy from geosynchronous orbit to Earth. The satellite optical system comprises solar panels, lasers, bidirectional beam projector, and a beacon system in the center of each target solar array.

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Highland Room AK

14:00 -- 15:30

FM4B • VR/AV Theme: Novel Systems

Presider: Jennifer Hunter and Jung-Ping Liu; Feng Chia Univ., Taiwan

FM4B.1 • 14:00 (Invited)

Efficient Eyepiece Designs for Mixed Reality Displays via Foveation, Hong Hua¹; ¹*Univ of Arizona, Coll of Opt Sciences, USA*. In this talk, I will present examples of efficient eyepiece designs for head-mounted displays by applying the foveation characteristics of the human visual system and discuss the benefits of applying foveation techniques to optical design.

FM4B.2 • 14:30 (Invited)

Delivering Tailored Smart Glasses and AR Waveguide Solutions that Scale: Challenges and Opportunities, Abe Jordan¹; ¹*Vuzix Corporation, USA*. AR smart glasses require customized waveguide solutions tailored to diverse applications and form factors. This talk explores the technical, materials, and manufacturing challenges and opportunities in delivering high-performance AR platforms that scale.

FM4B.3 • 15:00 (Invited)

Vision Augmentation via Optical See-Through AR, Yuta Itoh¹; ¹*Inst. of Science Tokyo, Japan*. Looking toward a future of everyday AR glasses, this talk explores vision augmentation beyond mere image display, presenting our efforts to reshape human vision through optical see-through AR.

Highland Room BJ

14:00 -- 15:30

FM4C • Optical Computing I

Presider: Juergen Czarneck; Technische Universität Dresden, Germany

FM4C.1 • 14:00 (Invited)

Model-free Training of Laser and Spiking Photonic Neural Networks, Daniel Brunner¹; ¹*Femto-st, France*. We trained fully hardware implemented semiconductor laser neural networks (LNN, 5000 neurons) and a photonic spiking neural network (PSNN, 40000 neurons) with record breaking accuracy (LNN) and high levels of sparsity (PSNN).

FM4C.2 • 14:30 (Invited)

Diffraction Information Processing, Che-Yung Shen¹; ¹*Univ. of California Los Angeles, USA*. I will discuss diffractive optical processors designed by deep learning, which transform input light through scalable, spatially engineered surfaces to all-optically perform complex functions, enabling wavefront reshaping, imaging, sensing, and high-throughput free-space computing.

FM4C.3 • 15:00 (Invited)

Controlling Linear and Nonlinear Photonic Devices Like a Display, Martin M. Stein^{1,2}; ¹*Department of Applied Physics, Yale Univ., USA*; ²*Physics & Informatics Laboratories, NTT Research, Inc, USA*. I will present our work on high-dimensional and free-form control of linear (Onodera and Stein et al., 2025) and nonlinear (Yanagimoto et al., 2025) photonic chips by projecting “virtual electrodes” onto them using display technology.

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Highland Room CH

14:00 -- 15:30

FM4D • TFLN and Si Photonics

Presider: Stefan Rothe; Universiteit Twente, Germany

FM4D.1 • 14:00 (Invited)

Next Generation Silicon Photonics for Scaling Optical Interconnects, Leili Shiramin¹; ¹*InterUniv.*

Microelectronics Center, Belgium. AI-driven computing demands highly efficient optical interconnects to overcome bandwidth, latency, and power bottlenecks in data centers. imec is advancing next-generation silicon photonics and co-packaged optics technologies, enabling scalable, high-performance connectivity for future AI and cloud computing.

FM4D.2 • 14:30 (Invited)

Commercial Thin Film Lithium Niobate Photonics, Jeffrey Holzgrafe¹; ¹*Univ. of Cambridge, USA.* Thin-film lithium niobate overcomes the modulator bottleneck limiting integrated photonics, offering higher bandwidth, lower drive voltage, and lower loss. We review the maturation of TFLN from laboratory demonstrations to a qualified manufacturing platform spanning datacom, telecom, and quantum.

FM4D.3 • 15:00 (Invited)

Scaling Short-Wavelength Silicon Photonics for AR/VR and Sensing Microsystems, Wesley D. Sacher¹;

¹*Max-Planck-Inst für Mikrostrukturphysik, Germany.* This talk presents my group's work on foundry-fabricated active silicon photonics for visible and submicrometer near-infrared wavelengths, alongside photonic circuit demonstrations of laser-scanning light engines for smart glasses and implantable tools for neuroscience.

Highland Room DG

14:00 -- 15:30

FM4E • Light Matter Interactions

Presider: Julia Mikhailova; Princeton Univ., USA

FM4E.1 • 14:00

High Harmonic Spectroscopy of Correlated Solids, Barry D. Bruner¹, Jan Maximilian Klingner¹, Lior Faeyman¹, Shuang Liu^{3,4}, Eran Mishuk², Anna-Eden Kosoy², Yishay Feldman², Ayelet Vilan², Sigal Keshet², Iddo Pinkas², Peng Chen⁴, Ofer Neufeld³, Nirit Dudovich¹; ¹*Department of Physics of Complex Systems, Weizmann Inst. of Science, Israel;* ²*Department of Chemical Research Support, Weizmann Inst. of Science, Israel;* ³*Schulich Faculty of Chemistry, Technion – Israel Inst. of Technology, Israel;* ⁴*Department of Physics, Guangdong Technion – Israel Inst. of Technology (GTIIT), China.* We employ two-color high-harmonic spectroscopy to investigate sub-cycle dynamics in the correlated insulator NiO. Combined with TDDFT and SBE calculations, our measurements uncover the influence of strong electron-electron correlations on ultrafast electronic motion.

FM4E.2 • 14:15 (Invited)

Probing Dynamic Matter via The Spatiotemporal Structure of Light, Eileen Otte¹; ¹*Univ. of Rochester, USA.* Structured optical fields can serve as sensitive probes of complex, dynamic environments. We demonstrate the capabilities in both the paraxial and non-paraxial regime, for example through

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extracting microfluidic parameters from flowing droplet emulsions.

FM4E.3 • 14:45

Collective Rydberg Spinwaves in Gradient Echo Memory Enabled by Zero-k Excitation Scheme., Bartosz Niewelt¹, Stanislaw Kurzyna¹, Mateusz Mazelanik¹, Wojciech Wasilewski¹, Michal Parniak¹; ¹*Centre for Quantum Optical Technologies, Poland*. We demonstrate a four-photon excitation scheme that suppresses motional dephasing in collective Rydberg excitations, extending spin-wave lifetimes to 20.7(9) μ s. The scheme enables using Gradient Echo Memory to spatially engineer Rydberg interactions.

FM4E.4 • 15:00 (Invited)

Twisted hBN as a New Platform for Moiré Engineering, Xiaoqin Li¹; ¹*Univ. of Texas at Austin, USA*.

Twisted hexagonal boron nitride provides a remote electrostatic moiré landscape that decouples potential engineering from functional materials, enabling exciton confinement and actively patterned light emission in adjacent semiconductors for versatile moiré materials design and control.

Grand Lilac Ballroom South

14:00 -- 15:30

LM4F • Nanophotonics and Quantum Emitters

Presider: Viktor Podolskiy; Univ. of Massachusetts Lowell, USA

LM4F.1 • 14:00 (Invited)

Light-Matter Interactions in 2D Magnets: From Strong Coupling to Transduction, Vinod M. Menon¹; ¹*City Univ. of New York, USA*. I will discuss our recent work on the 2D magnet CrSBr, which exhibits strong interactions among excitons, magnons, and photons, enabling self-hybridized polaritons, coherent magnon fingerprints, magnetically controlled nonlinearities, and microwave-to-optical transduction.

LM4F.2 • 14:30 (Invited)

Excitons and Exciton-Polaritons in Quasi 1D vdW Materials, Han Htoon¹; ¹*Los Alamos National Laboratory, USA Minor Outlying Islands*. We report two distinct, isotropic and anisotropic exciton-polariton states in the quasi-one-dimensional van der Waals antiferromagnet CrSBr, alongside the observation of highly diffusive excitons and propagation of exciton-polaritons in ZrS van der Waals nanowires.

LM4F.3 • 15:00

High-Intensity Photoluminescence Spikes and Photon Antibunching from Plasmonic Silver Nanocubes, Emily DeVeyra¹, Svetlana G. Lukishova¹; ¹*Univ. of Rochester, USA*. Ultrabright photoluminescence spikes, reaching up to ~1 million counts/s, appear sporadically over time in 100 nm silver nanocubes used in plasmonic nanoantennas. Photon antibunching was observed under both 405 nm and 532 nm laser excitation.

LM4F.4 • 15:15

Rare-Earth-Modified Luminescent Two-Dimensional Danosheets Derived from Oxidized Mo₂CTx MXene, Sameera Sampath K. Kurumbara Arachchige¹; ¹*State Univ. of New York at Buffalo, USA*. This work establishes a new class of REE modified 2D systems capable of combining structural tunability with

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efficient optical emission, opening pathways for advanced photonic and optoelectronic device architectures.

Grand Lilac Ballroom North

16:00 -- 17:30

FM5A • Space Optics Theme: Optical Communications

FM5A.1 • 16:00 (Invited)

Photonic Integrated Circuit Design Workflow for Optical Wireless Communications, Chris Maloney¹, Shi Li¹, Eugene Sokolov¹; ¹*VPIphotonics, USA*. We present a photonic integrated circuit (PIC) design workflow for optical wireless communication systems, covering PIC component simulation, atmospheric channel modeling, and full-system co-simulation addressing end-to-end free space optical communication system-level performance.

FM5A.2 • 16:30 (Invited)

Space-Based WDM Optical Amplifiers, Justin Cook¹; ¹*Fibertek, Inc., USA*. We report on the development of WDM-based optical amplifiers for space-based applications. Challenges associated with operating long-term in different space environments are discussed and their impact on laser system design, packaging and performance.

FM5A.3 • 17:00 (Invited)

User Growth & Scalability Offered by Multiple-Access Space Lasercom, Jeff Roth¹; ¹*Laser Communications Group, MIT Lincoln Laboratory, USA*. This talk will discuss how multiple-access free-space laser communications can help revolutionize and scale laser communications to high-densities of users. We will look at the approaches that can be used to implement multiple-access lasercom. Then we will look at applications for multiple-access in space lasercom, using a Lunar relay node architecture. We will talk about important technology areas that feed into multi-access, such as wide field-of-view optics, broadband amplifiers, and integrated photonics.

Highland Room AK

16:00 -- 18:00

FM5B • VR/AV Theme: Novel Devices and Algorithms

Presider: Hong Hua; Univ of Arizona, Coll of Opt Sciences, USA

FM5B.1 • 16:00 (Invited)

Computer-Generated Holograms and its Application for Near-Eye Display, Jung-Ping Liu¹, Wen-Kai Lin¹, Hao En Tang¹; ¹*Feng Chia Univ., Taiwan*. Computer-generated-holograms (CGH) is an advanced technique for three-dimensional display. We will introduce different algorithms to produce computer-generated-holograms (CGHs). The application of CGH for near-eye display will also be discussed.

FM5B.2 • 16:30 (Invited)

Beyond Color: AI-powered AR displays with Integrated Sensing, Luke Benoit¹; ¹*Creol, Univ. of Central Florida, USA*. In this talk, we examine the perspectives and challenges for novel optical sensing architectures in AI-powered AR glasses, including waveguide-based eye tracking, depth sensing, and

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physiological monitoring, to enable adaptive displays and user-centric applications.

FM5B.3 • 17:00 (Invited)

Computational Holography for Advanced Display and Vision Systems, Hakan Urey¹; ¹*Koç Üniversitesi, Turkey*. We review computational holographic display architectures for near-eye, automotive HUD, and ophthalmic systems, focusing on wavefront synthesis, pupil and focus control, system architectures, and emerging device technologies addressing field-of-view, eyebox, efficiency, and spatial-bandwidth limitations.

FM5B.4 • 17:30 (Invited)

Chip-Level Optical Manipulation of Micro-LEDs for Augmented Reality Near-Eye Displays, Yunfei Ma⁴, Enguo Chen^{2,3}, Chao Ping Chen¹; ¹*Shanghai Jiao Tong Univ., China*; ²*Fuzhou Univ., China*; ³*Fujian Science & Technology Innovation Laboratory for Optoelectronic Information of China, China*; ⁴*Univ. of Michigan, USA*. This presentation introduces a series of chip-level optical manipulation strategies for Micro-LEDs. These approaches are designed to enhance light extraction efficiency, suppress optical losses, and achieve beam collimation, providing an effective route toward compact, high-performance projection engines and augmented reality displays.

Highland Room BJ

16:00 -- 18:00

FM5C • State of the Art Devices for Optical Communications

Presider: Chisato Fukai; NTT Corporation, Japan

FM5C.1 • 16:00

Highly Compact Ultra-Wideband Amplifier Using Semiconductor Optical Amplifiers, Tzu-Yung Huang¹, Cris Bolle¹, Cosimo Calò², Célia Cruz², Arnaud Wilk², Olivier Delorme², Nicolas Vaissière², Karim Mekhazni², Igor Mijovic², Christophe Caillaud², Jean Decobert², Frédéric Pommereau², Rose Kopf¹, Mark Cappuzzo¹, Mark Earnshaw¹; ¹*Nokia Bell Labs, USA*; ²*III-V Lab, France*. To extend existing network architectures, compact modules with ultra-wideband amplification are needed. We demonstrate a highly compact polarization-independent amplifier across the C+L band based on free-space hybrid integration of semiconductor optical amplifiers.

FM5C.2 • 16:15

Agile and Energy-Efficient O-band Quantum Dash Frequency Comb Laser for Co-Packaged Optics, Youcef Driouche^{2,1}, Cosimo Calò³, Arnaud Wilk³, Olivier Delorme³, Nicolas Vaissière³, Florence Martin³, Gustavo Afonso de Castro³, Igor Mijovic³, Karim Mekhazni³, Alexandre Shen³, Frédéric Pommereau³, Sofiane Belahsene¹, Abderrahim Ramdane², Kamel Merghem¹; ¹*SAMOVAR, Télécom SudParis, Institut Polytechnique de Paris, France*; ²*CNRS C2N, Université Paris-Saclay, France*; ³*III-V Lab, A joint laboratory between Nokia Bell Labs, Thalès Research & Technology and CEA-LETI, France*. We report an agile O-band quantum dash laser in a self-injection locked regime. Adjusting feedback strength enables either 12nm spectral broadening (50 channels) or 22nm spectral tunability, providing an energy-efficient solution for co-packaged optics applications.

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FM5C.3 • 16:30

Multiwavelength Fiber Laser Based on an Aluminum-Coated All-SMF Michelson Interferometer Filter, Adriana B. Gasca¹, Marco Bianchetti², Julián Estudillo¹, Roberto Rojas¹, Juan Sierra¹; ¹*Ingeniería Electrónica, Universidad de Guanajuato, DICIS, Mexico*; ²*Departamento de Estudios Multidisciplinarios, Universidad de Guanajuato, DICIS, Mexico*. An all-SMF Michelson interferometer coated with aluminum is proposed as a wavelength-selective filter for fiber lasers, enabling single-wavelength operation into stable three-wavelength emission with an SMSR of up to 48 dB.

FM5C.4 • 16:45

Characterization of Heterogeneously Integrated MQW Photodiodes on Silicon Nitride, Lance T. Shaffer¹, Yang Shen², Minh Tran², Andreas Beling¹; ¹*Univ. of Virginia, USA*; ²*Nexus Photonics, USA*. We report on multi-quantum well photodiodes (PDs) on a low-loss silicon nitride (SiN) photonic platform. The PDs have sub-nA dark currents, capacitance below 100 fF, and a 3-dB bandwidth of 16 GHz.

FM5C.5 • 17:00

Automatic Bias Control for Silicon IQ Modulators Using Three Monitoring Photodiodes to Independently Control Three MZMs for Enhanced Stability, Zile Jiang¹, Ziyi Zhu², Muralekrishnan Ramakrishnan¹, James M. Venditto³, Xinzhou Su¹, Huibin Zhou¹, Abdulrahman Alhaddad¹, Yue Zuo¹, Yingning Wang¹, Yuxiang Duan¹, Wing Ko¹, Wei Li², Moshe Tur⁴, Ricard Menchon-Enrich⁵, Allen Chan², Keren Bergman³, Alan Willner¹; ¹*Univ. of Southern California, USA*; ²*Altera Corporation, USA*; ³*Columbia Univ., USA*; ⁴*Tel Aviv Univ., Israel*; ⁵*Intel Corporation, Spain*. We demonstrate an automatic bias control system for silicon IQ modulators using three monitoring photodiodes to independently control three MZMs. We show ~1% EVM penalty under random bias distortions, while the conventional single-PD method can fail to lock.

FM5C.6 • 17:15

Differentiable Neural-Physical Modeling of Fringing-Field Effect in LCoS-based WSS, Xingyu Chai¹, Haoyu Wei¹, Haining Yang¹; ¹*Southeast Univ., China*. A differentiable neural-physical architecture integrates a neural fringing-field effect module with an LCoS-based WSS physical model, improving attenuation and isolation prediction accuracy over Gaussian-kernel convolution method and generalizing across grating periods.

FM5C.7 • 17:30

Comparison of Long-Term Reliability Challenges for Co-Package Optics (CPO) vs. Pluggable Optics for Reliable AI Infrastructure, Viral Lowalekar¹; ¹*Meta Platforms Inc, USA*. As LLMs expand, compute and I/O demands escalate, causing network scaling challenges. This paper compares Co-Packaged Optics and pluggable optics for reliability and serviceability, including predictions of long-term AI infrastructure failure patterns.

FM5C.8 • 17:45

Continuous Entanglement Distribution with Exponentially Accelerated Polarization Stabilization, Jinyi Du¹, En Teng Lim¹, Xingjian Zhang^{1,2}, Hongwei Gao³, George Chen³, Dawn Tan³, Alexander Ling^{1,4}; ¹*Centre for Quantum Technologies, National Univ. of Singapore, 3 Science Drive 2, Singapore 117543, Singapore.*, ²*Quantum Research Center, Technology Innovation Inst., Masdar City, Abu Dhabi, UAE., United Arab Emirates*; ³*Photonics Devices and System Group, Singapore Univ. of Technology and Design, 8 Somapah Rd, Singapore 487372, Singapore.*, ⁴*Department of Physics, National Univ. of*

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Singapore, 2 Science Drive 3, Singapore 117551, Singapore., Singapore. We demonstrate a new route to continuous, pilot-laser-free entanglement distribution that overcomes two major bottlenecks in fibre quantum networks: calibration downtime and loss-limited polarization feedback. The approach delivers an exponential speedup feedback over 133 km of fibre testbed, and 95.4% entanglement fidelity sustained for 24 hours.

Highland Room CH

16:00 -- 18:00

FM5D • Design, Optimization, and Nonlinear Dynamics in Photonic Integrated Circuits

Presider: Aseema Mohanty; Tufts Univ., USA

FM5D.1 • 16:00 (Invited)

PDK Components for Scalable Photonic Integrated Circuits, Youngik Sohn¹; ¹*Korea Advanced Inst of Science & Tech, Korea (the Republic of)*. In this talk, I will discuss PIC component design methods specialized for fabrication-error tolerant and spatial mode multiplexing. They include rapid adiabatic couplers and adiabatic tapers and bends synthesized by DREME (Dataset-recycled EME).

FM5D.2 • 16:30

Revisiting Inverse Design with Parameterized Photonic Integrated Circuits, Jonathan Friedman¹, Kevin Zelaya¹, Mostafa Honari-Latifpour², Mohammad-Ali Miri¹; ¹*Rochester Inst. of Technology, USA*; ²*Physics Department, The Graduate Center, USA*. Inverse design of photonic integrated circuits yields compact, energy efficient, and fault-tolerant solutions. We show that black-box optimizations of an over-parameterized system of interleaved mixing and delay layers achieves robust programmability for linear multi-wavelength functions.

FM5D.3 • 16:45

Generative Inverse Design of Nanophotonic Coherent-Mode Splitters for Partially Coherent Light, Sha Liu¹, Ziyao Zhou¹, Haining Yang¹, Mengdi Sun¹; ¹*Electronic and Science and Engineering, Southeast Univ., China*. We propose an integrated nanophotonic coherent-mode splitter for two-mode partially coherent light, inverse-designed via unsupervised learning. Across 200 random tests, it achieves 0.800/0.755 mean separation ratios.

FM5D.4 • 17:00

Deep Learning for Robust Resonance Extraction in Noisy Optical Spectra, Lukas M. Weituschat¹, Martin Sanchez¹, Christer Everly¹, Pablo Postigo¹; ¹*Inst. of Optics, Univ. of Rochester, USA*. A deep neural network trained solely on synthetic ring resonator spectra accurately recovers resonance positions under low-SNR conditions. Generalization maps reveal robust performance across diverse noise regimes, while experimental validation demonstrates successful transfer from synthetic to measured spectra.

FM5D.5 • 17:15

Switching between Single-Soliton and Breather-Soliton States in Thermally Controlled Optical Microresonators, Haoran Wang¹, Xing Wang², Libo Teng², Zhichao Ye³, Shihua Chen², Junpeng Lu¹, Zhenhua Ni¹, Tong Lin¹; ¹*School of Electronic Science & Engineering, Southeast Univ., China*; ²*School of Physics, Southeast Univ., China*; ³*Hangzhou Qoretek Company, China*. We demonstrate thermally controlled generation of single-soliton and breather-soliton states in silicon nitride microresonators

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using a microheater, together with stable and reproducible switching between these two regimes.

FM5D.6 • 17:30

High-Energy Kerr Solitons in Si₃N₄ Micro-Resonators, Zhenhua Guo¹, Sushant Kumar¹, Xue Dong¹, Yi Zhang¹, Jiewei Xiang¹, Arunima Nauriyal¹, Junchi Zhang¹, Elias Vailleux¹, Jaime Cardenas¹, William Renninger¹; ¹*Inst. of Optics, Univ. of Rochester, USA*. High-energy ultrashort Kerr solitons are demonstrated through strong over-coupling combined with efficient pulse pumping. We predict and observe ultrashort pulses with a record 6-pJ output energy in a 12-GHz Si₃N₄ cavity with 30% coupling.

FM5D.7 • 17:45

Chip-Scale Sub-100-fs Soliton Laser via Photorefractive-Assisted Kerr Mode Locking, Qili Hu¹, Yan Yu², Shixin Xue¹, Qizhao Tong¹, Raymond Lopez-Rios¹, Jeremy Staffa¹, Zhengdong Gao¹, Yueteng Zhang¹, Kerry Vahala², Qiang Lin¹; ¹*Univ. of Rochester, USA*; ²*Caltech, USA*. We introduce photorefractive-assisted Kerr mode locking, enabling the first chip-scale laser supporting sub-100-fs transform-limited pulses, with 5.14-THz 3-dB bandwidth, 53-Hz intrinsic linewidth, and repeatable turn-key operation.

Highland Room DG

16:00 -- 18:00

FM5E • Deep Learning and Quantitative Imaging in Biomedical Applications

Presider: Yang Liu; Univ of Illinois at Urbana-Champaign, USA

FM5E.1 • 16:00 (Invited)

Band-pass Raman Spectroscopy for Non-invasive Glucose Monitoring, Jeon Woong Kang¹; ¹*Massachusetts Inst. of Technology, USA*. Based on our first direct observation of glucose Raman signals from in-vivo skin, we introduce band-pass Raman spectroscopy, enabling non-invasive, physiological-level continuous glucose monitoring in a compact device. This will enable wearable Raman-based CGM devices.

FM5E.2 • 16:30 (Invited)

Multiscale Quantitative Phase Imaging for Precision Biology and Medicine, Yang Liu¹; ¹*Univ of Illinois at Urbana-Champaign, USA*. Multiscale quantitative phase imaging combines optimized bright-field optics, computational reconstruction, and AI to enable label-free mesoscale tissue pathology, longitudinal live-cell phenotyping, and 3D imaging, linking cellular biophysics with precision biology, medicine, and broad translational applications.

FM5E.3 • 17:00

Uncertainty-Aware Automated HER2 Scoring via Lensfree Holography and Deep Learning, Che-Yung Shen¹, Xilin Yang¹, Yuzhu Li¹, Leon Lenk¹, Zixiang Ji¹, Aydogan Ozcan¹; ¹*Univ. of California Los Angeles, USA*. We introduce a compact, cost-effective lensfree holographic imaging system integrated with deep learning and uncertainty quantification for reliable automated HER2 scoring of immunohistochemically stained breast tissue sections.

FM5E.4 • 17:15

AI-Enabled Label-Free Cell Viability Assessment from Brightfield Imaging, Amir Reza Vazifeh¹, Christian Ziegler², Sornanathan Meyyappan², Richard Jeske², Jason Fleischer¹; ¹*Princeton Univ., USA*; ²*Waters*

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Corporation, USA. We present an AI-based method for cell viability assessment directly from brightfield images, without fluorescent imaging or staining. We demonstrate its efficiency in CHO cells under a wide range of viability conditions.

FM5E.5 • 17:30

Machine Learning-Based Peripheral Nerve Identification Using Polarimetric Contrast, Haolin Liao¹, Zongyuan Lu¹, David Mitten², Wayne Knox¹; ¹*The Inst. of Optics, Univ. of Rochester, USA*; ²*Department of Orthopaedics, Univ. of Rochester, USA*. We present in-vivo human peripheral nerve imaging using Rotating Crossed Polarization Imaging (RXPI), with an AUC of 0.962 for nerve tissue differentiation. Physics-derived contrast can be an effective preprocessing step for automated nerve identification.

FM5E.6 • 17:45

Deep Learning for Fast CARS Signal Phase Retrieval: High-Fidelity Imaging of Human Skin via Synthetic Training, Jesús Giovanni Estrada Cárdenas^{1,2}, Vincent Tombelaine³, Josselin Breugnot⁴, Romain Jugé⁴, Amandine Magnaudeix⁵, Philippe Carré², David Helbert², Philippe Leproux¹; ¹*Univ. of Limoges, XLIM, CNRS, France*; ²*Univ. of Poitiers, XLIM, CNRS, France*; ³*LEUKOS, France*; ⁴*Silab, France*; ⁵*IRCER, France*. We demonstrate standard and physics-informed U-Net architectures for fast CARS phase retrieval. Trained on synthetic data, these models achieve over 700-fold acceleration over classical algorithms while enabling robust label-free imaging of human skin biopsies.

Grand Lilac Ballroom South

16:00 -- 18:00

LM5F • Optical Platforms for Quantum Information Science I

Presider: Lindsay LeBlanc; Univ. of Alberta, Canada

LM5F.1 • 16:00 (Invited)

Quantum Electrodynamics Near Atomic Arrays, Kanu Sinha¹; ¹*Univ of Arizona, Coll of Opt Sciences, USA*. In this talk I will discuss how *atomic quantum mirrors* -- collections of atoms with state-dependent optical response -- modify paradigmatic quantum electrodynamics (QED) phenomena and give rise to non-Markovian electromagnetic environments.

LM5F.2 • 16:30 (Invited)

Recent Advances in Neutral Atom Integration with Photonic Integrated Circuits, Chen-Lung Hung¹, Ahreum Lee¹; ¹*Purdue Univ., USA*. We present our experiment integrating neutral atoms with a photonic integrated microring circuit and investigations on the collective emission dynamics. We also present our demonstration of near-deterministic loading of single atoms onto a microring resonator.

LM5F.3 • 17:00 (Invited)

Organic Quantum Emitters in Nanophotonic Cavities: Collective States and Hybrid Networks, Jonathan D. Hood¹; ¹*Purdue Univ., USA*. Dibenzoterrylene molecules are exceptional quantum emitters, producing lifetime-limited photons below 3 K. We demonstrate collective superradiant states of molecule pairs and hybrid integration of DBT emitters with high-Q photonic crystal cavities, reaching 40% coupling efficiency.

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LM5F.4 • 17:30

A Fiber-Optic Platform for Cryogenic Laser-Pump Neutron-Probe Magneto-Optical Measurements, Lazar Kish¹, Andrei T. Savici², Tyler K. White², Vladislav N. Sedov², Andrey A. Podlesnyak², Matthias D. Frontzek², Barry L. Winn², Igor A. Zaliznyak¹; ¹*Brookhaven National Laboratory, USA*; ²*Oak Ridge National Laboratory, USA*. We report a fiber-optic laser-pump neutron-probe method for momentum- and frequency-resolved magneto-optical measurements. The technique uses neutron spectroscopy to measure two-point magnetization correlations under resonant photoexcitation, demonstrated by nonequilibrium measurements of Yb-based magneto-optical materials.

LM5F.5 • 17:45

Over 100-GHz Real-Time Measurement of 5 dB Squeezing with RF-Signal-Preserving Phase Locking, Taichi Yamashima¹, Takahiro Kashiwazaki¹, Asuka Inoue¹, Shunya Konno¹, Akito Kawasaki², Warit Asavanant², Takeshi Umeki¹, Akira Furusawa^{2,3}; ¹*Device Technology Labs., NTT Inc., Japan*; ²*OptQC Corp., Japan*; ³*The Univ. of Tokyo, Japan*. We demonstrate real-time detection of 5.1 ± 0.1 dB squeezing using a homodyne measurement system with over 100-GHz bandwidth. For phase locking, optical tapping replaces tapping of the detected electrical signal, reducing electrical-noise-induced effective loss.

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Tuesday, 29 September

Grand Lilac Ballroom North

08:00 -- 09:00

FTu1A • Communication and Sensing over Free Space and Optical Fiber Links

Presider: Yingning Wang; Univ. of Southern California, USA

FTu1A.1 • 08:00 (Invited)

Simultaneous Communication and Sensing With OAM, Yasaman Ghasempour¹, Ruiyi Shen¹; ¹*Princeton Univ., USA*. Orbital angular momentum (OAM) beams offer new opportunities for integrated sensing and communication. This talk presents a physics-driven framework that reconfigures OAM modes to simultaneously enable high-capacity data transmission and spatial sensing, validated through sub-Terahertz experimental demonstrations.

FTu1A.2 • 08:30

Acoustic Sensing via Coherent Transceivers, Max Brenner¹, Alice V. Drozdov¹, Mikael Mazur², Mitchell A. Cox¹; ¹*Univ. of the Witwatersrand, South Africa*; ²*Nokia Bell Labs, USA*. We compare state-of-polarisation and carrier phase channels of a coherent transceiver for audible-range acoustic sensing. CPE achieves higher peak SNR and broader bandwidth, while SOP provides a lower, stable noise floor.

FTu1A.3 • 08:45

Integrated LiDAR Sensing and Free-Space Optical Communication with Non-Line-of-Sight Transmission, Zhenghao Yang¹, huaxia wang¹, Ben Wu¹; ¹*Rowan Univ., USA*. We propose and demonstrate an integrated optical sensing and communication system. The LiDAR sensing results guide the communication system for beam alignment. The non-line-of-sight transmission simplifies the alignment process and enables continuous data transmission.

Highland Room AK

08:00 -- 09:00

FTu1B • Optical Computing II

Presider: Che-Yung Shen; Univ. of California Los Angeles, USA

FTu1B.1 • 08:00 (Invited)

Computational Imaging at the Interface of Artificial Intelligence and Hardware Development, Kaan Aksit¹; ¹*Univ. of London, UK*. This research explores the intersection of artificial intelligence, computational imaging, and hardware development. It addresses fundamental challenges in holographic displays, optical ray tracing, and immersive technologies to enhance computational efficiency and imaging quality.

FTu1B.2 • 08:30

Per-Ring-Calibrated 31-Level RAMZM for Coherent Optical Systems, Minkyu Cho¹, Woo-Young Choi¹; ¹*Department of Electrical and Electronic Engineering, Yonsei Univ., Korea (the Republic of)*. We propose and experimentally demonstrate a method for calibrating a ring-assisted Mach-Zehnder modulator by

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mapping microring drop-port power to corresponding through-port field trajectory, achieving 31 RAMZM output levels in a fabricated photonic integrated circuit.

FTu1B.3 • 08:45

Information Transfer Through Volumetric Scattering Media Using Interleaved Diffractive Networks, Yuhang Li¹, Yiyang Wu¹, Shiqi Chen¹, Xilin Yang¹, Aydogan Ozcan¹; ¹*Univ. of California, Los Angeles, USA*. We present an interleaved diffractive optical network that recovers optical information through random volumetric diffusers using passive structured layers interleaved within the scattering medium. These layers progressively correct scattering-induced distortions, enabling robust information transfer through unseen random diffusers.

Highland Room CH

08:00 -- 09:00

FTu1D • Optical and Photonics Devices

Presider: Groot Gregory; Keysight Technologies, USA

FTu1D.1 • 08:00

Optical Crosstalk Suppression in Submicron Color-Conversion Aperture Arrays with Simplified Fabrication for Full-Color Micro-LED Displays, Chih-Yuan Tsai¹, Hao-Sung Chiu¹, Cheng-Yan Wang¹, Wei-Zhe Li¹, Ting-Yu Meng¹, Ching-Fuh Lin¹; ¹*National Taiwan Univ., Taiwan*. This work demonstrates an ultrahigh-resolution color-conversion aperture array using a custom black photoresist integrated with an X-cube prism, achieving >20,000 PPI multicolor output while suppressing diffraction-induced crosstalk via optical confinement.

FTu1D.2 • 08:15

Generation of Equal-Intensity Vortex Arrays Using a Digital Micromirror Device, Guannan Guo¹, Zekai Chen¹, Elisha Harber¹, Eileen Otte¹, Nicholas Bigelow¹; ¹*Univ. of Rochester, USA*. We use a Digital Micromirror Device (DMD) to generate equal-intensity optical vortex arrays using Damman gratings and quantitatively compare the results with the application of a Lee hologram.

FTu1D.3 • 08:30

Offset-Diagonal Architecture for Efficient, Scalable, and Sparsity-Enabled Optical Processors, Arjun Iyer¹, Abhishek Tyagi², Liam Young¹, Yuhao Zhu², William Renninger¹; ¹*Inst. of Optics, Univ. of Rochester, USA*; ²*Department of Computer Science, Univ. of Rochester, USA*. We introduce an efficient, scalable, and sparsity-enabled optical computing system by simultaneously leveraging spatial, temporal, and wavelength multiplexing with optical-delay-based operations. Experiments demonstrate near-ideal performance and optimal computational speedups on standard benchmarks across all sparsity levels.

FTu1D.4 • 08:45

Complex Wavefront Engineering via Decoupled Space-Time Modulation, Virat Tara¹, Anna Wirth-Singh¹, Johannes E. Fröch¹, Arka Majumdar¹; ¹*Univ. of Washington, USA*. We demonstrate a hybrid architecture for Spatial Light Modulators. By integrating metasurfaces with photonic integrated circuit, we achieve independent 2D electrical control over each phase-element while simultaneously realizing a three-fold reduction in effective pixel pitch.

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Highland Room DG

08:00 -- 09:00

FTu1E • Ultrafast Optical Interactions

Presider: Julia Mikhailova; Princeton Univ., USA

FTu1E.1 • 08:00

Temperature-Tunable Third-Harmonic Generation in an Integrated Silicon Nitride Waveguide,

Surendar Vijayakumar¹, Austin Graf², Karl J. McNulty³, Alexander L. Gaeta³, Michal Lipson³, Qiang Lin¹, Robert W. Boyd¹, Margoth Córdova⁴; ¹Univ. of Rochester, USA; ²Photonic and Phononic Microsystems, Sandia National Laboratories, USA; ³Columbia Univ., USA; ⁴Univ. of Ottawa, Canada. We demonstrate temperature-tunable third-harmonic generation in an integrated silicon nitride waveguide using modal phase matching. The generated green light tunes at 0.014 nm/K, in close agreement with the predicted 0.013 nm/K slope.

FTu1E.2 • 08:15 (Invited)

Strong Field Interactions in Nanostructures, Peter Dombi¹; ¹Hun-Res Wigner Research Ctr for Physics, Hungary. Strong-field interactions in nanostructures explore ultrafast light-matter dynamics enabled by nanoscale field enhancement. I will highlight nanoplasmonic confinement, nonlinear photoemission, and tunneling transitions at low light intensities, advancing strong-field nanophysics in metals and dielectrics.

FTu1E.3 • 08:45

Holographic Imaging of Ultrafast Demagnetization Dynamics, Alessandro Baserga¹, Federico Visentin², Christian Negrin¹, Davide Benettin¹, Giovanni Gandini¹, Martin Hormann¹, Christian Rinaldi¹, Giulio Cerullo¹, Stefano Dal Conte¹, Ettore carpene², Franco Camargo²; ¹Politecnico di Milano, Italy; ²Cnr, Italy. We employ ultrafast holographic chiroptical microscopy to study spatio-temporal dynamics of laser-induced demagnetization in a Pt/CoFeB/MgO heterostructure. We observe a complex interplay of electronic, spin and lattice dynamics from 100-fs to 100-ps timescales.

Highland Room BJ

08:00 -- 09:00

FW1C • Quantum Imaging

Presider: Svetlana Lukishova; Univ. of Rochester, USA

FW1C.1 • 08:00 (Invited)

Multiparameter Quantum Imaging and Sensing, Alessio D Errico¹, Yingwen Zhang¹; ¹Univ. of Ottawa, Canada. This talk explores multi-parameter entanglement in SPDC photon pairs for quantum imaging and sensing, highlighting recent advances in 3D imaging, quantitative phase imaging, hyperspectral imaging, and quantum-enhanced beam tracking.

FW1C.2 • 08:30

Quantum Imaging with X-rays, J. C. Goodrich², R. Mahon², J. Hanrahan², D. Bollweg², M. Dziubelski², Raphael A. Abrahao^{2,1}, S. Karmakar³, K. J. Gofron⁴, T. A. Caswell², D. Allan², L. Berman², A. Nomerotski^{5,7}, A. Fluerasu², C. DaVìa^{3,6}, S. McSweeney²; ¹Rochester Inst. of Technology, USA; ²Brookhaven National Laboratory, USA; ³Stony Brook Univ., USA; ⁴Oak Ridge National Laboratory, USA; ⁵Florida International

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Univ., USA; ⁶The Univ. of Manchester, UK; ⁷Czech Technical Univ., Czechia. We report world-record photon-pair generation rate via Spontaneous Parametric Down Conversion (SPDC), where the pump and both down-converted photons are in the X-ray spectrum. We perform a quantum imaging experiment using a pixelated area detector.

FW1C.3 • 08:45

High-NA Quantum Quantitative Phase Microscopy of Biological Samples with Two-photon Phase and Resolution Enhancement, Long D. Nguyen¹, A. Nicholas Black¹, Saleem Iqbal¹, Yang Xu^{3,4}, Robert W. Boyd¹, Kevin T. Crampton², James E. Evans²; ¹*Univ. of Rochester, USA*; ²*Pacific Northwest National Laboratory, USA*; ³*Cornell Univ., USA*; ⁴*NTT Research Inc., USA*. We present a high-NA quantum quantitative phase microscope incorporating double-pass Pancharatnam-Berry phase shifting, enabling two-photon phase and resolution enhancement. Phase images of calibration targets and biological cells verify accuracy and demonstrate practical microscopy applications.

Grand Lilac Ballroom South

08:00 -- 09:00

LTu1F • XFEL and Strong-Field Science

Presider: David Purschke; Laboratory for Laser Energetics, USA

LTu1F.1 • 08:00

Resolving Sub-Angstrom Vibrational Dynamics Using Two-color Strong-Field Rescattering, Dina S. Eissa^{1,4}, Abraham Garibay^{1,3}, Vyacheslav Leshchenko¹, Cosmin Blaga⁵, Misha Ivanov², Pierre Agostini¹, Louis DiMauro¹; ¹*Physics, Ohio State Univ., USA*; ²*Physics, Max-Born Inst., Germany*; ³*Physics, Instituto Politecnico Nacional, Mexico*; ⁴*Physics, Indiana Univ., USA*; ⁵*Physics, Kansas State Univ., USA*. Two-color strong-field scattering uses phase-controlled fields to drive and probe ionic-state dynamics in N₂⁺, revealing sub-Å bond-length modulations within the few-femtosecond rescattering window.

LTu1F.2 • 08:15

Attosecond Interferometry at Angstrom Wavelength, Yanwen Sun¹, River Robles¹, Thomas Linker¹, Ying Chen¹, David Cesar¹, Matthieu Chollet¹, Taran Driver¹, Vincent Esposito¹, Carolyn Gee¹, Veronica Guo¹, Shambhu Ghimire¹, Alex Halavanau¹, Yoshio Ichii¹, Ichiro Inoue², Jiawei Yan⁵, Haoyuan Li¹, Kazutaka Nakahara¹, Alberto Lutman¹, Chance Ornelas-Skarin¹, Taito Osaka³, Selene She¹, Sean O'Toole¹, Harrison A. Pasquinelli¹, David Reis¹, Takahiro Sato¹, Sanghoon Song¹, Nicolas Sudar¹, Mark Sutton⁴, Kenji Tamasaku³, Ydran Willard¹, Shao-Ci Wu¹, Makina Yabashi³, James Cryan¹, Matthias F. Kling¹, Agostino Marinelli¹, Diling Zhu¹; ¹*SLAC National Accelerator Laboratory, USA*; ²*Univ. of Tokyo, Japan*; ³*RIKEN SPring8 Center, Japan*; ⁴*McGill Univ., Canada*; ⁵*Deutsches Elektronen-Synchrotron DESY, Germany*. Attosecond X-ray free-electron lasers have developed rapidly in recent years. We report the design and initial testing of an ångström-wavelength split-delay line, characterizing the coherence length and sub-femtosecond duration of these attosecond hard XFEL pulses.

LTu1F.3 • 08:30 (Invited)

Nanoscale Ultrafast Lattice Modulation with Hard X-ray Free Electron Laser, Haoyuan Li⁸, Wang Nan¹², Leon Zhang^{11,2}, Sanghoon Song⁸, Yanwen Sun⁸, May-Ling Ng⁸, Takahiro Sato⁸, Dillon Hanlon¹⁰, Sajal Dahal¹⁰, Mario D. Balcazar⁸, Vincent Esposito⁸, Selene She¹¹, Chance Caleb Ornelas-Skarin^{1,2}, Joan Vila-Comamala³, Christian David³, Nadia Berndt⁴, Peter Richard Miedaner⁴, Zhuquan Zhang⁴, Matthias

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Ihme^{5,6}, Mariano Trigo^{2,7}, Keith A. Nelson⁴, Jerome B. Hastings^{8,6}, Alexei A. Maznev⁴, Laura Foglia⁹, Samuel Teitelbaum¹⁰, David Reis^{11,6}, Diling Zhu⁸; ¹*Electric Engineering Department, Stanford Univ., USA*; ²*Stanford PULSE Inst., USA*; ³*Paul Scherrer Inst., Switzerland*; ⁴*Department of Chemistry, Massachusetts Inst. of Technology, USA*; ⁵*Mechanical Engineering Department, Stanford Univ., USA*; ⁶*Department of Photon Science, SLAC National Accelerator Laboratory, USA*; ⁷*Stanford Inst. for Materials and Energy Sciences, USA*; ⁸*Linac Coherent Light Source, SLAC National Accelerator Laboratory, USA*; ⁹*Elettra - Sincrotrone Trieste S.C.p.A., Italy*; ¹⁰*Physics Department, Arizona State Univ., USA*; ¹¹*Applied Physics Department, Stanford Univ., USA*; ¹²*Physics Department, Stanford Univ., USA*. Hard X-ray transient grating spectroscopy is demonstrated in SrTiO₃ using synchronized free-electron laser pulses to generate ~10 nm excitation patterns, enabling wavevector-selective coherent acoustic phonons and revealing ballistic thermal transport at nanometer scales.

Grand Lilac Ballroom North

09:15 -- 10:00

FTu2A • FiO Visionary Session II: Virtual Reality and Augmented Vision

Presider: Hong Hua; Univ of Arizona, Coll of Opt Sciences, USA

FTu2A.1 • 09:15 (Visionary)

Toward Perceptually Realistic AR Glasses for the AI Era, Jae-Hyeung Park¹; ¹*Seoul National Univ., Korea (the Republic of)*. Future AI glasses require not only compact hardware but also perceptually realistic visual experiences for comfortable everyday use. This talk reviews display technologies for correct depth perception, realistic interaction, and accurate appearance, including Maxwellian, light-field, holographic, occlusion-capable, and color-aware displays, and discusses future directions toward human-centered augmented vision.

Grand Lilac Ballroom South

09:15 -- 10:00

LTu2B • LS Visionary Session I

Presider: Viktor Podolskiy; Univ. of Massachusetts Lowell, USA

LTu2B.1 • 09:15 (Visionary)

Classical and Quantum Photonics: From Interconnects to Processors, Jelena Vuckovic¹; ¹*Stanford Univ., USA*. Integrated photonics is essential in all of modern computing hardware (AI and quantum), sensing systems, and wearable technology. To achieve desired efficiency, robustness, and functionalities of these devices, it is necessary to employ new design approaches (such as inverse design), new physics and to explore new materials and integration approaches.

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Empire Hall - Theater

10:30 -- 11:30

JTU3A • Joint Plenary Session I

Presider: Sterling Backus; Thorlabs Laser Division Boulder, USA

JTU3A.1 • (Plenary)

High Power Ultrafast Reaches the Terahertz, Clara J. Saraceno¹; ¹*Ruhr Universität Bochum, Germany.*

Terahertz light is becoming a ubiquitous tool in many scientific fields and is also increasingly deployed in industrial settings, in inspection, non-destructive testing and other security applications. Terahertz wave “see through” optically opaque objects, and can provide rich spectroscopic information. In science, they can excite and probe a plethora of low energy phenomena in condensed matter. While these systems have seen tremendous progress in last decades, efficient, and labbased THz generation methods combining ultra-broad bandwidth and high dynamic range (e.g., as provided by high THz average power and correspondingly high repetition rate) remain very rare, and most measurements remain too slow, which limits their wide applicability. In recent years, an emerging research area has gained speed: increase the average power of broadband THz sources using state-of-the-art, high-average power ultrafast Yb-gain based lasers providing multi-100-W to kilowatt average-power levels as excitation sources. Recent results have allowed to reach power levels in the THz domain in the multi-ten to multi-hundred milliwatts in different repetition rate regions – which was previously restricted to accelerator - type THz sources. This progress opens the door to a multiplicity of new and old research areas to be revisited. In this talk, we review recent progress in the generation of high-average power THz-TDS. We will present the state-of-the-art of high-power ultrafast laser sources with potential for driving THz sources, current technological challenges in scaling THz average power, and applications areas that could potentially benefit from these novel sources.

Empire Hall - Poster Session

11:30 -- 13:00

JTU4A • Joint Poster Session I

JTU4A.1

Radiation-Induced Coupling of Bandwidth and Generation–Recombination Noise in Silicon Photonic Modulators, Awanish Pandey¹; ¹*Optics and Photonics Centre, Indian Inst. of Technology, India.*

Radiation-induced SRH defects reduce carrier lifetime in silicon modulators, expanding bandwidth. We show the same trap population raises total g–r noise power and shifts its spectral weight upward, coupling bandwidth gain to in-band noise.

JTU4A.2

Tensor Processing with Nonlinear Optical Media, Zhouzhi Xia¹, Jinchen Zhao^{1,2}, Haoyu Wei¹, Martin M. Stein^{1,2}, Logan Wright¹; ¹*Yale Univ., USA*; ²*NTT Research, Inc., USA*. We predict that patterned $\chi(2)$ media can perform nearly arbitrary bilinear tensor contractions, and that their energy per operation can surpass digital electronics at far smaller vector sizes than linear photonics requires.

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JTu4A.3

Relativistic Tunable Terahertz to Mid-infrared Radiation from Magnetized Laser-Plasma Interaction, Sida Cao¹, Matthew Edwards¹; ¹*Stanford Univ., USA*. We report tunable, relativistic terahertz to mid-infrared pulse generation in strongly magnetized plasma through phase-matched difference-frequency mixing of broadband or two-color pumps, with particle-in-cell simulations demonstrating field strengths exceeding 150 GV/m.

JTu4A.4

GHz Limit-Cycle Oscillations in an Annular Exciton-Polariton Condensate, Joaquín G. Zurschmitten¹, Ignacio Carraro-Haddad¹, Gonzalo Usaj¹, Axel Bruchhausen¹, Klaus Bierman², Paulo Santos², Alexander Kuznetsov², Alejandro Fainstein¹; ¹*Instituto Balseiro, Argentina*; ²*Paul-Drude-Institut für Festkörperelektronik, Germany*. Experimental study of self-sustained ultrafast (20 GHz) oscillations in annular microcavity exciton-polariton condensates, exhibiting phonon-resonant mode splitting and first-order coherence oscillations at the confined phonon frequency, consistent with mesoscopic limit-cycle dynamics.

JTu4A.5

Characterization of Plasma Structure Produced by Intense Spatiotemporal Optical Vortex, Nishchal Tripathi¹, Scott W. Hancock¹, Howard M. Milchberg¹; ¹*Univ. of Maryland at College Park, USA*. We report the first characterization of plasma formed by an intense spatiotemporal optical vortex (STOV) pulse. The plasma structure is probed with transverse interferometry while monitoring STOV's spatiotemporal intensity envelope.

JTu4A.6

Sleep Stage Signal Classification Using Strain Stress Filtering and 1D CNN, Muhammad Fajar Faliasthiunus Pradipta¹, Brian Pamukti¹, Edrick Hansel Limantoro¹, Shien-Kuei Liaw¹, Chien-Hung Yeh²; ¹*National Taiwan Univ of Science & Tech, Taiwan*; ²*Feng Chia Univ., Taiwan*. This study proposes a simple fiber-based framework using SSFN preprocessing and a lightweight 1D CNN, achieving 91.25% overall accuracy in classifying four sleep stages from time series voltage signals with a non-intrusive setup.

JTu4A.7

Electro-Optic Supercontinuum Optimization via Genetic-Algorithm-based Seed Control, Jaew Bae^{2,1}, Sangsik Kim², Minhyup Song¹; ¹*Photonic/Wireless Devices Research Division, Electronics and Telecommunications Research Inst., Korea (the Republic of)*; ²*Electrical Engineering, Korea Advanced Inst. of Science and Technology, Korea (the Republic of)*. We demonstrate genetic-algorithm-based pulse shaping for electro-optic supercontinuum optimization. Phase optimization broadens the bandwidth from 32.89 nm to 61.93 nm, and amplitude optimization reduces peak-to-peak comb-line power variation from 22.94 dB to 14.09 dB.

JTu4A.8

Papoulis-Gerchberg Reconstruction of Spectroscopic Diffraction Maps, Alexander Bartenev¹, Ivan Yakovkin², Larry Theran¹, Majid Aalizadeh^{3,4}, Nataliia Petrova⁵, Esteban E. Montalvo-Marrero¹, Andriy Serebryannikov⁶, Leonid Poperenko⁷, Sergiy Lysenko¹; ¹*Department of Physics, Univ. of Puerto Rico Mayaguez, USA*; ²*Department of Theoretical Physics, Inst. of Physics of the National Academy of Sciences of Ukraine, Ukraine*; ³*Department of Biomedical Engineering, Univ. of Michigan, USA*; ⁴*Biointerfaces Inst., Univ. of Michigan, USA*; ⁵*Department of Adsorption Phenomena, Inst. of Physics of the National Academy*

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of Sciences of Ukraine, Ukraine; ⁶Division of Physics of Nanostructures, ISQI, Faculty of Physics and Astronomy, Adam Mickiewicz Univ., Poland; ⁷Faculty of Physics, Taras Shevchenko National Univ. of Kyiv, Ukraine. We demonstrate the reconstruction of angle-resolved diffraction spectra of single-rod meta-array using Papoulis-Gerchberg approach. Momentum-space reconstruction fills the absent spectral data, preserving major features in finite-element simulations, showing good agreement between theory and experiment.

JTu4A.9

Sensitivity Enhancement of Water Salinity Detection Using a BK7/Ag/S-Rich ZnS/BP Surface Plasmon Resonance, Shaik A. Mohiddeen¹, Xuecheng Liu², Yesudasu Vasimalla¹, santosh Kumar¹; ¹Koneru Lakshmaiah Education Foundation, India; ²Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, Shanghai Inst. for Advanced Communication and Data Science, Shanghai Univ., China. This study presents S-rich-ZnS/BP Label-free to detect water salinity. Enhancements in real-time monitoring applications are also highlighted by the capability of resonance angle shifts to detect salinity-induced refractive index variations with improved sensitivity.

JTu4A.10

Aqueous Refractive Index Sensing Using a Zinc Oxide /Zinc Sulfide /Hafnium Diselenide-Based Surface Plasmon Resonance Sensor, Dondapati Naga Jeevana Sandhya¹, Xuecheng Liu², Yesudasu Vasimalla¹, santosh Kumar¹; ¹Koneru Lakshmaiah Education Foundation, India; ²Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, Shanghai Inst. for Advanced Communication and Data Science, Shanghai Univ., China. This work presents an aqueous refractive index sensing platform using zinc oxide, zinc sulfide, and hafnium diselenide that improves the surface plasmon resonance sensor performance by providing higher sensitivity and accurate detection.

JTu4A.11

Bragg Condition Matching Technique between Volume Holographic Optical Elements in Light Field Near-Eye Displays, Yeh-Wei Yu¹, Sheng-Min Shen¹, Yu-Hua Chou¹, Tsung-Hsun Yang¹, Ching-Cherng Sun¹; ¹National Central Univ., Taiwan. We present a planar waveguide near eye display integrating volume holographic elements with light field rendering to eliminate visual conflict. Introducing material shrinkage compensation significantly improves depth dependent image reconstruction accuracy without bulky microlens arrays.

JTu4A.12

Amplification of OAM Modes in a Weakly Coupled 7-Core Erbium Doped Fiber, Ishani De¹, Vipul Rastogi¹; ¹Indian Inst. of Technology Roorkee, India. We have designed a homogeneous, weakly coupled 7-core erbium-doped fiber, in which each graded-index ring core supports 10 OAM modes in the C-band. A gain of more than 20 dB was achieved for 7×10 OAM modes × 8 WDM signal channels with 300 mW of core-pumped power.

JTu4A.13

Prospects of Airy Beam Wavefront Sensor, Surya Kamal¹; ¹Chester F. Carlson Center for Imaging Science, Rochester Inst. of Technology, USA. A theoretical Airy-beam-based wavefront-sensing framework is proposed. Simulations show that aberrations alter interference between two curved trajectories,

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indicating potential for phase retrieval and aberration sensing without conventional collection optics.

JTu4A.14 ·

Probabilistic Model for the Number of Active Particles based on Polisher Pad Morphology during CMP of Fused Silica Optical Glass, Aparajita Parashar¹; ¹AcSIR - CSIO, India. This study proposes a probability based model for estimating the number of active abrasive particles based on polishing pad morphology during CMP of fused silica optical glass. A maximum material removal rate of 662.41 nm per minute, was achieved under optimized polishing conditions.

JTu4A.15 ·

Amyloidosis Extracellular Matrix Remodelling Assessed by Multiphoton Microscopy, Luisa H. Araújo¹, Thaís d. Araújo², Vanessa d. Bernardes³, Ana Maria de Paula¹; ¹Departamento de Física, ICEx, Universidade Federal de Minas Gerais, Brazil; ²Departamento de Clínica, Patologia e Cirurgias Odontológicas, Faculdade de Odontologia, Universidade Federal de Minas Gerais, Brazil; ³Departamento de Patologia, ICB, Universidade Federal de Minas Gerais, Brazil. Multiphoton microscopy combined with quantitative collagen analysis revealed extracellular matrix remodelling in oral amyloid deposits. SHG-derived features enabled moderate discrimination between amyloid-associated and non-amyloid regions, supporting label-free optical assessment of tissue microstructure.

JTu4A.16 ·

Vergence Angle Estimation Using Power Ref 3 During Vergence-Accommodation Conflict Simulation, Linda Krauze¹, Tatjana Pladere¹, Anastasija Jakovica¹, Gunta Krumina¹; ¹Univ. of Latvia, Latvia. Vergence responses during vergence–accommodation conflict simulation in multifocal augmented reality were estimated from PowerRef 3 binocular gaze measurements. Vergence angles were reduced relative to theoretical values, with increased inter-individual variability at larger conflict magnitudes.

JTu4A.17

Conical Waves and Bessel Beams, Jürgen Jahns¹, Stefan Helfert¹; ¹Fernuniversität in Hagen, Germany. Bessel beams are a superposition of partial waves tilted towards the optical axis which together form a conical wave. We consider the relationship of Bessel beams and conical waves from a mathematical and physical perspective.

JTu4A.18

Reflective Optoelectronic Reservoir Computing Based on an Optical Fibre Delay Line, Xiang Wang¹, Fumiya Iida¹; ¹Department of Engineering, Univ. of Cambridge, UK. A reflective optoelectronic reservoir is proposed to increase virtual nodes by doubling the optical path length. Simulation results show improved linear and quadratic memory capacities with increasing reservoir size.

JTu4A.19

Nonlinear Optical Response from Silicon-based Non-centrosymmetric Nanopillar Structures, Hung-Chi Lin¹, Ching-Fuh Lin¹; ¹National Taiwan Univ., Taiwan. We demonstrate nonlinear optical responses in Ag/SiO₂ nanopillars fabricated on a silicon substrate, enabled by non-centrosymmetric characteristics, achieving a second-harmonic generation conversion efficiency of 3.761*(10⁻⁴)%

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JTu4A.20

Bright and Fast Single-Emitters for Room-Temperature Single-Molecule Sensing, Margoth Córdova¹, Robert W. Boyd²; ¹*Univ. of Ottawa, Canada*; ²*Univ. of Rochester, USA*. We show that using Purcell enhanced emitters coupled to high LDOS metamaterials and detected at the single-molecule level, can serve to translate very minute changes in the electromagnetic environment and in molecular nanositions to detected signals such as bright point sources.

JTu4A.21

In Situ Measurement and Control of Strong-Field Ionization in Attosecond Science, Eugene Frumker¹, Noam Shlomo¹; ¹*Ben-Gurion Univ. of the Negev, Israel*. Accurately characterizing the peak intensity of strong-field femtosecond pulses within the interaction volume has long remained a major bottleneck in attosecond science. We present an in situ method that solves this problem.

JTu4A.22

Programmable-Photonic Emulation of Self-Accelerating Wave Packets: Interferometric Reconstruction of the Cubic Kennard Phase, Maximilian L. D. D. Pellner², Georgi G. Rozenman¹; ¹*Massachusetts Inst. of Technology, USA*; ²*Ludwig-Maximilians-Universität, München, Germany*. We theoretically develop interferometric reconstruction of the cubic Kennard phase of self-accelerating Airy wave packets, comparing heterodyne and density-based extraction. An Airy–Gaussian geometry maximizes robustness; a preliminary programmable-photonic (DMD) realization demonstrates the method.

JTu4A.23

Optical Vortex-Assisted Asymmetric Cryptosystem for Double Image Encryption via QZ Decomposition in the Gyrator Domain, Poonam Yadav¹; ¹*Northcap Univ., India*. A novel asymmetric optical cryptosystem employing optical vortex phase masks, QZ decomposition, and the gyrator transform is proposed for image encryption. The method enhances security, expands key space, and demonstrates robustness and reliability against cryptographic attacks through simulations.

JTu4A.24

A New Method for the Discovery of the Distant Exoplanets II: Question of Signal-to-Noise Ratio, Peter B. Lerner¹; ¹*Univ. of Maryland Global Campus, USA*. Our first paper (*SPIE Proceedings* 12680: 126802(M)) proposed a Hanbury-Brown-Twiss inspired method to find exoplanets with a very slow-changing influence on their host star. A very small signal-to-noise ratio for HBT makes application of this method difficult. In the current paper, we discuss the possibilities to enhance the low SNR of the method.

JTu4A.25

Highly Wavelength Sensitive Hollow-core Fiber Plasmonic Sensor: Physics and Design, Mohammad Al Mahfuz¹, Md Selim Habib¹; ¹*Florida Inst. of Technology, USA*. An analyte-filled hollow-core anti-resonant fiber integrated with plasmonics technology has been proposed to detect various bio-samples. The state-of-the-art finite element modeling confirms that the fiber can trace refractive indices from 1.25 to 1.44 with exceptional wavelength sensitivity of >10000 nm/RIU.

JTu4A.26

Strongly Inhibited-coupled Fiber Plasmonic Sensor for Ultra-low Refractive Index Detection, Mohammad Al Mahfuz¹, Md Selim Habib¹; ¹*Florida Inst. of Technology, USA*. We propose a solid-core fiber plasmonic sensor based on inhibited-coupling guiding mechanism for detecting ultra-low refractive

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indices. Extensive finite element modeling confirms that the proposed sensor achieves an unprecedented amplitude sensitivity of $>5.5 \times 10^3 \text{ RIU}^{-1}$ for tracing sample indices from 1 to 1.15.

JTu4A.27

Theory of Precision Multi-Layer Nematic Liquid Crystal Gratings, Xiulian Shan¹; ¹RIT, USA. The relaxation of sequentially layered periodic nematic liquid crystals depends on the thickness-to-period ratio, boundary conditions, and elastic properties. We discuss how planar alignment may be maintained throughout the layered structure to produce precision gratings.

JTu4A.28

Lowering Costs of Two Photon Polymerization by Creation of Visible Wavelength Processes, Blake Daiber¹; ¹Auburn Univ., USA. We show that preexisting two photon polymerization processes can be customized to a visible light source. To demonstrate viability of our process we fabricated micro-arches on commonly used optical substrates.

JTu4A.29

QBER Analysis of Beamsplitter Attacks in BB84 QKD for Optical Communication Networks, Shashwat Saxena¹, Anand Srivastava¹, Vimal Bhatia³, Pravindra Kumar², Ritu Raj Singh¹; ¹Department of Electronics and Communication Engineering, Netaji Subhas Univ. of Technology, India; ²Department of Electronics and Communication Engineering, Thapar Inst. of Engineering and Technology, Patiala, India; ³Department of Electrical Engineering, Indian Inst. of Technology Indore, India. Numerical simulations investigate how channel distance, detector efficiency, and beamsplitter reflectance influence quantum bit error rate (QBER). Results show that increasing reflection reduces effective transmittance and causes earlier error growth, closely mimicking channel loss and noise in practical systems.

JTu4A.30

A Four-Qubit Helium Benchmark for Variational Quantum Eigensolvers, Matthew Daddino¹, Ching Man Wong¹, Son Nguyen¹, Xiao-Feng Qian¹; ¹Stevens Inst. of Technology, USA. We construct a tapered four-qubit helium VQE benchmark from uncontracted STO-3G primitives, using Jordan-Wigner mapping, symmetry tapering, VQE optimization, and benchmarked against exact diagonalization.

JTu4A.31

Phase Speed Enhancement by a Linear Magneto-Electric Response, Elliton O. Brandão¹, Eduardo Bittencourt², Danilo H. Spadoti³; ¹isee, Unifei, Brazil; ²Ifq, Unifei, Brazil; ³Iesti, Unifei, Brazil. This work presents order-of-magnitude estimates of the phase velocity changes induced by the linear magnetoelectric effect. Using experimental parameters, we demonstrate measurable effects and compare traceless antisymmetric and symmetric sectors, highlighting the feasibility of detection using phase-sensitive and resonant techniques.

JTu4A.32

Low-Cost Edge Computing Acquisition System with Gigabit Optical Isolation for High-EMI Industrial Environments, Josué B. Sanchez¹, Christian H. Lamin¹, Danilo H. Spadoti¹; ¹Univ Federal de Engenharia de Itajubá, Brazil. We developed a low-cost optical edge-computing data acquisition device for high-EMI environments, capable of sensing 4–20 mA signals and transmitting via optical fiber, with LoRa redundancy ensuring reliable operation.

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JTu4A.33

Post-Quantum Cryptography in Topologically Protected Synthetic Frequency Photonic Lattices, Raktim Haldar¹, Sumana Maiti¹; ¹*Indian Inst of Technology Bhubaneswar, India*. We propose topologically protected synthetic-frequency photonic lattices for the realization of post-quantum cryptographic algorithms. Flexible high-dimensional quantum frequency states in modulated coupled microrings enable programmable noisy lattice manifolds, robust spectral transport, and scalable secure high-dimensional photonic communication.

JTu4A.34

Chip-Scale Coupled-Laser Photonic Reservoir Computing Based on Lang–Kobayashi Dynamics, Chixuan Chen¹, Claire F. Gmachl¹; ¹*Princeton Univ., USA*. We present an on-chip in-line four-laser reservoir modeled with stochastic Lang–Kobayashi equations. For Iris classification, ridge and logistic readouts achieve 98.69% $\pm$ 1.39% and 100% $\pm$ 0% accuracy, outperforming baselines and demonstrating compact reservoir feasibility.

JTu4A.35

Complex-Valued Radiance Fields for Fast Novel-View Hologram Synthesis, Yicheng Zhan¹, Dong-Ha Shin², Seung-Hwan Baek², Aksit Kaan¹; ¹*Univ. College London, UK*; ²*Department of Computer Science and Engineering, Pohang Univ. of Science and Technology (POSTECH), Pohang Univ. of Science and Technology (POSTECH), Korea (the Republic of)*. We propose complex-valued holographic radiance fields, optimizing 3D scenes with complex-valued Gaussian primitives that jointly encode amplitude and phase, enabling 30-10000x faster novel-view hologram synthesis at on-par image quality.

JTu4A.36

Inverse Designed 3D Freeform Volumetric Metasurface as an RGB Low-Pass Angular Filter, Ting Lei¹, Mengdi Sun¹, Haining Yang¹; ¹*Southeast Univ. (China), China*. We inverse-designed a 40-layer 3D freeform volumetric metasurface for RGB low-pass filtering (0°–40°). Zeroth-order transmission is >0.7 in passband (0°–8°) and <0.1 in stopband (15°–40°).

JTu4A.37

Adjoint-Optimized Bullseye Cavities: Design and Experimental Verification, Martin Sanchez¹, Christer Everly¹, Lukas Weituschat¹, Sophia Korono¹, Jaymit Surve¹, Pablo Postigo¹; ¹*U of Rochester, The Inst. of Optics, USA*. Bullseye cavities are inverse-designed with a cylindrical FDFD adjoint solver, targeting maximum Q and a perovskite single-photon emitter's linewidth, achieving $F_p = 46$ and $\eta = 0.50$. White-light reflectometry verifies fabricated max-Q cavities with Q bracketing simulation ($Q \approx 631$).

JTu4A.38

Computational Vernier Enhanced Fabry–Perot Wrist Patch for Ultra-Sensitive Pulse Monitoring, Arvind K. Maurya¹, Pratik Mishra¹, Rajan Jha¹; ¹*Physics, Indian Inst. of Technology Bhubaneswar, India*. This study presents a PDMS-embedded Fabry-Perot patch using virtual Vernier processing without a physical reference arm, enabling remotely tunable sensitivity for compact and ultrasensitive real-time pulse monitoring.

JTu4A.39

Plasmonic Dimer-Assisted Polarized Single-Photon Coupling to Nanofiber-Guided Modes, Subrat Sahu¹, Kali P. Nayak², Rajan Jha¹; ¹*Department of Physics, Indian Inst of Technology Bhubaneswar, India*;

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²*Department of Engineering Science, Univ. of Electro-Communications, Japan.* A quantum emitter-coupled gold nanorod dimer hybrid system is proposed for channeling plasmon-enhanced polarized single photons into optical nanofiber-guided modes. We show that the spontaneous emission is strongly enhanced with high degree of polarization ~99%.

JTu4A.40

Spectral State Classification of a Linear-cavity Mode-locked Fiber Laser Based on Nonlinear

Polarization Interferometer, Weijie Sheng¹, Zikun Jin¹, Zebin Gao¹, Qian Li¹; ¹*Peking Univ., China.*

Intelligent mode-locking spectra of an all-PM Er-doped fiber laser are classified using 1D-CNN, ISACNN, and Random Forest, where ISACNN achieves an F1-Score of 0.9919 without requiring spectral feature extraction.

JTu4A.41

Photonic Array Integrated Dual-Phase CsPbBr₃–CsPb₂Br₅ Nanosheets for Enhanced Photodetection,

Jagriti Ahuja¹, Shobhit Rastogi², Saurabh Pandey¹, Shereena Joseph¹, Krishna Balasubramanian², Nagarajan Subramaniam¹, Joby Joseph¹; ¹*Indian Inst. of Technology Delhi, India;* ²*Material Science and Engineering, Indian Inst. of Technology Delhi, India.* We report a hybrid photonic perovskite platform by integrating CsPbBr₃-CsPb₂Br₅ nanosheets perovskite with a TiO₂-coated two-dimensional photonic array for enhanced photodetection. The device demonstrates responsivity of 25.0 mA/W and detectivity of 6.0×10^9 Jones at the resonant wavelengths.

JTu4A.42

Large Resonance Tuning in Sb₂Se₃-Based Metal-Insulator-Metal Fabry-Perot Cavities Enabled by Phase Transition,

Manoj K. Vishwakarma¹, Om Prakash¹, Shereena Joseph¹, Santanu Ghosh¹, Joby Joseph^{2,3}; ¹*Physics, Indian Inst. of Technology Delhi, India;* ²*Optics and Photonics Centre, Indian Inst. of Technology Delhi, India;* ³*Indian Inst. of Technology Delhi– Abu Dhabi, United Arab Emirates.* We demonstrate phase-change tuning of Fabry–Perot modes in Au/Sb₂Se₃/Au MIM cavities. Thermal crystallisation shifts resonances from 750 to 912 nm, 910 to 1085 nm, and 1270 to 1520 nm, matching FDTD simulations.

JTu4A.43

Low-Loss, CMOS Compatible Aluminum Nitride Waveguides for Quantum Interconnects,

John Serafini¹, Bogdan Dryzhakov¹, Bernadeta Srijanto¹, Alberto Marino¹, Steven Randolph¹, Kyle Kelly¹; ¹*Oak Ridge National Laboratory, USA.* We fabricate single-mode optical waveguides out of thin-film aluminum nitride (AlN) deposited onto a silicon-on-insulator (SOI) substrate. Transmission measurements reveal propagation losses as low as 1 dB/cm and edge couplers with losses of 2 dB/facet.

JTu4A.44

Physics-Based Flow Matching for Full-Field Prediction of Silicon Photonic Devices,

Joseph Quaratiello¹, Anthony Rizzo¹; ¹*Dartmouth College, USA.* PIC-Flow, a physics-based flow-matching model, predicts complex-valued electromagnetic fields for silicon photonic devices. A Helmholtz residual loss enforces wave-equation compliance, the model generalizes to held-out devices, and inference runs orders of magnitude faster than FDTD.

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JTu4A.45

Pulse Energy Scalable DSR Pulses from An All-PM NOLM-Based Yb-Doped Fiber Laser, Akshay Raj R¹, Munukutla S. Satish¹, Shyamal Mondal¹; ¹*Defence Inst. of Advanced Technology, India*. We report an all-PM NOLM-based Figure-of-8 Yb-doped fiber laser generating DSR pulses. The highest output power was ~205 mW, repetition rate ~3.9 MHz, SNR ~73 dB and pulse width ranging from 6.4 to 10.67 ns.

JTu4A.46

Analysis of Three-Dimensional Ablation Shape Formed by Femtosecond Pulse Laser in Polymer Materials, Lee Chaeyoung¹, Daejin Kim¹, Yoonsuk Kim², Yoonyeol Lee², Hyunsung Park², Yoonchan Jeong¹; ¹*Seoul National Univ., Korea (the Republic of)*; ²*Samsung Display Co., Ltd, Korea (the Republic of)*. We investigate the three-dimensional ablation profile induced by a femtosecond pulse laser using ray and thermal energy models, and find that the results accurately describe the morphology of craters formed by industrial laser ablation processing.

JTu4A.47

Hyperspectral Imaging in Diamond Analysis, Jiaying Wu¹, Daniel Jones¹, Tsung-Han Tsai¹; ¹*Gemological Inst. of America, USA*. We demonstrate a hyperspectral imaging system for gemstones that provides co-registered pseudo-absorption fingerprints and color coordinates, enabling simultaneous identification and color analysis of natural and treated chemical vapor deposition (CVD) pink diamonds.

JTu4A.48

Tailoring Multipolar Optical Trapping with Higher-Order Structured Beams, Nabendu S. Mishra¹, Eileen Otte¹; ¹*Univ. of Rochester, USA*. Using multipole-resonant excitations, we present the customization of optical trapping landscapes by higher-order structured light fields. Gray trapping performance was found to be enhanced by modifying a petal-structured beam, with exotic vector beams paving the way for potential applications in particle sorting and optical binding studies.

JTu4A.49 •

Two-Photon Lithographic Engineering of Photoluminescent MOF-Based Microarchitectures, Vinícius P. Pinto¹, Oswaldo José Rosas Rivas^{1,2}, Gaurav P. Singh¹, Gabriel d. Campos¹, Germán E. Gomez^{2,3}, Cleber R. Mendonça¹; ¹*São Carlos Inst. of Physics, Univ. of São Paulo, Brazil*; ²*Facultad de Química, Universidad Nacional de San Luis, Argentina*; ³*Instituto de Investigaciones en Tecnología Química (INTEQUI), Argentina*. Eu-doped MOF-76 particles were integrated into polymer microstructures by two-photon lithography. The fabricated architectures preserved Eu³⁺ photoluminescence after processing, demonstrating the potential of luminescent MOF-polymer composites for photonic microdevice fabrication.

JTu4A.50 •

Laser Ablation and Fragmentation of Ag_(1-x)Cu_(x) Alloy Targets for Optoelectronic Applications, Umut Taylan^{2,3}, Gizem Mutlay², Zeynep Ece Korkmaz^{2,1}, Can Okuyucu⁴, Yunus Eren Kalay⁴, Bülend Ortaç²; ¹*Hacettepe Univ., Turkey*; ²*Inst. of Materials Science and Nanotechnology Research Center, Bilkent Univ., Turkey*; ³*Laboratory for Advanced Materials Processing, Empa Swiss Federal Laboratories for Materials Science and Technology, Switzerland*; ⁴*Middle East Technical Univ., Turkey*. We demonstrate tunable localized surface plasmon resonance in diverse nanomaterials produced via pulsed laser ablation. Adjusting composition and laser parameters controls nanoparticle size and core-shell to biphasic transitions, tuning optical absorption for optoelectronic applications.

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JTu4A.51 •

Spatiotemporal Steering of Focal Trajectories in Two Dimensions, Sida Cao¹, Devdigvijay Singh¹, Lavonne Mack², John Palastro², Matthew Edwards¹; ¹*Stanford Univ., USA*; ²*Laboratory for Laser Energetics, USA*. We introduce a generalization of a flying focus that decouples the movement of the laser focus from the propagation direction. This enables control of the longitudinal and transverse focal velocity using holographic solid-state or plasma optics.

JTu4A.52 •

On-Demand Bell State Transformation in a Fully Guided Telecom C-band Platform, Khushboo Saxena¹, Vivek Venkataraman¹, Joyee Ghosh¹; ¹*Indian Inst. of Technology Delhi, India*. We demonstrated on-demand Bell state transformation using half-wave plates at a telecom wavelength of 1550 nm using an MgO:PPLN ridge waveguide, achieving fidelity > 88% and concurrence > 0.84, confirming high-purity entanglement for all four Bell states.

JTu4A.53 •

A Two-Component Cardiac Signal Resolves the Demographic Bias in Remote Photoplethysmography, Gurnoor Kaur², Vasudevan Lakshminarayanan¹, Simarjeet S. Saini¹; ¹*Univ. of Waterloo, Canada*; ²*Cameron Heights Collegiate Inst., Canada*. Remote photoplethysmography assumes one cardiac signal in skin video; we show there are two. The missing isochromatic component explains failure of every tested method on darker skin. Explicit two-component handling achieves clinical accuracy across cohorts.

JTu4A.54 •

Comparative Study and Numerical Analysis of Metal-Coated Metasurface Structures in the THz Domain, Pabitraa Madhurima², Siddhartha P. Duttagupta², Pradeep Dixit³, R.K. Singh Raman¹, Santosh Panjekar⁴; ¹*Mechanical and Aerospace Engineering, Monash Univ., Australia*; ²*Electrical Engineering, Indian Inst. of Technology Bombay, India*; ³*Mechanical Engineering, Indian Inst. of Technology Bombay, India*; ⁴*Department of Biochemistry & Molecular Biology, Monash Univ., Australia*. Electromagnetic wave frequency domain simulations evaluate nickel and gold coated quartz gratings as terahertz metasurfaces. Normalized transmittance, FWHM, and Q-factor compare metal-dependent plasmonic responses to identify a suitable coating for potential label-free biomarker sensing platforms.

JTu4A.55 •

Co-Alloyed Perovskite Quantum Dots for Controlled Hot-Carrier Dynamics and Phase Stable Optoelectronics, Afreen A¹, Shekhar Mondal², Abhijit Hazarika², K. V. Adarsh¹; ¹*Indian Inst of Science Ed & Res, Bhopal, India*; ²*Polymers and Functional Materials Division, CSIR-Indian Inst. of Chemical Technology, India*. Tunable bandgap along with strong carrier-phonon coupling, long carrier lifetime and controlled hot-phonon bottlenecks in co-alloyed FAPbI₃ and CsPbBr₃ quantum dots unveiled from the temperature-dependent photoluminescence and ultrafast transient absorption spectroscopy, emphasizing their potential for next-generation optoelectronics.

JTu4A.56 •

Direct Determination of the Translational Energy of CO₂ Molecular Beam Using Three-Photon Resonant Ionization and Ion Imaging Method, minali gorsi¹, Pranav Shirhatti¹; ¹*Tata Inst. of Fundamental Research, India*. We demonstrate direct measurement of translational energy of CO₂ molecular-beam generated by heated nozzle (from 1.5 to 3.5 eV) using (3+1) REMPI and delayed ion-

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imaging, eliminating indirect CO-proxy calibration used in previous dissociation studies.

JTu4A.57

Multiorder Exceptional Points in Optical Lattices, Athanasios Athanasopoulos^{1,2}, Dimitrios Kaltsas^{1,2}, Konstantinos Makris^{1,2}; ¹*Univ. of Crete, Greece*; ²*IESL, FORTH, Greece*. We examine a unique type of non-Hermitian degeneracies in two-dimensions, the multi-order exceptional Points (MoEPs). The symmetries and relevance of these quantum inspired classical systems in optical sensing will also be discussed.

JTu4A.58

Two-Stage High-Pressure Argon-Filled Hollow-Core Fiber Architecture for Scalable Microjoule Yb:YAG Pulse Compression, Dillon Lim¹, Andre M. Cote¹, Ramon Vicencio¹, Shawn M. Sederberg¹; ¹*Simon Fraser Univ., Canada*. We demonstrate two-stage spectral broadening of 351 fs, 35 μ J, 1040 nm Yb:YAG pulses in argon-filled hollow-core fibers. Stage one compresses to 60 fs; stage two further broadens the spectrum for future compression toward few-cycle pulse durations.

JTu4A.59

UAV-Based Multispectral Imaging for Plant-Level Potato Virus Y Monitoring Using Near-Infrared and Red-Edge Spectral Channels, Muhammad Shehzore Hashmi¹, Bradley M. Whitaker¹, Paul Nugent¹; ¹*Montana State Univ., USA*. UAV-based multispectral imagery incorporating near-infrared and red-edge wavelengths was evaluated for plant-level Potato Virus Y monitoring. Results demonstrate that NIR-enhanced spectral channels capture vegetation stress information and support optical disease sensing in agricultural environments.

JTu4A.60

Dual-Color Dark-State Polaritons from Dressed Atomic Manifolds, Dounan Du¹, Eden Figueroa^{1,2}; ¹*Suny Stony Brook, USA*; ²*Brookhaven National Laboratory, USA*. We investigate a dressed-state atomic configuration supporting a dark-state polariton whose two optical frequency components couple to a common spin-wave coherence, providing a platform for multicolor polariton dynamics and wavelength-flexible light-matter interactions.

JTu4A.61

Weak Measurement-based Differential Microscopy, Ritwik Dhara¹; ¹*Indian Inst of Science Ed & Res, Kolkata, India*. A new kind of optical differential microscope has been proposed in this work, based on the method of weak measurement that can produce the differential image of both phase and amplitude objects in a single embodiment.

JTu4A.62

Mask Optimization of Plasmonic lithography Based on Stochastic Parallel Gradient Descent Algorithm, Huwen Ding¹, Yayi Wei¹; ¹*Inst. of Microelectronics of CAS, China*. A mask optimization (MO) method based on the stochastic parallel gradient descent (SPGD) algorithm is proposed. Its imaging model is established by the improved rigorous coupled-wave analysis (RCWA) method, which is suitable for repeated calls during the optimization process.

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JTu4A.63

Polarization based W State Generation and Concurrence Analysis under Noise Channels, Manisha Prajapat¹, Manish Jangid¹, Kamal Kishor Choure², Ghanshyam Singh^{1,3}, Phuong T. Tran³; ¹*Malaviya National Inst of Tech Jaipur, India*; ²*School of Computer Science, Univ. of Petroleum and Energy Studies, Dehradun, India*; ³*Faculty of Electrical and Electronics Engineering, Ton Duc Thang Univ., Viet Nam*. A polarization-entangled W state is generated using spontaneous parametric down-conversion (SPDC) and analyzed with an eight-dimensional density matrix. The performance of this quantum communication system has been tested in various noisy environments.

JTu4A.64 ·

Evaluation of the Photodynamic Inactivation of Susceptible and Methicillin-Resistant *Staphylococcus aureus*, Carolina Salgado do Nascimento¹, Leonardo de Boni¹, Kate Cristina Blanco¹; ¹*Univ. of São Paulo, Brazil*. The increasing prevalence of antimicrobial resistance has intensified the search for alternative therapies. Photodynamic inactivation using a novel bromoimidazopyridine-substituted tetraphenylporphyrin effectively inactivated susceptible and methicillin-resistant *Staphylococcus aureus*, highlighting its potential against resistant infections.

JTu4A.65

Longitudinal OCT/OCTA Monitoring of Atopic Dermatitis Structure and Microvasculature, Fengxian Du¹, Junwei Xue¹, Qingliang Zhao¹; ¹*Xiamen Univ., China*. We demonstrate longitudinal OCT/OCTA monitoring of atopic dermatitis, capturing dynamic skin thickening, depth-resolved vascular remodeling, and treatment recovery in mice for label-free structural and multiparametric vascular assessment.

JTu4A.66

Polarimetric Analysis of Purity Parameters and Cross-Polarization in Oral Cancer Tissue, Deepak Panwar¹, Ashok Ashok¹, Anuj S. Saxena¹, Dalip S. Mehta¹, P. Senthilkumaran¹; ¹*Indian Inst. of Technology Delhi, India*. Tissue heterogeneity affects polarization preservation and degree of cross-polarization (DoCP). Using Stokes polarimetry and Mueller matrix microscopy, we quantify DoCP and purity parameters in oral tissue regions with distinct retardance. Variations in these metrics are associated with underlying microstructural heterogeneity.

JTu4A.67 ·

Performance Enhancement of CZTS Solar Cells through Interface Defect Passivation and Back Contact Engineering, Sudarshan K. Jain¹; ¹*Poornima Univ., Jaipur, India*. This study shows the effect of interface defect passivation and back contact optimization in Cu₂O/CZTS/TiO₂ thin film solar cells. Improved interface quality reduces carrier recombination, enhances charge transport, and significantly improves the photovoltaic device's performance.

JTu4A.68 ·

POF Treatment for Glucose Biosensor Optrode., Sandra M. Martinez Loide¹, Jorge Andres O. Contreras², Antonio R. Romero³, Edgar A. Méndez¹; ¹*Universidad de Guanajuato, Mexico*; ²*Universidad Tecnológica de León, Mexico*; ³*Universidad Michoacana de San Nicolás de Hidalgo, Mexico*. Successful bioprode measurements depend on propend POF treatment. A reproducible preparation method including cladding removal, polishing, and sol-gel thin-film deposition is described

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JTu4A.69 ·

Blind Fiber-Reach Classification in Radio-Over-Fiber Links Using Constellation-Derived Time-Series

Features, Carlos D. Ordoñez Salazar¹, Oscar A. Gutierrez Rivadeneira¹, Javier F. Botía Valderrama¹, Jhon J. Granada Torres¹; ¹*Universidad de Antioquia, Colombia*. We demonstrate blind fiber-reach classification in QPSK radio-over-fiber links using constellation-derived time-series features. Without OSNR/SNR inputs, the best machine-learning classifier identifies fiber-reach classes up to 40 km with 81% accuracy.

JTu4A.70 ·

Polarization Interferometer for Evaluating the Electro-Optic Response of Liquid Crystals,

Surya K. Gautam^{1,2}; ¹*CSIR National Physical Laboratory (NPL), India*; ²*Physics, Academy of Scientific and Innovative Research (AcSIR), India*. A polarization interferometer is proposed to evaluating the voltage dependent phase response of liquid crystals. Off axis interferograms enable accurate phase retrieval, demonstrating a simple, stable, and sensitive technique suitable for electro-optic characterization across different illumination wavelengths.

JTu4A.71

Ultrahigh-Sensitivity Refractive Index Sensing of Compacted Powders using Silicon Nitride MZI-TMI

Architecture, Saanvi P. Vijapur¹, Kaustav Bhowmick¹; ¹*PES Univ., India*. We present a Silicon Nitride MZI-TMI photonic sensor for solid-phase packing density quantification. Bruggeman Effective Medium Theory combined with Vernier enhanced dual-mode interference gives 10× sensitivity magnification for compacted powder monitoring.

JTu4A.72

Optical Thermal Diagnostics of PEM Fuel Cell Hydration Using Time-Resolved Thermal Lens

Spectroscopy, Prashant Chitranshi¹, Aman Sharma¹, Yogeshwar Nath Mishra¹; ¹*Physics, Indian Inst. of Technology Jodhpur, India*. In this study, we computationally validated Time-Resolved Thermal Lens Spectroscopy using COMSOL modelling for non-invasive monitoring of Nafion hydration in PEMFCs, where dehydrated membranes shows stronger photothermal signals due to reduced thermal conductivity and restricted heat dissipation.

JTu4A.73

Bound States in the Continuum on Graphene-based Dimer Metasurface,

Shuvajit Roy¹, Sweta Rani¹; ¹*Sister Nivedita Univ., India*. A C_{2v} symmetric unit cell is proposed on a graphene-based metasurface. Quasi-Bound states in the continuum transmission radiation channels are accessed by breaking the C_{2v} symmetry by altering the radius of the dimer.

JTu4A.74

Diffusion-Based Micro-Expression Generation Via Active Time-of-Flight Infrared Imaging,

Jiaonan Zhang^{1,2}, Zhilin Zhang¹, Muhammad Fraz¹, Ayesha Mahmood¹, Omer Altahir Omer Haroon¹, Zhongqi Pan², Yang Yue¹; ¹*Xi'an Jiaotong Univ., China*; ²*Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, USA*. A diffusion-based framework using time-of-flight active-infrared imaging is proposed for micro-expression generation under poor illumination, fusing identity-preserving reference and motion cues to improve expression transfer robustness, temporal consistency, and identity preservation over RGB methods.

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JTu4A.75

Double-Window Electromagnetically Induced Transparency due to Intersubband Transition in Tripod System, Pooja Kumari¹, Manoj Mishra², S Shwetanshumala¹; ¹*Department of Physics, Patliputra Univ. , Patna, India;* ²*Faculty of Science, Somaiya Vidyavihar Univ., India.* Optical susceptibility provided by asymmetrically coupled quantum well possessing four subband have been studied and parameter regime for single and double electromagnetically induced transparency window have been identified to explore the possibility of soliton propagation .

JTu4A.76

Study of Photothermal and Heat-Transfer Dynamics in CBNP Nanofluids via Thermal Lens Spectroscopy, Rohit K. Maurya^{1,2}, Aman Sharma³, Sumit Kotwal³, Debabrata Goswami^{1,4}; ¹*Dept. of Chemistry, Indian Inst. of Technology Kanpur, India;* ²*Dept. of Chemistry, Pt. Prithi Nath (P.G.) College, Chhatrapati Shahu Ji Maharaj Univ., India;* ³*Centre for Lasers and Photonics, Inst. of Technology Kanpur, India;* ⁴*Center for Bits and Atoms, Massachusetts Inst. of Technology, Cambridge, MA, USA, USA.* This study investigates the photothermal response of CBNP nanofluids using femtosecond laser-induced thermal lens spectroscopy (FTLS). Enhanced photothermal heating and convection features were observed with increasing CBNP concentration, revealing heat-transfer dynamics in nanofluids.

JTu4A.77

Role of Third-Order Diffraction in Determining Equilibrium States of Nonlocal Solitons, Mohit Sharma¹, Rashmi R. Desai², Manoj Mishra², S. K. Tiwary³, Soumendu Jana⁴; ¹*MUST, India;* ²*Somaiya Vidyavihar Univ., India;* ³*JEC-RDVV, Jabalpur, India;* ⁴*TIET, India.* This article analyzes the role of third-order diffraction on equilibrium configurations of nonlocal solitons using NNLSE-derived governing equations and linear stability theory across varying nonlocality levels.

JTu4A.78

Selective Topological-Interface-State Lasing in Disordered Photonic Heterostructures, Jyoti Mandal¹, Nitish K. Gupta², Anjani K. Tiwari^{1,3}; ¹*Centre of Photonics and Quantum Communication Technology, Indian Inst. of Technology Roorkee, India;* ²*Department of Electrical and Electronics Engineering, Birla Inst. of Technology and Science (BITS) Pilani, Hyderabad Campus, India;* ³*Department of Physics, Indian Inst. of Technology Roorkee, India.* We study the effect of disorders on the existence of topological interface states of 1D photonic heterostructures. Matching the gain profile with the spatial profile of the interface state, topological lasing modes are selectively excited.

JTu4A.79

Multi-Layer Polaronic Multi-Electron Nondispersing Trojan-Like Wavepackets on Multiple Click-Click Balls Trajectories with Dichotomy in Atoms and Quantum Dots, Matt Kalinski¹; ¹*Utah State Univ., USA.* Multi-electron extension of the Trojan-like wave packets on the Langmuir oscillating trajectories with dichotomic split is found with the electrons fractionally orbiting the nucleus and bouncing collectively from each other in analogy to few groups of multiple Click-Click Balls.

JTu4A.80

Twin THz Pulse Generation in Two-Color Air Plasma Mediated by Interface-Induced Second-Harmonic Emission, Rajat Kumar¹, Debkanta Ghosh¹, Prasanta Kumar Datta¹; ¹*Indian Inst. of Technology Kharagpur, India.* We demonstrate twin THz pulse generation in a two-color air-plasma system using BBO crystals. Interface-induced second-harmonic emission produces temporally delayed THz pulses

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whose interference modifies the waveform, spectrum, and angular modulation, yielding crystal-thickness-dependent phase shifts.

JTu4A.81

Photoacoustic Entropy Extraction from CuO Thin Films for a Potential True Random Number

Generator, Yukta N. Telrandhe¹, Devnath Dhirhe¹, Abhinav Cherukuth¹; ¹*Defence Inst. of Advanced Technology, India*. We demonstrate a physical true random number generator using photoacoustic signals from CuO thin films. Multi-parameter LSB extraction and SHA-256 post-processing yield Shannon entropy of 1.000000\,bits/bit, with five statistical randomness tests passed.

JTu4A.82

Edge Detection: Optical Spatial Differentiation using Structured Light, Asif Habib¹, Vijay Kumar¹; ¹*NIT Warangal, India*. Edge detection is fundamental to image processing. We demonstrate structured light as multi-level edge detection filters, enabling enhanced image analysis and manipulation while offering new opportunities for structured optical field applications

JTu4A.83

Quantum-Secured Optical Backhaul Networks for 6G Communications: A BB84-Based FSO–Fiber Performance Study, Arav Jain¹, Vriti Miglani¹; ¹*Ece, Ggsipu, India*. A quantum-photonic framework integrating BB84-QKD, hybrid FSO–fiber links, and attenuation-aware analytics is proposed for secure 6G optical networks. Architecture supports AI-assisted routing, channel resilience prediction, and quantum-aware intrusion detection in post-classical communication systems.

JTu4A.84

Spectroscopic Characterization of Citric Acid-Modified Rice Starch for Enhanced Resistant Starch and Reduced Glycemic Response, Jasmine Binoy¹, Nirmal Mazumder¹, Bhoomika R. Hande¹, Nandana B¹; ¹*Manipal Academy of Higher Education, India*. Native starch exhibits rapid digestibility and high glycemic response. Citric acid modified rice starch showed increased resistant starch content, altered starch structure, and reduced GI characterized using resistant starch estimation, FTIR, and GI.

JTu4A.85

Raman Spectroscopic Characterization of Asian Rice Varieties, Somashekar Patil¹, Bhoomika R. Hande¹, Nirmal Mazumder¹, Nandana B¹, Sampath U. Gunathilake²; ¹*Manipal Academy of Higher Education, India*; ²*Department of Polymer Science, Faculty of Applied Science, Univ. of Sri Jayewardenepura, Sri Lanka*. Raman spectroscopy characterized flour and starch fractions from eight rice varieties (400–1800 cm⁻¹). All samples exhibited a starch crystallinity band at 480–482 cm⁻¹ and carbohydrate bands at 860–1465 cm⁻¹.

JTu4A.86

Label-Free Polarized Light Microscopy for Structural Characterization of Oral Squamous Cell

Carcinoma: A Pilot Study, Albin J. Shaju¹, Gagan Raju¹, Vathsala Patil², Adarsh Kudva³, Manikanth Karnati¹, Nirmal Mazumder¹; ¹*Biophysics, Manipal School of Life Sciences, India*; ²*Oral Medicine & Radiology, Manipal College of Dental Sciences, India*; ³*Oral and Maxillofacial Surgery, Manipal College of Dental Sciences, India*. This pilot study employs label-free polarized light microscopy (PLM) to investigate structural differences between normal oral mucosa and OSCC, emphasizing collagen-rich stromal alterations and establishing a foundation for future machine learning-based tissue classification.

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JTu4A.87

Polarization mapping of a birefringent material via Hong-Ou-Mandel interference, Sandeep Singh¹, G. K. Samanta¹; ¹*Atomic Molecular and Optical Physics, Physical Research Laboratory, India*. We extend Hong-Ou-Mandel interferometry from the temporal to the polarization domain and use it to map, projection-free, the transverse birefringence pattern of a q-plate imprinted on 810 nm photon pairs from type-0 SPDC.

JTu4A.88

Climatology-Aware Satellite Optical Channel Model for Slant-Path Propagation, Anand Verma¹, Yugnanda Malhotra¹, Himanish Puri², Jolly Parikh¹, Rajneesh Talwar³; ¹*Bharati Vidyapeeth Coll of Engineering, India*; ²*Thapar Univ., India*; ³*Chitkara Univ., India*. A climatology-aware satellite optical channel model integrating ERA5 meteorology and CAMS aerosol data within a slant-path framework is proposed. Results across five Indian sites at 785 nm show 23.2–24.7 dB losses, significantly outperforming conventional free-space and ITU-R visibility-based models.

Empire Hall - Poster Session

14:00 -- 15:30

JTu5A • Joint Poster Session II

JTu5A.1 •

Automatic Imaging of Multiple Tumour Spheroids Using Image-Based Feedback and Dynamic OCT Instrument, Rameesa Rafi MH¹, Rion Morishita¹, Yuping Zheng¹, Shadil Basheer¹, Ibrahim A. El-Sadek^{1,2}, Atsuko Furukawa³, Shuichi Makita¹, Satoshi Matsusaka³, Yoshiaki Yasuno¹; ¹*Computational Optics Group, Univ. of Tsukuba, Japan, Japan*; ²*Department of Physics, Faculty of Science, Damietta Univ., Egypt, Egypt*; ³*Clinical Research and Regional Innovation, Inst. of Medicine, Univ. of Tsukuba, Japan*. We present an automated 3D tumor spheroid imaging system combining image-based feedback with a synchronized three-dimensional linear translation stage and dynamic OCT control. The system automatically targets, focuses, and images multiple spheroids in a 96-well plate for high-throughput screening.

JTu5A.2 •

Machine Learning for Single-Photon State Characterization and Quantum Communications, Sita Dawanse¹, Manon Bart^{1,2}, Nick Savino¹, Ryan Glaser¹; ¹*Tulane Univ., USA*; ²*Namur Univ., Belgium*. Single-photon sources are fundamental for quantum communication and computing. We present a deep-learning method that distinguishes single-photon and pseudo-thermal light from minimal temporal data, achieving over 98% accuracy under low-intensity, mixed, and realistic experimental conditions.

JTu5A.3 •

Photon Antibunching from Hot Rubidium Vapor in a Slot Photonic-Crystal Microring, Khoi T. Hoang^{1,2}, Sharoon Austin¹, Alexey Gorshkov^{1,2}, Kartik Srinivasan^{1,2}; ¹*Univ. of Maryland at College Park, USA*; ²*National Inst. of Standards and Technology, USA*. Hot alkali vapors combined with integrated photonics are promising chip-scale quantum light sources. Simulating rubidium vapor in a silicon-nitride slot photonic-crystal microring, we find antibunched transmission ($g^{(2)}(0) \approx 0.7$) via defect localization, and

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$g^{(2)}(0) < 0.1$ with heralding or atom-driven emission.

JTu5A.4 ·

Hyperentanglement Preservation in a Free-Space Optical Delay Line, Yu Guo¹, Arya Chowdhury^{3,2}, Jia Boon Chin¹, Pranay Tiwari³, Anindya Banerji¹, Alexander Ling^{1,3}; ¹*Centre for Quantum Technologies, National Univ. of Singapore, Singapore*; ²*Thales Research and Technology, Singapore*; ³*Department of Physics, National Univ. of Singapore, Singapore*. A high-efficiency, broadband free-space optical delay line preserves polarization-energy-time hyperentanglement. After 647 ns, energy-time visibility remains 93.9%, while input-output polarization-state fidelity reaches 99.5%, supporting delay-based quantum memories for synchronization and multiplexing.

JTu5A.5 ·

Shot-Noise-limited Few-Cycle Cr:ZnS Frequency Comb, Jakub Jaworski¹, Karolina Suliga¹, Michal Pietrzak¹, Pawel Szczypkowski², Pawel Kaczmarek¹, Alexander Weigel^{3,4}, Jaroslaw Sotor¹, Maciej Kowalczyk¹; ¹*Wroclaw Univ. of Science and Technology, Poland*; ²*Univ. of Warsaw, Poland*; ³*Center for Molecular Fingerprinting Research, Hungary*; ⁴*Max-Planck-Inst. of Quantum Optics, Germany*. We present a fully-stabilized ultralow-noise 2.3- μm Cr:ZnS frequency comb generating 10 fs pulses. By minimizing pump-power fluctuations, we achieve an integrated RIN of 0.0043%, reaching the shot-noise limit in the 10–100 kHz range.

JTu5A.6 ·

A Label-free FASnI₃/WS₂-Assisted Plasmonic Sensor for Sugar Content Analysis in Soft Drinks, Dondapati Naga Jeevana Sandhya¹, Xuecheng Liu², Yesudasu Vasimalla¹, santosh Kumar¹; ¹*Koneru Lakshmaiah Education Foundation, India*; ²*Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, Shanghai Inst. for Advanced Communication and Data Science, Shanghai Univ., China*. This paper presents an optimized a Label-free plasmonic sensor for analysing the sugar content in soft drinks using formamidinium tin triiodide (FASnI₃) and Tungsten disulfide (WS₂)-based structure.

JTu5A.7 ·

Controlling Ablation Threshold of Materials with Optical Vortex Beams, Melika Afshar¹, Jean-Luk Begin², Alessio D'errico¹, Ebrahim Karimi^{1,3}, Ravi Bhardwaj¹; ¹*Physics, Ottawa Univ., Canada*; ³*Chapman Univ., USA*. The ablation threshold is assumed to be immutable under fixed laser processing conditions. This work demonstrates that it can be tuned using asymmetric optical vortex beams by controlling beam helicity and shifting the phase singularity.

JTu5A.8 ·

Nonlinear Processes in Cryogenic Lithium Niobate Nano Photonics, Tristan Kuttner¹, Ulrich Sauter¹, Robert J. Chapman¹, Myriam Rihani¹, Jost Kellner¹, Alessandra Sabatti¹, Giovanni Finco¹, Andreas Maeder¹, Rachel Grange¹; ¹*ETH Zurich, Switzerland*. We characterize nonlinear processes in thin-film lithium niobate from room temperature down to 5 K, observing a 22% increase in V_{π} , an 18 nm blue-shift for Type-0, and a 64 nm red-shift for Type-II quasi-phase-matching.

JTu5A.9 ·

Learning-based Active Polarimetric 3D Imaging for Complex Specular Surfaces, Jiazhong Wang¹, Hyelim Yang¹, Tianyi Wang¹, Florian Willomitzer¹; ¹*The Univ. of Arizona, USA*. We propose a learning framework

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that jointly exploits complementary polarization and structured illumination cues for accurate single-shot surface normal estimation of complex specular surfaces.

JTu5A.10 ·

Monitoring Early Biochemical Alterations in *Human Citomegalovirus* (HCMV) Infected Patients Using FTIR Vibrational Spectroscopy and Multivariate Analysis, Jaime Zamora¹, Herculano da Silva Martinho¹, Maria Cristina Carlan¹; ¹*Universidade Federal do ABC, Brazil*. FTIR spectroscopy combined with multivariate analysis identified early biochemical alterations in serum from HCMV-infected kidney transplant recipients. Distinct spectral signatures preceding high viremia demonstrate the potential of label-free vibrational spectroscopy for infection monitoring.

JTu5A.11 ·

Pulse Cleaning and Compression by Divided Pulse Spectral Broadening, Meenakshi Mini Ashok^{1,2}, Nayla Jimenez^{1,2}, Ingmar Hartl¹, Marcus Seidel^{1,2}; ¹*Deutsches Elektronen-Synchrotron, Notkestraße 85, 22607, Germany*; ²*Helmholtz Inst. Jena, Fröbelstieg 3, 07743, Germany*. A multi-pass cell for spectral broadening of 75- μ J, 210-fs pulses was inserted into a Sagnac-type interferometer. A 60/40 energy splitting ratio in the interferometer arms led to a strong suppression of pulse pedestals after recombination and compression to 52 fs.

JTu5A.12 ·

Design and Performance Analysis using Titanium Dioxide-Lithium Iodate-Based Surface Plasmon Resonance Biosensor for Non-Invasive Pregnancy Detection Using Urine Samples, Jyothsna Vaadaala¹, Xuecheng Liu², Ragini Singh³, Yesudasu Vasimalla¹, Santosh Kumar¹; ¹*Koneru Lakshmaiah Education Foundation, India*; ²*Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, Shanghai Inst. for Advanced Communication and Data Science, China*; ³*Department of Biotechnology, Koneru Lakshmaiah Education Foundation, India*. This work proposes a Titanium Dioxide–Lithium iodate-based Surface Plasmon Resonance sensor for non-invasive pregnancy detection using urine refractive index, enabling real-time, label-free, highly sensitive detection with excellent performance for rapid and accurate early pregnancy diagnosis.

JTu5A.13 ·

Experimental Benchmarking of Optical Cryptographic Robustness Using SPDC-Derived Quantum Entropy, Utkarsh K. Singh¹, SAHIL SAINI¹, Devnath Dhirhe¹; ¹*Defence Inst. of Advanced Technology, India*. We present a Quantum Entropy Perturbation Framework (QEPF) using SPDC-based QRNG data to emulate optical perturbations. Unlike Gaussian and salt-and-pepper models, these mapped perturbations degrade ciphertext fidelity more effectively, providing an empirically grounded robustness benchmark

JTu5A.14 ·

Acoustic Phonon Dynamics in Co-Doped BaFe₂As₂ Thin Film, Alexander Bartenev¹, Roman Kolodka¹, Larry Theran¹, Ki-Tae Eom², Jong-Hoon Kang², Jason Kawasaki², Chang-Beom Eom², Sergiy Lysenko¹; ¹*Department of Physics, Univ. of Puerto Rico Mayaguez, USA*; ²*Department of Materials Science and Engineering, Univ. of Wisconsin--Madison, USA*. Pump-probe optical spectroscopy demonstrates coherent acoustic oscillations in a Ba(Fe_{0.92}Co_{0.08})₂As₂ film, revealing a sound speed of $v_s=2640$ m/s.

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Modified logistic-function analysis indicates temporal redistribution of coherent acoustic energy, consistent with anharmonic decay of the higher-frequency mode.

JTu5A.15 ·

Diamond Nanopillar–Fiber Bundle Interface for Endoscopic Readout of Nitrogen-Vacancy Quantum Sensors, Olayinka I. Atobatele¹, Mariusz Mrózek¹, Adam Wojciechowski¹; ¹*Marian Smoluchowski Inst. of Physics, Jagiellonian Univ., Krakow, Poland.* This work presents a fiber-coupled NV-diamond nanopillar platform that improves photon collection and optical readout efficiency, offering a flexible and scalable approach to nanoscale magnetic sensing applications.

JTu5A.16

Design of a Very-Large-Mode-Area Fiber to Compress Ultrashort Pulses with a 2 μm Wavelength, Aashish Kumar¹, Bharat B. Sharma¹; ¹*Department of Physics, N.R.E.C. College, Khurja, Bulandshahr, Uttar Pradesh, India- 203131 Affiliated to Chaudhary Charan Singh Univ., Meerut, Uttar Pradesh, India, India.* We design a very large mode area (VLMA) fiber to compress ultrashort pulses at 2 μm wavelength. We achieve pulse durations from 500 fs to 57 fs, which corresponds to an 8.8 compression factor.

JTu5A.17

Exploiting Turbulence-Induced Measurement Diversity for Acoustic Sensing with Frequency-Diverse Structured Light, Arash Shiri¹, J. Keith Miller¹, Matthew Reid¹, Eric Johnson¹; ¹*Univ. of Central Florida, CREOL, USA.* We demonstrate turbulence-resilient underwater acoustic sensing using frequency-diverse structured light. Turbulence-induced beatnote decorrelation increases measurement diversity, enabling joint manifold processing to improve 8-FSK recovery from 73.6% to 85.9% under strong turbulence without optical-field compensation.

JTu5A.18

Holographic Technique for Lens Alignment Measurements, Jan Liesener¹; ¹*Zygo Corporation, USA.* A model-based digital holographic technique measures alignment parameters of small optical systems from a single camera exposure.

JTu5A.19

On-Site Optical Troubleshoot Methodology in Hyperscale Datacenters for AI Applications, Curtis Y. Wang¹, Abhijit Chakravarty¹; ¹*Meta Platforms Inc, USA.* This scalable on-site optical transceiver troubleshoot technology addresses the high No Trouble Found (NTF) rate in datacenter RMA processes. BER Illusion Methodology (BIM) testing demonstrates a ~70% NTF reduction, validating a significant cost reduction opportunity from re-deployment.

JTu5A.20

Optical Interactions of Lithium Diborate Glass Doped with Sm^{3+} and Containing Ag Nanoparticles, Janet Elias¹, Miguel Á. Vallejo-Hernández¹; ¹*Universidad de Guanajuato, Mexico.* Optical properties of Lithium Diborate glass doped with Sm^{3+} and silver nanoparticles were studied. Absorption and emission analysis showed enhancement due to interaction of scattered light and energy transfer between silver nanoparticles and Sm^{3+} ions.

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JTu5A.21

Emission Stabilization Under High Temperature Provided by Plasmonic Structure, Janet Elias¹, Luis A. Diaz-Torres², Eduardo Montes¹, Miguel Á. Vallejo-Hernández¹; ¹*Universidad de Guanajuato, Mexico*; ²*Centro de Investigaciones en Optica, Mexico*. Samples with rare-earths and metallic nanoparticles were synthesized. UV–Vis–IR absorption spectra present an enhancement with plasmonic concentration. The addition of plasmons is responsible for emission stabilization when the temperature is increased.

JTu5A.22

Bias-Dependent Impedance Spectroscopy of $\text{Sr}_{0.9}\text{Ca}_{0.1}\text{CoO}_{3-\delta}$ Perovskites for Functional Sensing and Optoelectronic Applications, Aayush Mittal¹, Pramod Kumar¹, Harish Verma¹, Shail Upadhyay¹; ¹*Indian Inst of Technology (BHU) Varanasi, India*. Bias-dependent impedance spectroscopy of $\text{Sr}_{0.9}\text{Ca}_{0.1}\text{CoO}_{3-\delta}$ reveals tunable charge transport and relaxation dynamics driven by defect-mediated conduction. The observed electrical modulation demonstrates the potential of cobaltite perovskites for sensing interfaces and multifunctional electronic materials.

JTu5A.23

Recursive Solution of the Transport of Intensity and Phase Equations: Fourier Transform versus Discrete Cosine Transform, Ram Kumar¹, Partha P. Banerjee², Naveen K. Nishchal¹; ¹*Indian Inst. of Technology Patna, India*; ²*Dayton Univ., USA*. Recursive solution of the TIE and TPE using the FFT-based method is not suitable for accurate phase retrieval near the boundaries. In this paper, a DCT-based framework is presented to suppress the boundary artifacts and improve numerical stability.

JTu5A.24

Self-Referential Point Spread Function for Super Resolved Separation Estimation of Point Sources, Valeria C. Viteri-Pflucker^{1,2}, Sethuraj K. R.^{1,2}, Nickolas Vamivakas^{1,2}; ¹*Inst. of Optics, Univ. of Rochester, USA*; ²*Center for Coherence and Quantum Optics, Univ. of Rochester, USA*. We adapt a class of self-referential functions, previously shown to improve range resolution in coherent radar/ranging, to incoherent imaging. We show the self-referential advantage is preserved, allowing a pathway to super resolved imaging.

JTu5A.25

Broadband Ultrafast Optically Induced Reflectivity Dynamics of Crystalline Bulk 3D Topological Insulators, Shiwangi Puri¹, Sridevi M^{2,3}, Sanyam Jain^{2,3}, Rajiv K. Singh^{2,3}, Sunil Kumar¹; ¹*Femtosecond Spectroscopy and Nonlinear Photonics Laboratory, Department of Physics, Indian Inst. of Technology Delhi, India*; ²*Academy of Scientific and Innovative Research (AcSIR), India*; ³*Photovoltaic Metrology Section, Advanced Materials and Devices Division, CSIR- National Physical Laboratory, India*. We present results from broadband transient reflectivity measurements on a compensated three-dimensional topological insulator. Coherent generation of optical and acoustic phonon modes by direct laser excitation and multi-exponential relaxation of electronic modes from the bulk and the surface states are revealed.

JTu5A.26

Self-Homodyne Retrieval of Few-Cycle Squeezing via Pump CEP Control, Dina S. Eissa^{1,2}, Amr Hossameldin^{1,2}, Chen-Ting Liao^{1,2}; ¹*Physics, Indiana Univ., USA*; ²*Indiana Univ. Quantum Science and Engineering Center, USA*. Few-cycle squeezed-field characterization lacks a bias-free delay-scan route: group-velocity mismatch causes > 20% squeezing underestimation at 5 fs. Pump carrier-envelope-phase

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scanning preserves overlap, enabling distortion-free self-homodyne retrieval of ultrafast squeezing without an external local oscillator.

JTu5A.27

Photoluminescence Measurements of Beryllium Implanted Silicon, Mathew F. McClure¹, Walid Redjem², Thomas G. Brown¹; ¹*The Inst. of Optics, Univ. of Rochester, USA*; ²*Department of Nanoscale Science & Engineering, Univ. at Albany-Suny, USA*. A potential candidate for a silicon-based single photon source is the isoelectronic Beryllium center (Be-center). We report sample implantation, annealing, and characterization methodology using a cryogenic confocal scanning microscope equipped with single photon counting detection.

JTu5A.28

Bifurcation and Stability of Optical Bullets in Nonlinear Graded-Index Optical Fibers, Sonali Maity¹, Samudra Roy¹; ¹*Indian Inst. of Technology Kharagpur, India*. We investigate optical bullet formation in nonlinear graded-index fibers using variational approach. Stable and unstable solution branches are identified through bifurcation analysis, revealing stable low-amplitude propagation, while SPM at higher amplitudes leads to beam collapse.

JTu5A.29

Mid-IR QCL based Ro-Vibrational State Selective Preparation of CO in Molecular Beam, Ardra P S¹, Pranav Shirhatti¹; ¹*TIFR Hyderabad, India*. We demonstrate the use of a frequency stabilized narrow linewidth quantum cascade laser to vibrationally excite CO molecules in a molecular beam for scattering experiments.

JTu5A.30

Structured Light Beam Propagation Through Atmospheric Turbulence: A Comparison of LG, BG, and POV Beams., Nilesh Tiwari¹, Vivek Venkataraman¹, Joyee Ghosh¹; ¹*Indian Inst. of Technology Delhi, India*. This work investigates the propagation behavior of Laguerre-Gaussian (LG), Bessel-Gaussian (BG), and Perfect Optical-Vortex (POV) beams under turbulence. Simulations reveal that turbulence-induced intensity distortion and topological charge degradation with POV and BG beams exhibit robustness.

JTu5A.31

Improved Half-Meter Class Lightweight Mirror Fabrication, Eric Lintz¹, Mike Hyman¹, Jennifer Coniglio¹, Thomas Hordin¹, Thomas Olson¹; ¹*Optimax Systems Inc, USA*. A lean manufacturing cell integrating fabrication, polishing, and metrology enables production of half-meter class lightweight space optics with an eight-week schedule at a rate of two optics per month. Production results demonstrate repeatable sub-10 nm RMS performance.

JTu5A.32

Time-Reversed Young Interferometry: Source-Space Interference with a Fixed Detector, Jianming Wen¹; ¹*Suny Binghamton, USA*. We introduce time-reversed Young interferometry, where a fixed detector re constructs interference by scanning the source coordinate. The resulting source-space fringe provides a statistical-optics platform for conditional response measurement and source coded metrology

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JTu5A.33

Harmonic-Expansion Theory for Resonant W-Triphoton Direct Generation by SSWM, Yu Zhang¹, Jianming Wen¹; ¹*SUNY Binghamton, USA*. We present a harmonic-expansion theory for resonant spontaneous six-wave mixing, enabling self-consistent linear and fifth-order optical responses for direct narrow band W-triphoton generation in atomic ensembles and quantitatively predicting tripartite temporal correlations for quantum networking sources.

JTu5A.34

Blue-Light Induced Barrier-Height Reduction in Metal-Si Schottky Junction, Yao-Han Dong¹, Ankur Sharma¹, Ching-Fuh Lin¹; ¹*National Taiwan Univ., Taiwan*. Blue light dynamically lowers the Schottky barrier in Ag/n-Si devices, enhancing short-wave infrared hot-carrier internal photoemission. This approach boosts responsivity 120-fold, enabling highly efficient silicon-integrated photodetectors.

JTu5A.35

Reliable Photon-Number Resolution through SNSPD Pulse Processing and Time Tagging Optimization, Matteo Moioli¹, Jeremy Doreia², Tim Rambo², Maré Sutphen¹; ¹*Swabian Instruments, Germany*; ²*Quantum Opus, USA*. Swabian Instruments' Time Taggers, combined with Quantum Opus' SNSPDs, enable precise Photon Number Resolution with picosecond precision and ultra-low jitter, reliably distinguishing single- and two-photon events through optimized pulse processing and threshold selection.

JTu5A.36

Modeling of Light Propagation in Highly Multimode, Yb-doped Fiber Amplifiers, Darcy Smith^{2,3}, Kabish Wisal³, Baichuan Huang³, Stephen Warren-Smith^{2,4}, Ori Henderson-Sapir^{2,5}, Sida Cao³, David Ottaway^{1,5}, Douglas Stone³; ¹*Univ. of Adelaide, Australia*; ²*Inst. for Photonics and Advanced Sensing (IPAS) and the School of Physics, Chemistry and Earth Sciences, Adelaide Univ., Australia*; ³*Department of Applied Physics, Yale Univ., USA*; ⁴*Future Industries Inst., Adelaide Univ., Australia*; ⁵*OzGrav - Australian Research Council Centre of Excellence for Gravitational Wave Discovery, Australia*. We present a field-based model for highly multimode Yb-doped fiber amplifiers incorporating gain-induced mode coupling and spatial hole burning. We identify two efficiency-limiting regimes: ASE-limited operation in smaller-core fibers and spontaneous-emission-limited operation in larger-core fibers.

JTu5A.37

Finding Optimum Operating Parameters for Efficient Photon-Correlation Measurement, Vijay Vijay¹, Awanish Pandey¹, Joyee Ghosh¹, Vivek Venkataraman¹; ¹*Indian Inst. of Technology Delhi, India*. In this work, we explored the effects of operational parameters, such as detector quantum efficiency, dead time, and coincidence bin-width, on photon-correlation measurements. The optimized parameters lead to efficient photon-correlation measurement, yielding higher coincidence counts and a higher CAR.

JTu5A.38

Exclusive-OR Logic using Vector Vortex Beams with Multiple Radial Zones, Neha Choudhary¹, Naveen K. Nishchal¹; ¹*Indian Inst. of Technology Patna, India*. Optical exclusive-OR logic using vector vortex beams with multiple radial zones is proposed. Each zone is characterized by independently controllable topological charges, offering parallel XOR operations for high capacity optical computing and encryption applications.

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JTu5A.39

Investigation of the Temperature-Dependent Emission Cross Section and Fluorescent Lifetime of Yb:LuLiF₄ for Use in Cryogenic Laser Amplifiers, Rebecca B. Swertfeger¹, Charles Abbott¹, Ildar A. Begishev¹, Sara Bucht¹, Ethan Burnham-fay¹, Jake Bromage¹; ¹*Laboratory for Laser Energetics, Univ. of Rochester, USA*. The temperature dependence of the fluorescent lifetime and emission cross section of 1%, 5%, and 10%-doped Yb:LuLiF₄ is measured from 78 K to 300 K using fluorescent spectroscopy.

JTu5A.40

Broadband Liquid Crystal Solar Sail, Sai Keshav Sasanapuri¹, Grover A. Swartzlander¹; ¹*Rochester Inst. of Technology, USA*. We designed a sun-facing chiral liquid crystal Bragg reflector solar sail having a transverse momentum transfer efficiency of 49% for a single polarization state with wavelength band 0.47 - 1.67 μ m.

JTu5A.41

Multiparameter Quantum Fisher Information Analysis of Wavefront Aberrations and Image Resolution, Kevin Liang¹; ¹*Physics Department, Adelphi Univ., USA*. Optical systems with common wavefront aberrations can possess greater superior quantum-limited resolution. Such improvements may hold even when aberration coefficients must be jointly estimated with object intensity values.

JTu5A.42

A Precision Medical Diagnosis and Monitoring Method Using Deep Optical Spectral Imaging, Joyce L. Liu¹; ¹*School of Medicine and Dentistry, Univ. of Rochester Medical Center, USA*. A theoretical multibeam interference optical spectral imaging method is proposed to achieve high-resolution, deep-penetration, tomographic medical imaging with reduced scattering noise, potentially improving precise disease diagnosis and physiological monitoring beyond existing optical spectral imaging techniques.

JTu5A.43

Photon Antibunching from Femtosecond-Laser-Induced Color Centers in Silicon Nitride, Emily DeVeyra¹, Svetlana G. Lukishova¹, Martin Sanchez¹, Matthew Belzer¹, Pablo Postigo¹, Michele Cotrufo¹; ¹*U of Rochester, The Inst. of Optics, USA*. In the context of single-photon sources, we demonstrate for the first time photoluminescence from defects (color centers) created in low-autofluorescence silicon nitride by femtosecond laser irradiation. Photon antibunching with $g^{(2)}(0) = 0.45$ was observed.

JTu5A.44

Theoretical Investigation of a Polarization-Based Optical Imaging Method with Deep Penetration for Biomedical Applications, Joyce L. Liu¹; ¹*School of Medicine and Dentistry, Univ. of Rochester Medical Center, USA*. This work theoretically proposes a deep-penetration biomedical optical polarization imaging method that combines multibeam interference with polarization-sensitive imaging. The method may simultaneously improve imaging depth, contrast, and disease discrimination capability in highly scattering biological tissues.

JTu5A.45

Influence of Development Conditions on the Structural Integrity of Dexamethasone-Doped SZ2080 Microstructures via 2PP, Marta Rodríguez Lorenzo¹, Carmen Bao Varela¹, Ana I. Gomez Varela¹; ¹*Universidad de Santiago de Compostela, Spain*. Dexamethasone incorporation induces mechanical weakening in 2PPfabricated SZ2080 microstructures. Evaluating five development protocols, this study

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demonstrates that standard methods can lead to structural collapse or insufficient clearing, highlighting the critical need for balanced solvent strategies.

JTU5A.46

Numerical Investigation of Liquid Crystal Integrated Plasmonic MIM Waveguide Based All-Optical Half-Adder Circuit, Kashish Paul¹, Anjly Anjly¹, Lokendra Singh¹; ¹*Graphic Era Univ., India*. The requirement of fast processing devices with low-power consumption and compact footprints is the need of the time. Therefore, this work presents a liquid crystal integrated waveguide platform based half adder using plasmonic Mach-Zehnder interferometer.

JTU5A.47

Transition in the Dynamics of Strong-Field Ionization: Keldysh, Classical Models, and Bicircular Fields, Jan L. Chaloupka¹; ¹*Univ. of Northern Colorado, USA*. A detailed computational study of strong-field ionization in intense bicircular laser fields has uncovered a dramatic shift in ionization dynamics. By utilizing a classical model across a range of atomic species and laser intensities, the role of the Keldysh parameter that defines the tunneling and multiphoton regimes is explored in a new way.

JTU5A.48

On-chip Nanoparticles Characterization with Coherence-gated DLS, Erick Zora-Guzmán¹, Roberto Alvarez-Aguirre¹, Gabriel Caballero-Robledo¹, Jose Guzman-Sepulveda¹; ¹*cinvestav Unidad Monterrey, Mexico*. We present an optofluidic platform that integrates optical fiber-based coherence-gated DLS into microfluidic channels made of PMMA for non-contact, in situ characterization of flowing nanoparticles that allows for simultaneous particle sizing and velocimetry.

JTU5A.49

Narrowband Photoacoustic Generation for Direct Air-to-Underwater Communication, Sahil Saini¹, Abhinav C¹, Pankaj Bhujbal¹, Vaishali Soni¹, Utkarsh K. Singh¹, Devnath Dhirhe¹; ¹*Defence Inst. of Advanced Technology, India*. We demonstrate experimental validation of a modulated microsecond-pulse photoacoustic regime for direct air-to-underwater communication, concentrating acoustic energy into a narrowband peak and achieving 53% signal enhancement via quasi-CW heat accumulation.

JTU5A.50

Withdrawn.

JTU5A.51

Singular States and Phase Conjugation in Inhomogeneous Non-Hermitian Waveguides, Konstantinos Makris^{2,1}, Demetri Psaltis³; ¹*Univ. of Crete, Greece*; ²*IESL, Forth, Greece*; ³*Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland*. We address the problem of focusing in multimode systems, that contain gain/loss defects along propagation, in the context of non-Hermitian photonics. The role of singular eigenstates of the transmission matrix (power eigenchannels) is examined.

JTU5A.52

Hybrid Deep Learning for Robust Upconversion Imaging Within Epsilon-Near-Zero Environments, Hao Zhang^{1,2}, Yang Xu³, Wenwen Zhang¹, Saumya Choudhary³, M. Zahirul Alam⁴, Long D. Nguyen³, Matthew Klein⁵, Shivashankar Vangala⁵, J. Keith Miller⁷, Eric G. Johnson⁶, Joshua R. Hendrickson⁵, Robert W. Boyd^{3,4}, Sergio Carbajo^{1,2}; ¹*Univ. of California Los Angeles, USA*; ²*SLAC, USA*; ³*Univ. of Rochester, USA*;

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⁴Univ. of Ottawa, Canada; ⁵Air Force Research Laboratory, USA; ⁶Univ. of Central Florida, USA; ⁷Clemson Center for Optical Materials Science and Engineering Technologies, USA. We propose a hybrid-supervised deep learning pipeline designed for image reconstruction in scattering environments. The results indicate that this algorithm resolves the underlying images, eliminates vignetting, and extends the field of view with improvement of average PSNR by 124%, SSIM by 231%.

JTu5A.53

High-Q Dual-Resonant Chirality Engineering through Cavity Rotation in Bilayer Dielectric

Metasurfaces, Vishakha Sharma¹, Ravindra K. Sinha¹, Yogita Kalra¹; ¹Delhi Technical Univ., India. A dual-sided Ω -shaped dielectric metasurface supporting high-Q dual quasi-BIC resonances is designed. Opposite circular dichroism peaks of +0.9 and -0.9 are achieved, while cavity rotation from 0°–90° continuously switches chirality and tunes resonance wavelengths.

JTu5A.54

Design of a Silicon-Nitride Slot Racetrack Ring Resonator for Refractometric Sensing Toward Pb²⁺ Monitoring in Contaminated Water

Rodrigo Acuna Herrera¹, Pedro I. Torres Trujillo¹, Samuel Serna²; ¹Universidad Nacional de Colombia, Colombia; ²Department of Physics, Photonics, and Optical Engineering, Bridgewater State Univ., USA. varFDTD-calibrated compact simulations of a silicon-nitride slot racetrack add-drop ring for Pb²⁺ water monitoring predict 331 nm/RIU sensitivity, Q=2500-5500, and $\sim 3 \times 10^{-5}$ RIU LoD; selective readout requires crown-ether functionalization.

JTu5A.55

Simulation-Trained CNN for Particle Size Estimation Using Dual-Wavelength Mie Scattering, Victor Argueta¹; ¹Alma College, USA. A simulation-trained CNN estimates PMMA particle diameter from dual-wavelength Mie scattering profiles. Experimental validation on 3 μm particles yields a mean prediction of 2823.2 ± 1.1 nm without experimental training data

JTu5A.56

Performance Analysis of an Mxene-hBN Nanostructure-Integrated SPR Biosensor for Microplastic Detection

Manish Jangid¹, Manish K. Saini², Vijay (. Janyani¹; ¹Malaviya National Inst of Tech Jaipur, India; ²Fortis Escorts Hospital, Jaipur, India. This work presents a numerical investigation of an MXene-based SPR biosensor that exhibits a sensitivity of 100.86°/RIU and a limit of detection of 9.91398E-06, demonstrating significant promise for label-free detection of microplastic contamination in daily-used drinking water.

JTu5A.57

Ultrafast Laser Writing of NV- Centers in Diamond, Arunava Das¹, Xuyang Xu¹, Vedin Dewan¹, Michelle Wang¹, Kiran Kovi², Aleksei Zheltikov³, Alastair Stacey², Julia M. Mikhailova¹; ¹Princeton Univ., USA; ²PPPL, USA; ³Texas A&M Univ., USA. Ultrafast laser writing in diamond with 25-fs pulses reveals NV- photoluminescence preceding noticeable structural modification, consistent with defect generation by n-photon ionization with enhanced positioning precision, suggesting path toward sub-diffraction laser writing for integrated quantum photonics

JTu5A.58

Two-Photon Assisted Excited-State Absorption in Anisotropic Silver Nanocrystals, Amit K. Pradhan¹, Pranati Gupta², Amiya Priyam², Prasanta K. Datta¹; ¹Indian Inst. of Technology Kharagpur, India;

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²*Department of Chemistry, Central Univ. of South Bihar, India.* We investigate the nonlinear optical behavior of pentagonal silver pyramidal nanocrystals using Z-scan at 550 nm. The results show initial saturable absorption followed by reverse saturable absorption, attributed to two-photon absorption-assisted excited-state absorption.

JTu5A.59

Adaptive Pump Modulation for OAM Entanglement via Machine Learning, Hao Zhang^{1,2}, Yang Xu^{3,4}, Sergio Carbajo^{1,2}; ¹*Univ. of California Los Angeles, USA*; ²*SLAC, USA*; ³*Cornell Univ., USA*; ⁴*NTT Research, USA*. We present a Bayesian optimization of a low-dimensional pump parametrization method to generate high-dimensional orbital angular momentum (OAM) entanglement via spontaneous parametric down-conversion. The optimization increases the Schmidt number by 178% relative to a Gaussian baseline.

JTu5A.60

Multimodal Surface-Enhanced Raman and Infrared Spectroscopy for PFAS Detection in Water, Balaji Baskar¹, Kai Chang¹, Julio S. Alonso¹, Heng Pan¹, Guillermo Aguilar¹; ¹*Texas A&M Univ., USA*. We present multimodal plasmonic sensing technologies combining surface-enhanced Raman and infrared spectroscopy for PFAS detection in water. Such engineered nanostructures provide complementary molecular fingerprints, enhancing sensitivity and selectivity while advancing cost-effective approaches for environmental monitoring.

JTu5A.61

Pulse Picking Enhances Two-Photon Autofluorescence in The Living Mouse Retina, Wuao Jia¹, Rosa M. Martínez-Ojeda², Jennifer J. Hunter³; ¹*Univ. of Rochester, USA*; ²*Universidad de Murcia, Spain*; ³*Univ. of Waterloo, Canada*. Pulse picking enhanced two-photon fluorescence of the living mouse retina without increasing average excitation power. Reducing repetition rate from 80 to 4 MHz increased SNR up to 6-fold and dark-corrected fluorescence intensity 21-fold.

JTu5A.62

Asynchronous Optoretinography and Positive Scotopic Threshold Response Measurements Using a Spectral-Domain OCT System in the Rodent Retina, Simran Pattar¹, Khushmeet K. Dhaliwal¹, Jennifer J. Hunter¹; ¹*Univ. of Waterloo, Canada*. A 250 kHz SD-OCT+ERG system asynchronously measured ORG OPD of photoreceptors and pSTR responses during flicker stimulation in Brown Norway rats. Quantification of between-animal variability establishes functional endpoints and a baseline for future retinal disease studies.

JTu5A.63

Light-Induced Processes in Living Cells Mediated by Nanostructured Carbon Nitrides, Deborah Amos Adigun¹, Nikita Belko¹, Hanna Maltanova¹, Steffi Goffart², Polina Kuzhir¹; ¹*Department of Physics and Mathematics, Univ. of Eastern Finland, Finland*; ²*Department of Environmental and Biological Sciences, Univ. of Eastern Finland, Finland*. Nanostructured carbon nitrides (n-CN(Li) and n-CN(Na)) were synthesised via hydrothermal alkaline etching and evaluated for light-induced biological effects. Both samples generated reactive oxygen species (ROS) under 385 nm irradiation, induced oxidative stress, and caused cell death in HeLa cervical cancer cells in a light-dependent manner.

JTu5A.64 ·

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Complex Refractive Index Modeling for Thick Lens Imaging in Lossy Chiral-Dielectric Media and Its Effect on Monochromatic Image Reconstruction, Salaheddeen G. Bugoffa¹, Rajab Y. Atai², Abdulmajid Mrebit², Hussin Ragb³, Issa Elbelazi⁴; ¹Norfolk State Univ., USA; ²Benedict College, USA; ³Christian Brothers Univ., USA; ⁴Faculty of Technical Science, Libya. A complex refractive-index model is derived for lossy chiral media, incorporating losses from permittivity and chirality, and applied to monochromatic thick-lens imaging to analyze their effects on phase, attenuation, reconstruction fidelity, resolution, and imaging performance.

JTu5A.65

Star-Topology Quantum Network Enabled by TFLN Polarization-Entangled Photon Source, Jinyi Du², Xiaodong Shi¹, Yue Li³, Lin Zhou³, Ran Yang^{3,4}, En Teng Lim^{2,4}, Sakthi Sanjeev Mohanraj³, Mengyao Zhao³, Xu Chen³, Xiaojie Wang³, Guangxing Wu³, Hao Hao², Veerendra Dhyani¹, Sihao Wang¹, Alexander Ling^{2,4}, Di Zhu^{1,5}; ¹A*STAR Quantum Innovation Centre (Q.InC), Agency for Science, Technology and Research (A*STAR), Singapore 138634, Singapore. Inst. of Materials Research and Engineering (IMRE), Agency for Science, Technology and Research (A*STAR), Singapore 138634, Singapore., Singapore; ²Centre for Quantum Technologies, National Univ. of Singapore, Singapore 117543, Singapore., Singapore; ³Department of Materials Science and Engineering, National Univ. of Singapore, Singapore 117575, Singapore., Singapore; ⁴Department of Physics, National Univ. of Singapore, Singapore 117551, Singapore., Singapore; ⁵Centre for Quantum Technologies, National Univ. of Singapore, Singapore 117543, Singapore. Department of Materials Science and Engineering, National Univ. of Singapore, Singapore 117575, Singapore., Singapore. We demonstrate a four-user star-topology quantum network enabled by a single-waveguide thin-film lithium niobate chip that directly generates broadband polarization entanglement. Wavelength routing establishes all six pairwise links over deployed metropolitan fiber paths up to 50.8 km, achieving 93.4-98.0% link fidelities and 99.8% source fidelity.

JTu5A.67 • •

Quadratic-Soliton Laser Mode Locking in Lithium Niobate Nanophotonics, Yingchu Xu¹, Benjamin Gutierrez¹, Nicolas Englebert¹, Selina Zhou¹, Maximilian Shen¹, Mahmood Bagheri², Alireza Marandi¹; ¹California Inst. of Technology, USA; ²Jet Propulsion Laboratory, USA. We demonstrate a self-starting semiconductor mode-locked laser generating dissipative solitons using a near-instantaneous quadratic nonlinear interferometer in periodically poled nanophotonic lithium niobate. Soliton compression and intracavity electro-optic modulation enable 750-fs pulses.

JTu5A.68 •

Equivalence Theorems of Partially Coherent Beams Scattered by Deterministic and Random Media, Yi Ding¹; ¹Southwest Jiaotong Univ., China. The scattering equivalence theorem is generalized to partially coherent beams interacting with deterministic and random media. A dyad of equivalence theorems is reported and analytical conditions for identical spectral densities are obtained. Our results reveal structural ambiguities critical for inverse scattering problems.

JTu5A.69 •

Monte Carlo Analysis of Loss-Induced Degradation of Quadrature Squeezing in a Linearized Kerr Model, Vishal Navani¹, Gautam Das², V. Narayanan¹; ¹Department of Physics, Indian Inst. of Technology Jodhpur, India; ²Department of Physics, Lakehead Univ., Canada. We present a Monte Carlo analysis of quadrature squeezing in a linearized Kerr model including optical loss through the beam-splitter

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formalism. The numerical results agree with analytical predictions and show that increasing optical loss rapidly degrades the achievable squeezing, even for large Kerr shearing parameters.

JTu5A.70

Far from Resonance Spectrally Resolved Photon-Echo from CdSe Quantum Dots, Debabrata Goswami^{1,2}; ¹*Indian Inst. of Technology Kanpur, India*; ²*Center for Bits and Atoms, Massachusetts Inst. of Technology, USA*. We report large-scale 'far-from-resonance' photon-echo experiments, which uncover the excitonic dynamics of CdSe quantum dots using time-dependent Spectrally Resolved Photon Echo (SRPE) spectroscopy at 810nm. We can infer system dynamics indirectly, which is especially useful when these are hidden beneath the sample absorption maxima.

JTu5A.71

Spin and Valley-Resolved Photonic Spin Hall Shifts in Monolayer MoS₂, Muzamil Shah^{1,2}; ¹*Quaid-i-Azam Univ, Pakistan*; ²*Research Center of Astrophysics and Cosmology, Khazar Univ., Azerbaijan*. We calculate the spin-valley resolved photonic spin Hall effect (PSHE) in monolayer MoS_2 . The PSHE exhibits extreme values at the optical transition energies around Brewster's angles.

JTu5A.72

Topological Berry Phase and Third-Order Exceptional Point Encirclement in Photonic Time Crystal, Pratishtha Pandey¹, D. K. Dwivedi¹, Saurabh Mani Tripathi²; ¹*Madan Mohan Malaviya Uni. of Technology, India*; ²*Indian Inst. of Technology Delhi, India*. We study third-order exceptional points in photonic time crystals using a Floquet-based three-mode model. The system exhibits cube-root dispersion, cyclic mode exchange, and fractional Berry phase, enabling tunable non-Hermitian topology and enhanced sensitivity.

JTu5A.73

Reciprocal Exceptional-Point Dynamics in Fiber Bragg Gratings via Passive Auxiliary-Mode Elimination, Parth Joshi¹, Saurabh M. Tripathi¹; ¹*Optics & Photonics Centre (OPC), Indian Inst. of Technology Delhi, India*. We demonstrate reciprocal exceptional-point dynamics in fiber Bragg gratings through passive auxiliary-mode elimination. Schur-complement reduction yields an effective non-Hermitian generator exhibiting eigenvalue coalescence and square-root sensitivity while preserving reciprocity $S_{21} = S_{12}$.

JTu5A.74

Engineering Chirality Factor Using Symmetry-Protected Quasi-BICs in Graphene-Based Dimer Structures, Shuvajit Roy¹, Sweta Rani¹; ¹*Sister Nivedita Univ., India*. An all-graphene chiral metasurface is proposed. Equal slot angles support a symmetry-protected BIC with zero chirality factor. Angular perturbation in one dimer induces quasi-BIC radiation channels, yielding finite and tunable chirality responses.

JTu5A.75

Physical Versus ML QBER and SKR Modelling Under QPCWA Allocation in TF-QKD Multicore Fiber Systems, Ayush Patel¹, Tushar Tushar¹, Ritu Raj Singh¹, Shashwat Saxena¹; ¹*Netaji Subhas Univ. of Technology, India*. Core assignment is determined using an analytically derived Raman-scattering crossover distance, while wavelength slots are ranked by composite noise. Physics-based and ML QBER

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estimates closely agree, with secure operation maintained up to approximately 260-270 km, validating real-time ML prediction.

JTu5A.76

On-chip Random Lasing from the Collection of Quasi-monodispersed Microdroplets, Diksha Sharma¹, Nikita Choudhary¹, Anjani K. Tiwari^{1,2}; ¹*Indian Inst. of Technology Roorkee, India*; ²*Center for Photonics and Quantum Communication Technology, IIT Roorkee, India*. We demonstrate on-chip random lasing from the collection of quasi-monodisperse microdroplets, which are distributed in the ambient medium containing fluorescent dye molecules. The microdroplets act as scatterers, providing optical feedback and enabling random lasing.

JTu5A.77

Benchmarking Machine Learning Clustering Strategies for High-Dimensional Optical Wavefront Datasets, Graciana Puentes^{1,2}; ¹*Univ. of Buenos Aires, Argentina*; ²*Conicet, Argentina*. We rank neural network, hierarchical, and k-means clustering strategies for fluidic lens wavefront data. A hybrid approach outperforms individual methods, providing an ultra-stable, highly accurate clustering solution that eliminates dataset segmentation guesswork.

JTu5A.78

Fiber-Coupled laser-Written Vapor Cells for Optical Magnetometry, Yasin Taheri Mazinani¹, Hugo Jorge da Nóbrega³, Prajal Chettri², Roberto Osellame³, Giacomo Corrielli³, Vito Giovanni Lucivero^{1,4}; ¹*Univ. of Bari Aldo Moro, Italy*; ²*Polytechnic Univ. of Bari, Italy*; ³*Politecnico di Milano, Italy*; ⁴*Qsensato, Italy*. We present a fiber-coupled laser-written vapor cell (FC-LWVC) prototype for compact, high-sensitivity optical magnetometry, demonstrating the feasibility of integrating micro-optical components within all-glass chips.

JTu5A.79

Ion-Beam-Induced Ripple Anisotropy in Nanoporous Gold Films for Polarization-Selective Plasmonic Absorption, Jaspreet Singh², Pawan Kumar³, Nitish K. Gupta¹, Subhendu Sarkar²; ¹*Birla Inst. of Technology & Science, India*; ²*IIT Ropar, India*; ³*IIT Ropar, India*. We investigate the optical behaviour of uniform and ripple-textured porous gold films and find that ripple-textured porous films exhibit polarisation-dependent optical responses arising from the structural anisotropy induced by the ripple morphology.

JTu5A.80

Stable Bunched NLP at 1550 nm using Hybrid Graphene Oxide/NOLM SA for Femtosecond Lasers, Praveena S¹, Akshay Raj R¹, Dhanush D. B C¹, Moupriya Mukherjee², Goutam Pramanik², Shyamal Mondal¹; ¹*Defence Inst. of Advanced Technology, India*; ²*Department of Chemistry, UGC-DAE Consortium for Scientific Research, India*. Wavelength-tunable bunched NLP at 1550 nm using hybrid-GO/NOLM saturable absorber is demonstrated. Modelocking achieved at 2 W pump power with pulse energy of 0.53 nJ, repetition rate of 3.09 MHz, and SNR of 50 dB.

JTu5A.81

5-Gb/s FWM-Based All-Optical Convolution with AWG-Assisted Temporal-Alignment and Serial-Readout, Sachin Boyanapelly¹, Aneesh Sobhanan¹; ¹*Indian Inst. of Technology Hyderabad, India*. We numerically demonstrate a 5-Gb/s FWM-based photonic convolution processor using AWG-assisted

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temporal alignment and serial readout. Complete convolution coefficients are recovered with a single photodetector, showing close agreement with ideal outputs under realistic noise.

JTu5A.82

Tuning Fano Resonance for Polarization-dependent Enhanced Third Harmonic Generation in Germanium Metasurface, Hosna Sultana¹; ¹Univ. of Oklahoma, USA. Fundamental beam's polarization-dependent third-harmonic (TH) diffraction order control is rarely reported in the literature. In this context, this research focuses on how Fano-resonance coupling enhances TH conversion to selective orders by adjusting the nanoantenna's position

JTu5A.83

Femtosecond Laser Two-Photon Reduction and Micromachining for Single-Step Fabrication of Flexible Capacitive Pressure Sensors, Ajinkya Palwe^{2,1}, Saurabh Awasthi², Shobha Shukla¹, Sumit Saxena¹, SeungYeon Kang²; ¹Indian Inst. of Technology Bombay, India; ²Univ. of Connecticut, USA. We demonstrate a single-step femtosecond laser fabrication approach for flexible capacitive pressure sensors by directly patterning conductive silver electrodes and microstructures in gelatin, achieving high sensitivity (2.44 kPa⁻¹) and stable performance.

JTu5A.84

Profiled Plane Electromagnetic Wave Propagation Across Planar Chiral Interfaces, Monish R. Chatterjee¹, Mohammed Alfaifi¹; ¹Univ. of Dayton, USA. Extending a recent series of investigations for profiled (Gaussian) electromagnetic beam propagation across an achiral/chiral (ACC) interface, we apply the angular spectrum and effective Fresnel coefficient strategy to examine propagation for single interfaces and slabs.

JTu5A.85

Controllable OAM-resolved spectral shifts in random light beams, Isabelle Bubnick^{1,2}, Sushil Pokharel², Olga Korotkova²; ¹Univ. of Wisconsin, USA; ²Univ. of Miami, USA. Employing source correlation-induced spectral shifts to different orbital angular momentum components of the beam produces wavelength-spatial correlations, classical entanglement and enables fine remote control of the spectrum on propagation in vacuum.

JTu5A.86

Tailoring Zero-Dispersion Wavelength in Multimode Anti-Resonant Hollow-Core Fibers, Ambar Roy¹, Deepak Jain¹; ¹Indian Inst. of Technology Delhi, India. We investigated the chromatic dispersion characteristics of a multimode anti-resonant hollow-core fiber numerically. Core radius dependent Zero-dispersion wavelength tailoring is demonstrated, with the Zero-dispersion wavelength shifting towards shorter wavelengths as the core radius increases.

JTu5A.87

Direct Microfabrication of High-Index Titanium Polymeric 3D Helical Waveguides, Aman Singhal¹, Sumit Saxena¹, Shobha Shukla¹; ¹Indian Inst. of Technology Bombay, India. 3D helical waveguides were fabricated by femtosecond laser processing of a high-index organometallic titanium resin (n = 1.64 at 532 nm). The resin enabled strong optical confinement and compact curved geometries, demonstrating potential for out-of-plane routing, optical overpasses, and advanced integrated photonics.

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JTU5A.88

Optical Microscopic Characterization of Rice Starch, Netravati VN¹, Bhoomika R. Hande¹, Nandana B¹, Sampath U. Gunathilake²; ¹*Department of Biophysics, Manipal Academy of Higher Education, India*; ²*Department of Polymer Science, Univ. of Sri Jayewardenepura, Sri Lanka*. Rice starch was isolated and characterized using biophysical techniques to investigate its molecular structure, crystallinity. microscopic imaging were employed to evaluate structural organization. The study provides insights into starch morphology, functionality and potential nutritional significance.

JTU5A.89

POF Treatment for Glucose Biosensor Optrode., Sandra M. Martinez Loide¹, Jorge A. Ortega Contreras², Antonio R. Romero³, Edgar A. Méndez¹; ¹*Universidad de Guanajuato, Mexico*; ²*Universidad tecnologica de leon, Mexico*; ³*Universidad Michoacana de San Nicolas de Hidalgo, Mexico*. Successful bioprode measurements depend on propend POF treatment. A reproducible preparation method including cladding removal, polishing, and sol-gel thin-film deposition is described.

Grand Lilac Ballroom North

15:30 -- 17:00

FTu6A • Programmable Photonics for Computing and Signal Processing

Presider: Amirhassan Shams-Ansari; Monarch Quantum Inc, USA

FTu6A.1 • 15:30 (Invited)

Integrated Photonic Neuromorphic Computation, Chaoran Huang¹; ¹*Chinese Univ. of Hong Kong, Hong Kong*. This talk introduces neuromorphic photonic computing for AI beyond Moore's Law, highlighting its applications for high-speed signal processing and machine vision. It will also discuss hardware–algorithm co-design for improved accuracy and reliability of optical systems.

FTu6A.2 • 16:00

Non-Volatile FeFET-Programmed Microring as a Multi-Level Optical Weight Cell for Photonic Neural Network Inference, Raqqib Bin Kadir¹, Lilian Neim¹, Hector Rubio Rivera¹, Venkatesh Deenadayalan¹, Kai Ni², Stefan F. Preble¹; ¹*Rochester Inst. of Technology, USA*; ²*Univ. of Notre Dame, USA*. We demonstrate a non-volatile electro-optic cell (NoVo-EOC) combining a HZO FeFET with a silicon microring modulator, storing six discrete optical transmission levels as programmable synaptic weights for photonic neural network inference.

FTu6A.3 • 16:15

Mechanically Reconfigurable Optical Cavities based on Resonant Metasurfaces, Felix Wong¹, Michele Cotrufo¹; ¹*Univ. of Rochester, USA*. We numerically and experimentally investigate bilayer metasurface devices as tunable nanophotonic platforms, showing Q factor modulations larger than 8x in experiments (and >80x in simulations) by modulating the distance between two metasurfaces by less than 350nm.

FTu6A.4 • 16:30

Multi-Frequency Photonic Processor Via Optical Feedback, Kevin Zelaya¹, Jonathan Friedman¹, Mohammad-Ali Miri¹; ¹*Rochester Inst. of Technology, USA*. We experimentally demonstrate a compact, programmable photonic integrated circuit using embedded optical feedback loops. This architecture operates on spatial and frequency degrees of freedom, enabling universal linear transforms for efficient,

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parallel optical computing.

FTu6A.5 • 16:45

Photonic Blind Source Separation with Fine-Grained Channel State Information Reconstruction Based on Diffusion Model, Zhenghao Yang¹, Ben Wu¹; ¹Rowan Univ., USA. We propose and demonstrate a photonic blind source separation system that reconstructs fine-grained channel state information from sparse measurements. The reconstruction is based on a diffusion model and achieves near-zero error.

Highland Room AK

15:30 -- 17:00

FTu6B • VR/AV Theme: Future Displays

Presider: Jae-Hyeong Park; Seoul National Univ., Korea (the Republic of)

FTu6B.1 • 15:30 (Invited)

Challenges Towards Holographic Contact Lens Display, Yasuhiro Takaki¹; ¹Tokyo Univ of Agriculture and Technology, Japan. The holographic implementation of contact lens displays can generate images that can be focused by eyes with a thin form factor. The Japanese R&D project for the holographic contact lens displays is overviewed.

FTu6B.2 • 16:00 (Invited)

Wavefront-Switchable Geometric Phase Hologram Optics for Natural AR Viewing, Hak-Rin Kim¹; ¹Kyungpook National Univ., Korea (the Republic of). This talk presents polarization-programmable optical architectures for perceptually realistic AR glasses providing varifocal depth control, depth-matched occlusion, or gaze-adaptive eyebox steering via dynamically reconfigurable geometric-phase optics and polarization-controlled wavefront engineering for AR near-eye display applications.

FTu6B.3 • 16:30 (Invited)

Exploring Wave-optics Challenges for Future Thin Diffractive AR Waveguides, Vova Borisov¹; ¹Corning, Finland. Abstract not available.

Highland Room BJ

15:30 -- 17:00

FTu6C • Advances in Biomedical Technology and Applications I

Presider: Shuting Fan; Shenzhen Univ., China

FTu6C.1 • 15:30 (Invited)

Pushing The Limit of Imaging Depth of Multiphoton Microscopy, Chris Xu¹; ¹Cornell Univ., USA. Recent advances for in vivo imaging at unprecedented depths and speed will be presented. Several directions for continued technology development, including advances in laser sources and the design of optimal illumination schemes will be discussed.

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FTu6C.2 • 16:00 (Invited)

Imaging the Metabolic Machinery of Vision: Tracking Single Cell Blood Flow and Mitochondria in the Living Retina, Jesse Schallek¹; ¹*Univ. of Rochester, USA*. Abstract not available

FTu6C.3 • 16:30

Simplified PIC Biosensor Readout Using Low-Cost Off-the-Shelf Optics and Direct Camera Tracking, Joshua M. Bowman¹, Jordan Butt², Thomas Palone¹, Dorin Patru¹, Benjamin Miller², Stefan F. Preble¹; ¹*Rochester Inst. of Technology, USA*; ²*Univ. of Rochester, USA*. We present low-cost readout of PIC biosensors using off-the-shelf optics and direct camera detection, eliminating custom optics and output coupling while improving alignment tolerance and preserving performance relative to laboratory-grade systems.

FTu6C.4 • 16:45

A Label-free, Automated Holographic Imaging Platform Quantifies Plaque-Forming Dynamics in Antiviral Drug Susceptibility Testing, Merve Eryilmaz¹, Yuzhu Li¹, Xiao Wang¹, Max Zhang¹, Alp Inegol¹, Zixiang Ji¹, Lucas Thai¹, Guangdong Ma¹, Aydogan Ozcan¹; ¹*Univ. of California Los Angeles, USA*. An automated, label-free plaque reduction assay (PRA) platform integrating time-lapse lens-free holographic imaging and deep learning enables early plaque quantification and dynamic dose-response analysis for antiviral drug screening and resistance monitoring.

Highland Room CH

15:30 -- 17:00

FTu6D • Thermal and IR Light

Presider: Jeffrey Holzgrafe; HyperLight Corporation, USA

FTu6D.1 • 15:30 (Invited)

Optimizing the Transmission and Emission of Infrared Light, Aaswath P. Raman¹; ¹*Univ. of California Los Angeles, USA*. We demonstrate photonic mechanisms to control thermal emission, including its spectral, directional and polarization characteristics. Additionally, we illustrate the role of non-reciprocal photonic systems in enabling new technological capabilities for thermal emission control.

FTu6D.2 • 16:00 (Invited)

Silicon Photonic Engines for Energy-Efficient AI Interconnects, Arishti Melikyan¹; ¹*Coherent Corp., USA*. We review silicon photonic engines for pluggable transceivers and co-packaged optics (CPO), enabling energy-efficient future AI interconnects. We highlight a 6.4T CPO engine operating at 3.5 pJ/bit and silicon Mach-Zehnder modulators supporting 400G PAM4 modulation.

FTu6D.3 • 16:30

Broadband Meta-Optics Imaging in MWIR Wavelengths, Rose Johnson¹, Debrabrata Mandal², Zihao Zou², Arka Majumdar¹, Praneeth Chakravarthula², Johannes E. Frösch¹; ¹*Univ. of Washington, USA*; ²*Univ. of North Carolina at Chapel Hill, USA*. We demonstrate a single fabricated MWIR metasurface, paired with a compact learned restoration prior adapted from only four calibration captures, achieves broadband imaging performance over the complete 3-5 micron bandwidth.

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FTu6D.4 • 16:45

Optimizing Signal to Noise in Laser Heterodyne Radiometry for Weak Thermal Sources, Dario Tringali³, Jordan Wind⁴, Robin Swoboda^{3,1}, Ryan Cole^{3,2}, Connor Fredrick³, Scott A. Diddams^{3,4}; ¹Physics, Univ. of Konstanz, Germany; ²Physics and Astronomy, Bates College, USA; ³Physics, Univ. of Colorado Boulder, USA; ⁴Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA. We present a baseline drift correction method for Laser Heterodyne Radiometry on weak thermal sources. By intermittently mapping the baseline power, we mitigate temperature induced noise, achieving predictable signal-to-noise scaling for hours-long averaging times.

Highland Room DG

15:30 -- 17:00

FTu6E • Attoscience

Presider: Andre Staudte; National Research Council Canada, Canada

FTu6E.1 • 15:30 (Tutorial)

Attosecond Spectroscopy, Strong Field Physics, Xray, Matthias F. Kling¹; ¹Stanford Univ., USA. Abstract not available.

FTu6E.2 • 16:30 (Invited)

Tayloring Attosecond Locally-Chiral Light and Photocurrents in a Topological Semimetal, Alba de las Heras¹, Ofer Neufeld², Angel Rubio^{1,3}; ¹Max-Planck-Gesellschaft, Germany; ²Technion Israel Inst. of Technology, Israel; ³The Flatiron Inst., Center for Computational Quantum Physics, USA. First-principles calculations of high harmonic generation in RhSi show special features: i) locally chiral near fields exhibiting an asymmetric instantaneous torsion on attosecond timescales, and ii) a pulse-duration-sensitive cutoff arising from excited ladder electrons.

Grand Lilac Ballroom South

15:30 -- 17:00

LTu6F • Optical Platforms for Quantum Information Science II

Presider: Jonathan Hood; Purdue Univ., USA

LTu6F.1 • 15:30 (Invited)

Solid-state Quantum Emitters for Photonic Quantum Technologies, Alisa Javadi¹; ¹Univ. of Oklahoma, USA. Solid-state quantum optics offers a powerful platform for photonic quantum information processing. In this talk, I will present our progress toward key building blocks, including low-noise and scalable quantum emitters that enable Hong-Ou-Mandel interference visibilities of up to 93% between remote sources. I will also discuss our realization of quantum nonlinear optics in the time domain using quantum dots and show that we can sort laser pulses by the number of photons in their wave packets.

LTu6F.2 • 16:00 (Invited)

Optical Linewidth Narrowing for Device-Coupled Single T Centers, Songtao Chen¹; ¹Rice Univ., USA. Single T centers in silicon are promising spin-photon interfaces for quantum networking applications. We utilize above-band optical excitation to reduce the optical linewidth of device-coupled single T

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centers by more than 60%.

LTu6F.3 • 16:30 (Invited)

Optical Detection and Coherent Control of Nuclear Spins in a 2D Material, Tongcang Li¹; ¹*Purdue Univ., USA*. I will introduce quantum sensing with optically active spin defects in hexagonal boron nitride (hBN) and present our recent advances in optical detection and coherent control of single nuclear spins in hBN.

Highland Room BJ

08:00 -- 09:00

FTu1C • Atomic Control and Sensing

Presider: Jaime Cascante, Costa Rica

FTu1C.1 • 08:00 (Invited)

Quantum Control in Ultracold Gases, Lindsay J. LeBlanc¹; ¹*Univ. of Alberta, Canada*. Abstract not available

FTu1C.2 • 08:30

Dark State Spectroscopy in Nonlinear Waveguide Quantum Electrodynamics, Shay Nadel¹, Amir Sivan¹, Aviv Karnieli¹; ¹*Technion Israel Inst. of Technology, Israel*. We investigate theoretically a spectroscopy technique for probing completely dark states using squeezed light in nonlinear waveguides. The fluorescence spectrum probes transitions between dressed dark states, paving the way for robustly addressing quantum memories.

FTu1C.3 • 08:45

Atomic Sensing via Quantum Memory in a Laser-Cooled Ensemble, J.F. Chen^{2,5}, Xingchang Wang⁴, Georgios A. Siviloglou^{1,3}; ¹*Univ. of Crete, Greece*; ²*Southern Univ. of Science and Technology, China*; ³*FORTH, Greece*; ⁴*Shanxi Univ., China*; ⁵*International Shenzhen Quantum Academy, China*. We demonstrate a field sensing protocol that utilizes efficient quantum memory in a dense atomic ensemble. Combining temporally separated photocurrents from light storage measurements yields high-contrast interferometric fringes, eliminating lossy optical delay lines.

FTu1C.4 • 08:45

Pt-Decorated WSeTe Janus Monolayer as a Promising H₂S Gas Sensor: A DFT Study, Neetu R. Bharti¹, Neeraj Goel¹; ¹*Netaji Subhas Univ. of Technology, India*. This study uses DFT calculations to show that Pt-decorated Janus WSeTe monolayers greatly enhance H₂S sensing. The SeWTe-T_{Se} configuration exhibits the strongest adsorption (−1.906 eV), highest stability, and improved charge transfer, making it ideal for high-performance H₂S gas sensors.

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Wednesday, 30 September

Grand Lilac Ballroom North

08:00 -- 09:00

FW1A • Advances in Biomedical Technology and Applications II

Presider: Jun Ki Kim; Univ. of Ulsan, Asan Medical Center

FW1A.1 • 08:00 (Invited)

Deep Learning–Enabled Clinical Photoacoustic Imaging, Jun Xia¹; ¹*Univ. at Buffalo, USA*. This talk highlights deep learning methods developed in our laboratory for translational photoacoustic imaging, including noise reduction, vessel enhancement, and radiomics-based feature extraction. Their applications in breast cancer imaging and foot ulcer imaging are introduced.

FW1A.2 • 08:30

Using Fluorescent Beads to Approximate Single Fluorophores, Yi-Ting Feng¹, Luis A. Alemán-Castañeda², Thomas G. Brown¹, Sophie Brasselet², Miguel A. Alonso^{1,2}; ¹*U of Rochester, The Inst. of Optics, USA*; ²*Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, France*. We study optical microscopy calibration using fluorescent beads and single-molecule PSFs, showing how unpolarized emission affects system aberration measurement and evaluating phase masks designed to better emulate true single-fluorophore imaging behavior.

FW1A.3 • 08:45

Dual-Plasmonic Optical Microfiber for NIR-II Photothermal Cancer Theranostics., Pengwei chen¹, Dajiang Lu¹, yunyun Huang^{3,2}, Yibin Tian¹, Zongze Wu¹, Baiou Guan^{3,2}; ¹*College of Mechatronics and Control Engineering, Shenzhen Univ., China*; ²*College of Physics & Optoelectronic Engineering, Jinan Univ., China*; ³*Inst. of Photonics Technology, Jinan Univ., Guangdong Provincial Key Laboratory of Optical Fiber Sensing and Communications, China*. We report an evanescent-field-driven dual-plasmonic microfiber that integrates AFP-specific hepatoma sensing, FBG-calibrated NIR-II photothermal regulation, and post-ablation evaluation, achieving 78.9% photothermal conversion, 89% single-treatment cell ablation, and effective in vivo tumor suppression.

Highland Room AK

08:00 -- 09:00

FW1B • Advanced Optical Microscopy and Imaging

Presider: Wu Yuan; Chinese Univ. of Hong Kong, Hong Kong

FW1B.1 • 08:00 (Invited)

Phase-Diversity Wavefront Sensing for Adaptive Optics Light-Sheet Fluorescence Microscopy, Courtney C. Johnson¹; ¹*Janelia Research Campus, USA*. Adaptive Optics approaches to sensing and correcting optical aberrations are underused in light sheet microscopy due to cost and difficulty. Here we demonstrate rapid, sensor-free correction of sample-induced aberrations inside living *Caenorhabditis elegans* embryo volumes.

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FW1B.2 • 08:30

Self-Calibrating Jones Matrix Microscopy for Simultaneous Retardance and Diattenuation Imaging, Mark Polkovnikov^{2,1}, Matthew Sheinman^{2,7}, Luke Saunders^{2,6}, Ramprasath Rajagopal², Meadow Bradsby², Matthew Gregor², Morgan Li², Thomas Bifano³, Irving Bigio^{4,2}, Lawrence Ziegler^{3,5}, Jerome Mertz^{3,4}, Shyamsunder Erramilli^{2,3}; ¹*U of Rochester, The Inst. of Optics, USA*; ²*Physics, Boston Univ., USA*; ³*Photonics Center, Boston Univ., USA*; ⁴*Biomedical Engineering, Boston Univ., USA*; ⁵*Chemistry, Boston Univ., USA*; ⁶*Applied Physics, Harvard, USA*; ⁷*Biomedical Engineering, Univ. of Wisconsin Madison, USA*. We demonstrate a calibration procedure for Jones matrix microscopes requiring no reference samples. The calibration allows simultaneous retardance and diattenuation imaging of H&E-stained tissue while achieving negligible birefringence cross-talk.

FW1B.3 • 08:45

Exploring Light Guiding Properties of Neurons Using Tapered Fibers, Sophia A. Korono¹, Lukas Weituschat¹, Yusof Gusti², Supun Liyanaarachchi¹, Jared Endres², Michael Telias², Pablo Postigo¹; ¹*Univ. of Rochester, USA*; ²*Ophthalmology and Vision Inst., Univ. of Pittsburgh, USA*. Green fluorescent proteins (GFP) expressed in the nuclei of neurons were excited using two-photon microscopy. A tapered fiber measured the evanescent field of axons to determine the light guiding properties of neurons.

Highland Room CH

08:00 -- 09:00

FW1D • Optical Models and Algorithmic Learning

Presider: Prathmesh Deshmukh; Meta Platforms, USA

FW1D.1 • 08:00

Deep Learning in PT-symmetric Multimode Waveguide Sensors, Kyriakos Skarsoulis^{1,2}, Konstantinos Makris¹, Demetri Psaltis^{2,1}; ¹*Univ. of Crete, Greece*; ²*STI (School of Engineering), EPFL, Switzerland*. PT-symmetric coupled-waveguide arrays operating near exceptional points show enhanced sensitivity to refractive-index perturbations. Neural networks decode noisy output intensity to determine perturbation strength and position, enabling imaging through 2D perturbation map reconstruction from 1D measurements.

FW1D.2 • 08:15

A New Orthogonal Basis for Freeform Surfaces on Circular Domains, John P. Mahoney¹, Yannis Nuzzolo^{1,2}, Gregory Forbes³, Miguel Alonso^{1,4}; ¹*Univ. of Rochester, USA*; ²*Centrale Mediterranee, France*; ³*Macquarie Univ., Australia*; ⁴*Aix-Marseille Univ., France*. An asymptotic approximation to the N=1 rapidly-decaying Fourier-like (RDF) basis over circular domains is used for mid-spatial frequency (MSF) characterization. Comparable performance to the RDF basis with faster evaluation is achieved from recurrence relations.

FW1D.3 • 08:30

Hybrid Learning Network for Nonlinearity Correction of Frequency-swept Laser in FMCW LiDAR, Hong Ye¹, Yi Hao¹, Qingyang Zhu¹, Annan Xia¹; ¹*Tsinghua Univ., China*. A hybrid learning network coupling iterative learning control with a convolutional network is demonstrated for frequency-swept-laser linearization in FMCW LiDAR, reducing residual-nonlinearity RMS by 97% and increasing ranging

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accuracy from 20.67 mm to 0.54 mm.

FW1D.4 • 08:45

Non-Gaussian Transport in Optothermal Biointerfaces: A Double-Lorentzian Model, Anand D. Ranjan¹, Ayan Banerjee¹; ¹*Indian Inst of Science Ed & Res, Kolkata, India*. The self-assembly of proteins employing optothermal microbubbles leads to a characteristic twin-peak fluorescence profile. We show that the corresponding central thermophoretic depletion and peripheral enrichment at the contact line are accurately described by a double-Lorentzian model, outperforming a double-Gaussian fit.

Highland Room DG

08:00 -- 09:00

FW1E • Ultrafast Lasers and Applications I

Presider: Shima Gholam Mirzaeimoghadar; Univ. of Ottawa, Canada

FW1E.1 • 08:00

Decoupling Local and Cumulative Stress Birefringence in Femtosecond-Laser-Written Fused Silica, Jason Lu¹, Heng Zuo^{1,2}; ¹*Mechanical Engineering, Univ. of New Mexico, USA*; ²*Optical Science and Engineering, Univ. of New Mexico, USA*. Femtosecond-laser-written line arrays in fused silica produce two coupled retardance responses: a local line signal and a cumulative inter-line halo. The transverse retardance distribution of the written lines evolves through a regime transition, affecting peak-based retardance metrics.

FW1E.2 • 08:15

In-Situ Waveform Sampling in a Reaction Microscope, Pooya Ghavami², Fatemeh Mousavi Karimi², Nida Haram¹, Katarzyna M. Kowalczyk¹, Heide Ibrahim³, Paul B. Corkum², Andre Staudte^{1,2}, Shima Gholam Mirzaeimoghadar²; ¹*National Research Council Canada, Canada*; ²*Physics, Univ. of Ottawa, Canada*; ³*ALLS, INRS, Canada*. We demonstrate in-situ optical waveform sampling inside a reaction microscope by measuring the delay-dependent modulation of strong-field ionization in argon. The method brings TPTOE field sampling directly into the COLTRIMS interaction region.

FW1E.3 • 08:30 (Invited)

Holographic Plasma Optics for Ultrafast Ultraintense Laser Science, Matthew Edwards¹; ¹*Stanford Univ., USA*. Plasmas can be shaped into diffractive optics with lasers, enabling the direct manipulation of high-intensity light. Here we describe how plasma holograms can focus, disperse, and impart spatiotemporal structure to high-power laser pulses.

Grand Lilac Ballroom South

08:00 -- 09:00

LW1F • Laser Science for XFELs and Electron Accelerators

Presider: Nicholas Matlis; Arizona State Univ., USA

LW1F.1 • 08:00

Harnessing Quasi-Static Transverse Fields for Efficient Relativistic Electron Acceleration in Femtosecond Laser Plasma Interaction, Ameya P. Parab¹, Bhooshan Paradkar², Aparajit C.¹, Anandam

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C¹, Sk Rakeeb¹, Sagar Dam¹, Prashant Kumar³; ¹Tata Institute of Fundamental Research, India; ²UM-DAE Centre for Excellence in Basic Sciences, Univ. of Mumbai, India; ³Tata Inst. of Fundamental Research Hyderabad, India. Relativistic laser irradiation of nanowire targets at ELI-NP demonstrates nanostructure survivability under a contrast of 10^{-10} at 50 ps, yielding enhanced electron flux, energy, and directional emission over flat targets, with promising scalability toward multi-petawatt facilities.

LW1F.2 • 08:15

Laser-Assisted Synthesis of SnS₂ Quantum Dots for Nonlinear Optical Limiting Applications, Hasana J. EK¹, Adarsh Raj KP¹, Vari Sivaji Reddy¹, Chandrasekharan Keloth¹; ¹National Inst. of Technology Calicut, India. We demonstrate the synthesis of SnS₂ quantum dots through pulsed laser irradiation of SnS₂ nanoflakes in water. The quantum dots exhibit blue photoluminescence and optical limiting behavior, demonstrating potential for nonlinear photonic applications.

LW1F.3 • 08:30

Nonlinear Photoinjector for a Compact X-ray Light Source, Casey A. Timms¹, Kevin Eckrosh¹, Sean Tilton¹, Lucas Malin¹, Lidia C. Santander¹, Hyung Seo Lee¹, Rejul Jaswal¹, Alex Gardeck¹, Eric Everett¹, Alan Dupre¹, Mukhtar Hussain¹, Sami Tantawi¹, William Graves¹, Mark Holl¹, Arvinder Sandhu¹, Robert A. Kaindl¹, Samuel Teitelbaum¹; ¹Arizona State Univ., USA. A nonlinear photoinjector avoids ultraviolet laser induced damage in optics and generates a high-charge, short-bunch length electron beam from a copper cathode.

LW1F.4 • 08:45

Broadband Optical Pulse Shaping Across the Ultraviolet with an Acousto-optic Modulator, Ian Gabalski¹, Brian Kaufman², Leah Reid¹, Maria Castro Duran¹, Andrew Howard¹, Joseph Robinson², Martin Cohen³, Thomas Weinacht³, Matthew Bain², Ruairidh Forbes¹; ¹Department of Chemistry, USA; ²Linac Coherent Light Source, SLAC National Accelerator Laboratory, Afghanistan; ³Department of Physics, Stony Brook Univ., USA. We demonstrate shaping of tunable, broadband ultraviolet pulses generated by resonant dispersive wave emission using a 4f-based acousto-optic modulator system, achieving sub-10 fs compression in-air and programmable pulse sequences in a single device.

Grand Lilac Ballroom North

09:15 -- 10:00

JW2A • Joint Visionary Session: Extreme Light

Presider: Csaba Toth; Lawrence Berkeley National Laboratory, USA

JW2A.1 • 09:15 (Visionary)

Extreme Light for Discovery Science: Opportunities at LaserNetUS, Félicie Albert¹; ¹Lawrence Livermore National Laboratory, USA. LaserNetUS connects high-power laser facilities across North America to enable discovery science in plasma physics, fusion energy, particle acceleration, and advanced diagnostics. This talk highlights scientific opportunities across the network, including at LLNL's Jupiter Laser Facility, and shows how coordinated access, innovation, and partnership are advancing extreme light science.

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Grand Lilac Ballroom South

09:15 -- 10:00

LW2B • LS Visionary Session II

Presider: Markus Raschke; Univ. of Colorado Boulder, USA

LW2B.1 • 09:15 (Visionary)

Colloidal Quantum Dots and Plasmonic Enhancement for Infrared Optoelectronics, Philippe Guyot-Sionnest¹; ¹*Univ. of Chicago, USA*. Colloidal quantum dots, already proven in visible displays, can also provide strong infrared transitions. They offer a low-cost, adaptable alternative to single-crystal and epitaxial materials, which could transform infrared technologies. Examples include LEDs and detectors made by spin coating the dots on appropriate substrates, using plasmonic enhancement for higher performance.

Empire Hall - Theater

10:30 -- 11:30

JW3A • Joint Plenary Session II

Presider: Robert Kaindl; Arizona State Univ., USA and Irina Novikova; College of William & Mary, USA

JW3A.1 • (Plenary)

Chip-Based Optical Frequency Combs, Alexander L. Gaeta¹; ¹*Columbia Univ., USA*. I will review our recent work on Kerr frequency combs generated in microresonators. Such combs offer a rich system for studies of complex nonlinear dynamics and for applications in time and frequency metrology, spectroscopy, sensing and data communications.

Empire Hall - Poster Session

11:30 -- 13:00

JW4A • Joint Poster Session III

JW4A.1 •

Design and Performance Analysis of a BK7/Ag/ZrO₂/ZnO/BP Based SPR Sensor for Water Contamination Detection, Vasanthi Gundala¹, Balaji Ramachandran¹, Yesudasu vasimalla¹, Xuecheng Liu², santosh Kumar¹; ¹*Koneru Lakshmaiah Education Foundation, India*; ²*Shanghai Inst. for Advanced Communication and Data Science, Shanghai Univ., China*. This paper presents a BK7/Ag/ZrO₂/BlueP/WS₂/BP-based SPR sensor for water contamination detection. The Ag, ZrO₂, BlueP/WS₂ heterostructure, and BP collectively enhance plasmon confinement, light-matter interaction, and analyte adsorption, improving refractive index sensing performance.

JW4A.2 •

Quantum Fourier Transform Assisted Quantum Classification for Energy-Time Signal Analysis of Radiation Damping in Ultra-Intense Laser Matter Interaction, Rishi R. Pandit¹; ¹*benedict College, USA*. Energy-time data of radiation damping in ultra-intense laser matter interaction is analyzed by investigating the hybrid classical-quantum framework combining Fast Fourier Transform (FFT), Quantum Fourier Transform (QFT), and Quantum Classification (QC)

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JW4A.3 ·

Passive Cross-Basis Mode Transitions Along a Single Freely Propagating Bessel Beam, Henry P. Evans¹, Layton A. Hall¹; ¹*Los Alamos National Laboratory, USA*. We demonstrate a way to vary the spatial mode of a freely propagating optical beam using a single static phase-only Spatial Light Modulator. Our techniques are derived from the geometric properties of the Bessel beam. We first show mode variation within a single symmetry class followed by mode variations between symmetry classes.

JW4A.4 ·

Optical Reflectance Behavior of Femtosecond Laser-Induced Columnar Structures on Aluminum, Taehoon Park¹, Yong-dae Kim¹, Jongweon Cho², Byounghwak Lee³, Taek Yong Hwang¹; ¹*Korea Inst. of Industrial Technology, Korea (the Republic of)*; ²*Department of Integrative Energy and Department of Physics, Myongji Univ., Korea (the Republic of)*; ³*Korea Military Academy, Korea (the Republic of)*. The optical reflectance of femtosecond laser-induced columnar structures (fs-CSs) on aluminum was investigated. Contrary to typical monotonic reductions, we report an increase in reflectance with a higher number of irradiating pulses on fs-CSs.

JW4A.5 ·

Toward a Temperature-Insensitive Composite Diamond Clock, Sean A. Lourette^{1,2}, Andrey Jarmola^{1,2}, Jabir Chathanathil², Victor M. Acosta³, A. G. Birdwell², Peter Blümler⁴, Dmitry Budker^{4,5}, Sebastián C. Carrasco², Tony G. Ivanov², Shimon Kolkowitz¹, Vladimir S. Malinovsky²; ¹*Univ. of California Berkeley, USA*; ²*DEVCOM Army Research Laboratory, USA*; ³*Center for High Technology Materials and Department of Physics and Astronomy, Univ. of New Mexico, USA*; ⁴*Johannes Gutenberg-Universität Mainz, Germany*; ⁵*GSI Helmholtzzentrum für Schwerionenforschung GmbH, Germany*. We demonstrate a temperature-insensitive composite diamond clock formed by interleaving measurements of the NV electronic zero-field splitting and nuclear quadrupole parameter, achieving fractional instability below 5×10^{-9} at 200 s averaging time with 200× improved long-term stability over single-transition operation.

JW4A.6 ·

Photon Correlation Measurements in a Sub-Threshold Quantum Well Laser QRNG, Utkarsh K. Singh¹, Devnath Dhirhe¹; ¹*Defence Inst. of Advanced Technology, India*. We report a QRNG based on second-order photon correlation measurements of sub-threshold emission from a quantum well laser. HBT measurements yield $g^2(0) = 0.36 \pm 0.13$, confirming non-classical TM-polarized photon statistics. Extracted randomness passes all NIST SP 800-22 tests.

JW4A.7 ·

Intrinsic Optical Bistability in Rydberg Vapors from Self-Consistent Steady States, Bartosz Kasza¹, Tomasz Prokop¹, Wojciech Wasilewski¹, Michal Parniak¹; ¹*Univ. of Warsaw, Poland*. Mean-field nonlinearities make the bistable steady states of hot Rydberg vapors challenging to model. We address this with an efficient method that maps the self-consistent steady states and visualizes bistability interactively.

JW4A.8 ·

Development of a Rubidium-87 Rydberg-EIT Platform Toward Signal-Processing-Assisted Quantum Microwave Sensing, Basdev Yadav¹, Garrett Chambers², Jonathan Blakely²; ¹*Department of Physics and Astronomy, The Univ. Of Alabama in Huntsville, USA*; ²*Department of Electrical and Computer Engineering, The Univ. of Alabama in Huntsville, USA*. We demonstrate saturated absorption

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spectroscopy of the Rb-87 D2 transition and develop a ladder-type Rydberg-EIT platform for quantum microwave sensing. Current work focuses on stable EIT and future characterization of receiver bandwidth toward signal-processing-assisted enhancement of effective sensing performance.

JW4A.9 ·

Neural Fields for Single-Shot Image Reconstruction in Fiber Bundle Imaging Systems, Amir Reza Vazifeh¹, Jason Fleischer¹; ¹*Princeton Univ., USA*. We present an unsupervised method for image reconstruction in fiber-bundle imaging from a single input image and the known fiber layout using implicit neural representations. The approach is validated on both simulated and experimental data.

JW4A.10 ·

Gated SNSPDs for High-Suppression of Temporally Filtered Excitations, Antonio Guardiani¹, Henri Vlot¹, Lieuwe Locht¹, Katyayani Seal¹, Martin Calderola¹, Andreas Fognini¹; ¹*Single Quantum B.V., USA*. We investigate advanced time-gated operation of SNSPDs with gate transition times that are sub-nanosecond, where the detection current is actively modulated to prevent saturation under strong illumination enabling precise temporal control of the detector sensitivity.

JW4A.11 ·

Dispersion Dependent Gaps and Gap Soliton Formation in Photonic Hypercrystals, Munazza Zulfiqar Ali¹; ¹*Univ. of the Punjab, Pakistan*. Photonics hypercrystals combine the properties of photonic crystals and hyperbolic metamaterials. The red shifted, blue shifted and plasmon polariton gaps appear in its different frequency regions. The Gap Soliton formation inside these gaps is explored.

JW4A.12 ·

Tunable Microcavity Platform For Vertical Cavity Optical Parametric Oscillation, Yassine Bakkouch¹, Ouri Karni¹, Ryotatsu Yanagimoto¹, Kenta Takata¹, Chirag Vaswani¹, Thibault Chervy¹; ¹*NTT Research, USA*. We report the fabrication and performance of a tunable microcavity that will support vertical-cavity optical parametric oscillation at nanowatt-scale excitation. We present key fabrication steps resulting in high-finesse modes and their tuning into mutual resonance.

JW4A.13 ·

Optoacoustic Buffer for Photonic Signal Processing, Charlotte Finger¹, Olivia Saffer^{2,1}, Lisa Fischer^{2,3}, Gladys Jara-Schulz^{2,3}, Jesús Humberto Marín Cabello^{2,1}, Linqiao Gan^{2,1}, Andreas Geilen^{2,1}, Steven Becker^{2,1}, Xinglin Zeng², Birgit Stiller^{2,3}; ¹*Department of Physics, Univ. of Erlangen-Nuremberg, Germany*; ²*Max Planck Inst. for the Science of Light, Germany*; ³*Inst. of Photonics, Leibniz Univ. Hannover, Germany*. We present the extension of a photonic buffer based on stimulated Brillouin scattering towards higher storage times and larger capacity. The capacity is increased by using phase states and two-spin polarization multiplexing.

JW4A.14

Milliradian Precision Carrier-Beam Steering Over 60° by Solid-State Device with Single-Voltage Control, Peter Radic¹; ¹*Rose Hulman Inst. of Technology, USA*. A single-voltage-controlled carrier-beam steers over 60° with 3 milliradian precision. A fully monolithic device uses a SiN leaky-wave grating with a liquid-crystal overcladding, operating in the standard telecommunication 1550 nm band with 82% total efficiency.

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JW4A.15

Optimized Phase Masks for All-Optical Augmented Reality Microscopy, Maha Sahloul^{1,2}, Kaan Aksit³, Fatih toy^{1,2}; ¹*Biomedical Engineering, Istanbul Medipol Univ., Turkey*; ²*Research Inst. for Health Sciences and Technologies (SABITA), Istanbul Medipol Univ., Turkey*; ³*Computer Science, Univ. College London, UK*. We introduce phase mask optimization methods for Augmented Reality (AR) microscopes to reduce computational load. The proposed approach enables real-time all-optical target augmentation during object movement, eliminating the need for per-frame computation and tracking requirements.

JW4A.16

Interaction Enhanced Microwave-field Detection with Long-lived Collective Rydberg Excitations, Stanislaw Kurzyna¹, Bartosz Niewelt¹, Mateusz Mazelanik¹, Wojciech Wasilewski¹, Rafal Demkowicz-Dobrzanski¹, Michal Parniak¹; ¹*Uniwersytet Warszawski, Poland*. By prolonging the Rydberg spinwave lifetime and exploiting inter-atomic dipolar interactions, we proposed an error-prevention protocol for lossy measurements. With current parameters, we achieved a 35 pV s / cm pulse sensitivity for microwave field detection.

JW4A.17

Deterministic Vortex beams in Atmospheric Turbulence, Gregory J. Gbur¹, Caitlin Gilman¹; ¹*Univ of North Carolina at Charlotte, USA*. Vortex beams and partially coherent beams have been considered for freespace optical communication systems. We look at the stability of several classes of partially coherent deterministic vortex beams in atmospheric turbulence.

JW4A.18

Simulation of Femtosecond Laser Microprocessing on Glass, Akif Qadeer¹, Nathan Klein¹, Jie Qiao¹; ¹*Rochester Inst. of Technology, USA*. We demonstrate a simulation framework for predicting single-pulse ablation dynamics during femtosecond laser processing on glass. The model prediction of plasma and heat affected zones enables offline optimization of laser micromachining.

JW4A.19

Fourier Goniometric Flow Cytometry, Vincent M. Rossi¹; ¹*Utah Valley Univ., USA*. Fourier Goniometric Flow Cytometry maps scattered light to the Fourier plane along forward- and side-scatter channels, maintaining angular resolution lost by traditional flow cytometry and providing greater sensitivity between cell populations with subtle scattering differences.

JW4A.20

All-Optical Excitation of Magnetostatic Spin Waves in Ferromagnetic Fe₈₀Al₂₀ Thin Films, Prasanta K. Datta¹, Debkanta Ghosh¹, Chitra Dolai¹, Bijoy K. Kuanr²; ¹*Indian Inst. of Technology Kharagpur, India*; ²*Special Center for Nanoscience, Jawaharlal Nehru Univ., India*. We demonstrate all-optical excitation of multiple spin-wave modes in a ferromagnetic Fe₈₀Al₂₀ thin film using TR-MOKE. Dispersion-based analysis identifies Kittel and Damon–Eshbach modes, while the high-frequency resonance indicates magnetoelastic coupling with coherent acoustic phonons.

JW4A.21

Accelerated Coherent Phase Locking Using Log-Normal-Assisted CMA-ES, Hansol Kim¹; ¹*Quantum Information Science and Engineering, Sejong Univ., Korea (the Republic of)*. We propose a log-normal-assisted CMA-ES for coherent beam combining. Numerical simulations of a 127-channel system

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demonstrate significantly faster phase locking, reducing the time to reach a BCE of 0.8 from 36–41 s to 2.1–2.4 s without additional computational cost.

JW4A.22

Imaging of Polarimetric-Phase Object Through Scattering Medium by Off-Axis Coherence Fringe

Analysis, Prateek Agrawal¹, Rakesh Kumar Singh¹; ¹*Indian Inst of Technology (BHU) Varanasi, India*. We demonstrate imaging of polarimetric-phase objects through scattering media using off-axis coherence holography and intensity correlation. A tilted x-polarized object field spatially separates the object-frequency terms in the complex coherence function, enabling single-shot reconstruction.

JW4A.23

Deployment of Augmented Reality Experiences in E&M Introductory Physics, Matthew Anderson¹,

Elizabeth Flynn¹, Cynthia Coria¹, Jasmine Ceballos¹, Janet Bowers¹, Dustin Thoman¹, Adrian Larios¹, India Wishart¹, Luke Anderson², Beau Green², Bharat Ahluwalia², Jamie Fleming²; ¹*San Diego State Univ., USA*; ²*Altoura Inc., USA*. We have deployed an augmented reality environment for teaching electric fields, magnetic fields, and electromagnetic waves. We will demo the experience and discuss results from our deployment

JW4A.24

Large-Signal Analysis of On-Chip Optical–Electrical–Optical (OEO) Conversion for Reconfigurable

Neuromorphic Activation Functions, Raqqib Bin Kadir¹, Hector Rubio Rivera¹, Venkatesh Deenadayalan¹, Stefan F. Preble¹; ¹*Rochester Inst. of Technology, USA*. We demonstrate the first combined large- and small-signal analysis of on-chip OEO circuits, enabling reconfigurable sigmoid, ReLU, and RBF neuromorphic activations, with optimal bias identified through total harmonic distortion minimization.

JW4A.25

Mach-Zehnder Interferometric System for Concrete Compressive Strength Monitoring, Sandisiwe

Bangani¹, James Jena¹, Victor C. Agbakoba¹, David Waswa¹; ¹*Department of Physics, Nelson Mandela Univ., South Africa*. This study uses embedded Mach-Zehnder Interferometric (MZI) sensors in concrete beams to non-destructively monitor compressive strength development during 28-day curing. Logarithmic slopes closely match cube tests, confirming MZI reliability across mixtures.

JW4A.26

Depth and Motion Analysis using a Stereoscopic Optical Correlator, Akash Pal¹, Naveen K. Nishchal¹;

¹*Indian Inst. of Technology Patna, India*. This study proposes a stereoscopic optical correlator for simultaneous depth and motion estimation. Binocular vision creates disparity, while correlation peak localization and temporal shift analysis enable three-dimensional position and motion extraction with fast processing capability.

JW4A.27

Geometry-Dependent Optical Redistribution in NV Diamond Nanopillar Arrays, Sondos Quqandi¹,

Sharad Yadav¹, Ayman Hoblos¹, Jawaher Almutlaq¹; ¹*Material Science and Engineering and Applied Physics, King Abdullah Univ. for Science and Technology, Saudi Arabia*. Optical redistribution between pillar and inter-pillar regions is observed in dense NV diamond nanopillar arrays. Widefield photoluminescence imaging reveals strong geometry and focus dependence, while FDTD modeling

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captures redistribution trends that influence array-level optical fidelity.

JW4A.28

Adaptive Focus Shifting Through Random Media Using Gradient Descent Algorithm, Sarita Mehra¹, Sayantan Gantait^{1,2}, Atul Kumar², Rakesh Kumar Singh¹; ¹*Department of Physics, Indian Inst. of Technology (BHU) Varanasi, India;* ²*Department of Electronics Engineering, Indian Inst. of Technology (BHU) Varanasi, India.* We have presented a stochastic parallel gradient descent (SPGD)-based wavefront-shaping and adaptive focusing method that leverages randomness via spatial light modulator. Beam focusing and shifting through a random medium is demonstrated using simulation and experiment.

JW4A.29

Thermally and Bend Compensated Large Mode Area Fiber, Soorej Thekkeyil¹, Anirban Dhar², Deepak Jain¹; ¹*Optics and Photonics Centre, India;* ²*Fiber Optics & Photonics Division, CSIR-Central Glass & Ceramic Research Inst., India.* This thermally and bend-compensated large-mode-area fiber integrates dual compensation to enable effectively single-mode guidance under practical coiling while suppressing thermo-optic modal coupling, raising the TMI threshold and enabling stable multi-kW with elevated nonlinear thresholds.

JW4A.30

Coherence Generation in Kerr Beam Self-Cleaning beyond the Ideal Photonic Gas, Haoyu Wei¹, Logan Wright¹; ¹*Yale Univ., USA.* Kerr beam self-cleaning produces a clean beam from a speckled input, but whether modes phase-lock is unclear. Retaining the Kerr term in optical thermodynamics, we predict equilibrium phase coherence between modes, consistent with NLSE simulations.

JW4A.31

Reconfigurable Directional Asymmetry of Photon Pair Emission in Bilayer Metasurfaces, Matthew H. Belzer¹, Michele Cotrufo¹; ¹*Univ. of Rochester, USA.* We numerically demonstrate a bilayer metasurface that simultaneously enhances SPDC efficiency and enables mechanically tunable asymmetrical emission, by steering signal and idler to two different semi-spaces depending on their energy.

JW4A.32

Cylindrical Vector Beam Basis for 3D Degree of Polarization of Focused Light, Samuel L. Erdogan¹, Eileen Otte¹; ¹*Inst. of Optics, Univ. of Rochester, USA.* In imaging or sensing, non-paraxial light and its degree of polarization (DoP) can reveal usually invisible nanoscale information. We propose using the cylindrical vector beam basis for investigating the 3D DoP and coherence matrix.

JW4A.33

Withdrawn.

JW4A.34

Effects of Water on Induced Refractive Index Modification During Femtosecond Laser Writing in Hydrogels, Quazi Rushnan Islam¹, Wayne Knox¹; ¹*Univ. of Rochester, USA.* Hydration state during femtosecond laser micromachining influences the resulting refractive index modification in transparent hydrogels. Dry-state writing produced larger peak refractive index changes and more confined axial

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index distributions than structures written directly in hydrated-state.

JW4A.35

Manifold Learning for Space-Based Hyperspectral Environmental Monitoring, Jason Salmanowitz¹, Emmett Ientilucci¹, David Messinger¹; ¹*Rochester Inst. of Technology, USA*. We demonstrate the ability of the manifold learning algorithm ISOMAP to identify leaf senescence in space-based hyperspectral imagery more effectively than principal component analysis as an example of using a non-linear manifold for environmental monitoring.

JW4A.36

Sampling Near-infrared Waveforms Using Nonlinear Photoemission from a Microchannel Plate Detector, Fatemeh Mousavi Karimi^{1,2}, Pooya Ghavami^{1,2}, Sebastian Pachon-Quesada^{1,2}, Nida Haram², Paul B. Corkum^{1,2}, Michael Chini³, Andre Staudte^{2,1}, Shima Gholam Mirzaeimoghaddar^{1,2}; ¹*Univ. of Ottawa, Canada*; ²*National Research Council of Canada, Canada*; ³*Ohio State Univ., USA*. We demonstrate near-infrared optical waveform sampling using nonlinear photoemission from a microchannel plate detector, introducing a commercially available, readily integrable platform for field-resolved metrology at petahertz frequencies applicable to high-field experiments and pump-probe timing diagnostics.

JW4A.37

Chlorine-doped Graphitic Carbon Nitride-Zinc Ferrite Triangular Nanoplates for Tunable Optical and Magnetic Response, Soumi Mukherjee¹, Ajinkya Palwe¹, Tejas Suryawanshi¹, Shobha Shukla¹, Sumit Saxena¹; ¹*Indian Inst. of Technology Bombay, India*. Scalable one-pot synthesis of chlorine-doped graphitic carbon nitride-zinc ferrite triangular nanocomposites (~175 nm) is demonstrated. The nanostructures exhibit excitation-dependent photoluminescence, a 2.8 eV indirect bandgap, and temperature-dependent magnetism, enabling potential photonic, magneto-optical, and quantum-regime applications.

JW4A.38

High-Speed Robust VOA-Based Static Optical Memory for Integrated Photonic Systems, Ankur Singh¹, Akhilesh Jaiswal¹; ¹*Univ. of Wisconsin Madison, USA*. A high-speed GF45SPCLO variable optical attenuator (VOA)-based photonic memory is proposed, using programmable attenuation states for optical storage and retrieval, demonstrating 20-GHz write speed for compact, energy-efficient on-chip buffering, switching, photonic computing, and interconnect applications.

JW4A.39

Robust Multiparticle Quantum Plasmonics for Gas Sensing, Jannatul Ferdous¹, Riley B. Dawkins¹, Cameron Bachar², Mingyuan Hong¹, Yang Mu³, Khadijatu N. Alhassan², Chenglong You¹, Kevin M. McPeak², Omar Magana-Loaiza¹; ¹*Department of Physics & Astronomy, Louisiana State Univ., USA*; ²*Gordon and Mary Cain Department of Chemical Engineering, Louisiana State Univ., USA*; ³*Advanced Microscopy and Analytical Core, Louisiana State Univ., USA*. We demonstrate scalable quantum plasmonic sensing with up to thirty particles extracted from classical plasmonic fields. Applied to hydrogen sensing, the protocol enhances Fisher information, lowers detection limits, and accelerates response under noise and loss.

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JW4A.40

Photonic Interconnects and Radio-and-Power-Over-Fibre (RPOF) Architectures for Energy-Efficient 6G Data Centre and Edge Networks, Nkosingiphile N. Sibaya¹; ¹NMU, South Africa. Photonic interconnects and Radio-and-Power-over-Fibre architectures are investigated for sustainable 6G infrastructures. Analytical evaluation demonstrates how simultaneous optical power delivery and data transport can reduce energy consumption, improve scalability, and support convergence between data centres and edge networks.

JW4A.41

Thermalization Rates Towards Equilibrium in Optical Thermodynamics, Emmanouil Theodoros Kokkinakis¹, Do Hyeok Jeon², Hediye M. Dinani², Abraham M. Berman Bradley², Mercedeh Khajavikhan², Demetrios N. Christodoulides², Konstantinos Makris¹; ¹Univ. of Crete, Greece; ²Univ. of Southern California, USA. Weakly nonlinear multimode systems equilibrate toward Rayleigh--Jeans modal distributions. We show that identical power and internal energy do not uniquely determine thermalization rates; initial states with the same equilibrium can thermalize at markedly different distances.

JW4A.42

Thermalization of Skin Solitons, Emmanouil Theodoros Kokkinakis¹, Do Hyeok Jeon², Hediye M. Dinani², Abraham M. Berman Bradley², Mercedeh Khajavikhan², Demetrios N. Christodoulides², Konstantinos Makris¹; ¹Univ. of Crete, Greece; ²Univ. of Southern California, USA. Non-Hermitian skin solitons emerge from the interplay between asymmetric coupling and self-focusing effect. Within the framework of optical thermodynamics, we investigate their thermalization process and the approach to equilibrium governed by the system's conserved quantities.

JW4A.43

Spatial-Mode Beam Splitting and Squeezing in Laguerre-Gaussian-Pumped SPDC, Takumi Jinushi¹, Hirokazu Kobayashi¹; ¹Graduate School of Engineering, Kochi Univ. of Technology, Japan. We introduce an operator-based framework revealing that Laguerre-Gaussian-pumped spontaneous parametric down-conversion can be factorized into spatial-mode beam splitting and two-mode squeezing, leading to total spatial-mode conservation for high-purity spatial-qudit generation.

JW4A.44

Quantum Exceptional Points in Optomechanics, Aritra Ghosh¹, Mishkat Bhattacharya¹; ¹Rochester Inst. of Technology, USA. We discuss how optomechanical exceptional points capture distinct signatures of quantum dissipation. Unconditional Lindblad dynamics and non-Hermitian no-jump evolution yield different Liouvillian and Hamiltonian coalescence points, while non-Markovian memory renormalizes exceptional-point coordinates.

JW4A.45

Amplification and Filtering of Noise in Nonnormal Photonic Lattices, Ioannis Kiorpelidis^{2,1}, Konstantinos Makris^{2,1}; ¹Forth-Iesl, Greece; ²Physics, Univ. of Crete, Greece. We demonstrate that nonnormal photonic lattices with asymmetric couplings can simultaneously amplify signals and suppress noise. The critical role of transient power growth and singular eigenstates on signal amplification is systematically examined.

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JW4A.46

Integratable Monitor-free Random Number Generator Based on Photon Counting, Junhui Li¹, Yu Gao², Jie Yang^{1,2}, Mingze Wu¹, Yichen Zhang¹, Bin Luo¹, Bingjie Xu²; ¹*School of electronic engineering, Beijing Univ. Posts & Telecommun., China*; ²*Inst. of Southwestern Commun., China*. Random number generator with only light source and photon number resolved detector is proposed. Extractable randomness is assessed with registered photon counts and calibrated or estimated detector's quantum efficiency, free of monitoring light source information.

JW4A.47

Impact of Detector Noise on Free-Space Unidimensional CV-QKD: Experimental Study, Rachita Nandan^{1,2}, Jayanth Ramakrishnan¹, Shashi Prabhakar¹, R P Singh¹; ¹*Physical Research Laboratory, India*; ²*Indian Inst. of Technology Gandhinagar, India*. We experimentally demonstrate free-space unidimensional continuous-variable quantum key distribution under high detector electronic noise. Security analysis shows finite secure key rates under trusted detection in low-loss channels, demonstrating feasibility depending on detector trust and transmittance.

JW4A.48

Direct Sampling of Electric-Field Fluctuations of bright Squeezed Vacuum, Shima Gholam Mirzaeimoghaddar^{1,2}, Michael Weil¹, David Purschke³, katarzyna kowalczyk², Andre Staudte^{2,1}, David Villeneuve², Paul B. Corkum¹, Jeff S. Lundeen¹, Tj Hammond⁴, Giulio Vampa^{2,1}; ¹*Univ. of Ottawa, Canada*; ²*National Research Council of Canada, Canada*; ³*Laboratory for Laser Energetics, Univ. of Rochester, USA*; ⁴*Department of Physics, Univ. of Windsor, Canada*. Using an attosecond field-sampling technique, we directly measure femtosecond bright squeezed vacuum, resolve stochastic coherence bursts with binary phase symmetry, and generate quantum random bit sequences, pointing toward randomness generation at near-petahertz rates.

JW4A.49

High-Sensitivity Optical AM Tone Tracking for Beaconless Optical Inter-Satellite Links, Kwon-Seob Lim¹, Kiwook Baek¹, Manseok Uhm¹, Dongpil Chang¹; ¹*Etri, Korea (the Republic of)*. This paper presents a high-sensitivity beaconless optical tracking system using a quadrant photodiode, digital lock-in amplifier, and real-time coordinate estimation. Reliable tracking was demonstrated down to -50 dBm, achieving tracking errors below 3.54 μ rad for a tracking system with a 0.1 mrad field of view.

JW4A.50

All-Fiber Polarized Mode-Locked Erbium-Doped Self-Starting Fiber Laser Using a CNT/NaCMC Gold Mirror Saturable Absorber, Taina M. Ramírez¹, Jaime Cascante¹, John Rosses², Esteban Avendaño¹, Mavis Montero¹; ¹*Universidad de Costa Rica, Costa Rica*; ²*FYLA Laser S.L., Spain*. An all-fiber polarized mode-locked Erbium-doped fiber laser with a carbon nanotube/sodium carboxymethyl cellulose saturable absorber over a gold mirror is demonstrated. Its most stable performance had central wavelength of 1555 nm, output power of 2.830 mW and pulse width of 792.67 fs, showing self-starting behavior with a range of output power.

JW4A.51

Acoustic Detection System Based on an SMF-COF-SMF Structure Encapsulated in a Glass Capillary with Liquid Infiltration, Stephanie G. Hernández García¹, Everardo Herrera-Ramírez¹, Julián Estudillo¹, Roberto Reyes Ayona¹, Juan C. Hernandez Garcia¹, Maximino R. Tapia Garcia¹, Roberto Rojas¹, Juan

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Sierra¹, Jose D. Filoteo Razo²; ¹*Universidad de Guanajuato, Mexico*; ²*UAT, Mexico*. A fiber-optic acoustic sensor based on an SMF–COF–SMF structure encapsulated in a 50/50 alcohol solution was developed. Using a 1064 nm pulsed laser, the device detected sound disturbances, demonstrating potential for low-cost acoustic monitoring

JW4A.52

Imaging and Raman Spectroscopic Techniques for Environmental Microplastic Analysis, Martin Zanazzi¹, Korryn Narvaez¹, Courtney Ebert², Radu Boitor³, Christopher Corden³, Sara S. Rocks², Ioan Notingher³, Dustin W. Shipp¹; ¹*Department of Physics, Utah Valley Univ., USA*; ²*Department of Chemistry, Utah Valley Univ., USA*; ³*School of Physics and Astronomy, Univ. of Nottingham, UK*. Raman spectroscopy is a leading technique for microplastic (MP) identification, but faces significant challenges. This presentation explores methods for improving the accuracy and efficiency of MP classification to better understand MP origins.

JW4A.53

Scalable Fabrication of Femtosecond Laser-Induced Columnar Structures on Aluminum, Taehoon Park¹, Yong-dae Kim¹, Jongweon Cho², Byounghwak Lee³, Taek Yong Hwang¹; ¹*Korea Inst. of Industrial Technology, Korea (the Republic of)*; ²*Myongji Univ., Korea (the Republic of)*; ³*Korea Military Academy, Korea (the Republic of)*. Femtosecond laser-induced columnar structures (fs-CSs) were investigated on aluminum. Following fs laser irradiation, ablated microcluster redeposition drives structural initiation, and flat-top beams enable selective oxidation and redeposition, allowing their scalable fabrication and controlled vertical growth.

JW4A.54

Intravital SRRF Imaging of Mitochondrial Dynamics in Doxorubicin-Induced Hepatotoxicity, Joonseup Hwang¹, Jeongmin Oh², Jun Ki Kim^{1,2}; ¹*Department of Convergence Medicine, Brain Korea 21, Univ. of Ulsan, College of Medicine, Korea (the Republic of)*; ²*Biomedical Engineering Research Center, Asan Medical Center, Korea (the Republic of)*. To evaluate anticancer hepatotoxicity, we tracked hepatic mitochondria in doxorubicin-treated mice via two-photon eSRRF. Day 3 revealed severe fragmentation, concluding that doxorubicin directly disrupts in vivo mitochondrial dynamics by inducing excessive fission.

JW4A.55

Label-Free Physicochemical Analysis of Colon26 and MC38 Cells Using Combined ODT–Raman Platform, Minju Cho¹, Minseong Kwon¹, Suyeon Kang¹, Jun Ki Kim^{1,2}; ¹*Department of Convergence Medicine, BK21, Univ. of Ulsan, Korea (the Republic of)*; ²*Biomedical Engineering Research Center, Asan Medical Center, Korea (the Republic of)*. ODT and Raman spectroscopy were combined to profile colorectal cancer cell line, Colon26 and MC38 cells. MC38 showed higher RI-based density, whereas Colon26 exhibited stronger protein/lipid-related Raman ratios, demonstrating complementary physicochemical cell profiling

JW4A.56

Joint Brain-Tumor MRI Classification and Segmentation via Regression-Free Bidirectional Coupling, Kyeong Ryeol Kim¹, Jeongmin Oh², Jun Ki Kim^{1,2}; ¹*Univ. of Ulsan, Korea (the Republic of)*; ²*Asan Medical Center, Korea (the Republic of)*. Cross-task coupling for joint brain-tumor MRI classification and segmentation risks regressing baseline performance. An identity-at-initialization design removes that

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risk, preserves in-distribution performance, and reduces out-of-distribution false-positive tumor calls at an external site.

JW4A.57

Vernier-Enhanced SiN Ring-MZI-Sagnac Sensor for Aqueous Refractive-Index Monitoring, Camilo Hurtado Ballesteros¹, Samuel Serna², Rodrigo Acuna Herrera¹, Pedro I. Torres Trujillo¹; ¹*Universidad Nacional de Colombia, Colombia*; ²*Bridgewater State Univ., USA*. We present a silicon nitride Vernier refractive-index sensor combining an add-drop microring resonator and an unbalanced Mach–Zehnder Sagnac interferometer. Simulations predict 4319 nm/RIU envelope sensitivity and a 1.16e-6 RIU detection limit at 1550 nm.

JW4A.58

Multiplex Biomarker Analysis in Digital Histopathology Using Fluorescence Lifetime Imaging, Kiri Lee¹, Dong Hui Seo¹, Youngjae Won², Seungrag Lee¹; ¹*Medical Device Development Center, Osong Medical Innovation Foundation, Korea (the Republic of)*; ²*intekmedi, Korea (the Republic of)*. We propose a phase-analysis-based real-time confocal fluorescence lifetime imaging system for tumor cell characterization, enabling rapid structural and molecular analysis for digital histopathology and cancer diagnostics

JW4A.60

Overcoming Imaging Aberrations in Laser Beam Modal Decomposition Through Joint Optimization of Modes and Wavefront Distortions, Shu-Chun Chu¹, Hong-Ruei Chen¹, Yung-Hsiang Huang¹, Xiang-Jun Xin¹; ¹*National Cheng Kung Univ., Taiwan*. A stochastic parallel gradient descent (SPGD)-based framework is proposed for simultaneous reconstruction of laser modes and optical aberrations, enabling accurate modal analysis and robust laser beam characterization in the presence of wavefront distortions.

JW4A.61

Far-Detuned Quantum-Enhanced Atomic Magnetometry via Four-Wave Mixing, Sumrah Hussain¹, Nicolas DeStefano¹, Rob Behary¹, Todd Averett¹, Shukui Zhang², Alexandre Camsonne², Seth Aubin¹, Eugeny Mikhailov¹, Irina Novikova¹; ¹*College of William & Mary, USA*; ²*Thomas Jefferson National Accelerator Facility, USA*. We use Rb vapor to generate intensity-correlated twin beams and boost their magneto-optical response to develop a sub-shot-noise-limited atomic magnetometer as a step towards a quantum-enhanced charged particle tracker.

JW4A.62

Autofluorescence Evaluation of Biopolymers Using Confocal Microscopy, Sanjana Gupta¹, Shreya S Shahapur¹, Siya Jain¹, Pooja N¹, Edwin Pious¹, Nirmal Mazumder¹; ¹*Manipal Academy of Higher Education, India*. Confocal microscopy indicated varying autofluorescence intensities in potato starch-based films. Plain starch showed low fluorescence, while starch-reduced graphene oxide-anthocyanin films had moderate emission. Starch-anthocyanin films exhibited the highest, uniform autofluorescence, confirming anthocyanin as the main fluorescent component.

JW4A.63

Performance Analysis of an Advanced SPR Biosensor Incorporating , and for Peptide Biomarker Detection, Sandeep Boddu¹, Xuecheng Liu¹, Yesudasu Vasimalla², Santosh Kumar²; ¹*Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty*

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Fiber Optics and Advanced Communication, Shanghai Inst. for Advanced Communication and Data Science, No. 99 Shangda Road, 200444, China, Shanghai Univ., China; ²*Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, India.* This article presents a surface plasmon resonance (SPR) sensor, which is a label-free and real-time applicable device, employing the FK51A prism, Silver, Silicon Quantum Dots, Black Phosphorus, and Carbon Quantum Dot, this sensor is used for Peptide Biomarker detection.

JW4A.64

Photonic Nanobeam in A Hybrid Tio₂/Polymer Vertical Nano-Waveguide, Ebere Mercy Onah¹, Shyamalie Y. Wijesiri¹, Fangfang Li¹, Antonin Patricio Gomes¹, Matthieu Roussey¹; ¹*Univ. of Eastern Finland, Finland.* We demonstrate a 1550 nm hybrid polymer/TiO₂ nanobeam filter with 1547 nm bandgap, 24 dB extinction, 13 nm FWHM and systematic photonic bandgap tunability via geometry. Cavity characterization as future work for wavelength selectivity.

JW4A.65

Electrical Insights of Iron Oxide-Biochar@Protonated Carbon Nitride Nanocomposite on Cu-IDE for Tetracycline Detection, Nikhil K. Daimari¹, Prakash Nandi¹, Rajib Biswas¹; ¹*Tezpur Univ., India.* Leveraging the conductivity of iron oxide-biochar@protonated carbon nitride, herein we report fabrication of nanocomposite modified interdigitated electrodes (IDE) by analysing current-voltage (I-V) characteristics for tetracycline detection.

JW4A.66

Mode-Engineered SMS Fiber Sensor for Multi-Parameter Sensing with Neural Network-Based Decoupling, Neha Ahlawat¹; ¹*Optics and Photonics Centre, IIT Delhi, India.* We report a compact, mode-engineered SMS fiber sensor for simultaneous strain and temperature sensing. Spectral features are reduced via PCA and processed by a regression ANN, achieving RMSEs of 13.75 μm and 14.56°C, demonstrating effective multi-parameter decoupling in a small-data regime.

JW4A.67

Fourier-Space Theory of Turbulence-Induced Momentum Broadening and Scintillation Reduction, Shouvik Sadhukhan¹; ¹*Indian Inst. of Space Sci & Tech, India.* A rigorous Fourier-space theory is developed to explain turbulence-induced momentum broadening and the reduction of scintillation obtained by vortex beam shaping. The analysis shows that vortex phase plates redistribute turbulence energy among orbital angular momentum modes through deterministic Fourier-space mixing rather than turbulence removal.

JW4A.68

RGB and Light-Weight ToF Sensor Fusion for Low-Light Indoor Depth Estimation, Muhammad Fraz¹, Jiaonan Zhang¹, Zhilin Zhang¹, Ayesha Mahmood¹, Omer Altaf Omer Haroon¹, Zhongqi Pan², Yang Yue¹; ¹*1. School of Information and Communications Engineering, Xi'an Jiaotong Univ., China;* ²*2. Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, USA.* Low-Light Depth Network (LLD-Net) is proposed for RGB and light-weight ToF sensor fusion under dark indoor conditions. Confidence-guided per-pixel modality weighting enables zero-shot generalization, surpassing all existing benchmarks by over 20% on public ZJU-L5 dataset.

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JW4A.69

A Matrix Differential Operator for Polarization: Example of Bessel Light Beams, Sameen A. Khan¹; ¹*Dhofar Univ., Oman*. We present a matrix differential operator for transition from the Helmholtz scalar wave optics to the Maxwell vector wave optics. The operator is used to obtain the cross polarization in Bessel light beams.

JW4A.70

Theoretical Modelling of SPR Sensor for Detection of Lead Ions in Water, Nitesh Mudgal¹, Sonam Gour¹, Ankit Agarwal², Sourabh Sahu³, Ghanshyam Singh⁴, Phuong T. Tran⁵; ¹*Poornima College of Engineering Jaipur, India*; ²*Department of ECE, Swami Keshvanand Inst. of Technology, Management & Gramothan, Jaipur, India*; ³*Department of Artificial Intelligence and Robotics, Gyan Ganga Inst. of Technology, Jabalpur, India, India*; ⁴*Department of ECE, Malaviya National Inst. of Technology, Rajasthan, India, India*; ⁵*Wireless Communications Research Group, Faculty of Electrical and Electronics Engineering, Ton Duc Thang Univ., Ho Chi Minh City, Vietnam, Viet Nam*. This paper presents a highly sensitive BaTiO₃ based prism SPR sensor using transfer matrix method (TMM) for the lead ions detections in the water. This structure opens a platform in environmental sensing field.

JW4A.71

Impairment-Aware Dynamic Core-Wavelength Allocation for QKD over 8-Core Multicore Fiber in C-Band, Upasana Tripathi¹, Ritu Raj Singh¹, Parul Garg¹; ¹*Netaji Subhas Univ. of Technology, India*. An impairment-aware dynamic core-wavelength allocation strategy for BB84 QKD over an 8-core C-band multicore fiber uses spatial interleaving and guard-band maximization, achieving an 86.8% secure key rate gain and reducing QBER from 7.70% to 2.14% at 100 km.

JW4A.72

Ionic Impact on Photothermal Effects in Water-DMSO and Water-Methanol Binary Mixtures, Sumit Kotwal¹, Aman Sharma^{1,2}, Rohit K. Maurya^{3,4}, Debabrata Goswami^{5,6}; ¹*Centre for Lasers and Photonics, Indian Inst. of Technology Kanpur, India*; ²*Department of Physics, Indian Inst. of Technology Jodhpur, India*; ³*Department of Chemistry, Indian Inst. of Technology Kanpur, India*; ⁴*Department of Chemistry, Pt. Prithi Nath (P.G.) College, Chhatrapati Shahu Ji Maharaj Univ., India*; ⁵*Centre for Lasers and Photonics & Department of Chemistry, Indian Inst. of Technology Kanpur, India*; ⁶*Center for Bits and Atoms, Massachusetts Inst. of Technology, USA*. This study explores how non-absorbing potassium iodide affects Water-Methanol and Water-DMSO binary mixtures using Dual-beam Femtosecond laser Thermal Lens (TL) spectroscopy, revealing changes in thermal and optical properties despite the absence of absorption.

JW4A.73

Synthesis of Composite Optical Merons, Sushanta K. Pal¹, Rudrashis Panda², Rakesh M. Das²; ¹*Siksha 'O' Anusandhan Univ., India*; ²*Physics, Kalinga Inst. of Industrial Technology Bhubaneswar, India*. We investigate composite optical meron field synthesis via coaxial superpositions of Laguerre-Gaussian beams. By varying the constituent orbital angular momenta, we achieve deterministic control over the topological configuration and the specific population of merons within the field.

JW4A.74

An Integrated Optofluidic Platform for Label-Free and Continuous Particle Sizing: Moving Beyond Dynamic Light Scattering, Abhishek Chaurasia¹, Amol Lalchand Salve¹, Earu Banoth¹; ¹*Department of*

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Biotechnology and Medical Engineering, National Inst. of Technology Rourkela, India. We propose an integrated label-free, low-cost optofluidic platform combining Fourier-plane imaging Mie scattering, bright-field microscopy, and APD-based in-flow sizing system, to characterize polydisperse milk samples with 95% accuracy for fat globules.

JW4A.75

Light-driven Soft Robot integrated with FRET-Assisted Random Lasing Tip, Nikita Choudhary¹, Diksha Sharma¹, Anjani K. Tiwari^{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.* We realize an arrow-shaped LCE robot and integrate it with a FRET-assisted random lasing tip. Upon optical illumination, the robot performs an inching motion toward a predesignated target where its FRET tip generates random lasing.

JW4A.76

All Optical Binary Logic Gates on SOI Platform for On-Chip Integrated Photonics, Yash Yadav¹, Jyoti Bhardwaj¹, Yogita Kalra¹, Ravindra K. Sinha¹; ¹*Delhi Technological Univ., India.* We realize a complete set of all-optical logic gates on a compact silicon-on-insulator platform using linear interference. FDTD simulations demonstrate femtosecond response times (0.81–1.03 fs) and high contrast ratios up to 44.5 dB across polarizations.

JW4A.77

Closed-Form Interference Optimum and Parametric Realization of Photon Blockade in Weakly Nonlinear Si₃N₄ Cavities, Krishna Sujith¹, Karthikeya Machiraju¹, Kaustav Bhowmick¹; ¹*PES Univ., India.* We derive closed-form unconventional photon blockade tuning conditions yielding $g^{(2)}(0) = 4.3 \times 10^{-5}$ at $U/\kappa = 0.1$, and map a parametric Si₃N₄ realization achieving $g^{(2)}(0) = 0.28$ with 100% fabrication yield under $\pm 5\%$ geometric variance.

JW4A.78

Fabrication-Tolerant Photonic Crystal Error-Control Architectures: Comparative Analysis and Optimization, Aakarsh M. S¹, Akshay Nag¹, Riya M Pastay¹, Kaustav Bhowmick¹; ¹*PES Univ., India.* We compare parity, repetition, and Hamming photonic-crystal error-control architectures on a common FDTD platform, identify dominant physical failure mechanisms, and evaluate optimization strategies for improving fabrication tolerance, power balance, and scalability in integrated photonic systems.

JW4A.79

Comparative Analysis of Diffractive Focusing and Imaging Performance in Chiral Kinoform and Chiral Fresnel Zone Plates, Nagi A. Buaossa¹, Rajab y Atai³, Elmoatazbellah Ben Omar⁴, Mansour Abdelrahman²; ¹*Engineering & Industrial Professions, Univ. of North Alabama, USA;* ²*North Alabama International College of Engineering and Technology, Guizhou Univ., China;* ³*School of Art and Sciences Computer Science, Physics & Engineering Department, Benedict College, USA;* ⁴*Electrical Engineering, Wright State Univ., USA.* A methodology based on electromagnetic wave propagation through planar chiral slabs and Fresnel coefficient analysis is applied to a chiral Kinoform Zone Plate (CKZP). The CKZP uses continuous phase modulation to improve diffraction efficiency, focusing performance, and imaging quality over conventional Fresnel Zone Plates

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JW4A.80

Black Phosphorus/SnO₂ Enhanced SPR Sensor for Wide Range NO₂ Detection, Md M. Mohtasim¹, Tanzila A. Shoile¹, Md Al Amin I. Utshob¹, Maymona B. Juwel¹, Khandakar M. Ishtiaq¹; ¹*Ahsanullah Univ. of Science & Tech, Bangladesh*. Design of NaF/SiC/Cu/SiC/BP/SnO₂-based SPR sensor for NO₂ measurement through TMM and FEM approaches at 633 nm wavelength is proposed. Continuous refractive index model facilitates accurate measurements from 0.5 to 200 ppm.

JW4A.81

Fiber-Optic Fabry-Perot Interferometer for Simultaneous Measurement of NaOH Concentration and Temperature, Tonglei Cheng¹; ¹*Univ. of Southampton, Optoelectronics Research Centre, UK*. A reflective fiber-optic Fabry-Perot interferometric sensor is developed for simultaneous measurement of NaOH solution concentration and temperature. The proposed sensor exhibits a refractive index sensitivity of 312.92 nm/RIU and a temperature sensitivity of -0.047 nm/°C.

JW4A.82

Experimental and Computational Analysis of GAWBS-Modified SBS Slow-Light Behavior in Optical Fibers, Christopher K. Horne¹; ¹*North Carolina A&T State Univ., USA*. Stimulated Brillouin slow-light measurements are compared with a compact Python model to separate average pulse-delay trends from spectral broadening and resonance splitting caused by Guided Acoustic-Wave Brillouin Scattering in silica fiber.

JW4A.83

Microstructural Determination of Dental Tissues Using Quantitative Polarisation Microscop, Manikanth Karnati¹, Gagana NA¹, Gagan Raju¹, Edwin Pious¹, Nirmal Mazumder¹; ¹*Manipal Academy of Higher Education, India*. Angular-resolved polarisation microscopy of human dental enamel at 0°, 90°, 180°, and 270° revealed directional birefringence through polar plots, confirming ordered hydroxyapatite crystallite orientation and demonstrating potential for quantitative enamel structural assessment.

JW4A.84

FTIR and XRD: Insight into The Short-Range Molecular Order and Crystallinity, Bhoomika R. Hande¹, Nirmal Mazumder¹, Nandana B¹, Manikanth Karnati¹; ¹*Manipal Academy of Higher Education, India*. Citric acid (CA) modification of foxtail and proso millet starch was characterized using FTIR and XRD. CA-modified starches showed reduced short-range molecular order but increased crystallinity, confirming esterification in amorphous regions while preserving crystalline architecture.

JW4A.85

Pentagonal Negative Curvature Anti-resonant Hollow-Core Fiber for Laser Beam Delivery, Kiran Maurya¹, Deepak Jain¹; ¹*Indian Inst. of Technology Delhi, India*. We explored the complete and incomplete resonant coupling mechanism between core mode and ring modes in the pentagonal negative-curvature hollow-core fiber for effective single-mode operation and found incomplete coupling offers higher suppression of higher-order mode.

JW4A.86

Whole-Slide Autofluorescence Ratio Mapping of Label-Free Oral Squamous Cell Carcinoma Tissue Sections, Edwin Pious², Gagan Raju², Manikanth Karnati², Vathsala Patil¹, Adarsh Kudva³, Nirmal

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Mazumder²; ¹*Department of Oral Medicine and Radiology, Manipal College of Dental Sciences, Manipal Academy of Higher Education, Manipal, Karnataka, India-576104, India;* ²*Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, Manipal, India - 576104, India;* ³*Department of Oral and Maxillofacial Surgery, Manipal College of Dental Sciences, Manipal Academy of Higher Education, Manipal, Karnataka, India-576104, India.* Whole-slide autofluorescence ratio mapping was performed on label-free oral squamous cell carcinoma (OSCC) tissue sections using fluorescence images acquired in the DAPI and FITC channels. The resulting ratio maps revealed spatial heterogeneity in autofluorescence characteristics across the tissue.

JW4A.87

A Comparative Machine Learning Analysis of Oesophageal Cancer Tissue Images Obtained from

Second Harmonic Generation Microscopy, Kausalya N. Makkithaya¹, Guan-Yu Zhuo², Nirmal Mazumder¹; ¹*Department of Biophysics, India;* ²*Inst. of Biophotonics, National Yang Ming Chiao Tung Univ., Taiwan.* This study applies machine learning analysis to second harmonic generation microscopy images for esophageal cancer tissue classification. While SVM exhibited notable instability, XGBoost achieved higher accuracy and stability, successfully mapping complex, collagen alterations in tissues.

JW4A.88 •

Implementation of an Automated LED-Array Low-Cost Fourier Ptychographic Microscope for

Quantitative Phase Imaging, María B. Gaál¹, Alejandro Silva¹, Julia R. Alonso¹; ¹*Universidad de la Republica, Uruguay.* We present an automated, low-cost Fourier Ptychographic Microscopy system utilizing an LED array for high-resolution quantitative phase imaging. The setup's performance and phase retrieval capabilities are successfully validated using calibration targets and biological microstructures.

Empire Hall - Poster Session

14:00 -- 15:30

JW5A • Joint Poster Session IV

JW5A.1 •

Power-Only Refractive-Index Readout Using a SiN Microring Cascade for Water Monitoring, Juan E.

Rodriguez Ochoa³, Rafael A. Casalins Hernandez³, Camilo Hurtado Ballesteros³, Samuel Serna^{1,2}, Rodrigo Acuna Herrera³, Pedro I. Torres Trujillo³; ¹*Physics, Photonics and Optical Engineering, Bridgewater State Univ., USA;* ²*Materials Science and Engineering, Massachusetts Inst. of Technology, USA;* ³*Physics department, Universidad Nacional de Colombia Sede Medellín, Colombia.* We designed a fourteen-MRR cascaded SiN photonic chip for aqueous refractometry. A water-clad sensing ring drives thirteen Si-coated spectrometer channels, enabling power-only cladding-index readout without wavelength sweeps, achieving validated power sensitivities up to +1464 dB/RIU.

JW5A.2 •

Design of a Silicon Photonics Micro-Transfer Printed Vertical MEMS Phase Shifter, Yang Liu¹, Yiming

Zuo¹, Emadreza Soltanian¹, Günther Roelkens¹; ¹*Photonics Research Group, Department of Information Technology (INTEC), Ghent Univ.–imec, Belgium.* We designed a micro-transfer-printed vertical MEMS phase shifter on silicon photonics. Electrostatic nanomembrane actuation gives Δn_{eff} up to 3.1×10^{-2} and

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$V_{\pi}L = 8.75 \times 10^{-3}$ Vcm, with < 0.05 dB insertion loss and near-zero static power.

JW5A.3 ·

A Hybrid Cesium Tin Iodide/Aluminum Antimonide Nanostructured SPR Biosensor for Ultra-Sensitive Detection of Carcinoembryonic Antigen, Shaik A. Mohiddeen¹, Xuecheng Liu², Yesudasu Vasimalla¹, Santosh Kumar¹; ¹Koneru Lakshmaiah Education Foundation, India; ²Key Laboratory of Specialty Fiber Optics and Optical Access Networks, Joint International Research Laboratory of Specialty Fiber Optics and Advanced Communication, Shanghai Inst. for Advanced Communication and Data Sci, Shanghai Univ., China. This work presents a hybrid cesium tin iodide/aluminum antimonide nanostructured SPR biosensor for ultrasensitive carcinoembryonic antigen detection. Improved sensitivity and accuracy achieved through design optimization highlight its suitability for early-stage cancer diagnostics and biomedical applications.

JW5A.4 ·

Topologically Protected Optical Quasiparticles for Efficient Second Harmonic Generation, Laxminarayan Laxminarayan¹, Praveen Kumar¹, Allam Srinivasa Rao², Andra Naresh K. Reddy², Soki Hirayama², Takashige Omatsu²; ¹Indian Inst. of Technology Bhilai, India; ²Chiba Univ., Japan. We herein demonstrate the high-quality second-harmonic generation of optical bimerons using dual Dual-BBO crystals with orthogonal optic axes, preserving polarization textures and skyrmion topology through nonlinear frequency conversion for advanced photonic imaging & communication.

JW5A.5 ·

Effect of Second-Harmonic Generation on Polarization Singular Beams, Rahul Joshi¹, Sunil Kumar¹, P. Senthilkumaran¹; ¹Indian Inst. of Technology Delhi, India. Second-harmonic generation of V-point polarization singular beams is experimentally demonstrated using a compact BIBO-based setup. A lateral shear interferometric technique is proposed for topological characterization, with applications in nonlinear imaging and structured-light photonics.

JW5A.6 ·

Novel Fiber-based Waveguide for Higher Order Radial Mode Suppression, Jin Wei^{1,2}, Justin Vella², Christopher Betters^{1,2}, Daniel S. Dahl², andrew ross-adams^{2,1}, Sergio Leon-Saval^{2,1}; ¹Sydney astrophotonic instrument Lab, Australia; ²School of Physics, Univ. of Sydney, Australia. We report the design and fabrication of two 6-core hybrid mode-selective photonic lanterns, designed to preferentially select the LP01 and LP02 modes, respectively. Off-axis digital holography characterisation confirmed low crosstalk with other supported modes.

JW5A.7 ·

Four-Wave Mixing in Dense Rubidium: Propagation and Suppression via Recursive Expansion, Gessiane C. da Silva¹, W.O. Albuquerque^{1,2}, L. F. Gonçalves¹, A. S. Alvarez¹, N. R. de Melo¹, J. Ferraz^{1,2}; ¹Física Aplicada, Universidade Federal Rural de Pernambuco, Brazil; ²Física, Instituto Quanta, Parque Tecnológico, Universidade Federal de Pernambuco, Brazil. Experimental and theoretical investigation of degenerate four-wave mixing in thermal rubidium vapor demonstrates signal suppression at high optical depths. A semiclassical model accurately reproduces the measurements, revealing the combined roles of absorption, propagation, and interference.

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JW5A.8 ·

Characterization of Interference Fringes Generated by Dual Pulse-Front-Tilted Femtosecond Beams in a Thin BBO Crystal, Shabnam Forutan¹, Adam Cummings², Richard Haglund², David Hilton¹; ¹*Baylor Univ., USA*; ²*Vanderbilt Univ., USA*. Two independently generated pulse-front-tilted femtosecond beams are over-lapped in a thin BBO crystal. Interference fringes recorded with CCD imaging are used to characterize spatial and temporal overlap, providing a diagnostic tool for alignment of ultrafast optical systems.

JW5A.9 ·

Pulsed Solutions to Coupled-Amplitude Equations in Optical Fibers, Keegan Finger¹, Andreas Becker¹; ¹*Univ. of Colorado Boulder, USA*. We present an extension of the coupled-amplitude equations used for nonlinear optical processes from plane-wave to pulsed solutions. This semi-empirical extension allows for the inclusion of delay and group velocity walk-off dynamics into analytic expressions.

JW5A.10 ·

Metasurface Based Spin-Decoupled Dammann Vortex Grating for Polarization Multiplexing, Swapnil Chitriv¹, Arpit Gupta¹, Kapil K. Gangwar¹, Gufran S. Khan¹, Paramasivam Senthilkumaran¹; ¹*Indian Inst. of Technology Delhi, India*. A spin-decoupled all-dielectric metasurface enabling independent Dammann vortex grating phase encoding for opposite circular polarizations is demonstrated. Propagation and geometric phases generate equal-intensity 2×2 vortex beam arrays with charges ± 1 and ± 2 under LCP/RCP illumination.

JW5A.11 ·

Robustness of Spiral V-point Lattices, Anuj Maurya¹, Rahul Joshi¹, Sushanta K. Pal², Paramasivam Senthilkumaran³; ¹*Department of Physics, Indian Inst. of Technology Delhi, India*; ²*Department of Physics, Centre for quantum science and technology, Siksha o anusandhan, India*; ³*Optic and Photonics Centre, Indian Inst. of Technology Delhi, India*. This study examines the robustness of periodic spiral V-point polarization singularity lattices under obstruction. Numerical results show disruption in polarization, amplitude, and phase after obstruction, followed by gradual self-healing during propagation, demonstrating the resilience of structured singular optical fields.

JW5A.12 ·

Channel-Spacing-Aware Apodization Selection for WDM FBG Sensing Arrays, Wardeh S. Al-Younis¹, Issam Trrad¹; ¹*Department of Communications and Computer Engineering, Jadara Univ., Jordan*. Inter channel isolation in WDM FBG sensing arrays depends strongly on channel spacing. At tight spacing (0.4~nm), Kaiser apodization leads with 58.4~dB isolation --- 20~dB above Gaussian --- while Blackman dominates at wider spacings, revealing spacing-aware design guidelines.

JW5A.13 ·

Reliable Quantification of Tripartite Entanglement with Certified Nonsignaling on NISQ Hardware, Harsh Mehta¹, Tomis Prajapati², V. Narayanan¹; ¹*Indian Inst. of Technology Jodhpur, India*; ²*Tata Inst. of Fundamental Research, India*. We quantify tripartite entanglement on IBM Quantum processors via the convex-roof three-tangle, validated against exact closed forms; certify nonsignaling correlations via prediction-based ratios; and show noise-induced decay is fundamental sudden death, not an artifact.

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JW5A.14 •

Time-Reversal Symmetry of Laser-Excited Gas-Phase Molecular Collision Processes, Denuwan K. Vithanage¹, Jimmy Clifford¹, Othmane El Houssi¹, Brian Stewart¹; ¹*Wesleyan Univ., USA*. Detailed balance provides an internal consistency test for level-resolved molecular collision rate constants. We systematically apply it to measured rate constants for laser-excited Li₂ ($v_i = 1$, $j_i = 0$) colliding with Li and Xe, finding generally good agreement.

JW5A.15 •

Security Against Trojan-Horse Attacks on a Self-Compensating All-Fiber Polarization Modulator, Alberto De Toni², Aynur Cemre Aka², Costantino Agnesi², Davide Giacomo Marangon², Giuseppe Vallone^{2,1}, Paolo Villorosi^{2,1}; ¹*Padua Quantum Technologies Research Center, Università degli Studi di Padova, Italy*; ²*Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Padova, Italy*. Investigation of the iPOGNAC polarization encoder demonstrates vulnerabilities to Trojan-horse attacks across strong and weak light regimes. Experimental evaluations inform proposed countermeasures to strengthen practical security for quantum key distribution systems.

JW5A.16 •

Direct Determination of the Translational Energy of CO₂ Molecular Beam Using Three-Photon Resonant Ionization and Ion Imaging Method, minali gorsi¹, Pranav Shirhatti¹; ¹*Tata Inst. of Fundamental Research, India*. We demonstrate direct measurement of translational energy of CO₂ molecular-beam generated by heated nozzle (from 1.5 to 3.5 eV) using (3+1) REMPI and delayed ion-imaging, eliminating indirect CO-proxy calibration used in previous dissociation studies.

JW5A.17 •

Laser Induced Persistent Holographic Gratings Formed in Praseodymium Doped Barium-Tellurite Glasses, Abdulatif Y. Hamad¹, Nathan Oliveira¹, Eric Voss¹; ¹*Southern Illinois Univ. Edwardsville, USA*. Strong persistent gratings were formed in praseodymium doped barium-tellurite glasses using the four-wave mixing technique. The gratings were written by an argon laser operating at 476.5 nm. The maximum change in the index of refraction was 0.00022.

JW5A.18 •

Atmospheric Modelling of Continuous Variable Quantum Key Distribution (CV-QKD) for Drone-Based Quantum Communication, Vedant A. Dhawale¹, V. Narayanan¹; ¹*Indian Inst. of Technology Jodhpur, India*. We investigate continuous-variable quantum key distribution over UAV-assisted free-space links using the atmospheric elliptical beam model. The probability distribution of transmittance (PDT), transmitted squeezing, and asymptotic secret key rates are evaluated for drone altitudes of 1, 2, and 5 km.

JW5A.19 •

Efficient Nonlinear Equalization with Distilled and Quantized Transformer Model, Naveenta Gautam¹, Prankush Agarwal², Stephen E. Ralph²; ¹*Electronics and Communications, Georgia Inst. of Technology, USA*; ²*Department of Electrical Engineering, Georgia Inst. of Technology, USA*. We demonstrate a knowledge distillation and quantization framework for Transformer nonlinear equalization in WDM systems, achieving 96.68% parameter reduction with 0.7dB gain, and threefold compression via INT8 quantization, enabling real-time deployment in coherent receivers

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JW5A.20 •

Intracavity Brillouin Auxiliary Pumping for Thermally Stable 2 μm Kerr Frequency Combs, Kanad Pathak¹, Ravi Pant¹; ¹*IISER Thiruvananthapuram, India*. We demonstrate thermally stable Brillouin-assisted Kerr frequency comb generation at 2 μm using intracavity auxiliary pumping. A Brillouin laser inside a 330- μm silica microsphere enables low-threshold, low-noise, wavelength- and dimension-tolerant comb generation without external auxiliary-laser stabilization intrinsically.

JW5A.21

Broadband Second-Harmonic Generation in Periodically Poled Lithium Niobate Waveguides, Zi Yin¹, Zhengdong Gao², Jeremy Staffa¹, Yueteng Zhang², Shixin Xue², Qili Hu¹, Qizhao Tong², Qiang Lin^{2,1}; ¹*Inst. of Optics, Univ. of Rochester, USA*; ²*Department of Electrical and Computer Engineering, Univ. of Rochester, USA*. We demonstrate broadband second-harmonic generation through quadratic nonlinearities in dispersion-engineered thin-film periodically poled lithium niobate waveguides, achieving 80 nm 7-dB bandwidth near 1550 nm and 4600 % $\text{W}^{-1} \text{cm}^{-2}$ normalized conversion efficiency.

JW5A.22

Diffraction Optics for the EarthCup L1 Sunshade Project, Grover A. Swartzlander^{1,2}, Ryan K. Williams², Bruce Campbell², Michael D. McDonald²; ¹*Rochester Inst. of Technology, USA*; ²*EarthCup L1 Project, USA*. The EarthCup L1 Project is a voluntary multi-decadal effort to develop the technology and workforce for future sunshades at the Earth-Sun L1 point. Wavelength-selective diffractive films are critical components.

JW5A.23

Transverse Optomechanical Interaction Mediated by Mechanically Induced Symmetry Breaking: Hamiltonian Dynamics, Lev Deych^{1,2}, Satyam Jha^{1,2}; ¹*Cuny Queens College, USA*; ²*Graduate Center of Cuny, USA*. We introduce a model of cavity optomechanics in which mechanical motion breaks cavity symmetry and dynamically couples otherwise independent optical modes. Even in the absence of external drive, the model exhibits rich Hamiltonian dynamics, such as Hopf bifurcations, broadband sideband generation, and Landau–Zener–type transitions.

JW5A.24

Optical Soliton Cooper Pairs in Mamyshev Oscillators, Tianhao Xian¹; ¹*East China Normal Univ., China*. Theoretical prediction and temporal observation reveal that two solitons can form high-stable long-range bound pair in the presence of intervening solitons, exhibiting similar characteristics to Cooper pair in superconductors.

JW5A.25

Advanced Plasmonic Nano tweezers for Single-Molecule Detection, Akila C¹; ¹*SRM Inst. of Science and Technology, India*. Advanced plasmonic nano tweezers utilize long range surface plasmon resonances to trap and detect individual molecules with exceptional sensitivity. This paper discusses their operating principles, recent technological advances, and applications in single-molecule detection for biological and nanophotonic research.

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JW5A.26

Rayleigh-Taylor and Parametric Instabilities in a Three-Component Bose-Einstein Condensate, Susovan Giri¹, Sonjoy Majumder¹; ¹*Indian Inst. of Technology Kharagpur, India*. We study Rayleigh-Taylor and parametric instabilities at two interfaces of a three-component BEC. We analyze and reveal how oscillating confinement induces nonlinear interface destabilization and pattern formation.

JW5A.27

Coincidence Time-Stamp-Learned Classification of OAM Quantum Correlations in SPDC Photon Pairs, Vijay Kumar¹, Purnesh Badavath¹, Jayanth Ramakrishnan², Shashi Prabhakar², R P Singh²; ¹*NIT Warangal, India*; ²*Physical Research Laboratory, India*. Random media maps spontaneous parametric down conversion (SPDC) idler-photon's Orbital Angular Momentum (OAM) spatial information onto temporal speckle signature, enabling neural networks to classify OAM quantum correlations directly from coincidence time-stamps of signal-idler photon pairs.

JW5A.28

Measuring Population-Dependent Energy Shifts of Rydberg Atoms in Hot Vapor, Tomasz Prokop^{2,1}, Bartosz Kasza^{1,2}, Michal Parniak^{1,2}, Wojciech Wasilewski^{1,2}; ¹*Faculty of Physics, Poland*; ²*Centre of New Technologies, Centre for Quantum Optical Technologies, Poland*. We demonstrate a method to measure Rydberg level energy shifts induced by Rydberg atom interactions in thermal vapors. We believe this approach could provide a valuable tool for accurately modeling optical bistability.

JW5A.29

Quantum Spectrometer for Space Applications and Beyond, J Ferrantini², J Crawford², S Kulkov³, J Jirsa³, A Mueninghoff⁴, L Lawrence², S Vintskevich⁵, T Milanese⁶, S Burri⁶, E Bernasconi⁶, C Bruschini⁶, M Marcisovsky³, P Svihra³, A Nomerotski³, P Stankus², E Charbon⁶, Raphael A. Abrahao^{1,2}; ¹*Rochester Inst. of Technology, USA*; ²*Brookhaven National Laboratory, USA*; ³*Czech Technical Univ., Czechia*; ⁴*Stony Brook Univ., USA*; ⁵*Technology Innovation Inst., United Arab Emirates*; ⁶*École Polytechnique Fédérale de Lausanne, Switzerland*. We report a state-of-the-art room-temperature data-driven single-photon-sensitive spectrometer based on a linear array of SPAD detectors. As a technological demonstration, we report observing the Hanbury Brown–Twiss effect with 5 frequencies simultaneously.

JW5A.30

Simulating Polarization Mode Dispersion Using Quantum Circuits, Bhavana Sharma¹, Utkarsh K. Singh²; ¹*Northcap Univ., India*; ²*Advanced Laser Laboratory, Department of Applied Physics,, Defence Inst. of Advanced Technology, India*. We present a quantum-circuit model for simulating polarization mode dispersion in optical fibers using single-qubit dynamics. Qiskit simulations demonstrate PMD-induced depolarization through reduced purity and fidelity, providing an intuitive quantum-information framework for polarization degradation analysis.

JW5A.31

In-Situ Calibration of Unitary Matrices Enabled by Minimum-Phase System Design in a PIC Platform, Emily A. Herbert¹, Hector Rubio Rivera¹, Venkatesh Deenadayalan¹, Stefan F. Preble¹; ¹*RIT Kate Gleason College of Engineering, USA*. We demonstrate direct calibration of complex-valued Mach–Zehnder interferometer meshes using a minimum-phase photonic framework. It reconstructs arbitrary unitaries without internal taps or infrared imaging, enabling real-time control and accelerating neuromorphic and

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quantum photonic computation.

JW5A.32

Examining the Robustness of Conventional and Unconventional Photon Blockade in Tavis-Cummings Models, Caden McCollum¹, Imran Mirza¹; ¹*Miami Univ. (Ohio), USA*. We study both conventional and unconventional photon blockades as methods for generating pure single photons using an externally driven Tavis-Cummings model with variable coupling regimes and two-photon dissipation.

JW5A.33

Influence of Particle Size Distribution and Wavelength-Dependent Refractive Index on Skin-Mimicking Scattering from Polystyrene Microspheres, Rana Dey¹, Robert H. Wilson¹; ¹*Univ. of Dayton, USA*. We modeled wavelength-dependent scattering from mono- and polydisperse polystyrene microspheres to investigate skin-mimicking optical behavior. Results show that 500 nm polydisperse microspheres reproduced skin-like scattering slopes, while refractive-index dispersion and particle-size heterogeneity significantly altered scattering.

JW5A.34

Variational Quantum Eigen Solvers with Classically Entangled Light, Son Nguyen¹, Matthew Daddino¹, Ching Man Wong¹, Xiao-Feng Qian¹; ¹*Stevens Inst. of Technology, USA*. We propose a classical-optical implementation of the Variational Quantum Eigen Solver using polarization and spatial-mode qubits. A UCCSD-inspired two-qubit H₂ ansatz is realized with standard optical components and characterized through Stokes-parameter tomography.

JW5A.35

RGB Schlieren Imaging of Ultrasound Wave Interference Using a Pulsed LED, Faith Poutoa¹, Matthew Anderson¹, Nick Crisafulli¹, Sydnie Duckworth¹; ¹*San Diego St Univ., USA*. We report on the development of an RGB Schlieren imaging technique for visualizing ultrasound field interference patterns in air and water. © 2026 The Author(s)

JW5A.36

Characterization of a Low-Cost LCD-Based Spatial Light Modulator Using Transport-of-Intensity Phase Reconstruction, Nyah Bentley¹; ¹*Middle Tennessee State Univ., USA*. A consumer LCD was modified as a low-cost spatial light modulator and characterized using TIE phase reconstruction. Structured illumination patterns increased reconstructed height variations, demonstrating the influence of intensity modulation and illumination uniformity on quantitative phase imaging accuracy.

JW5A.37

Design and Calibration of a Fourier Goniometric Flow Cytometer, Marren Williams¹, Vincent M. Rossi¹; ¹*Utah Valley Univ., USA*. A Fourier Goniometric Flow Cytometer maps scattered light to the Fourier domain via 0.55 NA objectives providing angular resolution over $\pm 33.4^\circ$ forward and $90^\circ \pm 33.4^\circ$ off-axis. Diffraction grating calibration validates this proof-of-principle system, demonstrating enhanced resolution for improved cell population differentiation.

JW5A.38 • 14:00

Flexible and Periodic SERS Substrate via Optical Disk Templating and Glancing Angle Deposition Technique for Protein Detection., Nidhi Mehta¹, Kanchan Saxena², Dalip Singh Mehta^{1,2}; ¹*Indian Inst. of*

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Technology Delhi, India; ²Opti-mode Diagnostics Pvt. Ltd., Research and Innovation Park, Foundation for Innovation and Technology Transfer (FITT), Indian Inst. of Technology Delhi, India. A flexible and periodic PDMS-based SERS substrate with a 270 nm pitch was fabricated using templating with a Blu-ray disc (BD) optical disk and glancing angle deposition techniques. The substrate exhibited excellent biosensing performance, enabling label-free detection of BSA at concentrations as low as 0.5 nM.

JW5A.39

Design and Analysis of a Tungsten-Based Metasurface Absorber with Near-Perfect Broadband Solar Absorption, Jyoti Bhardwaj¹, Yash Yadav¹, Yogita Kalra¹, Ravindra K. Sinha¹; ¹*Delhi Technological Univ., India.* Broadband and efficient tungsten based metasurface absorber for solar energy harvesting application is proposed. The designed absorber demonstrates near-unity absorption across the investigated range 200-3000 nm, with absorption above 94% in the spectral region.

JW5A.40

Unsupervised Discovery of Latent Electromagnetic Operating Phases in SU-8 Racetrack Resonators, Suman K. Pal¹, Arundhati Boruah¹, Syamsundar De¹, Shyamal K. Das Mandal¹, Pranabendu Ganguly¹; ¹*Indian Inst. of Technology Kharagpur, India.* Unsupervised analysis of electromagnetic fields from 2058 varFDTD-simulated SU-8 racetrack resonators reveals four latent electromagnetic operating phases with distinct confinement topologies and spectral-density regimes. The discovered phases are strongly geometry-dependent and predictably organized across the design space.

JW5A.41

Evaluation of SnS₂ and Ni-Doped WO₃ as Scattering Media in Dye-Based Random Lasers, Luiz F. Silva³, Vitor E. de Sá¹, Ian R. de Andrade³, Ana V. Carvalho², Guilhermina F. Teixeira², Hugo J. Mello³, Martin S. Barbosa², Leonardo de Boni¹, Leandro H. Cocca³; ¹*IFSC, USP, Brazil*; ²*Inst. of Chemistry, UFG, Brazil*; ³*Inst. of Physics, Federal Univ. of Goiás (UFG), Brazil.* The performance of SnS₂ and Ni-Doped WO₃ semiconductor scatterers in dye-based random lasers are investigated. Emission spectra obtained under pulsed optical excitation are analyzed to assess their capability to provide feedback for random lasing.

JW5A.42

Direct Baseband Data Recovery in Seamless Millimeterwave-Photonic Receivers, Niloy Ghosh^{1,2}, Sarang Pendharker³; ¹*Netherlands Inst. for Radio Astronomy (ASTRON), Netherlands*; ²*Eindhoven Univ. of Technology, Netherlands*; ³*Indian Inst. of Technology Kharagpur, India.* Direct data extraction in seamless mmWave-photonic receivers is demonstrated through baseband digital signal processing. This eliminates the need for conventional RF-downconversion chains, thereby enabling simpler and low-latency all-photonic receivers for emerging mmWave and sub-THz applications.

JW5A.43

Anderson Jumps in non-Hermitian Lattices with Coupling Disorder, Emmanouil Theodoros Kokkinakis¹, Ioannis Komis¹, Konstantinos Makris¹, Eleftherios N. Economou¹; ¹*Univ. of Crete, Greece.* Within non-Hermitian photonics, we show that real nonreciprocal random couplings produce jump-like wave transport. In one dimension, jumps can occur despite a purely real spectrum; in two dimensions, complex spectra generate Anderson jumps.

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JW5A.44

Transport Control by Evolving Disorder, Emmanouil Theodoros Kokkinakis¹, Ioannis Komis¹, Konstantinos Makris¹, Eleftherios N. Economou¹; ¹*Univ. of Crete, Greece*. We investigate evolving complex disorders in non-Hermitian photonic lattices. Rapid updates suppress localization and produce diffusion like spreading, whereas longer periods restore localized dynamics and Anderson jumps. Our systematic study reveals how period length controls transport.

JW5A.45

Optical Tautochrone in Nonuniform Lattices, Ioannis Kiorpelidis^{2,1}, Matthias Heinrich³, Alexander Szameit³, Georgios A. Siviloglou^{2,1}, Konstantinos Makris^{2,1}; ¹*Forth-lesl, Greece*; ²*Physics, Univ. of Crete, Greece*; ³*Physics, Univ. of Rostock, Germany*. We introduce a novel class of photonic lattices with nonuniform couplings related to two distinct phenomena. The tautochrone effect of classical mechanics and the squeezed states of quantum optics. The effect of nonlinearity is examined.

JW5A.46

Thin-film Quartz Piezo-Optomechanical Crystals, Cassady Mullaney¹, Milan Gemaljevic¹, Gaurav Nirala¹, Konrad Lehnert¹; ¹*Yale Univ., USA*. We report the design, fabrication, and optical characterization of thin-film quartz optomechanical crystal cavities. Optical resonances are observed in fabricated devices, and fabrication-induced loss mechanisms are identified, establishing a pathway toward high-Q quartz optomechanical systems.

JW5A.47

Phase Response of Ring Resonators Measured Using Engineered Scattering Elements, Nathan P. Killough¹, Tyler V. Howard², Jayvyn Dennis¹, Thomas G. Brown¹; ¹*The Inst. of Optics, Univ. of Rochester, USA*; ²*Lawrence Livermore National Laboratory, USA*. The phase excursion of a ring resonator is fundamental to device performance. This work utilizes the combination of engineered scatterers with a weak reflector to provide a camera-based measurement of the phase response through resonance.

JW5A.48

Masked GaN Photodiode Measurements and Dual-Diffuser Coupling Design for Omega Pulse-Shape Diagnostics, Yihan Liu^{1,2}, William Donaldson^{1,2}, Matthew Heimbuegger^{1,2}, Brian Kruschwitz^{1,2}; ¹*Univ. of Rochester, USA*; ²*Laboratory for Laser Energetics, USA*. A masked GaN UV photodiode and multi-wavelength electro-optic replication system are evaluated for single-shot 351-nm OMEGA pulse-shape diagnostics, with a dual-diffuser coupling system that supports future full-SSD operation according to speckle simulations.

JW5A.49

Role of Optical Blur in Myopia Control Lenses, Hannah P. Gonzales¹, Brian Vohnsen¹; ¹*Univ. College Dublin, Ireland*. Myopia control lenses introduce structured blur while maintaining central correction. Eye-model simulations and Hartmann–Shack wavefront measurements of a DIMS lens sample demonstrate treatment-zone phase changes, informing future comparison of spectacle-lens designs.

JW5A.50

Discrete Orthogonal Fourier-Mellin Moments for Image Description, Kejia Wang¹, Ziliang Ping², Yunlong Sheng³; ¹*Inner Mongolia Electronic Information Vocational Technical College, China*; ²*Inner Mongolia Normal Univ., China*; ³*Laval Univ., Canada*. Discrete orthogonal Fourier–Mellin moments are proposed,

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inheriting the favorable performance of OFMMs while being more suitable for discrete implementation. Image reconstruction experiments demonstrate their excellent image description capability.

JW5A.51

Analyzing Tissue Samples Stored in BxBoard® Using a Multi-Fiber Array and Spectroscopy, Marissa J. Jolley¹, Vincent M. Rossi¹; ¹*Utah Valley Univ., USA*. Tissues can be analyzed using multi-fiber arrays and diffuse reflectance spectroscopy. This technique was used to observe scattering coefficients of tissues stored in Lumea's BxBoard® as a measure of protein crosslinking with respect to time.

JW5A.52

Characterization of Low-Temperature Plasma-Induced Defects in Monolayer WS₂, Connor J. Reilly¹, Stanislav Musikhin², Satya P. Butler¹, Nathan Guisinger³, Saien Xie¹, Yevgeny Raites², Alice Kunin¹; ¹*Princeton Univ., USA*; ²*Princeton Plasma Physics Laboratory, USA*; ³*Argonne National Laboratory, USA*. Utilizing a combination of photoluminescence, time- and angle-resolved photo emission spectroscopy, and scanning tunneling microscopy, we seek to characterize the optoelectronic effects of defects induced by plasma processing in monolayer WS₂.

JW5A.53

Non-MZI-Configured Ring-Modulator-Based Photonic Dot-Product Engine, Ananda Hruday Cherukumilli¹, Hari Prakash Pinninty¹, Aneesh Sobhanan¹; ¹*Indian Inst. of Technology Hyderabad, India*. We demonstrate a non-MZI-configured lithium-niobate ring-modulator processor for dual-wavelength photonic vector-vector multiplication. Cascaded rings encode inputs and weights at 1550/1552 nm, and photodetection accumulates outputs closely matching expected dot products.

JW5A.54

Long Tapered Multimode Fibers Fabricated by Chemical Etching and Laser Fire Polishing for Efficient Free-Space Coupling to Multicore Fibers, Samuel J. Kassey^{1,2}; ¹*LaseOptics Corp., USA*; ²*Jacob School of Medicine & Biomedical, Univ. at Buffalo, USA*. A hybrid chemical etching and laser fire-polishing technique was developed for tapered multimode fibers. Large-core fibers (600 μm and 1000 μm) were reduced in diameter, producing smoother surfaces, lower scattering losses, and improved free-space coupling efficiency into multicore fibers.

JW5A.55

Satellite-Calibrated Chlorophyll-Based Performance Evaluation of UWOC Architectures with Hybrid Reed–Solomon and HARQ Coding, Seydouna H. Amar¹, Mangone Fall¹, Ahmed Dougoy Kora², Ibra Dioum¹; ¹*dakar, Ecole supérieure Polytechnique/UCAD, Senegal*; ²*Dakar, Ecole Supérieure Multinationale des Telecommunications (ESMT), Senegal*. Four UWOC architectures benchmarked against a ten-year MODIS/Aqua chlorophyll distribution reveal that a 56 dB hardware link-budget gap reduces annual outage from above 99% to 38 %, far outweighing any Reed–Solomon or HARQ coding gain.

JW5A.56

Low-Complexity Photonic Random Matrix Generator, Kevin Zelaya¹, Mohammad-Ali Miri¹; ¹*Rochester Inst. of Technology, USA*. This letter presents a unitary, low-depth, and programmable photonic circuit capable of generating matrices with random features induced by phase modulation. Two layers of phases suffice to produce optical signals with arbitrary profiles.

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JW5A.57

Power-Only Refractive-Index Readout Using a SiN Microring Cascade for Water Monitoring, Juan E. Rodriguez Ochoa¹, Rodrigo Acuna Herrera¹, Samuel Serna¹, Camilo Hurtado Ballesteros¹; ¹*Universidad Nacional de Colombia, Colombia*. We designed a fourteen-MRR cascaded SiN photonic chip for aqueous refractometry. A water-clad sensing ring drives thirteen Si-coated spectrometer channels, enabling power-only cladding-index readout without wavelength sweeps, achieving validated power sensitivities up to +1464 dB/RIU.

JW5A.58

Temporal Contrast Metrology of Single Shot Laser Pulses Using Self-Referenced Spectral Interferometry, Oleg Chekhlov¹, Nicolas Bourgeois¹, Steve Hawkes¹, Yunxin Tang¹, Eleanor Asquith¹, Rajeev Pattathil¹, Cristina Hernandez-Gomez¹; ¹*STFC Rutherford Appleton Laboratory, UK*. Temporal contrast measurements of a laser pulse after plasma mirrors enhancement were performed using a device based on 2D self-referenced spectral interferometry (SRSI) and compared with measurement obtained using a scanning cross-correlator. Experimental results of the measurements and features of SRSI application are discussed.

JW5A.59

Enhanced Trion Light Emission via Bound State in the Continuum Photonic Resonance, Trevor G. Ollis¹, Quang Nguyen¹, Mitesh Amin², Sreeparna Banerjee³, Pengfei Huo², Todd D. Krauss^{2,3}, Nickolas Vamivakas^{2,1}; ¹*Physics, Univ. of Rochester, USA*; ²*Optics, Univ. of Rochester, USA*; ³*Univ. of Rochester, Chemistry, USA*. In this work, we use a Bound State in the Continuum to access the weaker trion signal of CdSe nanoplatelets at room temperatures, indicating a platform for isolating and studying weaker emitters in materials.

JW5A.60

Machine Learning Assisted Recognition of Space-Time Wave Packets Carrying Orbital Angular Momentum in Dynamic Scattering Media, Sarmad Maqsood¹, Duvarakanath SenthilKumar¹, Mbaye Diouf¹; ¹*Rochester Inst. of Technology, USA*. We experimentally generate and classify space-time wave packets orbital angular momentum (ST-OAM) in dynamic scattering media using VortexNet, a deep-learning framework that leverages angular-domain feature extraction for OAM state classification.

JW5A.61

Sensitivity Optimization of SMS Fiber Sensors Through Controlled Chemical Etching, Natalia C. Lara Davila¹, Jeison R. Lara-Davila², Jorge A. Montoya-Cardona¹, Esteban Gonzalez-Valencia¹; ¹*Electronics and Telecommunications, Institución Universitaria ITM, Colombia*; ²*Independent professional, Colombia*. Etched singlemode-multimode-singlemode fiber sensors are experimentally characterized by correlating hydrofluoric acid etching time, multimode fiber diameter, and refractive index sensitivity. Diameter reduction to ~30µm yields a 4.65-fold sensitivity enhancement (786.67 nm/RIU) for reliable biosensing applications.

JW5A.62

End-To-End Performance Analysis of a Subcarrier Multiplexed If-Over Fibre System For 5g Fronthaul, Lilian M. Mutia¹, David Waswa¹, James Jena¹; ¹*Nelson Mandela Univ., South Africa*. This paper analyses an SCM-IFoF system for 5G fronthaul over a 10km fibre and 30m wireless link. Realistic simulations demonstrate BERs below 10⁻⁶, with the highest frequency channel experiencing the highest dispersion

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degradation.

JW5A.63

Dataset-Free Microscopy Deconvolution via Positional-Encoded Implicit Neural Networks, Sahil Sharma¹, Joby Joseph¹; ¹*Indian Inst. of Technology Delhi, India*. We present an unsupervised deconvolution framework using a position-encoded MLP to represent high-resolution fluorescence images. By optimizing through a simulated optical model, the method recovers finer details and reduces artifacts compared with Richardson–Lucy deconvolution, without requiring training data.

JW5A.64

Low-Cost Balanced Photodetector for Electro-Optic Terahertz Time-Domain Spectroscopy, Anvi Anand¹, Avelyn Xiang¹; ¹*Department of Physics, New York Univ., USA*. This research demonstrates a low-cost balanced photodetector for electro-optic terahertz time-domain spectroscopy. The custom photodetector recovered a terahertz waveform and produced a higher calculated signal-to-noise ratio than a commercial photodetector in one preliminary comparison.

JW5A.65

Effects of Roughness on Thin-Film Lithium Niobate-Based 1×2 MMI Splitter, Mijanur Rahaman¹, Pranabendu Ganguly¹, Syamsundar De¹; ¹*Indian Inst. of Technology Kharagpur, India*. We design a 3 dB 1×2 MMI splitter, including fabrication tolerances, and numerically study the effects of roughness (RMS roughness 0.1–40 nm) on the insertion loss, power imbalance, return loss, and polarisation.

JW5A.66

Atmospheric Turbulence-Aware Optimization of Generalized Kennedy Receivers for Coherent State BPSK Quantum Communication, Md Ashraf Hossain Iftly¹, Rahul Bhadani¹; ¹*Univ. of Alabama in Huntsville, USA*. We investigate generalized Kennedy receivers for quantum coherent state BPSK scheme over turbulent free-space optical channels. An ergodic mutual-information framework is developed to jointly optimize the receiver displacement and input prior probabilities under Gamma-Gamma fading.

JW5A.67

Miniaturized Fiber-Optic Endoscopes Using Metasurface Optics: A Simulation-Driven Design Approach, Charles J. Taylor¹, Majid Ebnali Heidari¹; ¹*SimuTech Group, USA*. We propose a simulation-driven dual-aperture metalens endoscope that encodes depth through left-right centroid disparity while preserving miniature diameter. Zemax and Lumerical workflows link target phase, meta-atom design, and predicted neurosurgical depth resolution below 10 micrometers.

JW5A.68

Comparative Analysis of Natural and Metamaterial Anti-Reflection Coatings at 10 GHz, Rajab Y. Atai¹, Salaheddeen Bugoffa², Nagi A. Buaossa³, Abdulmajid Mrebit¹, Esmail Abuhdima⁴, Ajani Davis¹, Elmoatazbellah Ben Omar⁵; ¹*Engineering and Computer Science, Benedict College, USA*; ²*Engineering Technology Department, Norfolk State Univ., USA*; ³*Engineering & Industrial Professions, Univ. of North Alabama, USA*; ⁴*Electroinc Engineering Technology, East Coast Polytechnic Inst. Univ., USA*; ⁵*Electrical Engineering, Wright State Univ., USA*. This paper presents a comparative study of natural-material and metamaterial anti-reflection coatings at 10 GHz. Analytical calculations and COMSOL Multiphysics simulations show that metamaterial coatings achieve reflectance below 1%, outperforming conventional natural-material designs.

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JW5A.69 •

Higher-Order Mode Confinement in Large Liquid-Core Bragg Fibers, Ajay Kumar¹; ¹*Indian Inst. of Technology Delhi, India*. This study examines the confinement loss of higher-order LP modes in liquid-filled large hollow-core Bragg fibers, while also providing a detailed sensitivity analysis of the refractive index of these modes.

JW5A.70

Data-Efficient Single-Image Rotational Speed Estimation, Zhilin Zhang¹, Yiwen Zhang², Jiaonan Zhang¹, Zhongqi Pan³, Yang Yue¹; ¹*Xi'an Jiaotong Univ., China*; ²*CCDC Drilling & Production Technology Research Inst., China*; ³*Univ. of Louisiana at Lafayette, USA*. A data-efficient framework for single-image instantaneous rotational speed estimation under scarce labelled target data is presented, reducing MAE and MAPE by factors of 2.39 and 1.94, respectively, through low-cost imaging and physics-guided priors.

JW5A.71

Single-Longitudinal-Mode Selection in Commercial Nd:YVO₄/KTP Microchip Lasers, Ahmed M. Saudi¹; ¹*National Inst. of Standards, Egypt*. Single-longitudinal-mode DPSS lasers are crucial for precision interferometry and length metrology. Stable 532 nm SLM emission with 7.01 mW output power is achieved by controlling pump current, temperature, and polarization over operating ranges of 300–388 mA and 18.5–30 °C.

JW5A.72

Dynamics of Colliding Moving Bragg Grating Solitons in a Semilinear Coupler with Cubic-Quintic Nonlinearity and Phase Mismatch, Etu Podder¹, Javid Atai¹; ¹*School of Electrical and Computer Engineering, The Univ. of Sydney, Australia*. We analyze the collision dynamics of moving Bragg solitons in a grating-assisted semilinear coupler with cubic-quintic nonlinearity and phase mismatch. The effect of the phase mismatch in shaping collision outcomes is also investigated.

JW5A.73

Precise Control of FSR and Wavelength Spacing in Arm-Length Difference Tunable Mach-Zehnder Interferometer Filters, Junchi Jiang¹, Yixin Zhu¹, Xinxin Jin², qian zhang¹; ¹*Suzhou City Univ., China*; ²*Beihang Univ., China*. This paper develops a theoretically validated simulation model for Mach-Zehnder Interferometer (MZI) filters. By tuning the arm-length difference ΔL , precise control of the free spectral range (FSR) and adjacent transmission-peak spacing is achieved, demonstrating the tunability and accuracy of the filter.

JW5A.74

Design, Development, and Performance Simulation of an LED-Based Photodynamic Therapy Device for Skin Cancer Treatment, Ashok Ashok¹, Deepak Panwar¹, Anuj S. Saxena¹, Dalip Singh Mehta¹; ¹*Indian Inst. of Technology Delhi, India*. A portable LED-based photodynamic therapy device for skin cancer treatment was designed and simulated using 632 nm and 405 nm LEDs with 5-ALA/PpIX. Simulation demonstrated effective light penetration, ROS generation, low thermal effects, and promising therapeutic potential.

JW5A.75

Fourth-Order Diffraction as a Stabilizing Mechanism in Nonlocal Nonlinear Solitons, Rashmi R. Desai², Mohit Sharma¹, Manoj Mishra², S Shwetanshumala⁴, Soumendu Jana³; ¹*Must, India*; ²*SciSER, Somaiya*

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Vidyavihar Univ., India; ³Thapar Inst. of Engg. and Tech., India; ⁴Patliputra Univ., India. The article examines the impact of fourth-order diffraction (FOD) on modulation instability (MI) in nonlocal nonlinear optical media, focusing on variations in the gain spectrum and gain-curve area with nonlocality.

JW5A.76

Machine Learning Optimized Multilayer SPR Biosensor for Dopamine Biomarker Detection, Md Al Amin I. Utshob¹, Maymona B. Juwel¹, Khandakar M. Ishtiak¹, Quazi D. M. Khosru²; ¹*Ahsanullah Univ. of Science & Tech, Bangladesh;* ²*Department of Electrical and Electronic Engineering, Bangladesh Univ. of Engineering and Technology, Bangladesh.* We propose a plasmonic SPR biosensor based on MgF₂ prism/Si/Ag/SnS₂/BP for highly sensitive, label-free detection of dopamine biomarkers by utilizing the principles of machine learning with optimal sensor performance for early medical diagnostics.

JW5A.77

Overlap-Controlled Boundary-Localized SHG in Centrosymmetric Thin Films for High-Contrast Optical Metrology, Ardra Muriyankandathil¹, Nitish K. Gupta¹; ¹*Birla Inst. of Technology & Science, India.* We present a thin-film metrology framework where bulk-forbidden second-harmonic generation in centrosymmetric media is recovered through phase-coherent interface-driven sources. Overlap analysis shows thickness and superstrate perturbations modulate nonlinear source interference, enabling ratio-based optical sensing.

JW5A.78

HoloBiFormer: Multi-Scale Transformer Learning for Raw Hologram Detection, Ayush Ranjan³, Ana Doblas¹, Earu Banoth³, Carlos Trujillo²; ¹*Department of Electrical & Computer Engineering, Univ. of Massachusetts Dartmouth, USA;* ²*School of Applied Sciences and Engineering, EAFIT Univ., Colombia;* ³*Department of Biotechnology & Medical Engineering, National Inst. of Technology Rourkela, India.* We propose HoloBiFormer, a platform integrating Swin Transformer features, multi-scale context aggregation, and bidirectional feature fusion to classify healthy/sickle cells in hypoxic and normoxic conditions. The platform achieves a 96% average classification accuracy.

JW5A.79

Reconfigurable Photonic MVM Processor, Prasanth Reddy Challa¹, Aneesh Sobhanan¹; ¹*Indian Inst. of Technology Hyderabad, India.* A scalable single-wavelength photonic matrix–vector multiplication architecture is demonstrated for 4×4 and 16×16 systems, enabling accurate, reconfigurable optical computation with 13.8 pJ/MAC efficiency, reduced hardware complexity, and scalable high-speed photonic accelerators for future computing platforms.

JW5A.80

Bulk Optical Loss Mechanisms and Dynamic Signal Distortion in Polymer and Glass Photonic Crystal Waveguides for Co-Packaged Optics, Krishna Sujith¹, Karthikeya Machiraju¹, Kaustav Bhowmick¹; ¹*PES Univ., India.* A five-channel loss taxonomy and closed-form dynamic loss function couple Beer–Lambert attenuation with thermo-optic detuning. 50 Gb/s simulations at +20 dBm confirm polymer photonic crystal link failure across practical group indices, versus error-free glass operation.

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JW5A.81

Thickness and Refractive Index Fitting of Subwavelength Thin Ge Film with Angle-Dependent Reflectance: A Simulation Approach, Hosna Sultana¹; ¹*Univ. of Oklahoma, USA*. Knowing the exact refractive index and thickness of subwavelength films is crucial for the optics and semiconductor industry. Here, the numerical simulations model the thickness-dependent optical index of Germanium thin films at 4 μm wavelength

JW5A.82

Novel Characterization Spatial Light Modulator Using Transport-of-Intensity, Hongbo Zhang¹, Nyah Bentley¹; ¹*Middle Tennessee State Univ., USA*. This study used a low-cost consumer liquid crystal display (LCD) as a transmissive spatial light modulator (SLM) and analyzed its optical performance using Transport-of-Intensity Equation, which for the first time was able to reconstruct the quantitative phase patterns of the device.

JW5A.83

Ergodic Behavior in Orbital Angular Momentum Spatio-Temporal Speckle Fields, Purnesh Badavath¹, Vijay Kumar¹; ¹*NIT Warangal, India*. We investigate the ergodic behavior of Laguerre-Gaussian spatio-temporal speckle fields by comparing spatial and temporal statistical averages. The agreement between these averages confirms that OAM speckle fields exhibit ergodic behavior.

JW5A.84

Optimized Multilayer SPR Structure for High-Resolution Detection of Kerosene Adulteration in Diesel, Sharar Ahmed¹, Mohammad Mahee I. Nur¹, Shadman I. Zaman¹, Md Al Amin I. Utshob¹, Maymona B. Juwel¹, Khandakar M. Ishtiaq¹; ¹*Ahsanullah Univ. of Science & Tech, Bangladesh*. We present an SPR biosensor using a multilayer structure for rapid detection of kerosene contamination in diesel through label-free sensing, demonstrating enhanced sensitivity and resolution than conventional techniques.

JW5A.85

A Fiber Sensor for Oral Temperature Monitoring Based on Er³⁺/Yb³⁺ Co-Doped Tellurite Glass Powder, Tonglei Cheng¹; ¹*Univ. of Southampton, Optoelectronics Research Centre, UK*. A compact probe based on fluorescence intensity ratio (FIR) using Er³⁺/Yb³⁺ co-doped tellurite glass powder was developed for oral temperature monitoring, achieving a response time of 14.5 s, which was suitable for clinical application.

JW5A.86

Comparative FTIR and XRD Analysis of Little Millet and Brown Top Millet: Insights into Starch Molecular Order and Crystallinity, Nandana B¹, Nirmal Mazumder¹, Bhoomika R. Hande¹; ¹*Department of Biophysics, Manipal Academy of Higher Education, India*. This study examines the molecular and crystalline structure of starch from little millet and browntop millet through FTIR and XRD analyses. The findings highlight variations in short-range molecular order and crystallinity, offering valuable information on the physicochemical properties of these millet starches.

JW5A.87

A Highly Sensitive Prism Based SPR Biosensor for Detecting Different concentration of Salinity in Water, Mohammed A. Alavee¹, Kazi Tanzid¹, Adnan S. Rafi¹, Khandakar M. Ishtiaq¹; ¹*Ahsanullah Univ. of Science & Tech, Bangladesh*. The proposed surface plasmon resonance biosensor exhibits high sensitivity and enhanced Quality Factor (QF), Figure of Merit (FOM) in terms of detecting different concentration of

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salinity level in water.

JW5A.88

Tunable Spectral Filtering in Hollow-Core Fibers, Muhammad Zain Siddiqui², Ahmet E. Akosman¹, Mustafa Ordu²; ¹Roger Williams Univ., USA; ²Unam, Bilkent Univ., Turkey. Spectral filtering in negative-curvature hollow-core fibers (NCFs) remains underexplored. Here, polarization-resolved selective transmission is demonstrated in NCFs for discrete frequencies. A transmission band centered at $1.500\ \mu\text{m}$ is tuned to $1.550\ \mu\text{m}$ via anisotropy engineering.

Highland Room DG

15:30 -- 17:00

FW6E • Structured Light

Presider: Eileen Otte; Univ. of Rochester, USA

FW6E.1 • 15:30 (Invited)

The Bitter Lesson, Refracted, Logan Wright¹; ¹Yale Univ., USA. I will, balancing skepticism with imagination, examine how lessons and tools from the last decade of artificial intelligence research may impact photonics. Integrated photonic systems, nonlinear optics, and light-matter interactions will be considered examples.

FW6E.2 • 16:00

Measurement of the Degree of Unpolarization to Discriminate Vectorial Structured Light Fields, Haozhe Guo¹, Valeria C. Viteri-Pflucker^{1,2}, Autumn Landwehr³, Xiaoran Yue¹, Mathew F. McClure¹, Sethuraj K. R.^{1,2}, Nickolas Vamivakas^{1,2}; ¹The Inst. of Optics, Univ. of Rochester, USA; ²Center for Coherence and Quantum Optics, Univ. of Rochester, USA; ³Department of Physics and Astrophysics, Univ. of North Dakota, USA. We present a beam agnostic method to discriminate paraxial unpolarized vectorial structured light fields from Stokes polarimetric data. We utilize Fibonacci lattice sampling on the Poincaré sphere in approximating the probability of polarization states.

FW6E.3 • 16:15

Multimode Radiation Pressure Actuation of a Mechanical Oscillator Using a Spatial Mode Sorter, Morgan E. Choi¹, Diego Torres¹, Dalziel J. Wilson¹; ¹Univ. of Arizona, USA. We demonstrate radiation pressure actuation of a membrane using dynamically structured light from a spatial mode sorter. Mapping the response visualizes intermodal coupling between Hermite-Gaussian modes and opens a new window into imaging-based optomechanics.

FW6E.5 • 16:45

Dihedral framework for generating kaleidoscopic beams, Abel Arizpe-Kisfalusi¹, Benjamin Perez-Garcia¹, Alfonso I. Jaimes-Nájera¹; ¹Tecnologico de Monterrey, Mexico. The dihedral group of rotations and reflections is used to map a diverse range of structured light into kaleidoscopic beam families exhibiting prescribed propagation dynamics and symmetries, rigorously analyzed through both theory and experiment.

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Grand Lilac Ballroom North

15:30 -- 17:00

FW6A • Quantum Theme: Quantum Networking

Presider: Nickolas Vamivakas; Univ. of Rochester, USA

FW6A.1 • 15:30 (Invited)

Title to be Announced, Saikat Guha¹; ¹*Univ. of Maryland at College Park, USA*. Abstract not available

FW6A.2 • 16:00 (Invited)

Title to be announced, Ben Dixon¹; ¹*MIT Lincoln Laboratory, USA*. Abstract not available

FW6A.3 • 16:30 (Invited)

From Deployment to Quantum Advantage, Noel G. Goddard¹, Mehdi Namazi¹; ¹*Qunnect Inc., USA*.

Quantum networks are being deployed globally at an accelerated pace. I will go over the recent projects we have done globally. These deployments paved the way towards application-focused entanglement networks.

Highland Room BJ

15:30 -- 17:00

FW6C • Quantum Networks

Presider: Sergei Slussarenko; Griffith Univ., Australia

FW6C.1 • 15:30 (Invited)

Integrated Photonics for Quantum Networking, Stefanie Barz¹, Shiang-Yu Huang¹; ¹*Universität Stuttgart, Germany*. Integrated photonics provides a route towards quantum networking. Topology optimization offers a systematic approach to designing components and circuits that improve performance, reduce footprint and losses, and support manufacturable photonic architectures.

FW6C.2 • 16:00

Massively Parallel Integrated Photonic Quantum Communication Network at the Hundred-User Scale, Hanyu Wang¹, Yun Zheng¹, Xinyu Jia¹, Jiahui Huang², Huihong Yuan³, Lin Chang², Jianwei Wang¹; ¹*State Key Laboratory for Mesoscopic Physics, School of Physics, Peking Univ., China*; ²*State Key Laboratory of Advanced Optical Communication Systems and Networks, School of Electronics, Peking Univ., China*; ³*Beijing Academy of Quantum Information Science, China*. A twin-field quantum key distribution network architecture with hundred-user capacity and communication distance up to several hundreds of kilometers could be supported by integrated photonics platform, showing the capability for building large-scale quantum communication networks.

FW6C.4 • 16:30 (Invited)

On Chip Weak Value Amplification, Jaime Cardenas¹; ¹*Univ. of Rochester, USA*. Weak value amplification is a quantum technique that can amplify the signal produced by an optical interferometer without increasing its noise. We will review weak value amplification and show how it is ideally suited for implementation on a photonic chip. We will show recent advances and how they can enhance the performance of interferometric sensors.

Frontiers in Optics + Laser Science Session Guide

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Highland Room CH

15:30 -- 17:00

FW6D • Optical Acquisition and Processing I

Presider: Jakob Dremel; Technische Universität Dresden, Germany

FW6D.1 • 15:30 (Invited)

Exploring Fundamental Limits in Biomedicine with Multiphoton Photothermal Microscopy, Nathaniel Hai¹; ¹*Boston Univ., USA*. Multiphoton photothermal microscopy leverages nonradiative absorption to probe endogenous biomolecules with high sensitivity and specificity. This talk presents its theoretical foundations and biomedical applications in label-free metabolic imaging and background-suppressed deep-tissue microscopy.

FW6D.2 • 16:00 (Invited)

Computational Passive Imaging via Incoherent Digital Holography with Diffractive and Meta Optics, Teruyoshi Nobukawa¹; ¹*Japan Broadcasting Corporation, Japan*. We have demonstrated single-shot phase-shifting incoherent digital holography under sunlight using liquid crystal devices. To further enhance spatial resolution, we develop diffractive and meta optics, enabling single-shot phase-shifting geometries with high spatial resolution.

FW6D.3 • 16:30 (Invited)

Microrobotic Guide Stars for Adaptive Optical Theranostics, Nektarios Koukourakis¹, John Boehm¹, David Castellanos², Mariana Medina-Sanchez^{2,3}, Juergen W. Czarske¹; ¹*Technische Universität Dresden, Germany*; ²*CIC Nanogune, Spain*; ³*B CUBE, TU Dresden, Germany*. Adaptive optics in scattering media requires guide stars that are both dynamic and controllable. Microrobots offer a new route to remotely addressable optical guide stars, creating opportunities for adaptive light delivery, localized sensing, and theranostic functionality.

Grand Lilac Ballroom South

15:30 -- 17:00

FW6F • Optical Design, Metrology and Quantum Technology

Presider: Leili Shiramin; InterUniv. Microelectronics Center, Belgium

FW6F.1 • 15:30 (Invited)

Optical Clock Networking Techniques for Quantum Networking Infrastructure, Tara M. Fortier¹, Nicholas Nardelli¹, Michael Grayson¹, Daniel Sorensen^{2,1}, Michael Mazurek^{2,1}, Krister Shalm¹, Dileep Reddy^{2,1}, Martin Stevens¹; ¹*National Inst of Standards & Technology, Canada*; ²*Univ. of Colorado at Boulder, USA*. This talk will discuss how optical frequency combs, precision timing, and phase-stabilized fiber links can provide the synchronization and infrastructure needed to scale quantum networks beyond laboratory demonstrations.

FW6F.2 • 16:00

Homodyne Measurement of Heralded Fock States Up to Five Photons, Takefumi Nomura¹, Hiromu Yoshimura¹, Zayneb El Omari El Alaoui², Sachiko Takasu³, Daiji Fukuda^{3,4}, Michael Stefszky^{5,6}, Christine

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Silberhorn^{5,6}, Mamoru Endo^{1,7}, Akira Furusawa^{1,7}; ¹*The Univ. of Tokyo, Japan*; ²*Ecole Polytechnique, Institut Polytechnique de Paris, Palaiseau, France, France*; ³*National Inst. of Advanced Industrial Science and Technology, Japan*; ⁴*AIST-UTokyo Advanced Operando-Measurement Technology Open Innovation Lab, Japan*; ⁵*Integrated Quantum Optics, Paderborn Univ., Germany*; ⁶*Inst. for Photonic Quantum Systems, Paderborn Univ., Germany*; ⁷*Center for Quantum Computing, RIKEN, Japan*. To overcome the non-Gaussian state bottleneck in optical quantum computing, we demonstrate the generation of heralded Fock states up to five photons. Homodyne tomography reveals the Wigner function negativity without loss correction.

FW6F.3 • 16:15

Increasing the Number of Spatially Isolated Single Quantum Dots by Focused-Ion-Beam Micropillar Fabrication, Lukas M. Weituschat¹, Trevor G. Ollis¹, Ainhua Gil Uriarte¹, Nickolas Vamivakas¹, Pablo Postigo¹; ¹*Inst. of Optics, Univ. of Rochester, USA*. Self-assembled InAs quantum dots were spatially isolated by milling micropillars with a Ga-focused ion beam (FIB). Low-temperature micro-photoluminescence reveals fewer discrete resonances than the unprocessed substrate, enabling individually addressable emitters for single-photon sources.

FW6F.4 • 16:30

Up Conversion Dual-Comb Passive Spectroscopy of Mid-IR Incoherent Light, Mingchen Liu¹, Matthew Heyrich^{1,2}, Sichong Ma^{1,2}, Scott A. Diddams^{1,2}; ¹*Department of Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA*; ²*Department of Physics, Univ. of Colorado Boulder, USA*. We introduce cross-comb correlation spectroscopy, which correlates signals from asynchronous sum-frequency sampling of mid-IR incoherent light with two near-IR combs. We experimentally measure the frequency of phase-randomized mid-IR light with 100-MHz resolution using near-IR detectors.

FW6F.5 • 16:45

Spatio-Temporal Microcavity Dynamics Measurement by Intracavity Optical Gating, Ouri Karni¹, Chirag Vaswani¹, Thibault Chervy¹; ¹*NTT Research Inc., USA*. We employ LiNbO₃ embedded in high-finesse Fabry-Pérot microcavities to extract and to initiate, through optical gating, spatio-temporal information about the resonant modes. Potential use cases are exploration of nonlinear and polaritonic cavity dynamics.

Highland Room AK

15:30 -- 17:00

JW6B • Extreme Light Theme: Technologies for Fusion and Laser-based Radiation Sources

Presider: Louise Willingale; Univ. of Michigan, USA

JW6B.1 • 15:30 (Invited)

Extreme optics for extreme laser light, Carmen S. Menoni¹; ¹*Colorado State Univ., USA*. High-performance interference coatings are indispensable in ultrahigh-intensity and -power lasers for directing and conditioning beams to target. This talk examines coating requirements and identifies pathways to push these optical components to the next frontier.

JW6B.2 • 16:00 (Invited)

Frontiers in Optics + Laser Science Session Guide

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High-Energy Nd:Glass Laser Development at TRUMPF Scientific Lasers, Stefan Scheuren¹, Dominik Ertel¹, Klaus Ertel², Bernd Metzger², Markus Graf², Katrin Schulz², Catherine Teisset¹, Klaus Albers², Alexander Killi², Sandro Klingebiel¹, Thomas Metzger¹; ¹*Trumpf Scientific Laser GmbH + Co KG, Germany*; ²*Trumpf Laser SE, Germany*. Trumpf Scientific Lasers systems delivering up to 1J at 1kHz with 500-900fs pulses are presented. Moreover, the new, under development, high-energy, Nd:Glass-based, gas-cooled prototype amplifier delivering up to 5J at 10Hz is introduced.

JW6B.3 • 16:30 (Invited)

Optical Challenges in Ultrafast Fusion Lasers, Gaia Barbiero¹; ¹*Beam Transport, Marvel Fusion GmbH, Germany*. Laser fusion drivers push optics to extreme short-pulse regimes, where LIDT scaling, contamination-driven degradation, and PW/EW power scaling impose limits. This invited talk presents LIDT investigations, mitigation strategies, and industrial constraints shaping next-generation fusion laser systems.

Grand Lilac Ballroom North

17:30 -- 19:00

FW7A • Quantum Theme: Integrated Photonic Approaches to Quantum Information Processing

Presider: Ben Dixon; MIT Lincoln Laboratory, USA

FW7A.1 • 17:30 (Invited)

Integrated Photonics for Scalable Trapped-Ion Quantum Computing, Azure Hansen¹; ¹*Quantinuum, USA*. Abstract not available

FW7A.2 • 18:00 (Invited)

Quantum Photonic Integrated Circuits, Stefan F. Preble¹; ¹*Rochester Inst. of Technology, USA*. Quantum photonic integrated circuits enable scalable quantum networking by integrating sources and circuits for state manipulation. This talk highlights integration strategies and demonstrations advancing chip-scale platforms for distributed quantum information across the Rochester Quantum Network (RoQNET).

FW7A.3 • 18:30 (Invited)

Developing Infrastructure for Distributed Quantum Systems, Robert M. Pettit¹; ¹*memQ Inc, USA*. In this talk, I will present some of memQ's recent hardware and software developments toward the goal of creating scalable and robust architectures for connecting quantum processors over a network for distributed computing.

Highland Room BJ

17:30 -- 19:00

FW7C • Quantum Source Engineering and Detection

Presider: Margoth Córdova; Univ. of Ottawa, Canada

FW7C.1 • 17:30 (Invited)

Noiseless Amplification of Photonic Quantum States, Sergei Slussarenko¹; ¹*Griffith Univ., Australia*. Noiseless linear amplification can achieve entanglement distillation rates across a lossy channel beyond the limits of direct transmission and amplify multi-photon states, while preserving coherence with a

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hundredfold intensity gain.

FW7C.2 • 18:00

Quantum-Light-Induced Control of High-Harmonic Generation, Lu Wang¹, Thomas Brabec¹; ¹*Physics, Univ. of Ottawa, Canada*. High-harmonic generation typically requires intense laser fields. We show that a weak classical field accompanied by a quantum field, such as bright squeezed vacuum, can uniquely control harmonic spectra, angular emission, and ionization in ways inaccessible to purely classical perturbations.

FW7C.3 • 18:15

Limits on Efficiency for Photon Pair Generation from an Emitter in a Cavity, Rituraj¹, Muhammad I. Mazhari¹; ¹*Indian Inst. of Technology Kanpur, India*. This work presents a theoretical investigation of two-photon generation from an emitter inside a photonic cavity. An analytical solution is derived by solving the Lindblad master equation to determine the limits on efficiency and brightness.

FW7C.4 • 18:30 (Invited)

Lithium Niobate and Nonlinear Optics as an Enabler for Quantum Technologies and Augmented Reality, Peter G. Smith¹; ¹*Univ. of Southampton, UK*. Abstract not available

Highland Room CH

17:30 -- 19:00

FW7D • Optical Acquisition and Processing II

Presider: Yuhang Li, USA

FW7D.1 • 17:30 (Invited)

Engineering of High-Performance Miniature Optics and Imaging Systems, Tomasz Tkaczyk¹; ¹*Rice Univ., USA*. This talk presents novel imaging and optical sensing systems and their capabilities enabled by components fabricated with 2-Photon Polymerization based Additive Manufacturing. These systems are being compared to traditionally built miniature optical devices.

FW7D.2 • 18:00 (Invited)

Computational 3D Metrology for Reflective Surfaces, Jiazhang Wang¹; ¹*Univ. of Arizona, USA*. This talk presents multimodal computational 3D imaging methods that bridge optical metrology and computer vision, enabling accurate and practical 3D sensing for specular and mixed-reflectance scenes.

FW7D.3 • 18:30 (Invited)

Physics-Informed Self-Supervised Learning for Optical Imaging and Sensing, Fei Xia¹; ¹*Univ. of California Irvine, USA*. We will present our recent progress in leveraging self-supervised learning to address challenging problems in optical imaging and sensing. By incorporating measurement physics and learning directly from acquired data, these approaches reduce reliance on large, manually labeled training datasets while enabling robust image reconstruction and information recovery. Representative applications will demonstrate how self-supervised models can be adapted to different optical systems and measurement conditions. These advances may facilitate more customized, data-efficient, and broadly deployable computational solutions for next-generation optical imaging and sensing.

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Highland Room DG

17:30 -- 19:00

FW7E • Optical Fiber Sensing Applications

Presider: Giovanni Milione; Sintela, Inc., USA

FW7E.1 • 17:30 (Invited)

Fibers as Environmental Sensors: How Distributed Acoustic Sensing (DAS) is Reshaping Marine Mammal Monitoring, Léa Bouffaut¹; ¹*Cornell Univ., USA*. Das provides marine mammal data with high spatio-temporal resolution in real-time, an opportunity for whale management and conservation that require thorough calibration and algorithm development to reach its full potential.

FW7E.2 • 18:00 (Invited)

Marine Soundscape Monitoring Integrated into High-Speed Fiber-Optic Communication., Boon S. Ooi^{1,2}, Talha Arif², Wahyu Gunawan², Islam Ashry²; ¹*Electrical, Computer, and Systems Engineering (ECSE), Rensselaer Polytechnic Inst. (RPI), USA*; ²*Electrical and Computer Engineering, King Abdullah Univ. of Science and Technology (KAUST), Saudi Arabia*. We demonstrate AI-aided marine soundscape monitoring using subsea single-mode fiber, integrating distributed acoustic sensing and communication via WDM and OFDM to suppress crosstalk, enabling 7.59 Gbps transmission and 85% classification accuracy in field deployment.

FW7E.3 • 18:30

Quantum Wrapper Datagrams Coexisting with a Distributed Temperature Sensor, Gamze Gul¹, Gina Talcott¹, Grace Wang¹, Gregory Kanter¹, Yaowen Li², Sarper Ozharar², Prem Kumar¹; ¹*Northwestern Univ., USA*; ²*NEC Laboratories America, Inc., USA*. We demonstrate coexistence of polarization-entangled photon pairs and Raman-based temperature sensing in a 48-km deployed fiber link. We map fiber temperature changes measured by the sensor to the arrival time delays of the photon pairs.

FW7E.4 • 18:45

Multi-Frequency Current Detection using a Coherent Transceiver, Alice V. Drozdov¹, Max Brenner¹, Mikael Mazur², Mitchell A. Cox¹; ¹*Univ. of Witwatersrand, South Africa*; ²*Nokia Bell Labs, USA*. Coherent transceivers continuously track light's polarisation state for data demodulation. We show this can be repurposed for AC current detection at multiple frequencies via the Faraday effect using CMA-based DSP, requiring no additional sensing hardware.

Highland Room AK

17:30 -- 19:00

JW7B • Extreme Light Theme: Frontiers of Strong-Field Laser Sources

Presider: Michael Chini; Ohio State Univ., USA

JW7B.1 • 17:30 (Invited)

High-Power Mid-Infrared Lasers: The New Frontier in Strong-Field Science, Zenghu Chang¹; ¹*Univ. of Ottawa, Canada*. Significant progress in developing Fe:ZnSe and ZGP-based high-intensity mid-infrared CPA and OPCPA sources has opened new opportunities for attosecond science and relativistic plasma physics, transforming our ability to explore strong-field dynamics.

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JW7B.2 • 18:00 (Invited)

Extreme Terahertz Field Engineering: A Programmable Interface to Quantum Matter, Nicholas Matlis¹;

¹*Arizona State Univ., USA*. High-energy terahertz sources are evolving from broadband drivers into programmable control tools. I will discuss extreme THz field engineering, where frequency, bandwidth, polarization, and field composition are independently tailored to access new nonlinear regimes and selectively control quantum materials.

JW7B.3 • 18:30 (Invited)

Generation of 100-J Infrared and Ultraviolet Broadband Incoherent Pulses via Optical Parametric Amplification and Sum-frequency Generation for the Mitigation of Laser–Plasma Instabilities,

Christophe Dorrer¹; ¹*Univ. of Rochester, USA*. The commissioning and early campaigns of the Fourth-generation Laser for Ultrabroadband eXperiments are described, including the generation of high-energy incoherent pulses with a fractional bandwidth of 3% in the infrared and 1% in the ultraviolet.

Grand Lilac Ballroom South

17:30 -- 19:00

LW7F • Ultrafast Nanoscale Dynamics and Control

Presider: Irina Novikova; College of William & Mary, USA

LW7F.1 • 17:30 (Invited)

Tracking and Controlling Ultrafast Exciton Dynamics in Novel 2D Materials, Alice Kunin¹; ¹*Princeton Univ., USA*. In this talk, I will present new experimental developments in the use of time- and angle-resolved photoemission spectroscopy to directly visualize the momentum-resolved ultrafast dynamics of excitons in novel quantum materials.

LW7F.2 • 18:00 (Invited)

Giant Chiral Magnetoelectric Oscillations in a Van Der Waals Multiferroic, Edoardo Baldini¹; ¹*Univ. of Texas at Austin, USA*. We investigate nonequilibrium dynamics of chiral electromagnons in exfoliated van der Waals multiferroics. Ultrafast measurements reveal giant magnetoelectric coupling and coherent intertwined dynamics of electric polarization and magnetization, highlighting collective chiral responses at terahertz frequencies.

LW7F.3 • 18:30

Ultrafast Nano-Imaging of Polaron Cation Coupling in Hybrid Perovskites, Branden L. Esses¹, Markus B. Raschke¹; ¹*Physics, Univ. of Colorado Boulder, USA*. Hybrid perovskites exhibit spatially heterogeneous coupling between polarons and cations. The corresponding polaron lifetimes are affected by local structure, disorder, and composition. We develop ultrafast heterodyne pump-probe nano-imaging to address the ensuing heterogeneous polaron dynamics.

LW7F.4 • 18:45

All-Optical Coherent Control of Two-Color Laser Excited Ultrafast Photocurrent in 2D SnSe₂ Films, Xiangyu La¹, Chenyin Dai¹, Jiangqi Huang¹, Zhen Tian¹, Jianming Dai¹; ¹*Tianjin Univ., China*. We investigate photocurrent injection in SnSe₂ films under two-color laser excitation and demonstrate all-optical coherent control of the photocurrent by tuning the relative phase and polarization states of the two-color fields.

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Thursday, 1 October

Grand Lilac Ballroom North

08:00 -- 09:00

FTh1A • Optical Coherence Tomography

Presider: Wu Yuan; Chinese Univ. of Hong Kong, Hong Kong

FTh1A.1 • 08:00 (Invited)

Polarimetric Imaging with Optical Coherence Tomography, Martin Villiger¹; ¹*Wellman Center for Photomedicine, USA*. Extending optical coherence tomography to measure tissue polarization effects provides contrast related to the microstructure and arrangement of tissue components. This talk will discuss recent technical advances and clinical applications across multiple medical specialties.

FTh1A.2 • 08:30

Quantitative Dynamic OCT for High Throughput Drug Screening, Jianbo Tang¹; ¹*SUSTech, China*. We present a quantitative dynamic optical coherence tomography technique (g1-OCT) for precise drug screening. This label-free cell viability imaging technique along with ultrathin fresh tissue slicing vibratome bridge tissue-based drug testing with clinical translation, which shows great potential to personalized oncology treatment.

FTh1A.3 • 08:45

Implantable Optical Window–Enabled OCT/OCTA for In Vivo Monitoring of Gastric Tumor

Microvasculature, Fengxian Du¹, Junwei Xue¹, Qingliang Zhao¹; ¹*Xiamen Univ., China*. We combine an implantable gastric optical window with OCT/OCTA to longitudinally monitor orthotopic gastric tumors, revealing structural growth, centripetal angiogenesis, and quantitative vascular remodeling in vivo.

Highland Room AK

08:00 -- 09:00

FTh1B • Advanced Photonic Integration and Nanofabrication

Presider: Amirhassan Shams-Ansari; Monarch Quantum Inc, USA

FTh1B.1 • 08:00 (Invited)

Photonic Wire Bonds and Facet-Attached Micro-lenses: Enabling Scalable Integration of Lasers and PICs, Laura Elizabeth Horan¹, Noémie Esopinana¹, Sebastian T. Skacel¹; ¹*Vanguard Automation GmbH, Korea (the Republic of)*. As photonic integration advances toward scalable, high-throughput manufacturing, the integration of active devices particularly lasers- remains a key challenge. Vanguard Automation addresses this with a unique solution of photonic wire bonds and facet-attached micro-lenses, which are fabricated in-situ at chip-level and can be applied to both batch processing and wafer level integration. This solution leverages 3D nano-printing technology to fabricate freeform optical structures with sub-micron precision which eliminate the need for active alignment, while enabling robust, low-loss, high yield photonic interconnects. Vanguard Automation's solution is uniquely positioned to meet industry demands, lighting the way for scalable next-generation photonic integration.

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FTh1B.2 • 08:30

Heterogeneous Photodiodes on Ultra-Thin Silicon Nitride Waveguides, Fatemehsadat Tabatabaei¹, Kaikai Liu², Jiawei Wang², Xiangwen Guo¹, Meiting Song², Andrew D. Vithoulkas¹, Thomas S. Keyes¹, Rahul Chawlani², Karl D. Nelson³, Daniel J. Blumenthal², Andreas Beling²; ¹*Univ. of Virginia, USA*; ²*Univ. of California, Santa Barbara, USA*; ³*Honeywell Aerospace Technologies, USA*. We demonstrate InGaAs/InAlGaAs/InP photodiodes on 80-nm-thick Si₃N₄ with up to 2.1 GHz 3-dB bandwidth and 0.61 A/W responsivity. The fabrication process includes top cladding removal/redeposition to enable integration and light confinement within the ultra-thin waveguide.

FTh1B.3 • 08:45

Sub-Wavelength Blazed Gratings for Structural Color Optical Authentication, Souvik Ghosh¹, Ioannis Papakonstantinou²; ¹*BITS Pilani Goa, India*; ²*EEE, Univ. College London, UK*. We demonstrate sub-wavelength blazed gratings for anti-counterfeiting applications, enabling wavelength selective light coupling, guiding, and extraction. Optimized through electromagnetic modeling and realized via nanofabrication, the devices generate distinctive structural color signatures with excellent theoretical and experimental agreement.

Highland Room BJ

08:00 -- 09:00

FTh1C • Quantum Networking over Existing Optical Fibers

Presider: Hao Song; Cisco Systems Inc., USA

FTh1C.1 • 08:00 (Invited)

Quantum Internet: What Is It, Why Do We Need it, and How Do We Engineer It? Prem Kumar¹, Gina Talcott¹, Gamze Gul¹; ¹*Northwestern Univ., USA*. We discuss a possible path to a scalable quantum internet that integrates both quantum and classical communications. We highlight our recent research on coexistence and Quantum Wrapper Networking that provides groundwork for such an internet.

FTh1C.2 • 08:30

Developing Quantum Network Compatible Entanglement Photon Sources, Chi-chih Chen¹, Eden Figueroa¹; ¹*Stony Brook Univ., USA*. In this paper, we develop a portable and data center compatible polarization entanglement source system, modeling the entanglement source for the direction to achieve high fidelity at a higher rate.

FTh1C.3 • 08:45

Real-Time Polarization Stabilization of Optical Signals in Quantum Networks via Physics-Informed Sequence Modeling, Yen Chun Chao¹, Raman Khurana¹, Ely Eastman¹, Prem Kumar¹; ¹*Northwestern Univ., USA*. We introduce an SO(3) constrained Selective State Space Model for real-time state-of-polarization correction. This physics-informed architecture computationally outperforms existing Transformer baselines, enabling high-fidelity polarization mode dispersion compensation important for continuous-variable optical and quantum networks.

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Highland Room CH

08:00 -- 09:00

FTh1D • 3D and Light-Field Optics and Space-based Imaging

Presider: Pierre-Alexandre Blanche; Amazon, USA

FTh1D.1 • 08:00 (Invited)

Advances in Multispectral Holography and Diffuser-Based Imaging for Lensless 3D Endomicroscopy,

Jakob Dremel¹; ¹*Technische Universität Dresden, Germany*. We present parallel investigations into multispectral holography and diffuser-based imaging for lensless single-shot 3D endomicroscopy. Efficient encoding/decoding methods and computational holography enable minimally invasive imaging, advancing biomedical diagnostics and offering complementary approaches for digital medicine and in vivo applications.

FTh1D.2 • 08:30

Dual-Color Fringe Projection with a Sinusoidal Phase Grating, Zijie Zhao¹, Yiqian Yang¹, Mengran Zhao¹, Liangcai Cao¹, Qiaofeng Tan¹; ¹*Tsinghua Univ., China*. To overcome the speed–depth trade-off in phase-shifting profilometry, we propose a sinusoidal phase grating projector that produces dual-color π -phase-shifted fringes over a large depth range, enabling single-frame 3D measurement with a compact architecture.

FTh1D.3 • 08:45

Correlation-Enabled Gabor Holography with Array-Based Photon Detection, Yiqian Yang¹, Zijie Zhao¹, Mengran Zhao¹, Liangcai Cao¹; ¹*Tsinghua Univ., China*. Array-based coincidence detection enables noise-robust quantum Gabor holography for lensless amplitude and phase imaging under ultra-low photon conditions. Spatial biphoton correlations further improve the reconstruction fidelity and suppress background noise.

Highland Room DG

08:00 -- 09:00

FTh1E • Ultrafast Lasers and Applications II

Presider: Nicolas Joly; FAU Erlangen-Nürnberg, Germany

FTh1E.1 • 08:00

Simultaneous Characterization of Two Ultrashort Pulses with Near-Zero-index material, Yang Xu¹, Tianyu Zhao¹, Hao Zhang², Junchi Zhang¹, Sergio Carbajo², Xi-Cheng Zhang¹, Robert Boyd¹; ¹*Univ. of Rochester, USA*; ²*UCLA, USA*. We propose a frequency-resolved optical gating scheme for the simultaneous characterization of two unknown ultrashort pulses using the efficient third harmonic generation on indium-tin oxide in its epsilon-near-zero regime.

FTh1E.2 • 08:15

High Peak-Power Raman Solitons in large-Core Fluoride Fiber, Martin S. Trpceski^{1,2}, James McKeown¹, Eric Welch¹, William R. Donaldson¹, Robert Boni¹, Patricia Estrela¹, Jeremy J. Pigeon¹, David Purschke¹; ¹*Laboratory for Laser Energetics, Canada*; ²*ECE, Columbia, USA*. We study the soliton self-frequency shift in stretched multi-mode ZBLAN fibers, enabling pumping with pulse energies an order of magnitude higher than previous demonstrations with femtosecond pulses.

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FTh1E.3 • 08:30 (Invited)

Generating and Characterizing Few-Cycle Laser Fields from UV to Mid-IR, Michael Chini¹; ¹*Ohio State Univ., USA*. Advances in attosecond science require control of few-cycle laser fields from ultraviolet to mid-infrared. In this talk, I present novel approaches to generation and characterization of such fields, as well as applications to sub-cycle spectroscopy.

Grand Lilac Ballroom South

08:00 -- 09:00

FTh1F • Spectroscopy and Interferometry

Presider: Prathmesh Deshmukh; Meta Platforms, USA

FTh1F.1 • 08:00

Cavity Mode Mismatch and Alignment Sensing with Only QPDs, Mitchell Schiworski¹, Stefan Ballmer¹; ¹*Syracuse Univ., Australia*. High power cavities suffer from mode mismatch arising from thermal deformations in the optics. This reduces the cavity power and can prevent locking altogether. We present a simple technique for sensing both mismatch and alignment which requires only QPDs by making use of cylindrical lenses and is easily adapted to a compact breadboard.

FTh1F.2 • 08:15

Visible-Light Spectropolarimetric Characterization of Critical-Angle X-Ray Transmission Gratings, Mateo Brancoli¹, Mark L. Schattenburg², Ralf K. Heilmann², Artitaya Boonkird², Mallory Whalen²; ¹*Franklin W Olin College of Engineering, USA*; ²*Kavli, MIT, USA*. We present a visible-light spectropolarimetric bench for in-situ characterization of critical-angle X-ray transmission (CAT) gratings. Transmitted spectra correlate with grating bar thickness, providing a fast, non-destructive quality metric scalable to individual grating and full-wafer production screening.

FTh1F.3 • 08:30

Shrinking the Echelle Spectrometer: Fabrication of Functional Concave Cross-Gratings, Daniela Stumpf¹, Sebastian Klimke¹, Ute Müller¹, Steffen Resche¹, Lukas Werner¹, Robert Brunner¹; ¹*Ernst-Abbe-Hochschule Jena, Germany*. The fabrication of micro-optical concave cross-gratings for compact echelle spectrometers is analyzed by considering two methods of fabrication. The results of Two-Photon-Lithography and direct laser writing are presented.

FTh1F.4 • 08:45

A Foveated Offner Imaging Spectrometer Based on Active Optics, Weijian Deng^{1,2}, Yongfeng Zhang^{1,2}; ¹*School of Optoelectronic Science and Engineering, Soochow Univ., China*; ²*Key Lab of Advanced Optical Manufacturing Technologies of Jiangsu Province and Key Lab of Modern Optical Technologies of Education Ministry of China, Soochow Univ., China*. We propose a novel foveated Offner imaging spectrometer based on active optics that achieves dynamic, high-resolution imaging of a 240 mm slit field of view and maintains a simple structure.

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Grand Lilac Ballroom North

09:15 -- 10:00

FTh2A • FiO Visionary Session III: Quantum Technologies

Presider: Nickolas Vamivakas; Univ. of Rochester, USA

FTh2A.1 • 09:15 (Visionary)

Structured Photons and Their Applications, Ebrahim Karimi¹; ¹Univ. of Ottawa, USA. Abstract not available.

Grand Lilac Ballroom South

09:15 -- 10:00

LTh2B • LS Visionary Session III

Presider: Matthew Graham; Oregon State Univ., USA

LTh2B.1 • 09:15 (Visionary)

What is Life? Can We Measure It? R. J. Dwayne Miller¹; ¹Univ. of Toronto, Canada. The posed quintessential question is not cast as an origins of life issue but rather directed towards understanding the underlying physics by which chemistry breathes life into otherwise inanimate matter. The real issue is how chemistry scales in complexity up to the level of biological systems. The light matter interactions being exploited to achieve this Moon Shot for Biology will be discussed as part of a proposal to launch a global initiative to map the cell.

Grand Lilac Ballroom North

10:30 -- 12:30

FTh3A • Quantum Theme: Distributing and Processing Quantum Information

Presider: Robert Pettit; memQ Inc, USA

FTh3A.1 • 10:30 (Invited)

Title to be announced, Brian J. Smith¹; ¹Univ. of Oregon, USA. Abstract not available

FTh3A.2 • 11:00 (Invited)

Enabling Photonics for Neutral-Atom Quantum Computing and Sensing, Alexander G. Radnaev¹; ¹Infleqtion, USA. I will discuss Infleqtion's neutral-atom quantum computing and sensing results, including demonstration of several logical qubits, optically addressed high-fidelity entangling gates, optical clocks, and Rydberg RF sensing, as well as enabling photonics challenges for future quantum systems

FTh3A.3 • 11:30 (Invited)

Title to be announced, Eden Figueroa¹; ¹SUNY Stony Brook, USA. Abstract not available

FTh3A.4 • 12:00 (Invited)

Frequency Combs as Enablers of Quantum Technologies, Marko Perestjuk¹; ¹Menlo Systems GmbH, Germany. Optical frequency combs are a key enabling technology for quantum computing, quantum clocks, and quantum radar. This talk will explore the various recent technological advances realized at

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Menlo Systems, setting records in all these fields.

Highland Room BJ

10:30 -- 12:30

FTh3C • Quantum Metrology and Sensing

Presider: Margoth Córdoba; Univ. of Ottawa, Canada

FTh3C.1 • 10:30 (Invited)

Nonclassical Sources for Quantum Sensing, Amr S. Helmy¹; ¹*Univ. of Toronto, Canada*. We show that broadband continuous-wave optical parametric amplification relaxes conventional squeezing-mode constraints, enabling self-conjugated time-frequency modes and partial homodyne detection to access arbitrary modes, with all-fiber measurements reaching 7.50 ± 0.12 dB squeezing.

FTh3C.2 • 11:00

Direct Polarization-Entangled Source Near 810 nm and Its Application for Nonlocal Phase Metrology, Shani Izhak¹, Inbar Hurvitz¹, Hagai S. Eisenberg², Ady Arie¹; ¹*Tel Aviv Univ., Israel*; ²*Hebrew Univ., Israel*. We demonstrate a compact, high-quality polarization-entangled photon source near 810 nm using a domain-engineered KTP crystal. We further exploit the entangled-state phase sensitivity to perform multi-wavelength nonlocal retardance measurements, establishing a practical platform for phase-sensitive quantum metrology.

FTh3C.3 • 11:15

How to Measure and Maximize Quantum Advantage of Multimode OPA Light?, Vitaly V. Kocharovskiy¹, Kunwar Kalra¹; ¹*Texas A&M Univ., USA*. We introduce a quantum-information complexity resource of multimode OPA light responsible for its quantum advantage. It is not Bloch-Messiah supermodes. It is based on multimode photon number statistics, convex optimization, Hafnian Master Theorem, #P-hard complexity.

FTh3C.4 • 11:30

Two-Photon Interferometry for Absorption and Phase Spectroscopy, Kyle M. Jordan², Alexander Duong¹, Duncan England², Yingwen Zhang^{2,1}, Andrew Proppe³, Jeff S. Lundeen¹, Benjamin J. Sussman^{2,1}; ¹*Department of Physics, Univ. of Ottawa, Canada*; ²*National Research Council of Canada, Canada*; ³*Perceptive Space, Canada*. We report on experiments using Hong-Ou-Mandel interference and time-of-flight spectroscopy to simultaneously probe the absorption and phase (refractive index) spectra of a molecular sample.

FTh3C.5 • 11:45

Bulk Optomechanical System with Ultra-Wide Frequency Tunability and >300-Millisecond Coherence Times, Arjun Iyer¹, Wendao Xu¹, Haozhen Xu¹, Michael Pomerantz¹, William Renninger¹; ¹*Univ. of Rochester, USA*. Phonon-frequency-tunable optomechanical interactions are demonstrated in single-crystal bulk acoustic resonators. Non-collinear all-optical coupling enables access to phonons with novel mode-selection rules, high quality factors ($>8 \times 10^8$), record-high coherence times (>300 ms), and frequency tunability over 10 GHz.

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FTh3C.6 • 12:00

Octave-Spanning Supercontinuum Bright Squeezed Vacuum Generation, Amr Hossameldin^{1,3}, Ashley Driesbach^{1,3}, Dina S. Eissa^{1,3}, Karel Veselsky^{1,2}, Sanjit Karmakar^{1,3}, Chen-Ting Liao^{1,3}; ¹*Physics, Indiana Univ., USA*; ²*FNSPE, Czech Technical Univ. in Prague, Czechia*; ³*Indiana Univ. Quantum Science and Engineering Center, USA*. We generate femtosecond-pulsed bright squeezed vacuum of light pumped by the second harmonic of an ytterbium laser, and characterize its photon-number scaling, pulse statistics, and 3-octave supercontinuum emission in the high-gain regime.

FTh3C.7 • 12:15

On-chip Source of Photons Entangled in Transverse Modes, Tavshabad Kaur¹, Jamika Ann Roque², Daniel S. Dahl³, Daniel Peace^{1,4}, Jacqueline Romero¹; ¹*School of Mathematics and Physics, The Univ. of Queensland, St. Lucia, QLD 4072, Australia*; ²*National Inst. of Physics, College of Science, Univ. of the Philippines, Diliman, Quezon City, 1101, Philippines, Philippines*; ³*School of Physics, The Univ. of Sydney, Sydney, NSW 2006, Australia, Australia*; ⁴*National Advanced Photonics Facility (NAPF), The Univ. of Queensland, St Lucia, Brisbane, QLD, 4072, Australia, Australia*. We demonstrate intramodal and intermodal four wave mixing (FWM) in silicon-on-insulator (SOI) multimode waveguides. A 4 mm long transverse-mode-encoded waveguide exhibits CAR>600 and CAR>25 for Type I and Type III FWM processes, respectively.

Highland Room CH

10:30 -- 12:15

FTh3D • Optical Computing III

Presider: Pierre-Alexandre Blanche; Amazon, USA

FTh3D.1 • 10:30

Information Driven Optimization of The Habitable Worlds Observatory Primary Mirror Sensor Positions, Trevor M. Shooshan^{2,1}, Charles S. Bevis², Benjamin Crome², Madeline Cowell², Laura E. Coyle²; ¹*Univ. of Rochester, USA*; ²*BAE Systems North America, USA*. The Habitable Worlds Observatory has picometer stability requirements for its segmented primary mirror. Mutual information is used as an optimization target to minimize the number of edge and laser metrology sensors for the required sensitivity.

FTh3D.2 • 10:45 (Invited)

Information Transmission Through Scattering Media with Neuromorphic Computing, Jie Zhang¹, qian zhang¹, Haoyi Yu², Qiming Zhang², Min Gu², Juergen W. Czarske¹; ¹*Technische universität dresden, Germany*; ²*Univ of Shanghai Science & Technology, China*. Optical analog computing is characterized by low energy consumption and low latency. However, distortions during propagation in scattering media pose a challenge. We present an optical diffractive neural network for real-time information processing.

FTh3D.3 • 11:15

Unidirectional Light Focusing Using Structured Surfaces, Yuhang Li¹, Tianyi Gan¹, Jingxi Li¹, Mona Jarrahi¹, Aydogan Ozcan¹; ¹*UCLA, USA*. We present a unidirectional system that focuses light in the forward direction while suppressing focusing in the opposite direction. Using optimized diffractive layers, this design achieves polarization-insensitive asymmetric focusing without nonlinear materials or active modulation.

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FTh3D.4 • 11:30

Optical-Neural Architecture for Energy-Efficient Deepfake Video Detection, Parnian

Ghapandarkashani¹, Shiqi Chen¹, Aydogan Ozcan¹; ¹*Univ. of California Los Angeles, USA*. We introduce a hybrid optical-neural architecture that simultaneously processes ≥ 15 video streams within a single optical propagation pass, enabling high-throughput and accurate video-level authenticity prediction at reduced computational cost compared with purely digital methods.

FTh3D.5 • 11:45

Universal Nonlinear Optical Computing with Single-Layer Encoder–Decoder Co-Localization, Yuntian

Wang¹, Alexander Chen¹, Md Sadman S. Rahman¹, Aydogan Ozcan¹; ¹*Univ. of California Los Angeles, USA*. A single phase-only diffractive surface co-hosting an input encoder and an optimized/static decoder is designed to approximate any arbitrary band-limited nonlinear function without cascaded diffractive layers or nonlinear optical materials.

FTh3D.6 • 12:00

Massively Parallel Nonlinear Function Approximation with an Incoherent Linear Diffractive Optical

Processor, Alexander Chen¹, Yuntian Wang¹, Md Sadman Sakib Rahman¹, Yuhang Li¹, Aydogan Ozcan¹; ¹*Univ. of California Los Angeles, USA*. A passive, linear diffractive processor with intensity-only encoding and differential readout enables massively parallel nonlinear function approximation under incoherent illumination, scaling to one million distinct functions, executed all in parallel in a single pass forward.

Highland Room DG

10:30 -- 12:00

FTh3E • Advanced Optical Sources

Presider: David Purschke; Laboratory for Laser Energetics, USA

FTh3E.1 • 10:30 (Invited)

Tailored Fibers for Quantum Optics: Generation, Manipulation and Transport, Nicolas Joly^{1,2}, ¹Fau

Erlangen-Nürnberg, Germany; ²Max Planck Inst. for the Science of Light, Germany. We report on specialized optical fibers for quantum applications, including submicron tapers for triplet photons, gas-filled hollow cores for manipulation of quantum states, and twisted fibers for quantum key transport.

FTh3E.2 • 11:00

Raman Kerr Combs Generation in Integrated Silicon Nitride Microresonators, Alekhya Ghosh^{1,2},

Arghadeep Pal^{1,2}, Shuangyou Zhang³, Toby Bi¹, Masoud Kheyri¹, Haochen Yan¹, Yaojing Zhang⁴, Pascal Del'Haye^{1,2}; ¹*Max-Planck-Inst Physik des Lichts, Germany; ²Friedrich Alexander Univ., Germany;*

³*Technical Univ. of Denmark, Denmark; ⁴The Chinese Univ. of Hong Kong (Shenzhen), China*. We demonstrate frequency comb generation via Raman scattering in silicon-nitride microresonators. The comb generation is facilitated by an interplay of Raman scattering in the fused silica cladding and Kerr-nonlinearity of the silicon nitride core.

FTh3E.3 • 11:15

20 GHz UV-Visible Coverage with a Frequency Comb for Precise Doppler Measurements, Yaru Luo¹,

Pooja Sekhar¹, Christina Moraitis¹, Tsung-Han Wu¹, Peter T. Chang¹, Nicolas Englebert², Selina Zhou², Alireza Marandi², Luke Handley², Andrew Howard², Scott A. Diddams¹; ¹*Univ. of Colorado Boulder, USA;*

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²*Caltech, USA.* We aim to generate a robust astrocomb spanning the full UV-visible spectrum at 10s of GHz repetition rates using both 20 GHz electro-optic frequency combs and nonlinear nanophotonic waveguides based on periodically-poled thin-film lithium niobate.

FTh3E.4 • 11:30

Microwave-to-Optical Transduction of Blackbody Radiation via Rydberg Atoms, Marcin Jastrzebski^{1,2}, Sebastian Borówka^{1,2}, Wiktor Krokosz^{1,2}, Mateusz Mazelanik¹, Wojciech Wasilewski^{1,2}, Michal Parniak^{1,2}; ¹*Centre of New Technologies, Univ. of Warsaw, Poland*; ²*Faculty of Physics, Univ. of Warsaw, Poland.* We present an experimental solution for sensing the black body radiation using the microwave-to-optical conversion in rydberg atoms. Our setup is tunable for a broad range of frequencies of the electromagnetic field.

FTh3E.5 • 11:45

Coherent Optical Transition Radiation from Ultrashort Electron Beams, Chad Pennington¹, Gia Azcoitia¹, Blae Stacey², Willi Kuroпка², Jackson Rozells¹, Francois Lemery², Florian Burkart², Sergio Carbajo^{1,3}; ¹*Univ. of California Los Angeles, USA*; ²*German Electron Synchrotron DESY, Germany*; ³*Stanford Univ., USA.* We report coherent optical transition radiation produced from ultrashort electron bunches. Coherent emission is observed to wavelengths as short as 550 nm, demonstrating visible CTR generated through strong RF compression of electron beams.

Highland Room AK

10:30 -- 12:30

JTh3B • Extreme Light Theme: Sources and Applications

Presider: Csaba Toth; Lawrence Berkeley National Laboratory, USA

JTh3B.1 • 10:30 (Invited)

The NSF ZEUS: an Extreme Field User Facility, Louise Willingale¹; ¹*Univ. of Michigan, USA.* The NSF ZEUS user facility is the highest power laser in the USA. ZEUS may study a broad range of plasma physics ranging from advanced accelerator and light source schemes to strong-field QED experiments.

JTh3B.2 • 11:00 (Invited)

Approaching kW-Class λ_3 Regime at ELI ALPS, Adam Borzsonyi¹; ¹*ELI-Hu Nonprofit Kft, Hungary.* ELI ALPS provides excellence-based access for researchers worldwide to cutting-edge ultrafast laser beamlines delivering hundreds of watts of average power. We discuss recent developments towards shorter pulses and improved spatio-temporal characteristics at enormous thermal loads.

JTh3B.3 • 11:30 (Invited)

Laser Technologies for High-Energy Electron and Muon Beams and Radiation at BELLA, Davide Terzani¹; ¹*Lawrence Berkeley National Laboratory, USA.* R&D at the BELLA Center aims to advance compact generation of high-energy electron and muon beams using PW-class 1 Hz laser systems, and to develop ~0.1 J, kHz fiber lasers for next-generation high-average-power operation.

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JTh3B.4 • 12:00 (Invited)

NSF OPAL – A Next-Generation Laser Reaching for the Brightest Light, Jonathan D. Zuegel^{1,2}; ¹*Univ. of Rochester, USA*; ²*Professor of Optics, Univ. of Rochester, USA*. The Univ. of Rochester leads an NSF-funded design project for NSF OPAL, a new, world-leading, user facility guided by science community needs identified by the 2022 Multi-Petawatt Physics Prioritization (MP3) workshop. It will provide a large-scale, open-access user facility. The project has completed a conceptual design and will complete preliminary design in early 2027. This talk will overview the frontier science NSF OPAL enables, the status of the facility design, and plans going forward.

Grand Lilac Ballroom South

10:30 -- 12:30

LTh3F • Ultrafast Nonlinear and Strong-Field Dynamics

Presider: Matthew Graham; Oregon State Univ., USA

LTh3F.1 • 10:30 (Invited)

Correlating Ultrafast Vibronic Dynamics with Spin, Charge, and Ions, James D. Gaynor¹; ¹*Northwestern Univ., USA*. This talk explores ultrafast electronic and vibrational dynamics in condensed phase molecules and materials that may be influential for photo-induced processes involving the motion of electron spins, charge, and intra- and intermolecular interactions involving ions.

LTh3F.2 • 11:00 (Invited)

Photophysical Dynamics of Colloidal Nanocrystals in the Strong Light-Matter Coupling Limit, Mitesh Amin¹, Benjamin Hancock¹, Farwa Awan¹, Liam Burke¹, Eric Koessler¹, Nickolas Vamivakas¹, Pengfei Huo¹, Todd D. Krauss¹; ¹*Univ. of Rochester, USA*. We will discuss CdSe nanoplatelet excitons strongly-coupled to dielectric Fabry-Pérot microcavities, forming hybrid light-matter excitations called polaritons. Mixed quantum-classical dynamics simulations of the angle-resolved photophysics provide a clear explanation of the measured polariton population dynamics.

LTh3F.3 • 11:30 (Invited)

Modeling of Linear and Non-linear Optical Response in Low-dimensional Material, Vasili Perebeinos¹; ¹*Univ. at Buffalo, USA*. Exciton lifetime and nonlinear optical response are key to optoelectronic applications. I will discuss phonon-assisted Auger nonradiative decay in doped two-dimensional materials and nonlinear light-matter interactions in 1D carbon nanotubes and defect-engineered 2D h-BN.

LTh3F.4 • 12:00

Temporally Resolved Nonlinear Dynamics of Solid-State Materials Probed by 1.5 cycle Mid-Infrared Source, Andre M. Cote¹, Dillon Lim¹, Ramon Vicencio¹, Gary Leach¹, Shawn M. Sederberg¹; ¹*Simon Fraser Univ., Canada*. We temporally-resolve the nonlinear response of indium tin oxide near its epsilon near-zero crossing using electro-optic sampling, observing intensity-dependent waveform reshaping, enabled by a 1.5 cycle mid-infrared source at 2 μm .

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LTh3F.5 • 12:15

Localized Vibrational Dynamics of Phenylalanine Fibrillar Assemblies Probed by Nanoantenna-

Enhanced Pump–Probe THz Spectroscopy, Rajat Kumar¹, Federica Piccirilli², Andrea Perucchi³, Prasanta Kumar Datta¹; ¹*Indian Inst. of Technology Kharagpur, India*; ²*Area Science Park, Italy*; ³*Elettra Sincrotrone Trieste, Italy*. Phenylalanine fibrils are studied using nanoantenna-enhanced terahertz pumpprobe spectroscopy. Nanoantenna arrays having resonance at 1.6 THz with ≈ 20 nm nanogaps localize THz fields, enabling sensitive probing of localized vibrational dynamics. Measurements are performed using FEL-based THz source.